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TO: All Participants in the Sea Turtle Fibropapilloma  
Meeting, March 1, 1993

From: Elliott Jacobson

Subject: In trying to assemble a proceedings for the above meeting, all of the presentations have been transcribed. Enclosed you will find a copy of your presentation and a disc with your paper in Word Perfect 5.1, IBM compatible. I have not even looked at your paper and I am sending it to you sight unseen. While our department typist is excellent, accents, voice quality, and scientific names made the transcriptions difficult. Please edit your paper and make corrections on the disc and get it back to me by July 1. At that time I will read your paper and add my editorial comments.

I appreciate the time and effort you will put into this document.

Thanks,

A handwritten signature in cursive script that reads 'Elliott Jacobson'.

**RECENT DEVELOPMENTS IN THE FIBROPAPILLOMA  
PROBLEM AFFECTING HAWAIIAN GREEN TURTLES**

**George H. Balazs**

**N.M.F.S.**

**Southwest Fisheries Center**

**Honolulu, Hawaii**

Let me say first and foremost I'm a field biologist of sea turtles in Honolulu in Hawaii for twenty years or so. Much of the work that Lou and I have been doing have paralleled each other over the this past decade at least and however, in addition to being a field biologist I'm also the last three years found myself to be the leader of the Southwest Fisheries Science Center's marine turtle research program for Hawaii and some of other areas of the Pacific. This has carried me into a number of administrative duties which aren't near as enjoyable as going out into the field, but they have also given me the sense to know that when I can't solve a problem locally or by myself that we need to attract in people, lots of other people, specialists, that have the talents to be able to address the problems that we are seeing in Hawaii. And therein with that short introduction tells you why we had the workshop on marine turtle fibropapilloma in December of 1990.

We were seeing over the past 5 years prior to that starting about 1985 alarmingly increasing numbers of stranded turtles and turtles in our foraging pastures with extensive fibropapillomas. And thank God for Dr. \_\_\_\_\_ he had the sense to give us a bit of add on

money that allowed many of you sitting here today to travel out to Hawaii without that extra add on money that he was kind of enough to give us and he is now retired by the way. We would have never had such a workshop in Hawaii because who can afford to fly. Most people can't afford to go to Hawaii to attend such three day meetings as it was.

We started out after this 3 day meeting with a sketch plan that had of course a very large budget in order to accomplish the things and I believe it was something in the neighborhood of 2-3 million dollars we estimated would be needed over the next five years. Obviously we all knew that that was very realistic, but we did start out with the little bit of monies we had moving ahead with both contracted and/or collaborative studies with various people that had been identified as 1) having expertise and 2) being motivated to actually work on this problem, having the time and the motivation and of course from the very start and even before our start Elliott has played a pivotal role in all of these studies.

I list here now just some of the things that we have been doing so that you can get some feeling of. All of these studies do have come directly out of the workshop plan that was developed.

Baseline pathogen survey by Dr. Alonso Aguirre, who you may remember wrote the epidemiological perspective that we were missing of the person at our workshop, the person couldn't make it and in order to fill in that blank he was kind enough to write an epidemiological perspective for us, which is included in the 1990 workshop report. He has since gone on to work on a number of items, one was the pathogen survey which he is going

to report on and then very shortly thereafter in collaboration with the Southeast Fishery Center, Nancy Thompson's shop were able to put together a little package of contract money that Elliott, Sidney Simpson and Gail Sherber used to pursue the herpes virus and I should stress with the amounts of money we are able to provide were not sufficient to do on their own. There was a lot of donations and other monies that came into this.

Much the same also for Dr. Murray Daily and Dr. Bob Morris, both of whom are here today to report on some of their parasitology studies and the diagnostic tools in immunology with Dr. Klein and graduate student Larry Herbst.

Toxicology - we have an on-going cooperative contracted study with Dr. Aguirre looking at some selected possible pollutants from Hawaii. We have supplied on a collaborative bases an extensive array of samples from fibropapilloma and non-fibropapilloma turtles that have all been made available with no strings attached to Wendy Teas and very recently and quite pleausrably Mary \_\_\_\_\_ did a short comparison on Green turtles that you just and Loggerheads from her area of the world near Virginia Institute of Marine Sciences which she just reported upon in the symposium that just happened.

Clinical treatment - developed a good work relationship and friendship with Dr. Bob Morris who we've been fortunate enough to bring to this meeting here today and at the previous symposium. Both on parasitology aspects every day advice on veterinary care of rehabed animals. We don't have many that do get rehab, they are mainly by the time we see them they are in a hospice condition and usually die shortly thereafter. He has also developed

done some experiments on using cryosurgery in the individual treatment of these animals and those of you at the symposium saw the some 80 something slides that Bob had documenting the treatment.

Public awareness - Tina was kind enough to host and show "Fall of the Ancients - Hawaii's Green Turtles in Crises." Her new project is basically two very pleasant and intelligent ladies from Hawaii named Laura \_\_\_\_\_ and \_\_\_\_\_ who are very concerned about sea turtles worldwide and put together a video with a piddling \$4,000.00 that turned out to be an extremely technologically slick in presentation and lots of donations there that tells the story of Hawaii's Green turtles with fibropapillomas and puts a sizeable dose of Caribbean flow to turtles in the movie also.

And last but not least some of the field studies that I have continued to do involving both sonic and satellite telemetry as well as the ecologic geography similar to what Lou has reported on and that is going to our various city sites. Doing a health assessment on the animals, grading the tumors, measuring their growth, doing the various things that I was doing all along for the purposes of growth demography but now doing a sizeable amount of that data collection relating to the fibropapillomas that are so very common on many of our animals.

A couple of studies here that we are working with also that I should mention. A very interesting one with George \_\_\_\_\_ at the Department of Zoology at the University of Hawaii collaborative and contracted dealing with the cleaning symbiosis that

we are seeing more and more frequently in Hawaii involving saddle-back \_\_\_\_\_, cleaning barnacles off the soft parts of turtles and the turtles posturing and posing presenting themselves for this cleaning behavior and we are looking at the possible tie disease transmission from mouth parts of these \_\_\_\_\_ which snap these little barnacles off and sometimes inflict pain and undoubtedly punctures as they snap off these barnacles and the turtles flinching from it but they must be pleasure in the pain of having these animals snapped. We have a manuscript now submitted, a full paper to COPIA on this topic and we are following it up this year with additional work.

Another collaborative work that is just starting is with Dr. George \_\_\_\_\_ who just passed through Hawaii and we held him in Hawaii, we tied him up and brought him up to the lab for a seminar for a day and also show us some of his techniques on bone aging estimates. One of the things that we are pursuing are the weights of the bones from tumored versus nontumored turtles and the reabsorption core which seems to be a much greater area of core in the tumored turtles at least in many of the tumored turtles which is of course very critical for making the age estimate and without that core being some semblance of integrity the estimates can't really be made, but the fact that the absorption of the bone material is taking place in apparently a greater degree in the tumored turtles, I don't believe has really been looked at. We have subjectively felt that was the case and is feeling the rigidity or lack thereof of the carapace on some of these animals as far as pursuing it in a more detailed manner we are starting to do that.

And also, last but not least very shortly we are going to get into some video imaging of all of our turtles, short clips of the ones with tumors to photo document by video the 3-dimensional aspects of these animals and then use it to clip it together for future references to exactly what is happening. We have this grading system, 0 through 4, sizes of the tumors, but its very difficult and sometimes the results aren't as good as you would like it to be. Counting warts as John Sunburger told me 2½ years ago, you ought to be out there counting warts, so we started counting a lot of warts and the still photography as all of you know is also inadequate because you can't get that 3-dimensional aspect and often times you take a picture of one part of a turtle, was it Barbara or Lou said you got to trust me there is on the other side and we feel that if we could rotate the animal and clip two minutes of video of it that might be insight into it.

Well, briefly moving ahead very quickly now just showing you some of the sites. We have sites in the Hawaiian Islands where our tumor situation is very severe and we have other sites in which we have no tumors at all. \_\_\_\_\_ Bay over here in the island of Ohawau is one of our most severe sites, southern coast of \_\_\_\_\_ that I'll say a few words about in a few minutes is also one of our worst sites, Hilo Bay, \_\_\_\_\_ Bay also bad. Waikiki that falls right in the middle here not very severe, very low percentage now may be 5-10% but if you go down here to the mouth of Pearl Harbor or you got out here toward KoKo Head, Maunalua Bay you have very severe rates. So, even short segments of coastline by our sampling methodology it would appear that there is great differences between the segments of coastline. Two areas, actually four areas now, \_\_\_\_\_ Bay, \_\_\_\_\_ coastline, the \_\_\_\_\_ Bay hotel area that we have been sampling extensively for a number of years,

we have in the neighborhood of 500 turtles tagged there. Personally seen and measured by me and many of them we captured numerous times over the past seven years. Not one tumor on any of them. Nothing. Zero. So, its very good to find places like that where that indeed is the case and we are doing everything we possibly can to keep it that way.

Just to show you \_\_\_\_\_ Bay where very high incidences occurs and where we went on the field trip from the 1990 workshop and also just to show you this one slide again of the youngest, John Nottin, who is now nearly as old as I am and he was the fellow in 1958 that was catching turtles and fish in \_\_\_\_\_ Bay, selling them on weekends to make a little extra money and low and behold they came across this single turtle that was loaded with tumors and that was the first time they had ever seen anything like that and this is the very earliest firmly documented record that I can find anywhere in the Hawaiian Islands of the turtle with tumors. That is not to say that have not been early records, but it certainly is the firmest place we plant it at and that is right there in \_\_\_\_\_ Bay.

We have 4 discrete study sites in \_\_\_\_\_ Bay where we sampled from. The percentage of tumors continues as I reported to you in 1990 ranges from approximately 47% on up to 90% depending on the individual areas that we sampled. The place we went on the field trip, you remember was right along this sandbar area, where we looked off the bow and punched in the water and grabbed a hold of turtles with our hands and brought them up for you to see. One being brought back to the boat and some of the folks that came out there the first time they had ever seen the turtle with the tumors, there was a great pleasure to Dr. Harshbarger come out there after corresponding and seeing him in DC on one



occasion and flooding him with all of these tumors and finally having him come out and actually see the animals that they had been clipped off of and seeing the expression on his face of my god made an impression on me John and then also Lou and I getting together in Florida Bay and also getting together in \_\_\_\_\_ Bay, our respective study sites to show each other to compare notes on with the actual live animals looking at them.

I felt that everyone would throw in a few pictures of turtles with worst case scenarios that sort of thing, I threw in the nice healthy beautiful Green turtle with its beautiful eye and then the devastation that can occur from this disease and at least some of the animals to this degree of severity and then massive degree, this is an adult female had previously been documented at the nesting grounds in 1985 with no tumors and recently stranded and attempts made to treat it by Dr. Morris and still quite vigorous. Many of these animals are very vigorous in spite of the extensive tumors even on their mouth, in their mouth on their eyes. When we are hand capturing them we always take extra precautions with the ones with tumors because if they are not severely emaciated, their bellies sunken in, they are more likely to have a very definite mean streak to them. They will try to snap at you, they will try and get away harder than other animals and its quite a dichotomy of view of thinking oh my gosh an animal like this must be pretty weakened when in fact it appears even to be to struggle and to fight harder to being restrained and captured. The exception of course is when you get this emaciation in the carapace and this is the worst case scenario with very sunken in limp and still nevertheless in our hospice quarters will hang on for many months until they expire or we graciously euthanize them and use them in some meaningful research project.

I wanted to throw this in because this is virtually the only case of regression I have personally witnessed in Hawaii. This turtle was originally tagged in 1981 with no tumors it was recovered in 1989 with tumors as you see here. And even though it does appear they are close to the tag but they are not originating from the tag incision. The tag site is commonly a place where the tumors occur and fortunately or unfortunately it also the place where our best tag retention is obtained, so this turtle here, in 1989 recaptured had these tumors and again if I had the video clip wouldn't that be nice, but you'll have to rest on my good word that in 1991 when we captured it about two years, two months later there was absolutely nothing. In fact, I had to really, we had three tags on nearly all of turtles I can assure you all three tag numbers matched up, it was definitely was the same turtle, but there was absolutely no sign of that tumor or another tumor on the other flipper. So, I now am a believer that regression can occur in at least some turtles.

We do inspect and I have encouraged everybody and I'm sure are getting into now of examining the mouth of every turtle. Here we use the Morris, Dr. Morris, vaginal speculum, which works very effectively for holding the mouth open safely and in this case in examining the mouth we found these clusters of \_\_\_\_\_ leeches which were not visible until we opened the mouth. In other cases we will find turtles with no external (excluding the mouth) tumors, and open the mouth and find lobes of nodules all around the glottis, the area of the glottis is a very seems to be a attractive place for these things to grow. And of course for other purposes of looking at the animals we frequently find little fish hooks and other things in there that really oughtn't to be, that need to be taken out.

A little data here to show you what has happened since I reported in December of 1990. This is foraging pasture site in the southcoast of \_\_\_\_\_. We now have tagged nearly 1100 turtles there in ten years, going on eleven years. We saw absolutely no turtles with tumors after handling 397 turtles and nearly everyone of those turtles were looked at by me personally. No tumors until October of 1985 a single turtle was seen with the tumors and quite severe. I often think that wondering rather than tagging the turtle and letting it go that may be I should have taken, taken it home with me and not let it go. The people on \_\_\_\_\_ have commented that to me once in a while. We caught another 82 turtles in June of 1987 and 1% of those had tumors and then the rest as enumerated here with goodly sample sizes, 5%, 10%, 17%. 26% was the data that I most reported on at the Honolulu meeting since that time another 86 turtles jumping up to 36%, another 121 turtles to 53% and then clumping two samplings that we made in July and just this past month 125 turtles 47% and whether this little down swing means we will start going down I'm not going to hold my breath on that one. The difference between 53 and 47 probably isn't all that statistically significant if it is at all. So, in increasing what we are seeing on \_\_\_\_\_ - \_\_\_\_\_ continuing concern, our stranding network - red = the total number stranded, orange = the number that were examined for tumors, in other words in some cases particularly on the outer islands we get a report of a stranded turtle, its too rotten to ship to us in Honolulu, the people don't want to touch it or they don't have the means to get it to an airport where we can then pay the freight to get to Honolulu, so we are really not certain whether it had tumors or not so we break it down to the orange bar of the total, how many were really examined for tumors, and of that the Green here = the number with tumors and the percentage is listed across here. You can see that the number of strandings have gone

up as has the number examined with the number with tumors but the percentages have stayed right around the magical 50% mark and the significance of that, well, it would be very nice if they had started declining in the last couple of years since we had that meeting, but these data indicate that for strandings they have not and this is only Green turtle strandings, we almost never get any other species in our stranding work at work except Green turtles.

Quickly here just to show you some of our strandings although not many have occurred in very focused places that draw the attention of people that develop concern even if they don't care about turtles, turtle stranding dead covered with tumors with Diamond Head in the background in Waikiki Beach are not the sort of thing that people in Hawaii nor the visitors industry, nor the visitors themselves want to be running into. So the concern goes well beyond anybody that has a concern for sea turtles per se.

A few words about our nesting grounds. We have had saturation tagging and the principal nesting site at French \_\_\_\_\_ Shoals that is east island. French \_\_\_\_\_ Shoals being about 800 miles from the big island of Hawaii and about 500 miles from Honolulu and about the mid point of the entire span of the 1450 mile long Hawaiian chain. We have had saturation tagging at French \_\_\_\_\_ for the past 5 years now. Every turtle that has crawled up on east island from late April until the middle of September has been catalogued in and looked for for tumors and I must say that in 1988 when that started perhaps the looking was not quite as intense as it was in 1990-1991-1992.

About 4½ \_\_\_\_\_ nice place to live. This is our sensing of nesting females, not nests, but nesting females, numbers of females since 1973 when I started working out there, and happy to report that 1992 was the best year ever by far for numbers of individual females crawling up on east island. 387 of them and I think the turtles try to make sea turtle biologists get stressed out from one year to another, worrying. Last year with 103 and a dropping down two years in a row, we thought "oh my gosh what is happening here", and then the report started coming in on my short-wave radio from the people working up there that it was going to be a better year with some nights as many as 50 and 60 turtles out on a night. Many of them false crawling as you all know. So, how many of those 387 had tumors? Seven percent of them had tumors, but that doesn't tell the whole story. Actually 27 of the 387 had tumors, but only 4 of those had tumors that even could be considered to be in the moderate category, that is my category 2 or thereabouts. The other 23 of them were very very lightly tumored in other words a wart here and a wart there. I should also point out that we do not get a ventral view of our turtles because we do not turn them over and probably most of you don't either. So, we are only talking about primarily dorsal surfaces, but much of the skin is visible if you go over the animal when it's in its supine position. So, comparing that with past years I reported in the Honolulu meeting that we had hoovered around 10% or some. 10% of all the turtles in the past. It's gone from 8 to 12% each year, so there has been no great change that I can detect in what we are showing here of the 7%.

One of the things that we wanted to do that was part of the work that I was delighted to do this past year was to do a little satellite telemetry using Telonics ST3 satellite backpack transmitters and we had several objectives in mind. One of our objectives was to compare

the migratory abilities and pathways of a turtle with tumors with one with no tumors. In radiocommunication with the people up there that we pinpointed several animals that would be good candidates. We also pinpointed animals that had a tagging history from the foraging pastures from years earlier of where we had tagged it with flipper tags. So we chartered our airplane to hit a window when we felt we would be able to encounter the turtles that we were actually looking for. And that is one that had more tumors than others. This one of them, this is our U236, you see a reasonably good sized tumor here on the eye and another 11 or 12 tumors of various sizes on the front flippers. The eye was not encroached upon all that much but given the turtles with tumors that were there for the year and the turtle that we were able to find we were delighted to be able to telemetry this animal here because we could have done a lot worse as far as more lightly tumored animals. We wanted to have a turtle had as extensive as tumors as possible and then our healthy turtle was U60. So just briefly the overview results of that, the experiment worked beautifully as far as the electronics and the satellite picking up of it goes. The turtles both amazingly traveled to their home pasture of \_\_\_\_\_ Bay, where we took you folks. The yellow track is the tumored turtle. It took 26 days to get there, averaging about 1 kilometer per hour on the whole trip. It traveled about 130 kilometers farther than the red U260 healthy turtle. Its track was a bit more zig-zagged. NOT all that much more zig-zagged though. Obviously more on these lines needs to be done but what does it show. It shows that a moderately tumored turtle at least was able to as efficiently find its way back to its home foraging pasture as the U260 was, the completely healthy turtle. But again we don't see turtles with heavy tumors at the nesting grounds. My working hypothesis on this is that if the turtle is in a stage 3 or 4 with tumors its simply doesn't have the energy, the

body fats, the ability whatever those navigational abilities are, to get to French \_\_\_\_\_ Shoals in the first place.

And another brief study, well it wasn't brief it was over a 13 month period. We did some sonic telemetry looking depth profiles in \_\_\_\_\_ Bay. We telemetered a total of 12 turtles with these little vimco depth sensitive transmitters. We picked turtles with devastated with tumors, not totally devastated, we didn't pick any that were massively emaciated, but as you can see, considerable eye involvement, considerable jaw involvement, and compared that with healthy turtles and I read you just briefly, we have a paper ready for submission to the Canadian Journal of Zoology on this work, but I read here just briefly from the abstract that "for both tumored and normal turtles the majority that is 80% of the submergent intervals with 30 minutes or less indicating that Green turtles normally maintain aerobic metabolism while submerged." No submergent intervals is longer than 66 minutes, we observed. Submergent intervals were shorter at night than during daytime in tumored but not normal turtles. Tumored turtles tended to have longer night-time submergent intervals than did normal turtles which may indicate that the former are somewhat less active than the latter. Although the differences were small, the differences were not statistically significant either." So a bit surprising that a turtle with this degree of tumor involvement we could not prove through this 13 month study that it was behaving significantly different than were the turtles that were perfectly clean. So, as with all of these studies you do one and then you open up these questions that we all know lead to the next one.

Last slide, here we are releasing one of the turtle with the satellite transmitter. I showed this at the first meeting, I toss it up again in the end rather than the beginning so we can remind ourselves, or at least I can tell you what the concerns are in the Hawaiian Islands and I list these here for people such as myself working for the agency that is responsible for these animals. The welfare of threatened and endangered species is of course our first concern of this disease. Other people in the Hawaiian Islands are very concerned about the possible toxic pollutants in the marine environment. They see these turtles on the beach, they see these turtles in the water and they want to know if whatever is affecting these animals would be affecting the greater part of the ecosystem for example, the fish they eat, the crabs they catch, the children swimming in the water, if it's affecting those turtles then by their common sense logic could they then be affected by swimming and working and being in this same marine environment. Their concern may not necessarily have anything to do for the turtles, just concern for themselves and the environment that they live. And then thirdly, the esthetic of marine tourism and photography as demonstrated by the tumored turtle on Waikiki Beach and photography has turned into quite a tourist interest of photographing and swimming with turtles, much like people come to Hawaii to view the humpbacked whales. We do definitely have a set of people that derive great pleasure from being in Hawaii, seeing turtles while they are scuba diving or seeing turtles while they are standing on the beach. Seeing their heads pop up, off shore and then those that also want to take beautiful pictures of turtles and fish and their pictures don't turn out too beautiful when they got these fist sized things hanging out of their eyes. And then the last item which turned out to be quite a little flurry of activity in the Hawaiian Islands relates to the potential human health hazards, not from the environment, but from the carcass itself, which



sometimes washes up in somebody's front yard on a beach front home and is even gone over to the fact of our state authorities refusing to handle the turtles at least in one division of our state government, refusing to handle any turtle that had tumors for fear that their workers themselves might catch something from it and in several cases they selectively pulled out of the tumor workshop report places where herpes virus was mentioned, of course this developed all sorts of emotional concerns and we have now pretty much taken over all aspects of the turtle stranding and salvage network in Hawaii. Even to the point of contracting University of Hawaii students through a marine study program there to handle strandings that occurred on weekends, holidays, and when my people aren't working simply because the state workers will not go down and pick them up for fear of law suits and whatever if they develop some disease from these tumors.

QUESTION/COMMENT:           Have you put any radios on severely affected turtles in your studies.

A couple of them that we telemetered were pretty severely affected, the thing is we wanted to telemetry turtles that were still functioning in the wild and just about any week of the month I can find a turtle that has been lodged against the shoreline that is still alive, the fact that it hit the beach and it won't go back in sort of ruled it out as being a suitable candidate to put a satellite, we may be just following the drift as it goes around, so we limited it to turtles that was still functioning in the wild, but I will tell you that several of the turtles, two of the turtles at least, were pretty sunken in and pretty extensively covered with tumors. Yet when you compare it with the whole 12 animals the six with tumors and

the six without it didn't show up all that different mainly because the normal turtles often did many of the lethargic behavior of laying down in the channels possibly long periods of rest between their feeding bouts. I don't think any of us still know how often a Green turtle feeds, we know what they eat, Colin Limpus and Greg Forbes have quantified and partitioned and told us all sorts of things about the diets as we have done a bit of the same in Hawaii but not quite as detailed, but how often does that animal feed? I don't think we know that and if I missed somewhere in the literature or at a conference please come tell me. It may feed only once every 4 or 5 days and the rest of the time sit around digesting that large body of \_\_\_\_\_ like material that's in it.

#### QUESTION/COMMENT:

The reason is that most things that are on the carapace, the shell is continually sloughing at the cellular level. The fact that the satellite transmitters were put on in a, with a fiberglass cloth, they'll probably fall off by themselves in about one year mark. We have comparable ones in sea life park in captivity. They are tagged through the flesh because that seems to be the only way that they will hold a tag and then it's not near as good as would like it to be. In the last couple of months we have gotten into pit tagging our animals. Passive inductive transponder, it that the correct three words that do for pit. Integrated transponder. This is an implanted tag in the flipper to get around the tag shedding problem that still we know does occur although it is not anywhere as bad as used to be. We need to talk about that round table discussion if you feel the tag is playing some role. I've question that. I've question just about everything that I'm doing to see if I've seen

the enemy and it was us researchers and I don't see how it can be when we fight continually find animals that have never been touched by us and they are devastated when the fibropapillomas. But certainly we will have to more discussion about that this afternoon.

#### QUESTION/COMMENT:

What are we talking about the \_\_\_\_\_ site. Oh, no I was there. I did it. No, no, absolutely not. Every turtle looked over. What I did not do in those earlier was look in the mouth. I was not looking in the mouth starting in 1982. I didn't start looking in the mouth till Bob walked into my office one day and said have you ever use one of these. We were looking in the mouth but you can't get the mouth open on all of them and a lot of times you get a nice bruise on your finger if your not real quick about it. No, that's real, if any of the sites that I'm working on real that is the one because of the large numbers of samplings, large sized sampling, along that same four kilometer long coastal area that we are working in, and also I should point out that the fisherman, the method of, you remember the fisherman that I contract has a large bull pen that his grandpa brought from the Philippines, is actually a \_\_\_\_\_ that is set in huge circle and the turtles get in there and swim in circles, they can't get out. They are not gild or tangled or anything. He grandpa brought that method from the Philippines in the 1930's I believe for one specific purpose along \_\_\_\_\_, and that was to catch, and eat and sell turtles. And his grandpa who I did talk to before he passed away several years ago and his grandson, Ed, who now does the fishing method, fishing turtles for research with me and then also fishing to sell fish and trade with family members. This is all new to them. Ed when he was a young boy, 12 or 13 years old,

would go out with his grandpa and they would catch turtles and eat them over there and people as you well know if people that eat turtle see something as grotesque as that on it or even a smaller size of it, I just find it very difficult to believe they could ever overlook something like that.

That's down in Florida too because the old literature in Florida talks about the Green turtles fisheries but doesn't say ....

In the Keys we know something at least back to the 20's but for the Indian River Lagoon we've got some old accounts of the fisheries there before the turn of the century, there is not a word in there about warts or box warts, or tumors or anything like that. Its hard to believe that people who were in the business and I guess most places in the world Green turtles are sold alive in the market and.... distract from the market value.

Its hard to believe there wouldn't have been something in that old literature, some 50% of the population right now...

I started sending samples to John about 1976 I believe somewhere in there, I may be off a year or two, and it was about in that time frame that I started getting calls from people. It was very legal to eat turtles back during those years and started calling me up asking me if the turtle was fit to eat even though it had this growth on it. And my answer was something to the effect "well, I certainly wouldn't eat it." Perhaps trying to be a little biased in my conservation efforts back then to discourage the use of it. But several of the people I distinctly remember that called said well what they were going to do was to lop off that

section of the appendage or whatever and they certainly wouldn't eat any tissue that was associated with the tumor but the rest of it they were going ahead and eat.

#### QUESTION/COMMENT:

Maybe Dr. Daily can say a few words about that and in one of the first studies we did collaborative with Murray was to look at little mollusks that occurred on algae in Hawaii looking for intermediate hosts of parasites in blood spored parasites, and one algae that we focused on in the beginning unfortunately we didn't find many mollusks on it was the \_\_\_\_\_ which came to Hawaii in 1974 in a farming experiment in \_\_\_\_\_ Bay and they put the algae on the top of a coral head and put some wire on it, and that darn algae escaped, it got out of its wire and it is now ubiquitous in the Hawaiian islands, it is all over and in some places it is creating a nuisance because it has little hooks on it, it tangles with other seaweeds, it grows primarily in shallow, calm water but when you get some storm waves it all rips up from the bottom and all rolls up on the beach and everything. Certainly the fibropapillomas were there before 1974, but Murray and I, Murray had some ideas that there is the potential for the algae to create, to cause intermediate hosts to flourish and that yes may be the tumor incidence prevalence, but that something that was introduced into the ecosystem or change in the ecosystem caused some factor that stimulate the tumor production to forage ahead and thereby see the great increase in incidences we are seeing in recent years. So that that tie between Florida and Hawaii is there, the other tie that I worked, I looked long and hard on was looking for a tie between Florida turtles coming to Hawaii. We had a very colorful gentleman who was the director

for the Waikiki Aquarium for many many years and he still alive today. He is in his early 80's and just sharp as a bell and I have talked to him at length on a number of occasions and he pretty much had the control over what turtles were going in and out. He knew the situation because it was the Waikiki Aquarium was virtually the only one there, Sea Life Park came decades and decades later. And the bottom line of the what the results of the various people that I contact here in Florida and Mr. Tinker and that, is that no turtles from Florida ever came to Hawaii, no Green turtles that is. We know of two cases of little Loggerheads that did in the late 60's, but no Green turtles ever came from Florida water or this part of the world to Hawaii, but a number of turtles from Hawaii did go to various aquaria on the eastcoast, mainly because back in the 1940's we had an abundance of juvenile turtles in the waters and certainly when Mr. Tinker's friends at various aquarium needed a turtle, here it was, he shipped off and off it went to. Some of those turtles actually went to the Vancouver Aquarium and three stayed there for 27 years and we had a welcoming home party for them. They were going to send them from Vancouver to Toronto and we convinced that they really ought to come back to Hawaii and they are now in Sea Life Park, no tumors on them and very healthy animals. So, we tried to run down a exchange of turtles, it seems to have been no such exchange happening - Florida to Hawaii.

#### QUESTION/COMMENT:

You need to go back and read Smith and Coats \_\_\_\_\_ and \_\_\_\_\_.

QUESTION/COMMENT:

The other thing is, George, since it started in Florida about the same time you started in Hawaii, increasing incidence as well as...

I think you need to look at something bigger and broader, than something that has moved from one place.

The increasing incidence started. Yes. I'm just trying to run down everything so that it can be eliminated because these are criticisms that come up. I should also point out that although perhaps as many as a dozen turtles, Green turtles, were brought from Hawaii to various places in the mainland United States, there is absolute no indication whatsoever that any of those turtles were ever released. There were taken to aquariums and some of them may have been released, but there is no evidence that was indeed was the case. In fact if somebody was so hungry to get a turtle from Hawaii to display in their aquarium it seems like that they would want to keep it in perpetuity or at least until it passed away. You recall in December of 1990 we sat around and talked and one of the informal discussion, but the press picked up in Honolulu, we had commented on the ozone depletion and I believe I had said that my wife over dinner the previous night had said well what about ozone, the buffers are now gone in Hawaii, may be this... I kind of tossed it out and made a joke about. Somewhere along the line the press picked that up and I had two prominent oceanographers from the University of Hawaii stop me as I was walking across campus and just berate the heck out of me for ever suggesting such a nonsense theory and I told them I was not suggesting it, we were just putting it out for discussion, but is there a better theory

yet. Now that I hear herpes virus may not be the \_\_\_\_\_. What do we have left? Where are we going?