INTERNATIONAL SYMPOSIUM ON **SEA TURTLES** '88

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Regarding the Publication of the International Sea Turtle Conference Minutes

The minutes of the International Sea Turtle Conference held from July 30, 1988, to August 3, 1988, in Hiwasa-cho, Tokushima Prefecture, and in Himeji City were completed.

At the conference, the preservation of sea turtles was discussed in Hiwasa-cho with the Sea Turtle Museum playing a central role in the discussions. Activities of the Municipal Aquarium served as the core of discussions in Himeji, which focused on the uses and conservation of sea turtles, with talks mainly centered on the hawksbill turtle.

The conference was characterized by attendance and active discussions by researchers, government officials, representatives of the Bekko industry, natural preservation organizations, and the general public. This is the first time that such a conference focussing on sea turtles has been held anywhere in the world. Therefore, it was necessary that the minutes should be published.

We feel great joy at the publication of these minutes, and would like to express our deepest appreciation to all those who have helped in preparing for the conference, its implementation.

Thank you

Conference Representative

Itaru Uchida

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THE MARINE TURTLES IN JAPAN

1988 REVIEW

by

ITARU UCHIDA

JULY 30 - AUGUST 3, 1988

[Keynote Speech]

"Present Situation of Sea Turtles in Japan and in the World"

Dr. Itaru UCHIDA

Thank you. Good morning, ladies and gentlemen. I have been designated to make the keynote speech. So, actually, about the present situation of the sea turtles in Japan and in the world, but when it comes to "in the world", we have top-notch experts coming here from many different parts of the world, and they are most qualified to talk on that subject. So, mainly I should like to focus my presentation on the Japanese situations.

But for many years, I spent many years in Indonesia for making survey with Mr. Nuitja since 1973. So, I am aware of the situation down there to some extent. So, I should like to mention one or two points about the overseas situations. And this will be just about the extent of my presentation about the world.

But when it comes to the Japanese situation, I am sure that our overseas visitors are very interested. And in our case, we have a language barrier, quite a formidable barrier, and it's very difficult for all of our information to get to overseas. So, I want to take this opportunity to spend some time in explaining about the situation in Japan. And I think that is one of the important purposes of this symposium. So, mainly I should like to focus my presentation on the Japanese situation. I understand that my time is up until 10:30, so I will try to be on time.

First of all, the connection between Japanese and sea turtles goes back to many many years ago in date, as you know, and it's published in the foreign publications. We have the story of "Urashima Taro", and the picture when you look at the "Urashima Taro", he looks very modern; doesn't quite look like a Japanese. This was found by Mr. George Barazs, and was sent to me. And it's one of my treasures in my house. And I explained this to Professor Bjorndal. And so, the "Urashima Taro" as published in the United States, I am sure that many of you know. So, this slide shows you that it was back many many years ago; this connection between the sea turtles and the Japanese people.

And if we try to explore this, it goes back to over B.C. 3000 to B.C. 1000; in the so-called "Jyomon Era" in the Japanese history. And this is the origin of the Japanese people. And when those people first arrived on the Japanese Archipelago, they had the shell mounds. In other words, after they eat the meat of the seashell, and they make a mound of it. And as you examine this, you find the skeletons of deer and all many different animals. And in those days, already, the sea turtle, the carapace and its skeleton are found in the midst of the seashells. So, this shows you that our connection between the Japanese and the sea turtles goes back many many years ago.

There is the Omori Shell Mound just outside of Tokyo, and at that time, in the early Meiji era, many hired foreign professors came to Japan, and those people really made a contribution to the dawn of the Japanese civilization. There was a Professor Morse, and he studied this Omori Shell Mound. And in the report written by Morse, he does point that there are rib bones of the big sea turtles found there.

So, from this we can see that the history goes back many many years. And perhaps in those days, they were utilizing they were thinking of the sea turtles as a source of food; eating.

And as we look into more detail, in the warmer part of Japan, like Okinawa, for example, on the Pacific sea coast, in the warm region, from the shell mounds in those areas, we find a lot of remains and skeletons of the sea turtles.

So, in those ancient times, our old Japanese people were using, and they knew that the sea turtle could be used as; and also, they may have been eating eggs. About the eggs, some of them are not remaining in a fossilized form; so we do not have a direct evidence. But in the history of Japan, when many things came to be recorded, like in Nara and Heian Periods, A.D. 1000, for example; 700 or 1000, the connection with the sea turtle gradually changed.

In other words, it became a sort of literature; the sea turtles began to appear in the works of literature, like "Urashima Taro", for example, is a good example. So, it's an interaction between animals and living things. In other words, if people looks after animals while in this world, and then, after he dies and goes into the Heaven, that kindness will be repaid by those animals. This seems to have been the basic concept.

So, if you do something good to the animal while you are alive, they usually repay you for such a kindness after you go to the heaven. And this is just my personal speculation, but in those days, in the local areas, particularly in the southern islands, like Okinawa or Nansei Islands, sea turtles were quite extensively used. But in Kyoto, or the then metropolitan areas, in their diet, in their cuisine, we do not have any evidence indicating that the sea turtles were eaten by those people. So, maybe they were localized in those islands.

But about three hundred years ago, in the era of the Genroku in the Japanese history, Japan went into the complete isolation from the rest of the world for many years. In other words, there was no contact; none whatsoever, with the outside world. But Nagasaki was the only exception. This was the only window, so to speak, from Japan to the outside world. And from there, gradually, the technique of the carapace carapace processing technique came into Japan.

And so, this brought our connection to different plateaus. In other words, the hawksbill is the turtle in question. And in that sense, the hawksbill became very important in connection with artifacts.

As you know, the hawksbill turtles are not found in Japan; almost nonexistent. Not as industry. So, all the hawksbill; Japanese location is too far in the north, and the hawksbill usually does not habitate(habit) in those areas. So, Japan had to import; had to depend on overseas source for the hawksbill materials. So, therefore, by trade Japan imported the materials.

While on the other hand, in that situation, in the Japanese Archipelago, in the southern extreme, like Ogasawara Islands or the Bonin Islands, we have the historical record to indicate that many great numbers of the green turtles in 1670. In those days, it's reported, some mariners, who were sea-wrecked in the Bonin Islands in 1670, were reporting that they had been able to survive by eating the meat of the green turtles. And after they came back to Japan, they made a full report to the Edo Government. And they are stating quite clearly that they saw an enormous number of the green turtles. So, it is stated in our history.

So, quite coincidentally, in 1670, those people were from Kaifu; they were from those areas. So, in other words, it's not very far from this place. But the fishermen, who were originally from here, were ship wrecked in the Bonin Islands. That was in 1670, just as I said now. And there they saw a great number of the green turtles. And by eating green turtles, they were able to survive, and eventually they were able to come back to Japan to join their family.

And after that, in 1830, mainly from the United States, whaling ships; they often came to Japan for the supply of water, and often in those days, their whaling operation was quite active to obtain the fat and oil. And those whaling boats often used to come to the Bonin Islands Ogasawara Islands.

And they are also reporting sighting of a great number, of the great colony of the green turtles. And they captured those, and their objective was to get the turtle oil; green turtle oil, it is called.

And so, that trend has perpetuated in that Island. And already in those times in the Bonin Islands, the Japanese people who were living in the Bonin Islands in those days knew that the green turtles could be economically exploited.

In other words, this was taught to them by the crews of the whaling fleet.

And therefore, in the Bonin Islands, a new relation emerged between the marine resources of green turtles and the people. So, whenever they come for the breeding purpose, they usually captured those female turtles; in order to capture them and in order to kill them, they even went to the offshore, out into the ocean. And they were catching the green turtles in those days; not just on the beaches.

And at that time, the Edo Government, in 1861, they sent a special envoy to those islands from the central government, and eventually, they sent a special mission to see what was happening in those island.

And then, there was a "samurai" of the Chikugo Mizuno, a special envoy from the Edo Government, and he reported sighting a great colony of the green turtles in the Bay Futami of the Bonin Islands. So, I should like to tell you something about it.

At the egg laying areas, there were so many of them that you could hardly walk on the beach. You looked around, and it was all green turtles, wherever you can see. So, you could hardly see any sand, because the beach was completely full of turtles, according to this samurai mission.

So, that's a part of the history. And since then, the population of the Bonin Islands has been increasing. But in the inverse proportion to the increase of the human population, the number of the sea turtles has decreased, almost in a direct inverse proportion.

And this phenomenon, it was in 1921, was intensively studied by the officials of the Department of Fisheries of the Tokyo Metropolitan Government. There was a gentleman by the name of Mr. Kanzaki. And we think that he is the greatest pioneer; particularly in the Bonin Islands, he did a very systematic, a very good study. And in 1921, this gentleman was sent out to the Bonin Islands for on-the-spot investigation at the request of the Tokyo Metropolitan Government.

And according to the investigation he made at that time, in 1880, in the Ogasawara Bonin Islands, 1,852 green turtles were killed captured and killed. But then, there has been a gradual decline, and in some year, it has dropped down to only 61 sea turtles green turtles. So, he is giving a very vivid explanation of the declining status.

And at the end of the report; at the beginning of the report, Mr. Kanzaki says: "Well, there is no one who does not regret deeply regret this declining of this great marine resources." And Mr. Kanzaki, in those days, is giving us a full account of what happened. And he did very interesting surveys and studies.

In the Bonin Islands, he checked the total catch of the green turtles year after year. And he came out with a finding that the return migration of the mature sea turtles as thirteen years, he says. In other words, according to the study he made, after thirteen years "1-3" years, the same turtle comes back, in his study. And he made such a finding as long as almost seventy years ago.

Just as I said to you earlier, there is a connection between the sea turtles and people. Well, exactly sixty-seven years ago, Mr. Kanzaki already gave a warning at that time. And the kind of thing, what we are discussing today, was already predicted almost one hundred percent by Mr. Kanzaki 67 years ago.

And Mr. Kanzaki's point was with the increase of the population of the people in the Bonin Islands,

the number of the capture increased, and in the inverse proportion, the sea turtles are decreased. And this point was made quite clear by Mr. Kanzaki so many years ago.

So, this is from the Meiji and the Taisho Eras. This is how the situation was between the Japanese people and the sea turtles. I just gave you one example.

So, how is the present situation in Japan? Well, that's something that I should talk about now. As many of you already know, in Japan, at the present moment, loggerhead and green turtle and hawksbill and Pacific Ridley and leatherback; those are five turtles being sighted, and they have actually migrated into the Japanese territories. And out of these, loggerhead and green turtle and hawsbill; they come to lay eggs in Japan. It is known as a fact.

So, of those three, in the north-eastern part of the Pacific area, that's where Japan is located, and what kind of role Japan is playing?

For the loggerhead, our role is very important, because Japan is a very important breeding ground. I think that the part we are playing in the loggerhead is very very important. As you know, Japan, even though small in size, but it stretches out covering lots of distance, but up to the north latitude 37, on the Pacific Coast side, and also on the Sea of Japan side, the breeding and egg-laying is seen. So, from Okinawa, up to the 37th north latitude, those sea turtles loggerheads come for egg-laying. And I am sure that many years ago, this kind of egg-laying could be sighted in many different parts.

And as for the green turtle, Japan is somewhat located too much to the north for the green turtle to be interested in laying eggs. So, with the exception of the Bonin Islands, Japan is not that important as far as the breeding purpose is concerned. The northern limit is, as I reported before, in the southern Kyushu; Yakushima seems to be the northern limit for the green turtle.

And the Bonin Islands is somewhat a little bit more to the north. So, Yakushima, as part of Japan, is considered is the northern limit for the egg-laying of the green turtle.

So, whenever the condition is right, they come to lay eggs. But the important nesting site for the green turtle is usually much more in the south, like Indonesia, or the Philippines and Malaysia. They are much more important for the green turtle. So, the role that Japan is playing for the green turtle breeding is not that important as those countries I just mentioned.

And as for the hawksbill, it is even more true. As you know, the hawksbill is tropical, and they are very closely related to the coral reef. So, the area where the coral reef is very well developed, you can see that. But in Japan, just Okinawa and Amami Islands are just about the only area that I can think of, where there is any substantial formation of the coral reef. So, not much activities in hawksbill.

So, the Japanese Archipelago is not very important as far as the breeding of the hawksbill is concerned, compared with the other countries which are located in a more tropical or subtropical zones.

So, the kind of conservation or protection that we are doing in Japan at the moment; and I am sure that this is closely related with the world problem, and must be a matter of the common concern to all of us. So, how Japan has been doing up to the present time, and what kind of action we have been taking for conservation and preservation?

On the national central government level, well, first of all, we designate the sea turtles as the national treasure, or national monument. But when you say the national monument, there are two different ways of designation.

One is to designate the species itself. And we call that. And the other is the regional designation. We call a certain area as the national monument. And right now in Japan, for the sea turtles, on a governmental level, it is a regional designation. We say that a certain area is a national monument.

So, this applies for the loggerheads. So, whichever loggerhead comes there is protected. So, it is not a species designation.So, the sea turtle, as long as it is there, is protected on that designated area. And then, they don't have to worry. They are safe as a national monument.

But once they leave that area, and then, they don't have protection. Well, they may be captured, and they may be killed. Well, their eggs may be stolen.

So, that's the kind of situation we have in Japan. So, that protection is just a spot protection. So, right now, in Japan, there are only two such areas protected.

This Hiwasa-cho, here, Ohama Beach, is one of them. So, in Ohama Beach, the loggerhead turtles which land for egg-laying are protected. And then, there is Omae-zaki, in Shizuoka Prefecture. So, in that region, loggerheads which come to that beach are protected. So, in other words, it's just a spot, only as a point, it's protected.

And then, if we expand the level now; how about at prefectural level now? And what kind of protection is being provided on a prefectural basis?

There is a Fishery Regulation Act. So, several prefectures are protecting loggerheads on that basis. And other governments or other countries are doing the same thing. For instance, the Prefecture of Tokushima, where we are now, they have the Fishery Regulation Act. And they have many detailed enforcement in loggerheads; from such day to such day no eggs can be captured, for example.

So, in Tokushima Prefecture, whenever we do our investigation, we must get a special permit from

the Governor. Without that, we cannot even touch the sea turtle.

In Hiwasa, for example, if we want to do some study, we must also get the license from the national government. So, Tokushima is very well protected as far as the loggerhead is concerned; a double protection. And Tokushima, Okinawa Prefecture, and also Tokyo Metropolitan Government; they are, on the prefectural government level, are enforcing the regulations.

But again; well, when the sea turtles go to our neighbouring prefecture, Kochi Prefecture, right now in the Kochi Prefecture, they don't have any regulations. The other day, Kochi is not very far from here the Prefectural border is not very far from; then, there is a town called Kannoura, it's a fishing village; and in the fish market there, you could see the green turtles; their flippers, and they are being disassembled and being sold. And I was very sad to see them being sold in the fish market.

So, the loggerheads, as long as they are in this prefecture, they are quite safe, but once they get out; once they get out and go and wander into the Kochi Prefecture, they don't have any more protections. And such a danger exists, and indeed, they are facing such a danger all the time.

And sea turtles, of course, don't know where the prefectural boundaries are. However spot they may be, they are not that much knowledgeable about the Japanese geography.

And furthermore, and as many people have been saying, that we should do more protection. So, now the cities or the towns or even the villages, are beginning to make or enforce those regulations.

So, that protection, as far as the region is concerned, is much smaller, because it's a village or a town we are talking about here. And they are designated as a sort of cultural asset. And some towns and some villages are doing that. But even then, it is a spot protection.

And for the other sea turtles, Japan is a signatory nation to the CITES. And within the context of the CITES, when we export, a very tight restriction is enforced under that treaty.

And another very important point is, right now in the protection that we are providing for the sea turtles, there are cases which do not fit into this. In other words, out of the instincts, when the eggs are being stolen, or sometimes the turtles are being captured or killed, and often there is special vehicle used for running all over the beaches, and these are deteriorating the climatic conditions. So, out of the human instinct, something must be done about this. So, there are sort of voluntary organizations, where there are several beaches where people are organizing.

I think a presentation will be made tomorrow: Hamamatsu of Shizuoka Prefecture is a good example. It's done by the people, out of the instinct, out of the desire, to do something about that.

But as we look at the current situation, those amateurs are organizing those volunteer organizations, because they have such affection and feeling for the sea turtles and for the egg protection. So, those activities are springing up. And usually, it is the starting point, and they wake up many people in the government, and usually it triggers more formal type of the protection.

So, Japan is quite long, south to north, and as the loggerhead breeding purpose, Japan plays occupies a very important role.

And when they are no longer able to breed in Japan, this would mean a danger situation for the loggerhead, and if we make a mistake in Japan, this could signal a very bad fortune for the future of the loggerheads. So, we have a very important international responsibility.

So, just protecting those on the spot basis is not good enough for Japan. We must try to cover the whole areas; the entire areas. There should not be loopholes.

So, as we look at the present situation of the loggerhead, they should be enhanced to the higher level as the object of the protection. Otherwise, there is no perfect protection for the loggerhead.

Another important point is people's intervention in the loggerhead, or people's involvement in the loggerhead who comes to Japan to lay eggs. And this is the involvement from the tourism. In Hiwasa, for example, the interaction between the loggerhead and people is quite interesting. Many enforcements and many restrictions unique restrictions are being enforced. And I am sure that the full explanation on this will be given tomorrow. And I hope that this will trigger many exciting discussions among all of you.

And there are some people who are critical about taking such a stance on the loggerhead, and some people might say that that kind of trend should be encouraged. So, I am sure that many people have different philosophy and difference in viewpoint on this, which we will find out tomorrow.

And also, recently in Japan, there is a greater interest in the stealing of the eggs; well, because they think it is a wonderful natural food. But with the kind of the protection measures that we have now, it is very difficult to protect the egg stealing. So, it's becoming a very important problem in Japan.

And another thing is connection with the fishery; fishing activities. For example, in the set nets, often there is an accidental catch of the sea turtles in the fishing net. And then, well, of course, the fishermen; they do not like those accidental catch, because this is not what they are aiming for originally when they go out for the fishing activities. So, this is causing a problem; not only for the sea turtles, but to them.

And also, another thing is that Japan is a great user of the hawksbill carapace. And, also the problems of leather. This applies to the Pacific Ridley, for using the leather, and also, for getting the oil. So, there are many of those commercial interests being shown, and other objects for processing, for the commercial purposes.

And also, tomorrow, I will come back again to the Symposium to make my own presentation. And then, at that time, I am going to talk about the new, unique phenomenon in Japan. You see, in that case, they made artificial barrier offshore to the normal breeding ground. And I am going to show you what kind of effect that this has created for the breeding activity by the loggerheads.

And also, there is destructions of beaches by people for many different purposes. So, in other words, the beaches are located between the ocean and the houses. So, that beach happens to be a very easy area to utilize for the people. Without spending too much money, it can be very easily utilized. For the Japanese people, for the people to live in the ocean, it's a very difficult thing and very economical. But the beaches are very easy to use commercially.

And so, those are developers commercial developers usually have the eyesight; their sights set on the beaches. But then, the beaches, as you know, are very very important for the sea turtles.

So, this is just to give you some most of the problems that we are faced with in Japan.

And about the world problem, as I said before, we have the top-notch experts from different parts of the countries. But in my case, from 1973 I was in Indonesia. And there are two things which came to my attention; to my serious attention, while I was there.

And one of them is whenever we talk about the sea turtle, particularly, the meat is often used extensively in many different parts of the world. And one of the reasons given is that it is a very good source of the protein intake. And so, the people often eat the sea turtles; green turtles, particularly. And they say; the justification they often give is: this is important as a protein source. And you hear this in many places you go.

So, I tried to make some survey. The green turtle is most consumed in the Bali Islands. And I tried to see how many percentage of their protein intake is occupied by the green turtles. I wish I had a slide to show you, because there are some figures involved here. But in the Bali Islands, they are eating they are consuming so many tons of the green turtles, but as a protein intake, how important is it as a source of the protein intake? And this was the objective of my study. Do they really have to eat green turtles as a protein source was a matter of my great concern.

And so, among all the marine resources capture, of the total catch amounts, I studied a little bit: From 1978 to 1980, and I studied a total amount. In 1974, they ate 4,680 tons, and this includes the seaweed. And in 1975, 6,256, and in 1976, 10,000 tons. And this went up to 15,562 in 1977. And in 1978, 16,730. And in 1980, it went up to 20,473 tons, of the marine resources. The total take by the inhabitants.

And out of this, how many green turtles have they eaten? They have eaten 318 tons. And the total resources were 16,730 ton. So, from this, you can see that the percentage is only 1.9 percent. So, only 1.9 percent was the green turtle meat that they were eating. So, the percentage-wise, it is very difficult to say that the green turtle meat is important as a protein source. It's only a 1.9 percent. So, I began to have a doubt about this.

And in 1979, out of the total, 22,910 tons of the total marine catch, 62.8 tons of the green turtle meat was consummated(consumed). So, it is only a 0.27 percent of the total catch.

So, from this, can we really say that the green turtle is still important as a source of the protein intake. For instance, again, to give you the figure for the 1980, for the Bali total Islands, marine intake was 24,473 tons. And out of this green turtle meat came to only 209.1 tons. So, in percentage, it's only 1.02 percent.

So, from these figures, I think we can say that the importance of the green turtle meat is over-estimated. And I have a very serious doubt on this. And also, at the same time, in many different parts of the world, the tendency to eat eggs, often, again for the same reason, that it is an important protein. This is often mentioned by many people. But I really doubt that if this is the case.

Well, I think the people are looking for the so-called "aphrodisiac" effect, a sort of superstition. Often in Malaysia and in Indonesia, the eggs; I tried one, but actually I think that the chicken egg is much more tasty and it's more compatible with our taste for food, I think.

So, right now, in Japan, also, sometimes those eggs are eaten. But usually they are only seeking for "aphrodisiac" effect.

And finally, I would like to say that this pressure for the capture by the human being, to catch the turtles and to kill; this pressure has been really building up. And what kind of effect this will have in the total area, was one of the areas of my important concern. So, in 1973 and thereafter, I have been to Indonesia many times. And one thing which really struck me was this fact.

So, as I said before, in Bali Islands, they catch 300 tons, or at least 100 tons year after year, of the green turtles. And in their case, the green turtles in Bali Islands, there is a port called "Tanjunbnoa"(phone.). And everything is all concentrated in Tanjunbnoa. And then, it is distributed throughout the islands. So, anything that you study at the Tan-

junbnoa, you can get the whole picture, about those 200 tons or 300 tons of the green turtle; where they come from; you can easily find out at that port.

In 1973, that's fifteen years ago, when I went there to the Tanjunbnoa Port for the first time, I stayed there for several days, and I had chance to talk to the fishermen. And they told me; that's fifteen years ago, mind you; that the green turtles all came within the radius about 1,000 kilometers, from the Bali Islands.

For example, all the Celebes, there is a place called Button Area, or, not quite to Ambon, or Kangean Islands; so, that is all; within one thousand kilometers, and they could go and catch all the 300 tons or about 3,000 sea turtles. But in 1981, the situation has completely changed.

I started again in Tanjungbnoa. And this time, the same fishermen were telling me that they now had to go to 2,000 kilometers radius in 1981; some seven years ago. Otherwise, they cannot get the green turtle that is needed in Bali Islands. So, this time, they had to go to the Alcay Shore Islands. So, they had to expand the areas of their fishing grounds and fishing activities.

So, in other words, if they had to secure 200 to 300 tons intake year after year, this means that by my simple calculation, every year they have to expand 125 kilometer radius to ensure the same intake. You have to go farther and farther to maintain that level. So that about 500 kilometers in four years.

So, this really gives us some message. So, this pressure of the marine catch by the human being, when the pressure builds up, this is the kind of a situation; this is what we have to deal with. You have to go farther and farther and farther to maintain the same level.

When I was in Tanjunbnoa, I said that I talked to the fishermen all the time. And now, usually it takes them about three months at a stretch. Once they leave the Tanjunbnoa Port and get the green turtles, and they don't come back to the port for three months. Otherwise, they cannot get all the sea turtles they want.

So, that's the kind of situation that we are faced with, and some action definitely has to be taken.

So, these things that I have been trying to explain: Well, we have the Japanese problems, which are the same problems being met in the world.

So there is a commonness, commonality of the problem. And those accidental catch or the egg stealing, and also, the commercial applications and commercial utilizations of the carapace and leathers: Time is running out for us, unless we do something about it.

We human beings have a destiny; I think it's a very sad destiny, I think, but for the human beings to depend to some extent for the utilization of the wildlife to some extent. And it is perhaps a fact of life. But if we only take and does not give back, the only thing left is the extinction.

And I think this is the message. We must also; use them, and also at the same time try to enrich them. And only in this way we can talk about the symbiosis or coexistence. And it is the main theme of this International Symposium, for which we have all gathered.

Sea turtles, as you know, are turtles in general. Just by being there, inside the characters what are we looking is not just only an (alternate) animal. But it is 200 million years built into under the surface of that carapace. It is, indeed, a great animal. We cannot find any other adjective to describe this animal, which we call the "turtle". Our history: What is the human being? Maybe 3 million years, or 4 million years?

Perhaps, we the latecomer to the surface of the planet, we first appeared as naked ape, and by our cruel treatment; and then, what other thoughts are passing through the mind of the turtles? Their sadness and their frustrations, and their anger. And it seems to me that I can listen, I can hear, their sighted voices.

If the sea turtles could speak the human language, what would they be saying to us? We must now, at this time, all of us who are researchers in the sea turtles, must go back to the statement of Dolittle, who understood the language of the animals; we must become Dolittle's, and we must try to listen to the voices, to the signals, that they are continuously setting out.

Thank you very much for your kind attention.

— APPLAUSE —

PRESERVATION OF SEA TURTLES AND INTERNATIONAL COOPERATION

1988 REVIEW

by

KAREN A. BJORNDAL

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COMMEMORATIVE SPEECH

DR. KAREN BJORNDAL

Thank you very much Dr. Marquez. Before I begin my speech, I would like to thank the interpreters for the wonderful job that they have been doing interpreting for us today. And I would like to remind the speakers who are to follow me that we should all try to speak slowly so that the interpreters have time to keep up with their translation. When we become excited about our topic, it becomes very difficult for the interpreters to follow us.

This symposium represents the international approach that is necessary to solve the problems of sea turtles, because sea turtles are themselves an international resource. Some of the examples that I'll be using this morning are from the Atlantic system, and I hope that you will excuse my use of examples from a system with which I am more familiar at a conference which is concentrating on the Pacific region. But I know that my colleagues who will be following me today and tomorrow will have ample examples of the shared resource of sea turtles in the Pacific region. I would like to start with my slides now. Could we have the slide projector turned on?

This is Dr. Archie Carr, a man that many of you have had the opportunity to meet, and many more have heard of. He gave us some of our first and most basic information on the biology of green turtles, and on the degree to which they moved among countries, and were a shared resource. He is shown here with a female green turtle at Torchigo Beach in Costa Rica.

Over the past 30 years, we have tagged more than 30,000 green turtles as they came ashore to nest at Torchigo, and we have received reports from tagged returns on those animals. The tag had been returned from more than 18 countries throughout the Caribbean region. The arrows on this map point to all of the different countries involved. This is a VERY important point, because what it means is that each country is exploiting this resource without regard to what is going on in other countries; without knowing what is going on; without having any quantitative measure. So that in Costa Rica the eggs and the nesting females are harvested at the beach. Juvenile turtles and adult turtles are harvested from the feeding grounds in Nicaragua, Venezuela, Columbia, Mexico, Jamaica, Dominican Republic, and all of the other countries from which we have tag returns.

Each of these countries often feels that they are the only country exploiting this sea turtle resource. This leads them to over-exploitation because each country is taking a piece of the pie essentially, without having knowledge of what is going on in other countries.

This underscores the very important need for research and for comprehensive international management plans to manage these populations. Without this, we will inevitably over exploit sea turtle populations.

Dr. Uchida, in his talk earlier this morning, gave a very good example of this problem within a country when he discussed the differential protection of sea turtles among the different prefectures in Japan. Just as he pointed out that this is a serious problem in Japan, on an international scope, it is a serious problem as well.

It was also the work of Dr. Carr who pointed out that many of the sea turtles -- many of the loggerheads that hatch out from the nesting beaches in Florida enter these trans-oceanic waters and spend years of their lives growing to a larger size class. In this they enter not only international oceanic zones, but also the territorial waters of European and African nations. Again, this expansive movement of a single population underscores our need to work with this as a shared resource.

This problem is found all over the world. For many years, Mr. de Silva, one of our colleagues who will be speaking later, has lamented that all of his efforts to protect sea turtles in the waters around Sabah are for naught when those turtles leave the Sabah territory and enter the Philippine territory where they are harvested completely.

This symposium brings together representatives from many Pacific nations, the most important nations in terms of sharing the sea turtle resource, and I hope that within the next few days we will be able to make progress in our understanding of the degree to which this resource is a shared one.

The international nature of sea turtle means that we must have international solutions to the management of our sea turtle resources. There are many contentious issues in international conservation of sea turtles. The ranching and farming of sea turtles seen by some as a way to save turtles is viewed by others as a great danger to the survival of our world sea turtles.

Last February, a panel of experts including Dr. Uchida and Dr. Marquez and Tom Milligan and myself, met in Costa Rica to discuss the ranching and farming of sea turtles. One of the main conclusions of the Workshop that there is no proven benefit of ranching or farming for sea turtle conservation. And, equally, there is no proven benefit of the headstarting of sea turtles.

Headstarting sea turtles is the practice of raising hatchlings for six months to a one year period, and then releasing them into the wild. This practice is done in the belief that these larger sea turtles are better able to avoid predation. However, we know

nothing about the future breeding success of these headstarted turtles. There is unanimous agreement among the experts at the panel in San Jose, Costa Rica, that headstarting has not been proven to be a benefit to wild populations, and should not be used as a conservation measure to offset exploitation. This is a very IMPORTANT point. We cannot justify the harvest of sea turtles by replacing them with headstarted turtles shown here. These are tanks in which green turtles are raised, and there's a small green turtle held in the foreground.

These turtles are often held in tanks as I showed and fed artificial pellated diets. Because we do not know the effectiveness of headstarting; because we do not know if these headstarted turtles will join the population and breed successfully, I want to underscore the idea that we should not be using the release of these turtles as a justification for harvest. This is still very much an experimental technique; one that may be able to help turtles, to conserve turtles. We just do not know at this time.

Another contentious issue is international trade in sea turtle products, particularly in Beco. We will be discussing this trade in greater detail at the Symposium in Himeji in a few days. Once again, please allow me to divert to the Atlantic system and share with you our very grave concern about the Atlantic Hawksbill. This species (one is shown here) is being hunted to extinction for Bekko trade. We are very concerned in the Caribbean because the nesting populations, whether they be in Costa Rica, Panama, Mexico, Dominican Republic, Cuba, Haiti, are all reported to have suffered grave declines. And it is getting to the point that unless something is done rapidly, there will be no hope for the Atlantic population of Hawksbills.

The population concentration in Indonesia is still great. We still have time to work to preserve that population. In the Caribbean, we are rapidly running out of time. We had once thought that the Hawksbills in the Caribbean would be saved by the time they reached what is known as the "point of economic extinction." That is that point when it is no longer worthwhile for the fishermen and turtlers to hunt the sea turtles. When they become so rare that they are caught less frequently and therefore cannot support a man who makes his livelihood hunting them.

This hope of ours has proven to be false for two reasons: First, the price for Bekko has continued to raise as the population of Hawksbills in the Caribbean had continued to drop. In many areas of the Caribbean, the shell of a grown Hawksbill is equal in value to an annual salary for a fisherman. That means that it is worthwhile for a man to invest an entire year hunting for one turtle. And if he can catch that one turtle, he will have made a year's salary. So it begins to seem that the point of economic extinction will never be reached because the price keeps going up.

The other reason that we now feel that the Hawksbill will be literally hunted to extinction in the Caribbean is because of the crawfish, or spiney lobster trade in the Caribbean. This is a very valuable animal, as I know you are all aware, and it shares the habitat of coral reefs with the Hawksbill. Throughout the Caribbean there is intensive hunting by divers for the spiney lobster. And these hunters, while they are hunting spiney lobsters will always take any Hawksbill they come across. Therefore, it does not have to pay that fisherman to be out just looking for turtles. He can be out making most of his money from hunting spiney lobsters, and then take the occasional Hawksbill that he comes across. Again, this will allow the fisherman, and encourage the fisherman to hunt the Hawksbill to extinction.

Leaving these more contentious topics, I would like to discuss today two aspects of international sea turtle conservation on which I believe all sea turtle biologists can agree. These are the need to control marine pollution and the need to control incidental catch.

Marine pollution is comprised of a vast array of items, oil and tar, plastics, discarded fishing gear, and can only be controlled through international treaties to stop the dumping of refuse into our oceans, and to prohibit fisheries from abandoning lines and nets that will continue to catch and kill sea turtles and other marine organisms for long periods of time.

Our concern is great for the small post-hatchling turtles. These small turtles inhabit drift line habitats, which is the slide that I show there. These drift lines are areas of convergence where two opposing currents meet each other, or where continuous winds form wind rows. In these areas of drift line, all floating matter in the ocean is congregated. The major component of these lines in the Atlantic is the algae sargassim (phonetic). Small turtles of several species have been reported from these drift lines. Here is a small loggerhead. And this is a picture of small green turtle. This picture is from the North Atlantic, and the winds and currents were so strong that what you're seeing here is the sargassim having been pushed up and piled up above the water, so this small green turtle in the center of the picture is literally walking across the top of a dry algae mat.

Unfortunately, all floating objects in the ocean are congregated in these drift lines by the same physical forces that congregate sea turtles here. This includes floating garbage, which can be seen in this slide: pieces of plastic, bottles, wood, glass. Sometimes garbage forms the main component of these drift lines. There have been many reports from the Atlantic of entire drift lines formed from

the thyaloom lights, or the chemical lights that are used as fish attracting on long line and gear.

Pollution impacts turtles in many ways. Turtles are killed when they are coated with tar, as shown in this slide here. This is a small Hawksbill that washed ashore dead on the coast of Florida after he had become totally coated with tar. This is an increasingly common sight along the United States seaboard, and these turtles are now nicknamed "tar babies."

Small sea turtles are indiscriminate feeders. They'll try to eat just about anything that can fit their mouths around. And often this gets them into serious trouble when they try to ingest either tar balls or other plastic debris. This is the esophogous and stomach removed from a small green turtle that washed ashore dead in Florida. Its esophogous was totally occluded with the tar ball that you see there.

The next three slides were kindly provided to me by Mr. George Balazs, and they represent turtle mortality in the Hawaiian Islands. As I said, ingestion of garbage is a big problem with sea turtles. This is nearly one kilogram of plastic that was removed from a dead Hawksbill that washed ashore in the Hawaiian Islands.

Entanglement in debris is also a serious problem. This is a picture of a green turtle that washed ashore dead with a plastic band around its neck. These are fairly common scenes. Sea turtles hopelessly entangled in monofilament lines, in other kinds of garbage, plastic packing bands are particularly bad, and lengths of rope. This final slide is of a Hawaiian sea turtle that washed ashore dead totally enwrapped in leftover netting. Netting that had been abandoned by a fishery. As Dr. Uchida mentioned earlier, this is a tremendous problem, and throughout the world this is a tremendous problem.

We must all press our governments to join and sign the Treaties that are now being enacted to control marine pollution. One in particular is the MAR POL Convention with Annex 5, that prohibits the at-sea dumping by ocean going vessels.

We must also press our governments to create treaties that control the abandonment of fishing gear. These senseless losses of sea turtles with no benefit to man must be stopped.

The other problem that I want to address today is that of incidental catch. Incidental catch of sea turtles is defined as the taking of sea turtles by a fishery that is directing its catch effort at other species of organisms. There are many examples of this problem around the world. Dr. Uchida discussed this problem in his talk earlier today. Another member of the Marine Turtle Specialist Group, Jean Mayal from the Mediterranean is working with the Incidental Catch of Small Loggerheads on the shark long line fishery in the Mediterranean.

Ms. Tan Yan Xiang has published a very valuable account of the disastrous results of the taking of adult leatherbacks in the shrimp trawlers in Malaysia.

Mike McCoy and George Balazs, two of my colleagues who will be speaking later, have both been involved in the incidental take of turtles by long line fisheries in the Pacific, and I hope that they will have an opportunity to address this problem this afternoon.

In the United States we have problems with gill nets, long lines, and driftnet fisheries, but our major problem in the Atlantic is with shrimp trawlers. This is an example of a fairly small shrimp boat. There are 14,000 ships in the U.S. fleet alone. Often when these trawlers bring up their nets, bring them over the side, and dump the contents onto the deck, a sea turtle, like the loggerhead shown here is included in the catch.

In fact in some areas of Florida, sea turtles are caught by shrimp trawlers in such abundance that it is an efficient way to sample marine turtle populations in those areas. This is a slide of one trawler, of one trawl net that is totally full of loggerheads. Each one of these layers here is an individual loggerhead. This was a trawl only after 45 minutes this many turtles were caught.

I am shown here with two of my graduate students, measuring a loggerhead that was brought up from the Cape Canaveral Florida population, a population that we have been monitoring for over 10 years, using shrimp trawlers. Some of you may recognize Kazu Horokoshi, shown here on your right. He is one of my graduate students, and has worked with several of you in the Ogasawara Islands.

Each year approximately 45,000 turtles are caught by shrimp trawlers in the United States waters. Of these, between 12,000 and 13,000 turtles are killed. We have these figures from observers who have been put onboard shrimp trawlers and who monitor the catch; from tag returns that shrimp trawler captains have sent to us of tagged turtles that they capture, and also from counting the number of carcasses that float ashore following the trawler fishery conducted offshore.

Most of the turtles that are caught and killed are loggerheads, like the one shown here. But many of them are Kemps Ridleys. This is a small Kemps Ridley. This is a common size for being caught in a shrimp trawler. It's being held by Dr. Archie Carr just after it had been brought up from the Florida Coast in a shrimp trawler. Kemps Ridleys are the most endangered species of sea turtle in the world.

It's the species of greatest concern to sea turtle conservationists, and we all are unanimous in feeling that unless the incidental capture of this species is stopped, there will be no hope for the recovery of this species.

Now one would think that a sea turtle could easily escape a fairly slow moving net. Shrimp trawls typically move at less than 2.5 miles per hour, and turtles can certainly swim more rapidly than that. Divers, working under water, have observed turtles being caught in nets and it's a very familiar pattern that happens over and over again.

First of all a sea turtle is taken back about this far in front of the net. It sees the doors on either side of the net, and it will swim rapidly to escape the net. Unfortunately, often the turtles will not turn to the side or go up to get out of the net's way. They will just swim straight forward. Then they will start swimming more slowly again; the net will catch up with the turtles, the turtle will speed up and then slow down, the net will catch up, in a very long cycle until the turtle is just exhausted and falls back into the shrimp net and is trapped, because many of these shrimp trawlers hold their nets underwater for 3 hours and longer, most of the turtles are drowned.

For the past l0 years the U.S. National Marine Fisheries Service has worked to develop a device that will exclude turtles from shrimp trawl nets. The resulting turtle excluding device, which is nicknamed TED cost over 1 million dollars to design, and is effective in keeping out 97 per cent of the turtles that would otherwise be captured. It also does not decrease the shrimp catch.

An early design is shown here, a very large flexible mesh in front of the net. This was discarded in favour of this design which is a trap door device that is inserted into the net just in front of the caught end of net. As shown here by this diver, when the turtle comes back and hits against the trap door, this upper trap door will open and the turtle is excluded from the net. These devices are also popular in areas of the United States that have tremendous problems with large sharks and rays, or very large jelly fish that tend to clog their nets very rapidly. These excluder devices also exclude those other large unwanted species.

Shrimpers have complained that the device is heavy and awkward and dangerous to use onboard a shifting vessel. The primary problem really has been that shrimpers are a very independent group of people who do not like to be told by anyone what they should or should not do. After trying for several years to educate the shrimpers in the importance of the voluntary use of the TED device in their nets, the National Marine Fisheries Service has found it necessary to enact Federal regulations requiring the use of TED in all nets. After a very long process of review and of judicial challenges, these regulations are now in effect, and starting next year all shrimp trawlers will have to use TED or limit their tow times to less than 90 minutes in U.S. waters.

When the shrimpers finally decided they were going to have to be required to use TED, they began to use their own ingenuity in designing TED. Most of the TEDS that the shrimpers have designed themselves are called "Soft TEDS." They're called "soft TEDS" because rather than having the hard parts that the TED of the National Marine Fisheries Service has, these TEDS are comprised of soft nets and baffles, as shown here, and shown more clearly in the next slide.

This loop, this opening or loop of netting hanging down from the front of the net is the exit part for sea turtles caught in shrimp trawls. The National Marine Fisheries Service has a certification program which all TEDS must pass before they are approved for use by shrimp trawlers. However, this certification process only ensures that the TEDS are effective in releasing turtles. They do not test whether the TED is effective in catching shrimp. This is left up to the shrimpers for them to test, and determine whether they wish to use these TEDS.

We now have the technology required to prevent the loss of sea turtles in shrimp trawlers. We need to ensure that the necessary technology reaches those countries where it can be used. The National Marine Fisheries Service of the United States has already sent technical advisers to Mexico, Indonesia, Panama and Surinam to give technical assistance. We know that the problem in Malaysia is a serious one. We know in Honduras there is a growing problem of a number of adult female green turtles that nest in Costa Rica being caught in the shrimp fleet there.

Recent reports from Thailand indicate that the Thai fishing fleet is catching many turtles, and having disastrous results on the turtle populations there.

We have the technology to solve this problem. Now we must act to implement it.

Only through international cooperation can we ensure that the survival of sea turtles as part of the natural heritage will exist for future generations. If we act wisely, sea turtles will continue to provide an important source of protein for local coastal people, and will continue to provide all of us with the source of beauty and wonder, as do the loggerheads nesting here in lovely Hiwasa.

Thank you very much.

THE MARINE TURTLES IN HAWAIIAN ISLANDS

1988 REVIEW

by

GOERGE HARVEY BARAZS

JULY 30 - AUGUST 3, 1988

Corresponding Consultants Appointed to Assist the Recovery Team

Karen Bjorndal, Chairman, IUCN Turtle Specialist Group

Sheila Conant, University of Hawaii

Thomas Fritts, U.S. Fish and Wildlife Service, New Mexico

Robert Johannes, Commonwealth Scientific and Industrial Research Organization, Perth, Australia

Steve Kaiser, Sea Life Park, Hawaii

Ernest Kosaka, U.S. Fish and Wildlife Service, Hawaii

Cynthia Krakowski, Wildlife Consultant, Honolulu

Robert Moncrief, U.S. Army Corps of Engineers (former turtle fisherman)

John J. Naughton, National Marine Fisheries Service, Hawaii (former turtle fisherman)

Noah Pekelo, Division of Conservation and Resources Enforcement, State of Hawaii (native Hawaiian)

Dennis Russell, Department of Biology, Seattle Pacific University, Washington

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DRAFT

Recovery Plan for Hawaiian Sea Turtles

Prepared by
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INTRODUCTION

The preparation of recovery plans are required for all species listed under the U.S. Endangered Species Act,. unless it is determined that a species will not benefit from such action. The Act allows for the formation of recovery teams responsible for developing recovery plans. A recovery plan for threatened and endangered sea turtles in the southeastern United States (western Atlantic, Caribbean, and Gulf of Mexico) has already been prepared by a recovery team and formally approved in September of 1984.

The present draft recovery plan for Hawaiian sea turtles was prepared by a recovery team appointed in 1985. The team met on five occasions, three of which involved several days of deliberations (October 22-25, 1985, April 29-May 2, 1986; and January 20-23, 1987). In addition, a team member (Dr. Harold F. Hirth) who was unable to attend the January 1987 meeting came to Hawaii September 14-17, 1987 to work with the team leader to finalize the draft plan. The plan represents the best scientific efforts and unanimity of professional opinion by the recovery team members.

This Recovery Plan for Hawaiian Sea Turtles contains separate plans for the two species with breeding populations in the Hawaiian Islands. They cover the green turtle, Chelonia mydas, and the hawksbill turtle, Eretmochelys imbricata. In addition, there is a combined plan for the leatherback, Dermochelys coriacea, and olive ridley, Lepidochelys olivacea, both of which occur in Hawaiian water but nest elsewhere. It was the decision of the recovery team to make each plan a complete product in it self, thereby requiring some necessary repetition where equivalent problems and solutions were identified for each species. Each plan consists of a series of concise recovery actions of either a management or research nature. The ultimate goal of these actions is to secure habaitat, and restore and maintain Hawaiian sea turtle populations at levels of abundance commensurate with the carrying capacity of the habitat (i.e., a state of biological recovery).

The recovery actions in each plan have been divided into two main elements that address limiting factors based on sea turtle habitat usage in 1) the marine environment, and 2) the terrestrial environment. This method of partitioning should prove beneficial for two reasons. First, it will help to simplify a potentially complex subject and aid the reader in better understanding the scope and nature of the recovery problems identified and solutions offered. As oviparous reptiles, sea turtles have two environmental components critical to their life cycle--terrestrial nesting beaches where eggs incubate; and marine foraging and resting areas in nearshore waters or, for some life stages and species, in the pelagic zone. Secondly, since federal jurisdictional responsibilities for the protection, management, and research of sea turtles are shared along terrestrial and marine boundaries, the division used in this plan should help the National marine Fisheries Service (NMFS) and Wildlife Service (USFWS) focus their respective agency resources in the mandated cooperative approach to achieve recovery.

Because many of the other Federal and State agencies involved with Hawaiian sea turtle management and research activities do not necessarily share the same priority of recovery actions within their statutory mandates or operating procedures, these agencies are not specifically identified for each recovery action. It is intended that agencies and organizations with responsibilities or expertise within any of the listed recovery actions would consider the highest applicable rated items in each section first in their operational plans. Where it is clear that certain agencies such as the NMFS, USFWS, State of Hawaii, U.S. Coast Guard, National Park Service, and military agencies have specific jurisdictions or legal requirements, they are identified for each appropriate recovery action.

An implementation schedule was not included in the Recovery Plan since many of the management and research actions are either on-going or require supplemental funding to complete or initiate.

It was not considered necessary, nor within the scope of this plan, to provide details on how to implement each of the recovery actions. However, some priorities were established by the team for major recovery tasks for each species. These priorities, summarized in the following

section, were divided into separate categories for management and research, since the two activities are complementary rather than competitive with one another. The setting of certain priorities in this manner should help all of the involved agencies in obtaining any additional funds needed to do the work.

PRIORITIES FOR THE RECOVERY OF HAWAIIAN SEA TURTLES

Priority listings by species

Due to its designation as an endangered species under federal and state law, and the inadequate knowledge of its life history and ecology, the Hawaiian hawksbill is considered to be the sea turtle species of highest priority for recovery actions.

Accordingly, the Hawaiian green turtle is designated as the next order of priority because of its listing as a threatened species.

In view of the fact that the leatherback (listed as endangered) and the olive ridley (listed as threatened) have no known historical or present breeding populations in the Hawaiian Islands, these species are given a lower priority in recovery actions.

Prioritized listings within species for important management and research actions

Baseline monitoring to ascertain population status and trends, and nesting habaitat carrying capacity, is considered fundamental to all recovery actions (see Appendix 1).

Hawaiian Hawksbill

Priority Management Actions

1. Implement immediate protection of existing nests in order to maximize natural hatchling production.

2. Inform and educate the public of the endangered and protected status of the Hawaiian hawksbill.

3. Implement as appropriate the required actions to reduce or eliminate incidental mortality and injury by fishing nest.

4. Increase and enhance law enforcement efforts to protect the Hawaiian hawksbill.

5. Protect known terrestrial and marine habitats used by the Hawaiian hawksbill.

6. Initiate captive breeding efforts for conservation purposes.

Priority Research Actions

1. Identify all essential terrestrial and marine habitats used by the Hawaiian hawksbill.

2. Document the full scope and magnitude of incidental mortality and injury by fishing nest.

3. Determine the food and foraging requirements of the Hawaiian hawksbill.

4. Investigate the sources and levels of egg and hatchling predation on the beach and evaluate the potential for management action.

5. Investigate predation by sharks and evaluate the potential for management action.

Hawaiian Green Turtle

Priority Management Actions

1. Protect marine and terrestrial habitats used by the Hawaiian green turtle.

2. Inform and educate the public of the threatened and protected status of the Hawaiian green turtle.

3. Increase and enhance law enforcement efforts to protect the Hawaiian green turtle.

4. Implement as appropriate the required actions to reduce or eliminate incidental mortality and injury by fishing nest.

5. Rescue and release hatchlings trapped in the nest by soil and vegetation impediments.

6. Encourage additional captive breeding efforts for conservation purposes.

Priority Research Actions

1. Investigate the incidence, impact, and cause of tumors in Hawaiian green turtles.

2. Increase and expand efforts to identify nearshore, pelagic, and terrestrial habitats used by the Hawaiian green turtle.

3. Document the full scope and magnitude of incidental mortality and injury by fishing nest.

4. Investigate the levels of hatchling predation by ghost crabs and evaluate the potential for management action.

5. Investigate predation by sharks on all life stages and evaluate the potential for management action.

6. Determine foraging habitat characteristics as they relate to differential growth rates and age of maturity in Hawaiian green turtles.

7. Assess the impact of synthetic debris and other pollutants on Hawaiian green turtles in pelagic developmental habitat.

8. Evaluate experimental headstarting for conservation purposes using captive-bred hatchling Hawaiian green turtles.

Leatherback and Olive Ridley in Hawaiian Waters

Priority Management Actions

1. Implement appropriate actions to eliminate or reduce incidental injury and mortality by fishing activities in the pelagic zone.

2. Inform and educate the private and commercial sectors to report sightings of leatherbacks and olive ridleys in marine and terrestrial habitats.

3. If an when additional nestings occur, provide immediate protection to nests through the incubation period and supervise the safe release of hatchlings.

Priority Research Actions

1. Document and investigate all incidental mortality and injury reported.

2. Catalog all sightings of individuals at sea and on land.

3. Assess the impact of pollutants and synthetic debris on all life stages in the pelagic zone.

Biological Overview of the Hawaiian Hawksbill

A serious shortage of information exists on all aspects of the life history and ecology of the hawksbill turtle in the Hawaiian Islands. Along with the green turtle, hawksbills were well known in the early Hawaiian culture. However, unlike the green turtle, the hawksbill was apparently not esteemed as food, probably due to sporadic fatal poisonings such as have been recorded elsewhere, even to the present time. Studies on other hawksbill populations have determined the species to be primarily a spongivore. This dietary factor is believed to somehow account for its occasional toxicity. The single adult Hawaiian hawksbill thus far examined for stomach contents (from a gill-net mortality) was filled to capacity with sponges. Another dead hawksbill examined--a juvenile washed ashore from pelagic habitat--had a massive intestinal blockage caused by hundreds of small pieces of ingested plastic debris.

Hawksbill nesting only occurs in the main Hawaiian Islands, primarily on several small sand beaches along the east coast of the Island of Hawaii., Two of these sites (Halape and Apua Point) are at a remote location in the Hawaii Volcanoes National park. Not all of the presently known hawksbill beaches have turtles nesting on them each year. The most consistently used sites seem to be at Kamehame Point on Hawaii, and a black sand beach at the river mouth of Halawa Valley at the east end of Molokai. Probably not more than three hawksbills per year nest at each of these two locations. Overall, there many not be more than a dozen hawksbills nesting annually on all beaches combined. From the little information that is available, the nesting season appears to extend from July through November.

There are no modern-day records of nesting hawksbills or their occurrence in nearshore marine habitat anywhere in the Northwestern Hawaiian Islands. According to some early historical accounts, hawksbills may have occupied this region in past centuries.

None of the known nesting beaches have shred usage by both hawksbills and green turtles (or any other sea turtle species). However, certain underwater resting habitats used by green turtles in nearshore waters along the east coast of the Island of Hawaii are reported to also be occupied by hawksbills.

Additional but limited background information available on the Hawaiian hawksbill can be found in the supporting literature shown in the bibliography.0

Hawaiian Hawksbill Recovery Actions for Limiting Factors

I. Marine Environment

A. Human Take

1. Increase surveillance and active law enforcement by developing a coordinated plan to prevent illegal capture, mortality, and trafficking. The directed capture of hawksbills takes place along with green turtles in Hawaii due to their similarity of appearance. Turtles are taken using spears, harpoons, nest, grappling hooks, firearms from shore, underwater bang sticks, nooses, and by hand capture. Elicit the cooperation of enforcement branches of the National Marine Fisheries Service, State of Hawaii, U.S. Fish and Wildlife Service, U.S. Customs Service, National Park Service, U.S. Coast Guard, country police departments, military agencies, and other authorities to apprehend and prosecute violators. Encourage the public to report suspected violations.

2. Eliminate intentional and unintentional harassment of hawksbills. Activities such as ski and scuba diving, vessel traffic, jet skis, and vessel anchoring may disturb or displace hawksbills These factors should be regulated or controlled to eliminate impacts, especially in sensitive and/or high density foraging and resting areas, nearly all of which are yet to be determined.

3. Establish networks to report incidental take. Along with (1) and (2) above, encourage reporting of incidental take of all dead or alive hawksbills resulting from nets, hooks, traps, monofilament fishing line, rope, debris ingestion and

entanglement, vessel collisions, explosives, and such illegal fishing methods as the use of "Clorox" and other chemicals. Inform fishermen and others involved in these networks how to identify the hawksbill and distinguish it from the green turtle. Special attention should be directed to documenting the incidental take of pelagic turtles by driftnets and longlines in the Hawaiian region.

4. Expand and enhance networks to report strandings. Along with (1), (2), and (3) above, promote the reporting of any hawksbill out of its element or in a physiologically distressed state. Dead turtles should continue to be salvaged for necropsies, and live turtles should be brought into captivity for possible rehabilitation. No diseased turtle should be returned to the wild.

5. Educate and inform the public on the endangered and protected status of the hawksbill in marine habaitat. The general public, including school children, fishers, scientific researchers, boat operators, military personnel, and tourists should be made aware of the fact that the hawksbill is an endangered and protected species in Hawaii, and that foraging and resting sites are sensitive and important areas worthy of protection.

6. Establish information and education programs extolling the role of the hawksbill turtle in the cultural heritage of Hawaiians and other ethnic backgrounds in Hawaii. By means of advertising and educational programs, promote the virtues of the environmental, conservation, and historical ethic.

7. Permitted research and management activities involving hawksbills may be allowed provided the benefits to the hawksbill population outweigh the costs. Permitted research and management actions involving other species and activities must be evaluated by the appropriate agencies to eliminate or minimize to acceptable levels any impacts on the hawksbill.

Hawaiian Hawksbill Recovery Actions for Limiting Factors

I. Marine Environment

B. Predation

1. Investigate the extent and severity of natural predation on hatchlings by sharks, finish, and seabirds in nearshore waters of breeding areas. Protection plans including predator control should be commensurate with the degree of predation identified.

2. Investigate the extent and severity of natural predation on juveniles in pelagic habitat. These studies are contingent upon determining the location of this marine habitat and identifying the predators involved. Protection plans, if feasible in this extensive and dynamic oceanic region, should be commensurate with the degree of predation identified.

3. Investigate the extent and severity of natural predation on immature and adult hawksbills in nearshore benthic habitat by sharks and finish. Turtles have been recorded in Hawaii amongst the stomach contents of sharks and groupers. Protection plans including predator control should be commensurate with the degree of predation identified.

Hawaiian Hawksbill Recovery Actions for Limiting Factors

I. Marine Environment

C. Disease

1. Investigate the incidence and impact of parasites and infectious agents on hawksbills. Virtually nothing is known in Hawaii about the occurrence of bacterial infections (e.g., Vibrios), virus and parasites such as blood flukes, leeches and burrowing barnacles, and possibly tumors, in the hawksbill.

2. If feasible, cooperate in investigations of the etiology of poisoning by hawksbills as it relates to human populations at other Pacific locations. In recent years, cases

involving mortality and severe illness from eating hawksbills have occurred in Tonga and Fiji. Sporadic outbreaks of poisonings are known worldwide and are thought to be due to some component of the hawksbills' prey items.

Hawaiian Hawksbill Recovery Actions for Limiting Factors

I. Marine Environment

D. Habitat Alteration

1. Maintain natural habitats. Emphasis should be placed on the maintenance of natural hawksbill ecosystems. The burden of proof, beyond a reasonable doubt, rests on the advocated in altering the natural condition.

2. Locate and assess foraging and resting habitats for the hawksbill. Foraging and resting areas are for the most part currently unknown. Baseline information is required to identify and understand natural and man-induced habitat alterations.

21. Important foraging and resting grounds should be designated for special consideration as natural preserves.

22. Shelter type, tides, temperature, salinity, and pressure they relate to depth should be investigated.

3. Eliminate adverse human induced habaitat alteration in order to maintain foraging and resting habitats.

31. Petrochemical pollution sources can range from small spills related to bilge pumping or broken transmission lines to large scale tanker spills. Spill contingency plans should be reviewed with respect to protecting foraging and resting sites.

32. Major spills or other pollution events need immediate response to determine what clean-up measures are required. Attention should be given to the clean-up measure to ensure that their impacts on hawksbills and their foraging and resting habitats are not greater than the spill itself.

33. Identify sources of synthetic debris that may entangle or be ingested by hawksbills in foraging and resting habitats,both in the nearshore and pelagic environment. Abatement programs should be initiated.

34. Prevent or mitigate impacts from dredging. Cumulative and secondary impacts, and loss of nearshore habitat, need to be quantified.

35. Assess the presence and impact in hawksbills of pesticide, herbicide, and other toxic agents used by humans that enter the coastal marine environment.

36. Minimize the effects of artificial illumination from vessels and onshore sources during the period of hatchling emergence in hawksbill breeding areas.

4. Investigate natural events that adversely impact foraging and resting habitats. For example, tsunamis have been known to hurl turtles in foraging pastures far up on shore where they died after being unable to return to the sea.

41. Compile historical information on catastrophic geological and climatological events, such as tsunamis, hurricanes, the "El Nino effect," lava flows, acid rain, coastal forest fires, and earthquakes. Such data will be used to determine the potential impact of future catastrophic events.

42. As for items for the hawksbill become known, investigate natural fluctuations in abundance and distribution.

43. Investigate the dynamics of oceanic currents, gyres, and zones of convergence as they relate to pelagic life stages and recruitment to nearshore benthic habaitat. Studies have suggested that the hawksbill passes through a pelagic stage of development similar to the green turtle and other sea turtle species.

Hawaiian Hawksbill Recovery Actions for Limiting Factors

II. Terrestrial Environment

A. Human Take

1. Increase surveillance and active law enforcement by developing a coordinated plan to prevent illegal capture, mortality, and trafficking. Elicit cooperation of enforcement branches of the U.S. Fish and Wildlife Service, U.S. Customs Service, National Park Service, U.S. Coast Guard, National Marine Fisheries Service, State of Hawaii, country police departments, military agencies, and other authorities to apprehend and prosecute violators and to encourage the public to report suspected violations.

2. Eliminate uninterntional and intentional harassment of hawksbills. Aircraft should not land nor fly low over nesting sites. Campers, hikers, beach combers, fishers, and other recreationists should be informed to report, but not disturb, nests, nesting turtles and hatchlings.

21. Egg nests and hatchlings are susceptible to crushing and hatchlings are disoriented by vehicles on nesting beaches. Hatchlings may also be deterred by tire tracks from reaching the ocean, thereby increasing their exposure to desiccation and predation. Adult females may be struck while ascending or descending the beach or while nesting. Elicit cooperation of appropriate law enforcement agencies and other public and private entities, including landowners, to eliminate vehicles on known nesting beaches.

22. Shoreline development resulting in increased human interactions with hawksbills on the beach should be controlled or eliminated to reduce adverse impacts.

23. Military exercises and other military activities should be evaluated regarding the potential to disturb nesting hawksbills. Consultations should occur at the earliest possible time with the agencies involved in eliminating or mitigating potential impacts.

3. Educate and inform the public about the endangered and protected status of the hawksbill on the nesting beach. The general public, including school children, fishers, scientific researchers, boat operators, military personnel, and tourists should be made aware of the fact that the hawksbill is an endangered species in Hawaii, and that nesting beaches are sensitive and important areas worthy of protection.

4. Permitted research and management activities involving hawksbills may be allowed provided the benefits to the hawksbill population outweigh the costs. Permitted research and management actions involving other species and activities must be evaluated by the appropriate agencies to eliminate or minimize to acceptable levels any impacts on the endangered hawksbill.

5. Experimental breeding efforts for conservation purposes should be encouraged using to the extent possible turtles presently in captivity. An adult female of known Hawaiian ancestry is currently in captivity at Sea Life Park which offers, in part, the potential for captive breeding for restocking purposes. A small number of wild hatchlings, preferably those rescued from natural entrapment in nests or otherwise doomed circumstances, should be raised in captivity should ideally be related at known nesting beaches on the following night Head starting with captive-bred hatchlings to a size appropriate for release into coastal foraging pastures is also encouraged for experimental restocking purposes. All turtles released into the wild must be certified free of disease.

Hawaiian Hawksbill Recovery Actions for Limiting Factors

II. Terrestrial Environment

B. Predation

1. Investigate the severity of egg loss by predation. The extent of this predation by ghost crabs, mongooses, cats, dogs, birds,

and possibly rats and feral pigs, needs to be determined. Studies should also be made on whether ghost crab burrows provide access to eggs for other organisms (e.g., ants, flies, and their larvae) or changes in the microenvironment of the incubation chamber (e.g., desiccation of eggs). Egg protection and predator control by government and private entities should be commensurate with degree of predation identified.

2. Investigate severity of hatchling predation. The extent of predation by ghost crabs, mongooses, cats, dogs, birds, rats and feral pigs needs to be determined. Hatchling protection and predator control should be commensurate with the degree of predation identified.

Hawaiian Hawksbill Recovery Actions for Limiting Factors

II. Terrestrial Environment

C. Disease

1. Investigate the incidence and impact of mosquitos and other blood sucking insects capable of transmitting disease to hawksbills on land. Adult females and hatchlings on the beach are exposed to a number of insects, including ones introduced to the main Hawaiian Islands, that are potential carriers of pathogens.

Hawaiian Hawksbill Recovery Actions for Limiting Factors

II. Terrestrial Environment

D. Habitat Alteration

1. Maintain natural habitats. Emphasis should be placed on the maintenance of natural hawksbill ecosystems. The burden of proof, beyond a reasonable doubt, rests on the advocates interested in altering the natural condition.

2. Maintain nesting beaches to eliminate adverse human-induced habitat alteration. Hawksbill beaches should be designated for special consideration as natural preserves. The nesting sites known at present are on Molokai at Halawa Beach, on Hawaii at Kamehame, Punaluu/Ninole, Kawa, Orr's Beach, Harry K. Brown Beach, and Halape in the Hawaii Volcanoes National Park; and on Oahu at Malaekahana. Other nesting sites may become known when efforts are undertaken to locate them.

21. Shoreline development plans, such as for roads, harbor construction, buildings, lighting, military installations, erosion control, and sand mining, should be evaluated at an early stage for their potential adverse impact on turtles. Developers and regulatory agencies should cooperate to eliminate or mitigate the adverse impacts identified.

22. Maintain suitable vegetation types to prevent erosion, foster successful nesting, and promote hatchling production. Manage shoreline plant communities to maximize hawksbill hatchling production.

23. Create a contingency plan. The State of Hawaii, country governments, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the National Park service should have a contingency plan to counter the inevitable demands that the growing tourist industry will make regading access to coastal areas with nesting beaches.

24. Control artificial illumination. A plethora of scientific research has shown that artificial illumination (from domiciles, street lights, vehicles, flashlights, etc.) will disturb nesting females and disorient hatchlings. The quantity of light should be controlled by limiting access and, where necessary, shoreline development. The quality of light present on natural nesting beaches needs investigation. Studies should be made on the intensity and color of light that has minimal effect on turtles of all sizes.

25. Prevent the introduction of exotic plants and animals. Some nesting turtles are adversely impacted by the

presence of certain types of vegetation and their root systems which respectively inhibit digging the body pit and egg chamber. Exotic vegetation may also alter the natural sun/shade mosaic on the nesting beach and thus produce abnormal ratios of males-females, as well as alter the duration of incubation. The ecesis of opportunistic animals, like rats and mongooses, must be prevented as they are predators of eggs and hatchlings. Control programs will be contingent upon and commensurate with the nesting beach and exotic plant or animal involved.

26. Monitor litter and pollution on the nesting beaches. Baseline studies should be made at least annually on the extent of pollution (plastic nets, fishline, tar balls, etc.) washed up on hawksbill nesting beaches. If warranted, methods should be developed to clean it up. Solid debris may obstruct or injure nesting females and inhibit hatchlings crawling to the sea. Volatile and water-soluble contaminants on the beach during the incubation period should be investigated as these contaminants can be absorbed into the egg and embryo. Sources of pollution and the polluters should be identified.

27. Major spills or other pollution events need immediate response to determine what clean-up measures are required. Attention should be given to the clean-up measures to ensure that their impacts on nesting habitat are not greater than the spill itself.

3. Study natural processes on the hawksbill nesting beaches. It is imperative to monitor, investigate and, where necessary and feasible, alleviate some of the important natural population control mechanisms.

31. Study impacts of basalt and calcareous chunks in the nesting beaches. Female turtles sometimes abandon their nest digging when they encounter large rocks or other debris. Hatchlings sometimes become entrapped when attempting to emerge from the nest. If warranted, these obstacles should be removed. Clutches should be exhumed after natural emergence and trapped hatchlings rescued and released at night.

32. Assess the vulnerability of nests to erosion. Conduct studies throughout the nesting season to determine the number of hawksbill nests damaged or lost to storms and beach erosion. Transplant doomed clutches on the berm shortly after oviposition. Establish egg hatcheries at a nearby protect6ed location, if data become available to show that such action is essential.

33. Investigate the effect of rain and salt water inundation on hatchability of eggs. Schedule benign experimental studies on the effect of rainfall (intensity, periodicity) and effect of salt water indunation (amount, duration0 on the gas diffusion within the egg chamber, on development of embryos, hatchability of eggs and entombment of hatchlings.

34. Assay the sand for bacterial content. Measure the build up of the bacteria and fungus in the sand in order to determine if bacterial/fungal action accounts for mortality.

35. Investigate the thermal profile of egg clutches to determine natural sex ratios. Temperature dependent sex determination is the norm among all sea turtle genera. Cooler incubation temperatures yield more males, and warmer temperatures produce more females. The natural sex ratios of hatchling Hawaiian hawksbills need to be determined.

36. Investigate the incidence and extent of natural catastrophic alteration of nesting habitat resulting from tsunamis, storm waves, hurricanes, lava flows, coastal forest fires, and earthquakes. For example, tsunamis have been known to wash away egg clutches on nesting beaches. Where feasible and necessary, mitigating actions should be taken (e.g., egg translocation, beach restoration). nesting hawksbills have been known to die by becoming entrapped, overturned or falling down inhospitable beach terrain. Hatchlings have suffered similar mortality from natural

geological features when they attempt to crawl to the sea. Management actions should be directed at eliminating or reducing these problems to the extent feasible.

Hawaiian Hawksbill

III. Criterion for Recovery

Recovery of the Hawaiian hawksbill population has been reached when nesting on all currently used nesting beaches, known and unknown, has been restored and maintained at carrying capacity. #"carrying capacity" is defined as the number of nesting females that results in the maximum average hatchling production. Carrying capacity is therefore synonymous with "optimum nesting population."

The first step in this recovery process will be to reduce and overcome limiting factors affecting the immediate survival of the population to the extent that it is no longer in danger of becoming extinct (e.g., reclassified from endangered to threatened status).

Biological Overview of the Hawaiian Green Turtle

The Hawaiian green turtle is a long-range migrant breeder and herbivore that spends most of its life foraging and resting in nearshore benthic habitat. Adult females undertake reproductive migrations at intervals of 2 more years, while the adult males often migrate to breed on an annual basis. The colonial breeding site for the Hawaiian green turtle is French Frigate Shoals, a cluster of sand islets in the Northwestern hawaiian Islands situated at lat. 23°45'N, long. 166°10'W, the approximate midpoint of the 2,450 km linear Hawaiian Archipelago (Fig. 1). French Frigate Shoals, along with Nihoa, Necker, Gardner Pinnacles, Laysan, , Maro Reef, and Pearl and Hermes Reef in the Northwestern Hawaiian Islands, is part of the National Wildlife Refuge System administered by the U.S. Fish and Wildlife Service. Tagging studies have shown that turtles nesting at French Frigate Shoals come from numerous foraging areas where they reside throughout the Hawaiian Archipelago, as well as from Jonston Atoll 800 km to the south.

At last 90% of all reproduction by green turtles in the Hawaiian Islands occurs at French Frigate Shoals, mainly on East Island. Due top their small size, nesting occurs throughout the interior of these islets, and not just along the shoreline beaches. The remaining 10% of nesting takes place at Laysan, Lisianski, and Pearl and Hermes Reef. Also, in recent years, a very low level of nesting by green turtles has occurred in the main Hawaiian Island.

Figure 1. Long distance migrations of adult green turtles (Chelonia mydas) in the Hawaiian Archipelago, as determined by tag and recapture studies. French Frigate Shoals is the major breeding colony.

The breeding season at French Frigate Shoals lasts for about 4 months (May-August) although many turtles, especially males, depart for their resident pastures after only a month or two. Copulation, which precedes nesting, occurs in shallow protected waters close to the islet where the female comes ashore to deposit her eggs. The females lay from one to six egg clutches (mean 1.80 at 11- to 18-day intervals (mean 13) within each season. During the internesting intervals, they actively avoid further mating attempts by makes, but remain in shallow water near their nesting beach or, along with males, crawl out on the beach. Land basking of this nature is rare among sea turtles, being limited to a few populations of green turtles found exclusively in the Pacific. In Hawaii this behavior is restricted almost entirely to the Northwestern Hawaiian Islands. It is believed to be carried out for thermoregulation, resting, and possibly for protection from the tiger shark, *Galeocerdo cuvieri*, an important predator of the green turtle.

Hatchling Hawaiian green turtles measuring 5 cm in straight shell length emerge from nests and enter the sea at French Frigate Shoals between July and October. The hatchlings swim immediately away from shore into pelagic habitat where they reside for at least 2 years. During this oceanic phase they are rarely seen, and therefore are not accessible for ecological investigation. Residency is thought to take place at or near the ocean surface, most likely along driftlines or areas where currents converge. Available food sources concentrated in these areas consist of various macroplankton. A combination of ocean currents and a strong swimming ability is believed to account for the turtles' eventual dispersal into nearshore benthic habitat. Turtles <35 cm in shell length are virtually never found in coastal waters of the Hawaiian Islands. The size of 35 cm is therefore assumed to be the minimum at

which recruitment occurs to nearshore habitat from the pelagic environment.

The eight main and inhabited islands consisting of Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau in the southeastern segment of the archipelago (Fig. 1) account for 96% (1,165 km) of the 1,210 km coastline found in Hawaii. Most Hawaiian green turtles from 35 cm juveniles to mature adults >82cm reside in the nearshore habitat of these eight islands. Factors responsible for this distribution include the greater amount of available habitat, and abundance of certain marine vegetation (algae and seagrass) preferred for food, and oceanic currents that appear favorable in transporting young turtles to the main islands for recruitment into coastal habitat. The nearshore benthic habitat surrounding the main islands is, however, limited in scope since great depth generally occur just a few kilometers from shore.

Although green turtles, like all sea turtles, only spend a small portion of their lives on land most research worldwide has been focused on the terrestrial phase of their life cycle. This is due to the critical importance of the breeding colony to the overall survival of each population, and also the easy access afforded to relatively large numbers of nesting females, eggs, and hatchlings in the terrestrial environment. Green turtles, like many other highly mobile marine animals, are difficult to study in their underwatrer habitat.

Immature Hawaiian green turtles living in the wild have been found to grow at a slow rate. From 10 to 60 years (mean 25) may be needed to reach sexual maturity. Based on 10 years of tagging data, the total number of adult females nesting at French Frigate Shoals has been estimated at approximately 750. Comprehensive biological and historical information on these and other major aspects of the Hawaiian green turtle population can be found in the supporting background literature shown in the bibliography.

Hawaiian Green Turtle Recovery Actions for Limiting Factors

I. Monitoring and Assessment of the Population

Overall objective: To continue the development of numerical models and population estimation procedures (See Appendix 1).

1. Adults

11. Nesting females. Continue annual censuses and tagging during the peak nesting season at French Frigate Shoals. Undertake saturation tagging for several consecutive years at French Frigate Shoals. Study the cause of cyclic variation in the annual number of nesting turtles at French Frigate Shoals. This phenomenon is known but as yet unexplained in sea turtle populations.

12. Non-nesting females in basking habaitat. Monitor while basking by tagging and other observations.

13. Males in basking habitat. Monitor while basking by tagging and other observations. Continue documenting the breeding cycles of males which varies from those of females.

14. Explore the application of the archival microchip tag to further elucidate reproductive migratory patterns between foraging pastures and nesting beaches.

15. Continue to evaluate skeletochronological aging techniques to estimate age at maturity.

2. Subadults and adults in nearshore resident habitat. Identify high density forging and resting sites and institute a permanent monitoring program, especially with respect to documenting natural growth rates.

3. Juveniles and hatchlings in pelagic habitat. Continue the development and testing of hatchling tags for estimating growth, mortality, and dispersal.

4. Eggs and hatchlings on the nesting beach. Continue to support mitochondrial DNA studies to genetically discriminate the Hawaiian green turtle from other geographically separated breeding populations of green turtles.

Hawaiian Green Turtle Recovery Actions for Limiting Factors

II. Marine Environment

A. Human Take

1. Increase surveillance and active law enforcement by developing a coordinated plan to prevent illegal capture, mortality, and trafficking. Elicit cooperation of enforcement branches of the National Marine Fisheries Service, State of Hawaii, U.S. Fish and Wildlife Service, U.S. Customs Service, National Park Service, U.S. Coast Guard, country police departments, military agencies, and other authorities to apprehend and prosecute violators. Encourage the public to report suspected violations.

2. Eliminate intentional and unintentional harassment of green turtles. Activities such as skin and scuba diving, vessel traffic, jet skis, and vessel anchoring may disturb or displace green turtles. These factors should be regulated or controlled to eliminate these impacts, especially in sensitive and/or high density foraging and resting areas, some of which are yet to be determined.

3. Establish networks to report incidental take. Along with (1) and (2) above, encourage reporting of incidental take of all dead or alive green turtles resulting from nets, hooks, traps, monofilament fishing line, rope, debris ingestion and entanglement, vessel collisions, explosives, and such illegal fishing methods as the use of "Clorox" and other chemicals. Special attention should be directed to documenting the incidental take of pelagic turtles by driftnets and longlines in the Hawaiian region.

4. Expand and enhance networks to report strandings. Along with (1), (2), and (3) above, promote the reporting of any green turtle out of its element or in a physiologically distressed state. Dead turtles should continue to be salvaged for necropsies, and live turtles should be bought into captivity for possible rehabilitation. No diseased turtle should be returned to the wild.

5. Educate and inform the public on the threatened and protected status of the green turtle in marine habitat. The general public, including school children, fishers, scientific researchers, boat operators, military personnel, and tourists should be made aware of the fact that the green turtle is a threatened species in Hawaii, and that foraging and resting sites are sensitive and important areas worthy of protection.

6. Establish information and education programs extolling the role of green turtles in the cultural heritage of Hawaiian and ethnic backgrounds in Hawaii. By means of advertising and educational programs, promote the virtues of the environmental, conservation, and historical ethic.

7. Permitted research and management activities involving green turtles may be allowed provided the benefits to the green turtle population outweigh the costs. Permitted research and management actions involving other species and activities must be evaluated by the appropriate agencies to eliminate or minimize to acceptable levels any impacts on the green turtle.

8. Catalog and tag all live green turtles being held in captivity. Legally acquired green turtles currently in privately owned ponds, commercial display facilities, and other captive environments should be inventoried and tagged to discourage the illegal take of live turtles from the wild.

Hawaiian Green Turtle Recovery Actions for Limiting Factors

II Marine Environment

B. Predation

1. Investigate the extent and severity of natural predation on hatchlings by sharks,

finfish, seabirds, and possibly monk seals in nearshore waters of breeding areas. Protection plans including predator control should be commensurate with the degree of predation identified.

2. Investigate the extent and severity of natural predation on juveniles in pelagic habaitat. These studies are contingent upon determining the location of this marine habitat and identifying the predators involved. Protection, if feasible in this extensive and dynamic oceanic region, should be commensurate with the degree of predation identified.

3. Investigate the extent and severity of natural predation on immature and adult turtles in nearshore benthic habitat by sharks and finfish. Turtles have been recorded in Hawaii amongst the stomach contents of sharks and groupers. Protection plans including predator control should be commensurate with the degree of predation identified.

4. Investigate the extent and severity of natural predation on remigrating adults in pelagic habitat. Large sharks and killer whales are likely predators in this environment. Protection plans should be commensurate with the degree of predation identified.

Hawaiian Green Turtle
Recovery Actions for Limiting Factors

II. Marine Environment

C. Disease

1. Investigate the incidence, impact and cause of fibropapillomas (tumors) in green turtles. Debilitating fibrous tumors are known to occur in Hawaiian and other populations of green turtles (i.e., Caribbean). However, the incidence of this disease appears to be increasing in Hawaii. Its etiology and effects as they relate to the viability of the population are presently unknown.

2. Investigate the incidence and impact of parasites and infectious agents on green turtles.

21. Determine the extent, impact, and mode of transmission, including intermediate hosts, of blood flukes and other internal parasites.

22. Determine the extent, impact, and mode of transmission of leeches (Ozobranchus) and burrowing barnacles (Stephanolepas) and other external parasites.

23. Determine the extent and impact of certain bacteria (i.e., Vibrios) and other infectious agents.

Hawaiian Green Turtle
Recovery Actions for Limiting Factors

II. Marine Environment

D. Habitat Alteration

1. Maintain natural habitats. Emphasis should be placed on the maintenance of natural green turtle ecosystems. The burden of proof, beyond a reasonable doubt, rests on the advocates interested in altering the natural condition.

2. Inventory and assess extensively utilized foraging and resting habitats. Baseline information is required to identify and understand natural and man-induced habaitat alterations.

21. Important foraging and resting grounds should be identified for special consideration as natural preserves.

22. Shelter type, tides, temperature, salinity, and pressure as they relate to depth, should be investigated.

3. Eliminate adverse human induced habitat alteration in order to maintain foraging and resting habitats.

31. Petrochemical pollution sources can range from small spills related to bilge pumping or broken transmission lines to large scale tanker spills. Spill contingency plans should be reviewed with respect to protecting foraging and resting sites.

32. Major spills or other pollution events need immediate response to determine what clean-up measures are required. Attention should be given to the clean-up measures to ensure that their impacts on foraging and resting habitats are not greater than the spill itself.

33. Identify sources of synthetic debris that may entangle or be ingested by green turtles in foraging and resting habitats, both in the nearshore and pelagic environment. Abatement programs should be initiated.

34. Prevent or mitigate impacts from dredging. Cumulative and secondary impacts, and loss of nearshore habaitat, need to be quantified.

35. Assess the presence and impact in turtles of pesticide, herbicide, and other toxic agents used by humans that enter the coastal marine environment.

36. Investigate the ecological aspects of sedimentation on foraging and resting habitats.

37. Investigate the effects of altering natural freshwater infusion from both springs and surface flow into foraging pastures.

38. Continue to minimize the effects of artificial illumination from vessels and onshore sources during the period of hatchling emergence in turtle breeding areas.

4. Investigate natural events that adversely impact foraging and resting habitats. For example, tsunamis have been known to hurl turtles in foraging pastures far up on shore where they died after being unable to return to the sea.

41. Compile historical information on catastrophic geological and climatological events, such as tsunamis, hurricanes, the "El Nino effect," lava flows, acid rain, coastal forest fires, and earthquakes. Such data will be used to determine the potential impact of future catastrophic events.

42. Investigate fluctuations in natural and introduced forage on resident pastures as they relate to recruitment, growth rates, and remigration intervals.

43. Investigate the dynamics of oceanic currents, gyres, and zones of convergence as they relate to pelagic life stages and their recruitment to benthic habitat. Recent studies have suggested that the green turtle's pelagic stage is longer than previously thought, hence the increased importance of this life cycle phase.

5. Continue to monitor and investigate the foraging assemblage of green turtles near the newly constructed and potentially dangerous nerve gas/chemical munitions incineration plant at Johnston Island. Implement management and research measures previously recommended as the result of earlier published studies.

Hawaiian Green Turtle Recovery Actions for Limiting Factors

III. Terrestrial Environment

A. Human Take

1. Increase surveillance and active law enforcement by developing a coordinated plan to prevent illegal capture, mortality, and trafficking. Elicit cooperation of enforcement branches of the U.S. Fish and Wildlife Service, National Park Service, National Marine Fisheries Service, U.S. Customs Service, state of Hawaii, U.S. Coast Guard, country police departments, military agencies, and other authorities to apprehend and prosecute violators and to encourage the public to report suspected violations.

2. Eliminate unintentional and intentional harassment of green turtles. Aircraft should not land nor fly low over nesting and basking sites. Residents, tourists, and military personnel should be informed to report, but not to disturb, nesting and basking turtles. Military activities on Midway, Kure, Kahoolawe, and elsewhere throughout Hawaii should be

programmed to mitigate disturbance of sea turtles.

21. In the main Hawaiian Islands egg nests and hatchlings are susceptible to crushing and hatchlings are disoriented by vehicles on nesting beaches. Hatchlings may also be deterred by tire tracks from reaching the ocean thereby increasing their exposure to desiccation and predation. Adult females may be struck while ascending or descending the beach or while nesting. Elicit cooperation of appropriate law enforcement agencies and other public and private entities, including landowners, to eliminate vehicles on known nesting beaches.

3. Educate and inform the public on the threatened and protected status of the Hawaiian green turtle. The general public, including school children, fishermen, scientific researchers, boat operators, military personnel, and tourists should be made aware of the fact that green turtles are threatened species in Hawaii and that nesting and basking beaches are sensitive and important areas worthy of protection.

4. Establish information and education programs extolling the role of green turtles in the cultural heritage of Hawaiians and other ethnic backgrounds in Hawaii. By means of advertising and educational programs point out the virtues of the environmental, and conservation and historical ethics.

5. Permitted research and management activities involving green turtles may be allowed provided the benefits to the green turtle population outweigh the costs. Permitted research and management actions involving other species and activities must be evaluated by the appropriate agencies to eliminate or minimize to acceptable levels any impacts on the green turtle. Permitted research involving tagging and censuses during the peak nesting season at East Island, French Frigate Shoals, should receive priority over the permitted activities at this critical site for the green turtle population. This research, which has been carried out continuously since 1973, is the basis for monitoring and assessment of the population through numerical models for population estimates and trends. There are no alternate times of the year or other sites where this work can be conducted.

6. Breeding effects for conservation purposes using turtles presently in captivity, such as conducted at Sea Life Park, should be encouraged. Healthy hatchlings produced in captivity should be encouraged. healthy hatchlings produced in captivity should ideally be released at known nesting beaches on the following night. Head starting with a portion of the *captive-bred hatchlings* to a size appropriate for tagging and release into coastal foraging pastures in encouraged for *experimental* restocking purposes. all turtles released into the wild must be certified free of disease.

Hawaiian Green Turtle
Recovery Actions for Limiting Factors

III. Terrestrial Environment

B. Predation

1. Investigate severity of egg destruction and predation. Previous work on East Island has shown that ghost crabs do not prey upon turtle eggs but studies should be made on whether crab burrows cause eggs to desiccate or provide access for other potentially harmful organisms)e.g., ants, flies, and their larvae).

11. Quantify egg destruction by abnormal nesters. Amputee nesters sometimes inadvertently break their own eggs during oviposition and concealment of the nest, and sometimes phenotypically normal females unconsciously destroy some of their own eggs during nesting.

12. Quantify egg destruction by nesters. In some areas because the nesting beach is limited, late nesters dig up eggs of earlier nesters, while in a few places (viz., Heron Island, Australia) density-dependent nest destruction exists. These phenomena should be analyzed in relation to the carrying capacity of the habitat.

13. Quantify egg destruction incidental so shearwater burrowing.

Preliminary observations of this occurrence at East Island should be augmented with statistical studies.

2. Investigate the severity of egg loss by predation. In the main Hawaiian Islands the extent of this predation by ghost crabs, mongooses, cats, dogs, birds, and possibly rats and feral pigs, needs to be determined. Egg protection and predator control by government and private entities should be commensurate with degree of predation identified.

3. Investigate severity of hatchling predation. Earlier work indicates that ghost crabs at french frigate Shoals prey on hatchlings. The extent of this predation needs to be documented. Likewise, the occurrence and extent of predation by frigate birds needs to be studied. Hatchling protection and predator control should be commensurate with the degree of predation identified.

31. Investigate severity of hatchling predation in the main Hawaiian Islands. The extent of predation by ghost crabs, mongooses, cats, dogs, birds, rats and feral pigs needs to be determined. Hatchling protection and predator control should be commensurate with the degree of predation identified.

Hawaiian Green Turtle Recovery Actions for Limiting Factors

III. Terrestrial Environment

C. Disease

1. Investigate the incidence and impact of ticks and other blood sucking insects capable of transmitting disease. Ticks (*Ornithodoros*) are present in the soil of all the islets at French Frigate Shoals where they periodically undergo population explosions. Seabirds are the principal blood sources for these ticks, however, they are also known to parasitize nesting turtles, monk seals, and humans. Their ability to transmit virus and other potentially harmful pathogens to nesting and basking turtles, as well as cause anemia to hatchlings in the nest, needs to be determined.

Hawaiian Green Turtle Recovery Actions for Limiting Factors

III. Terrestrial Environment

D. Habitat Alteration

1. Maintain natural habitats. Emphasis should be placed on the maintenance of natural green turtle ecosystems. The burden of proof, beyond a reasonable doubt, rests on the advocates interested in altering the natural condition.

2. Maintain nesting and basking beaches to eliminate adverse human-induced habaitat alteration. One of the main objectives of the green turtle recovery plan is to restore, and then maintain at carrying capacity, a natural number of nesting females on the existing Hawaiian nesting beaches. In addition, if feasible, depopulated beaches should be restored where green turtles historically nested in hawaii. The principal nesting sites are French frigate Shoals, Laysan Island, Lisianski Island, and Pearl and Hermes Reef. French Frigate Shoals is presently by far the most important since it hosts over an estimated 90% of all nesting by green turtles in the Hawaiian Islands. Within the past 5 years a few green turtles have nested sporadically on several beaches in the main Hawaiian Islands. The main sites of this activity include Lawai kai, Kipu Kai, and Kaupea on Kauai Kahuku on Oahu, and Moomomi on Molokai. Basking takes place at all of the nesting beaches in the Northwestern Hawaiian Islands, as well as at Kure Atoll and on lava rock ledges on Necker Island and Nihoa Island. Basking also occurs at a low level on the NaPali coast of Kauai. All of these nesting and basking beaches should be protected to eliminate or exclude undesirable habitat alteration.

21. Nesting and basking beaches in the main Hawaiian Islands should be designated for special consideration as natural preserves.

22. Control access to the nesting and basking beaches. The U.S. Fish and Wildlife Service regulates legal access to French Frigate Shoals through a permit system. It is essential that current levels of protection afforded by on-site management personnel at Tern Island be maintained as a deterrent against turtle poachers and other trespassers. The U.S. Fish and Wildlife Service should also continue to limit entry and strictly regulate human activities at other islands and reefs used by green turtles in the Hawaiian Islands National Wildlife Refuge. Other agencies (e.g., State of Hawaii, country governments, U.S. Navy, U.S. Coast Guard) should actively cooperate with the Fish and Wildlife Service and enforce regulations within their own jurisdictions.

23. Create a contingency plan. The State of Hawaii, country governments, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service should have a contingency plan to counter the inevitable demands that the growing tourist industry will make regarding access to the islands and coastal areas with nesting and basking beaches.

24. Control artificial illumination. A plethora of scientific research has shown that artificial illumination (from domiciles, lanterns, flashlights, flashbulbs) will disturb nesting females and disorient hatchlings. The quantity of light should be controlled by limiting access and, where necessary, shoreline development. The quality of light present on natural nesting beaches needs investigation. Studies should be made on the intensity and color of light that has minimal effect on turtles of all sizes.

25. Prevent the introduction of exotic plants and animals. Some nesting turtles are adversely impacted by the presence of certain types of vegetation and their root systems which respectively inhibit digging the body pit and egg chamber. Exotic vegetation may also alter the natural sun/shade mosaic on the nesting beach and thus produce abnormal ratios of males - females, as well as alter the duration of incubation. The ecesis of opportunistic animals, like rats and mongooses, must be prevented in the Hawaiian Islands National Wildlife Refuge as they would prey upon eggs and hatchlings. Control programs will be contingent upon and commensurate with the nesting beach and exotic plant or animal involved.

26. Remove human debris from East and other islets as French Frigate Shoals. For example, abandoned antenna wire is inhibiting normal nesting behavior of some female turtles on East Island. The U.S. Fish and Wildlife, State of Hawaii, and National Marine Fisheries Service, and military personnel should work together to clean up this debris. The hardpacked terrain and sheet-pile seawall at Tern Island limit the availability of terrestrial habitat for nesting and basking and are known to disorient and trap turtles on land. This necessitates on-site management personnel to rescue and release these turtles.

27. Implement improved garbage and human waste disposal methods on the nesting beaches. Garbage should be packaged and removed from French Frigate Shoals. Organic garbage dumped into the sea may attract sharks which may prey upon turtles also attracted on the debris. Plastics discarded into the sea can be ingested by or entangle sea turtles. Burying garbage on nesting beaches changes soil chemistry with potential negative impact on embryonic or hatchling imprinting. Proper disposal of toilet wastes from researches on the small islets at French Frigate Shoals that has the least impact on nesting turtles needs to be determined.

28. On-site management personnel need to be maintained at Tern Island to discourage illegal entry by vessels into French Frigate Shoals which could result in greater numbers of groundings, wreckage, and pollution.

29. Monitor litter and pollution on the nesting beaches. Baseline studies should be made annually on the extent of pollution (plastic nets, fishline, tar balls, etc.) washed up on the nesting and

basking beaches. If warranted, methods should be developed to clean it up. Solid debris may obstruct or injure nesting females and inhibit hatchlings crawling to the sea. Volatile and water-soluble contaminants on the beach during the incubation period should be investigated as these contaminants can be absorbed into the egg and embryo. Sources of pollution and the polluters should be identified.

3. Study natural processes on the nesting and basking beaches. It is imperative to monitor, investigate, and, where necessary and feasible, alleviate, some of the important natural population control mechanisms.

31. Removal of calcareous chunks from the nesting beaches. Female turtles at French Frigate Shoals sometimes abandon their nest digging when they encounter large pieces of limestone. Hatchings sometimes become entrapped when attempting to emerge from the nest. These obstacles should be removed along with the wire and other debris. Clutches should be exhumed after natural emergence and trapped hatchlings rescued and released at night.

32. Asses the vulnerability of nests to erosion. Conduct studies throughout the nesting season on the major beaches at French Frigate Shoals to determine the number of nests damaged or lost to storms and beach erosion. Transplant doomed clutches on the berm shortly after oviposition. There is no need to establish egg hatcheries on French Frigate Shoals at this time.

33. Investigate the effect of rain and salt water inundation on hatchability of eggs. Schedule experimental studies on the effect of rainfall (intensity, periodicity) and effect of salt water indunation (amount, duration) on the gas diffusion within the egg chamber, on development of embryos, hatchability of eggs, and entombment of hatchlings.

34. Assay the sand for bacterial content. Because of the presence of green turtles, seabirds, monk seals, and other biota at French Frigate Shoals for millennia, it is important to measure the build up of the bacteria and fungus in the sand in order to determine if bacterial/fungal action accounts for some of the egg mortality here.

35. Investigate abortive nesting attempts. Conduct studies on why up to one-half or more of the emerging females on any one night at French Frigate Shoals (especially East and Whale-Skate Island) may fail to lay eggs. Prevailing hypotheses which need further investigations revolve around insufficient soil moisture or rootlets, limestone chunks, and amputated hind flippers. Investigators should also look for evidence of sand-smelling and false crawls which are indicative of the accuracy of nest-site selection and reproductive readiness.

36. Investigate the thermal profile of egg clutches to determine natural sex ratios. Temperature dependent sex determination is the norm among all sea turtle genera. Cooler incubation temperatures yield more males, and warmer temperatures produce more females. The natural sex ratios of hatchlings produced at French Frigate Shoals need to be determined.

37. Investigate the incidence and extent of natural catastrophic alteration of nesting habitat resulting from tsunamis, storm waves, lava flows, coastal forest fires, and earthquakes. For example, tsunami have been known to wash away egg-clutches on nesting beaches. Where feasible and necessary, mitigating actions should be undertaken.

Hawaiian Green Turtle

IV. Criterion for Recovery

Recovery of the Hawaiian green turtle population has been reached when nesting on all currently used nesting beaches, known and unknown, has been restored and maintained at carrying capacity. "Carrying capacity" is defined as the number of nesting females that results in the maximum average hatchling production. Carrying

capacity is therefore synonymous with "optimum nesting population."

This does nit imply that currently unused nesting beaches which have been identified as historical nesting sites must necessarily be restored to carrying capacity as part of the Recovery Criterion. There may be restored to carrying capacity as part of the Recovery Criterion. There may be existing or historic factors which preclude the successful occupation of these sites and, realistically these areas should not be considered. However, there may be nesting sites that are now being used at less than carrying capacity which have not been discovered and should e included within the definition.

Biological Overview of the Leatherback and Olive Ridley in Hawaiian Waters

There are no historical records or other evidence from the early Hawaiian culture that breeding populations of the leatherback or olive ridley ever occurred in the Hawaiian Islands. The only known nesting of these species at present consists of a single egg-clutch laid by an olive ridley on Maui in September of 1985; and for the leatherback, a false nesting attempt on Maui in August of 1982 and a reported but not verified successful nesting on Kauau in December of 1986. There is, however, considerable indication that the pelagic zone surrounding the Hawaiian Islands constitutes regularly used foraging habitat and/or migratory pathways for both species.

Leatherbacks are commonly seen by fishermen in Hawaiian offshore waters, generally beyond the 100-fathom curve but within sight of land. Two areas where sightings often take place are off the north coast of Oahu and the West (Kona) coast the Island of Hawaii. Further to the north of the Hawaiian Islands, a high seas aggregation of leatherbacks is known to occur at lat. 35° - 45° N, long. 175° - 180° W. Incidental capture in this region has been reported to take place in pelagic drift nets deployed by foreign fishing vessels.

Available information suggests that the olive ridley also regularly uses the Hawaiian pelagic region for foraging and/or developmental migrations. Sightings of olive ridleys are fewer, but this is likely due to its small size in contrast with the larger and far more distinctive leatherback. It is not unusual for olive ridleys in reasonably good health to be found entangled in scraps of net or other floating synthetic debris. Small crabs, barnacles and other marine life often reside on the debris and likely serve as a food attraction to turtles.

Subadult leatherbacks, as well as juvenile and subadult olive ridleys, are among the life stages known to be present in Hawaiian waters. The significance of this finding rests in the fact that, for both species worldwide, very little information exists on the developmental ecology of the immature life stages. Such turtles are rarely ever seen in the wild, starting from the time they leave the beach as hatchlings until they return to nest as adults.

The leatherback is listed as an endangered species (since 1970), and the olive ridley as a threatened species (since 1978), except for east Pacific breeding populations in Mexico and in Surinam where they are listed as endangered. Olive ridleys in Hawaiian waters are herein considered as endangered because their derivation is most likely to be from the Pacific coast of Mexico.

Additional information on the leatherback and olive ridley can be found in the supporting background literature shown in the bibliography.

Leatherback and Olive Ridley Recovery Actions for Limiting Factors

I. Marine Environment

A. Human Take

1. Increase surveillance and active law enforcement by developing a coordinated plan to prevent illegal capture, mortality, and trafficking. Elicit the cooperation of enforcement branches of the National Marine Fisheries Service, State of Hawaii, U.S. Fish and Wildlife Service, U.S. Customs Service, National Park Service, U.S. Coast Guard, country police departments, military agencies, and other authorities to apprehend and prosecute violators. Encourage the public, especially offshore fishermen, to report suspected violations.

2. Establish networks to report incidental take. Along with (1) above,encourage reporting of incidental take of all dead or alive leatherbacks and olive ridleys resulting from pelagic driftnets, longlines, hooks, traps, lines, debris ingestion and entanglement, and vessel collisions. Inform fishermen and others involved in these networks how to identify the leatherback and olive ridley and distinguish them from the hawksbill and green turtle.

3. Expand and enhance networks to report strandings. Along with (1) and (2) above, promote the reporting of any leatherback

and olive ridley out of its element or in a physiologically distressed state. Dead turtles should continue to be salvaged for necropsies, and live turtles should be brought into captivity for possible rehabilitation. No diseased turtle should be returned to the wild. healthy turtles that are released should be tagged, photographed, measured, and weighed.

4. Educate and inform the public on the endangered and protected status of the leatherback and olive ridley in marine habitat. The general public, including school children, fishers, scientific researchers, boat operators, military personnel, and tourists should be made aware of the fact that the leatherback and olive ridley are endangered and protected species in Hawaiian waters.

5. Permitted research and management activities involving the leatherback and olive ridley may be allowed provided the benefits to the leatherback and olive ridley populations outweigh the costs. Permitted research and management actions involving other species and activities must be evaluated by the appropriate agencies to eliminate or minimize to acceptable levels any impacts on the leatherback and olive ridley.

Leatherback and Olive Ridley Recovery Actions for Limiting Factors

I. Marine Environment

B. Predation

1. Investigate the extent and severity of natural predation on adults, subadults, and juveniles in pelagic habaitat. These studies are contingent upon determining the location of this marine haabaitat and identifying the predators involved. Protection plans, if feasible in this extensive and dynamic oceanic region, should be commensurate with the degree of predation identified.

Leatherback and Olive Ridley Recovery Actions for Limiting Factors

I. Marine Environment

C. Disease

1. Investigate the incidence and impact of parasites and infectious agents on the leatherback and olive ridley. Virtually nothing is known in Hawaii about the occurrence of bacterial infections (e.g., Vibrios), virus, parasites such as blood flukes, leeches and burrowing barnacles, and possible tumors, in the leatherback and olive ridley.

Leatherback and Olive Ridley Recovery Actions for Limiting Factors

I. Marine Environment

D. Habitat Alteration

1. Eliminate adverse human induced habitat alteration in order to maintain pelagic habitats.

11. Petrochemical pollution sources can range from small spills related to bilge pumping or broken transmission lines to large scale tanker spills. Spill contingency plans should be reviewed with respect to protecting pelagic habitats.

12. Major spills or other pollution events need immediate response to determine what clean-up measures are required. Attention should be given to the clean-up measures to ensure that their impacts on pelagic habitats are not greater than the spill itself.

13. Identify sources of synthetic debris that may entangle or be ingested by leatherbacks and olive ridleys in pelagic habitats. Abatement programs should be initiated.

14. Asses the presence and impact in turtles of pesticide, herbicide, and other toxic agents used by humans that enter the pelagic environment.

2. Investigate natural events that adversely impact pelagic habitats.

21. Compile historical information on catastrophic events, such as hurricanes, and the "El Nino effect." Such data will be used to determine the potential impact of future catastrophic events.

22. As food items for the leather back and live ridley become known, investigate natural fluctuations in abundance and distribution.

23. Investigate the dynamics of oceanic currents, gyres, and zones of convergence as they relate to pelagic to pelagic life stages.

Leatherback and Olive Ridley Recovery Actions for Limiting Factors

II. Terrestrial Environment

1. The point of origin (nesting beaches) for leather backs and live ridleys in Hawaiian water should be determined.

11. Additional nesting within the Hawaiian Islands should be documented. The egg clutches should be protected and hatchlings cataloged prior to release.

Leatherback and Olive Ridley

III. Criterion for Recovery

A determination of conditions for the recovery of the leatherback and olive ridley in Hawaiian waters will only be possible when adequate knowledge becomes available on their life history and ecology, especially the exact locations and conservation status of the nesting beaches. Recovery actions will then have to be heavily focused on international cooperative efforts, since there are no known nesting colonies of these two species under U.S. jurisdiction in the Pacific region.

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APPENDIX 1

Considerations for Population Assessment and Monitoring of the Hawaiian Green Turtle

Prepared by Jerry A. Wetherall

This appendix examines several topics germane to the monitoring and assessment of Hawaiian green sea turtles, expanding on points raised in the main text of the Recovery Plan. Items discussed include monitoring objectives, basic concepts and information needs for population modeling, and strategies and procedures for nesting population assessment. In the last sections, the methods currently used to monitor nesting females at East Island are described, estimates of East Island nesters are presented, and critical areas for further research are identified.

I. Population Assessment and Monitoring Objectives

According to the Recovery Plan, the "recovery" of the Hawaiian green sea turtle population will be realized when the annual average number of nesting females on each currently used nesting beach, known or unknown, is restored to the beach's biological carrying capacity, and maintained at that level.

Three actions are necessary to implement the recovery rule. First, an inventory of "currently used nesting beaches, known or unknown" must be completed. Second, the !biological carrying capacity: of each beach must be estimated. Third, a standard procedure for assessing the status of nesting females on each beach must be developed.

The recovery criterion provides a very specific focal point for population monitoring and assessment activities. However, the scope of recovery program objectives should probably be somewhat broader. The set of important objectives might include the following:

(1) Monitor changes or trends in population abundance

In accord with the chosen recovery criterion, a basic requirement of the recovery program is a means of producing regular estimates of the size of the population of nesting females, or an index of its abundance. A long time series of abundance estimates (or indices) based on consistent survey and estimation procedures is required to reveal patterns of variability against which the significance of trends can be judged.

(2) Predict population size and recovery rate or time

Under ideal circumstances, in addition to monitoring nesting population levels, we would be able to predict the size of each cohort at various ontogenetic stages, given a model of the population dynamics and management action scenarios. Further, we would be able to estimate the time to recovery of the total population for a proposed set of management actions, within known limits of precision. This capability would require a sound knowledge of biological parameters of reproduction, (fairly readily available), maturation rates (still unknown), remigration rates (known) and survival rates (unknown at all stages from hatchling onwards), and their response to various management actions.

(3) Evaluate the effectiveness of recovery actions

Assessing performance of recovery actions requires having a defined measure of success (the recovery criterion), the ability to decide when success is achieved, and ultimately the ability to detect whether success was due to management actions or to other (natural) events.

Our present capabilities support objective (1) to some degree, with respect to the population of nesting females at East Island, French Frigate Shoals. Objective (2) can be attempted only roughly; we can substitute educated guesses for firm estimates of population parameters and project rates of population growth. To allow for uncertainty in the underlying assumptions, we can repeat the projections for a range of parameter scenarios. Objective (3) is important to recovery program management, but separating the effects of recovery actions from natural population changes will be extremely difficult.

II. Model of Population Dynamics

The second recovery objective, predicting population trends, requires a long-term program of biological research and analysis leading to a model of population dynamics.

Green turtle population dynamics may best be treated by considering discrete life stages, each characterized by a unique set of attributes with respect to habitat, behavior, and accessibility. A reasonable way to begin is to define the population of nesting females in a given year. This provides a starting point for a distinct cohort of offspring. At any point in time, a model of the total population dynamic can be constructed by tracing the history of each such cohort over its lifespan, and integrating over all cohorts still present in the population. The information needed for modeling the population dynamics varies among the stages, as follows:

(1) Nesting females

For modeling purposes, the key attributes of nesting females at a particular nesting beach are the distribution of their first arrival times at the nesting beach, the multiplicity of nesting episodes (number of clutches of eggs deposited per female0, the distribution of time intervals between successive nesting emergences (interesting interval), the distribution of the duration of each nesting episode (number of nights required to successfully deposit a clutch of eggs), and the distribution of clutch size (number of eggs deposited per nest). With such information, identification and enumeration of individual nesters (or their nests) during a beach survey allow estimation of the number of females nesting that season, the total number of nests dug, and the number of eggs deposited in the beach. Further, if neophytes can be distinguished from remigrants (e.g., by saturation tagging over several seasons), recruitment can also be estimated.

(2) Hatchlings

Knowledge of the distribution of hatching success among nests on a beach allows estimation of the probability of survival from deposition to hatching, and the total number of hatchlings produced during the season. Rates of predation during the crawl to the sea can also be observed, so the size of the cohort at the beginning of its sea life can be computed.

(3) Early juvenile pelagic stage

The parameters we need to know for this stage are growth rate and survival rate. A model of distribution dynamics, including rates of dispersal, range of movement, spatial patterns, social structure, and feeding behavior would also be valuable.

(4) Subadults

To develop complete models of this stage we will have to be able to age turtles, so we can compute growth rates, survival rates and maturation rates (distribution of ages at maturity and first nesting). Further, we need top find out how these processes are affected by such factors as forage type and abundance. Ultimately, we also need to know the rates of immigration of the smallest subadults to the inshore habitat, and rates and patterns of movement of the various subadults among different inshore areas.

(5) Adult males and non-nesting females

For turtles in these categories we need to know the growth and survival rates, and the distribution dynamics, i.e., the size- or age-specific migration patterns, habitat residence times, and so on. For the adult females in between nesting seasons, we need to know the factors affecting the reproductive cycle and the remigration interval (regenerative period).

III. Population Assessment Strategy

A. Constraints and Limitations

Several factors impinge on the options available for green turtle populationb assessment. The most important of these are:

(1) Limited access

Of the life stages outlined above, only the first and second can be monitored with reasonable ease and completeness. They involve land-based surveys (although aerial surveys of nesting activity are sometimes

done on beaches in the Caribbean and elsewhere), compressed both geographically and temporally. The other stages allow only partial observation, with the difficulty of at-sea observation over widespread habitats and extended time periods.

(2) Lack of aging method

A major impediment to building turtle population models is lack of age composition information. Aging capability would lead directly to estimates of growth and survival rates in all life stages, and a complete model of population size (cohort life history). In lieu of age composition data, we must rely on an index or proxy for total population abundance; this is provided by estimating the number of nesting females.

(3) Remigration behavior

Even without the ability to age sea turtles, we could use standard tag-and-recapture methods to estimate survival rates were it not for the multi-year regenerative period and cyclic remigration behavior. These result in the confounding of adult survival probabilities and remigration probabilities in tag-recapture models. To estimate the survival rates we have to make assumptions about remigration rates, and vice versa; we cannot get separate and independent estimates of the two. Fortunately, this problem does not affect estimation of nesting population size.

It is clear from these constraint that the only feasible strategy for monitoring recovery trends is the one embodies in the recovery criterion, i.e., to regularly estimate the number of females nesting at East Island and other beaches. Any other criteria would require a much better grasp of population dynamics than we now possess and greater resources than are now available to the recovery program.

An unavoidable drawback of this strategy is that management actions taken now to increase survival of eggs, hatchlings and juveniles may not affect the nesting population for several decades. Even then their impacts may be difficult to isolate due to smoothing effects and natural background variability. Similarly, current trends in the nesting population may e due as much to undocumented events decades ago as to any recent recovery actions.,

B. Estimating the Nesting Population

(1) Basic approaches

There are various approaches to estimating nesting populations. All of them involve surveying nesting habaitat during part of the nesting season (or the entire season if sufficient resources are available), and calculating the number of females hauling out to nest during the survey period(s). If only part of the season is surveyed, the number of nesters for the total season is computed by applying raising factors to expand the survey statistics.

The methods vary in the way the number of turtles nesting during the survey period is computed. In some green turtle colonies of the South Atlantic and Caribbean, surveyors count fresh nests or turtle tracks (excluding false crawls) each day during the survey period. Then daily counts of new nests are summed over the survey period or season, and the total counts a divided by the average number of nests per female. The latter quantity is determined by tagging turtles and resighting them on subsequent emergences. In other colonies, such as the one nesting at East Island, the number of females nesting during the survey period is determined directly, by examining each turtle hauling out and applying numbered tags to establish individual identities. Below, the East island method is described in detail.

(2) The East Island method

(a) Census counts

During the survey period (or periods), a complete count of turtles hauling out to nest on the beaches at East Island is made. Each turtle encountered is examined for the presence of an identifying flipper tag. If a turtle is tagless, one or more tags is attached and the tag number(s) recorded. Multiple tags assure that the turtle's identity will be known on subsequent encounters, and allow estimation of tag shedding rates.

The survey period(s) is chosen to coincide with the assumed peak of nesting activity, usually during a 2- or 3-week

interval in June and July. The length of the nesting season at East Island has been determined through periodic visits to the island over many years, and the within-season distribution of nesting activity has been estimated from comprehensive surveys in 1974 and 1975. A 2-week census period is just long enough that turtles nesting during the first nigh of the survey will be resighted once, on average. During longer surveys, turtles may be observed during several successive nesting episodes. Although resight intervals provide additional information on nesting behavior, they do not figure directly in the population estimation; only the initial encounter matters.

(b) Coverage rate model

The most critical part of the estimation procedure is the raising factor, the number multiplied by the census counter to compute the total season's nesting population. The raising factor is the reciprocal of the coverage rate, or the overall probability that a turtle nesting that season will be encountered during the specified survey period(s).

The coverage rate is computed from a stochastic model of residence time that takes into account the within-season distribution of arrival times (date of first haul out by a nester), the distribution of the number of nests completed per nester during the season, the distribution of the interval between separate nesting episodes (internesting interval)Z and the distribution of the duration of a nesting esisode. Each of these component distributions is itself a probability distribution estimated from data collected during the comprehensive surveys of 1974 and 1975, and other observations.

There are two ways to compute the coverage rate for a survey. One (the stochastic method) involves accounting for all possible combinations of events, i.e., all possible combinations of arrival time, number of nests, duration of nest-building activity, and internesting interval, that could produce the observed count of nesting turtles. This involves an enormous amount of nesting turtles. This involves an enormous amount of computation. An easier approach (the deterministic method) is to estimate the coverage rate using the average or expected values of the component distributions. As long as the underlying distributions are reasonably symmetrical, the "quick-and-dirty" method should produce estimates close to those of the exhaustive approach.

(c) Raising factor and East Island nesting population estimate

The nesting population at East Island is estimated by dividing the survey count by the coverage rate, or first computing the raising factor and multiplying this by the count.

(d) Statewide nesting population estimate

Surveys of other nesting beaches at French Frigate Shoals, or elsewhere in the Hawaiian Islands have been infrequent. The general assumption is that East Island is the key green turtle nesting habitat in the archipelago, accounting for roughly 55% of the total French Frigate Shoals nesting. The French Frigate Shoals nesting population, in turn, is thought to make up about 90% of the statewide nesting population. Until regular surveys can be established at other nesting beaches, a rough estimate of the annual number of females nesting in Hawaii may therefore be computed by doubling he East Island census figure.

In addition, for every female nesting in a given year, there are probably three or four mature, veteran nesters not breeding that year. The total statewide population of mature females may therefore be about six-eight times the number nesting each season at East Island. Expansion of this estimate to the total adult population, and to immature stages, would require knowledge of sex ratios and age composition; neither is available. Obviously, such extrapolations must be viewed circumspectly. Until better information is acquired on population structure, the sensible alternative is to focus only on the nesting population estimates for those beaches which are surveyed, and to compare these levels with carrying capacities, as the recovery criterion stipulates.

(e) Precision of the population estimate

Because the survey counts at East Island are assumed to be exact (determined without error), reliability of the population estimate is a function of uncertainty in the coverage rate only. This in turn depends on natural and sampling variation in the underlying component probability distributions. Intrinsic interannual variation in the arrival time distribution, for example, will contribute to uncertainty in a population estimate based on average conditions or on an assumed constant arrival distribution. Likewise, sampling error in estimating the underlying distributions will add to uncertainty in the final population estimate, even if the haul-out schedules and nesting behavior are constant from year to year.

Precision (and statistical bias) of the deterministic population estimate can be estimated by the method of bootstrapping. This is a computer-intensive method which will produce estimates of standard errors of nesting population estimates, and confidence intervals for population size. It has not yet been applied to the East Island data. Similar, but prohibitively expensive, bootstrap procedures could be used with the stochastic estimates.

IV. Recent Trends in the East Island Nesting Population

Historical records are insufficient to allow estimates of the number of green turtles nesting annually at East Island or other nesting beaches in the years prior to 1973.

However, since 1973, systematic surveys of East Island have been conducted. These studies, including comprehensive tagging of all turtles encountered (whether basking or nesting) were most extensive in 1974and 1975, when detailed data on nesting behavior and other biological parameters important to monitoring and population modeling were collected.

Using a coverage rate model developed from the detailed biological information, the number of females nesting annually at East Island has been computed for a 15-year period, 1973-87 (Fig. l). In most years, surveys were confined to a 2- or 3-week interval during the assumed peak of the nesting season. Coverage rates ranged from 84% in 1974 to 25% in 1977.

In general, the surveys show an increase in the nesting population over the 125-year period, with considerable variation. During the first 8 years of the monitoring period, the average annual nesting population was 127 turtles. During the second 7-ear interval, the average was 196 turtles, an increase of 54%. If the extremely low estimate for 1983 is excluded from the second series of years, the increase amounts to 73%. The twofold variation among annual estimates evident during the first 8 years decraesed considerably during the second 7-ear period (excluding the 1983 data).

The factors underlying the apparent increase in the East Island nesting population and the year-to-year variability are not understood. The rising trend in the population may be due to a reduction in harvest of mature turtles and subadults; green turtles have been fully protected in Hawaii since September 1978.

The increase in variability may have a number of causes. The cyclic nature of the regeneration and remigration process contributes to some of the systematic interannual variability, and this can be compounded by environmental perturbations. For example, a delay in reproductive development due to subnormal nutrition could conceivably generate a "bust" and "boom" situation. (Note that in late 1982, the year prior to the lowest recorded nesting population, inshore turtle

forage may have been adversely affected by hurricane Iwa.)

Another source of variability in the nesting population estimates is interannual variation in the residence time distribution. In the extreme (but unlikely) case that the nesting population is constant, variability among nesting population estimates will be determined entirely by variation in the processes determining residence time probabilities, and their departure from the 1974-1975 conditions.

Finally, as noted before, variability in the nesting population may arise from variations in recruitment, due in turn to vagaries of egg or hatchling survival half a century earlier.

V. Research Needed for Monitoring and Modeling Population Dynamics

Monitoring procedures and models of green turtle population dynamics can be improved by field experiments or analysis in several areas. Some of these are mentioned in the main text of the Recovery Plan, but are repeated here for emphasis.

(1) Bias estimation and reduction

The utility of the annual estimates for monitoring population trends depends on their consistency, i.e., any biases in the estimates must be proportionally constant. For more demanding analyses requiring knowledge of the absolute population size, biases must be reduced to negligible levels. In either case, further research is needed to define the types and magnitude of systematic biases affecting the population estimates generated by current procedures and assumptions.

A major potential source of systematic bias is in the assumptions concerning arrival time distribution and nesting behavior. Failure of such key assumptions will invalidate the coverage rate estimates. There are two problems. First, the parameters of some of these processes have been estimated from very little data. Second, although they are assumed to be constant, the underlying processes may vary from year to year in unknown ways. To measure interannual variability in the arrival distribution and nesting behavior, nesting activity at East Island must be observed in detail over several complete nesting seasons. The two seasons already studied in detail (and these not fully covered) are insufficient. Only through a series of such complete surveys will it be possible to assess the reliability of population trend assessments. During these comprehensive surveys, observations should be made on the various aspects of nesting behavior important in coverage rate estimation. In addition, studies of clutch size and egg and hatchling survival on the beach should be done.

(2) Estimate of precision

To evaluate the effectiveness of recovery actions and the statistical significance of observed changes in nesting population size, the precision of population estimates must be determined. The bootstrap analyses described above should be conducted using current assumptions on arrival time and nesting behavior distributions. Once this is done, it will be possible to estimate the number of years required to detect a specified change in the population size with a stated level of confidence.

Estimates of precision, as well as the level of precision itself, can be improved by conducting the complete surveys mentioned above in reference to bias estimation and reduction. In particular, the relative importance of intrinsic variation and sampling variation can be judged. When sources and levels of bias and variance are better understood, census design parameters (e.g., survey interval) can be optimized with respect to specified monitoring objectives and cost constraints.

(3) Census of other nesting grounds

Present assumptions on the contribution of East Island nesting activity to the total population's reproductive output should be tested by conducting complete surveys of other nesting grounds, at french Frigate Shoals and elsewhere. Such studies will also provide useful ancillary information on remigration intervals and site fidelity (straying).

(4) Monitoring of turtles in inshore habitats

While estimating the number of nesting females is currently the best way to judge total population trends, and the focal point for measuring recovery success, sections of inshore habaitat should be established for long-term annual monitoring of juveniles and non-nesting adults. Inshore habitat census procedures should be developed and standardized. Survey sections should encompass several regions of primary inshore habitat, and areas of marginal habaitat infrequently used. Besides turtle densities, the surveys should measure the character and quality of the habitat, e.g., forage density and composition.

(5) Estimating recruitment by saturation tagging

One result of a complete survey of the east Island nesting population would be the tagging of the year's entire cohort of recruits, remigrants which had not been encountered on earlier surveys, and any remigrants which had been tagged previously but had shed their tag(s). If each turtle is identified by multiple tags, the probability that it will be tagless during its next nesting season, 2-65 years hence, will be negligible. Thus, if saturation tagging with multiple tags is done for several consecutive years, eventually the only untagged turtles encountered during a survey will be neophytes, and the ratio of recruits to veteran nesters can be estimated.

However, to estimate recruitment annually would require complete coverage of nesting activity and saturation tagging each year, an unlikely possibility.

(6) Developing aging methods

(7) Estimating growth, mortality, and population size by tag-and-resight

Experiments to estimate growth and mortality rates should be conducted by releasing large cohorts of tagged hatchlings from the East Island beaches, and subsequently monitoring resights. Tag design studies should first be done by captive hatchlings. Release of tagged cohorts over two more consecutive years, coupled with an intensive resight program in nearshore waters, will permit estimates of survival rates during the early pelagic stage and inshore juvenile life. Tag resight data can also be used to estimate the contribution of East Island nesting to annual statewide reproductive output, and to estimate the aggregate nesting population.

(8) Modeling distribution dynamics using archival tags

When available, archival tags should be applied to nesting females, and to basking males and females at East Island, to monitor their movements and habitat usage.

(9) Analysis of population size and structure using tag-and-resight data for basking turtles.

THE MARINE TURTLES IN MEXICO

1988 REVIEW

by

RENÉ MÁRQUEZ M.

JULY 30 - AUGUST 3, 1988

INTERNATIONAL SYMPOSIUM OF SEA TURTLES IN HIWASA '88

THE MARINE TURTLES IN WEST MEXICO, 1988 REVIEW

by Rene Marquez M. *

ABSTRACT

The East Pacific Ocean coasts, between Mexico and north of Peru, are notorious by their turtle populations. In Mexico, the more important colonies are those of the "Pacific ridley", Lepidochelys olivacea, that jointly with those of Central America converge to feed in the wide Gulf formed by Panama, Colombia and Ecuador. The second in abundance is the "black", Chelonia agassizi, which only nests in Michoacan, Mexico, and small groups migrate up to Central American to feed. Also in the same Pacific region there are important rookeries for the "luth", Dermochelys coriacea, but with unknown feeding grounds and migratory routes. To the north west of Mexico, in Baja California, the "loggerhead", Caretta caretta comes, in a yearly schedule, between April to August, to feed. And finally small quantities of "hawksbills", Eretmochelys imbricata, are present in the region, in a spread nesting pattern.

The mexican scientific work to understand and evaluate the feeding colonies and to do the management and conservation of the resourse was started in 1965, in the National Fisheries Institute, unfortunately the efforts were soon overpassed by the fishery and the majority of the nesting colonies, principally those of the Pacific ridley were decimnated. Nowadays the interest to study and protect turtles from overfishing is rapidly increasing and as a result, in 1986 was implemented a wide net of Natural Reserves, that cover all of the more important nesting beaches. From about five years ago the campaings, besides the Fisheries Secretary and concerned Secretaries, are assisted by universities, wildlife societies and international foundations. By this way is reinforced the protection of more than a hundred thousand nesting females, that products more than 3.5 million, principally ridley, black and luth hatfchlings.

INTRODUCTION

The Central East Pacific Cost of America is one of the more important regions for reproductive and feedings grounds of sea turtles, all of the Pacific species but the Caretta caretta nest on this tropical beaches all around the year. In Mexico

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All those species are numerously presented. So the Olive ridley, Leoidochelys olivacea is the more abundant of all them, the next are the Black turtle, Chelonia agassizi and the Leatherback, Dermochelys coriacea, few and dispresd quantities of Hawksbill sea turtle are dwelling in coraline and insular places and finally, in the northwest of Mexico seasonally the Loggerhead (Caretta caretta) comes to feed, principally over deep waters.

All those species had been subjected to variable degree of capture depending of the national and international markets (Marquez, 1976, 1986; Marquez and villanueva, 1982), and wide variation on the populations had been occurred to all of them. After long periods of capture, specially of the Olive ridleys, several nesting population were depleted from many thousands to few hundreds. Official campaingns of conservation, education and management has been implemented by the mexican government, assisted by the industry, universities and other organization. Laws and decrees had been imposed and the commerce of all the majority of the species is now prohibited, nevertheless the ilegal capture of adults and the egg turtle smuggling continue but comparatively in a very lower level. Our actual and future work is directed to the enhancement of all the sea turtle populations specially the optimization of the Oaxacan population of Pacific olive ridley. To reach that goals has been organized a Sea Turtle Pacific Committee since 1987, composed by scientists, politics, students, naturalists, fishermen and interested public.

THE SPECIES

The Olive ridley - Lepidochelys olivacea.
Spanish : Tortuga golfina, frijolilla, amarilla.
Japanese : Hime umi game

This is the commonest marine sea turtle in the west coast of Mexico, it is present all around the year, but becomes more abundant during summer and autumn. The nesting season begins from June until November with the pick between August and October the incubation period lasts up to December or January. It nests from the middle of the west coast of Baja California Sur and Sinaloa up to the southern border of Mexico. Along this coast several nesting beaches have periodical arrivals but the Oaxacan beaches are the more importants, as those ones known as La Escobilla and Morro Ayuta, which could reach every year, between both places more than 200 thousands nests.

This species after nesting season migrates to northern and southern feeding grounds and be dispersed all along the distribution area and some groups could reach the Colombia waters and possibly Peru. During the feeding migrations this population could be mixed in some degree with the Central America colonies.

The Black sea turtle - Chelonia agassizi.
Spanish : tortuga prieta, negra, sacacillo.
Japanese : Ao umi game

This species is indigenous to the central western tropical Pacific Ocean and reproduces principally in the coasts of Michoacan, Mexico, Other dispersed nesting occur from Jalisco to Chiapas and besides it is reported from Central America. Possibly these Chelonia agassizi populations differ from those described as Chelonia mydas for the Galapago's region, but if there are specific separation it needs to be clarified in the taxonomic field. Apparently both groups do not mix physically and also genetically.

The nesting occur the summer and autumn or winter and the pick is between September and November, the incubation usually lasts up to January. Small groups could nest out of Michoacan, in this state two beaches are the more important: Colola and Maruata, where more than 80% of the total nesting occur there. The abundance of the nesting colonies have had wide yearly variations and the countings go from over one up to near six thousands nesting turtles. The last estimation shows that in 1986 around 3300 females nested in the coast of Michoacan (Alvarado and Figueroa, 1987).

In the lapse of the last ten years, because a selective fishery, the number of males have had an evident decrease from dozen of courtmates to one or two per female, in front of the nesting beaches.

After the period of reproduction the turtles starts to disperse along the geographical distribution area and some individuals can reach up to Central American coasts, specially in El Salvador. There are also several reports from Colombia. The Gulf of California and Oaxacan - Chiapas coastal lagoons have important colonies of juvenile and preadult individuals.

The Leatherback - Dermochelys coriacea
Spanish : tortuga laud, tinglada, siete filos, or baula.
Japanese : Osa game

Except the Olive ridley this species is the more abundant in the mexican western coasts. These giant turtles approach the coast in the end of the autumn to start their nesting season, that lasts up to the end of the winter with a pick in December, so the hatchout could be until March or April. The nesting is done from Baja California Sur and Sinaloa states up to the mexican south border. There are several major nesting beaches: Mexiquillo in Michoacan, Tierra Colorada in Guerrero and Bahia Chacahua in Oaxaca, but also several more medium density beaches are in between those mentioned. The mexican breeding population is one of the more important colonies in the world with those other ones in malaysia, French Guiana - Surinam and Costa Rica. (Marquez et al., 1981; Pritchard, 1982; Fretey and Girondot, 1987). In Mexico a total nesting was calculated over 25000 nests per year in the four studied nesting beaches (Marquez and Villanueva, 1982) but several other beaches should be investigated.

After several years of tagging work, no important results has been accomplished yet, so up to now remain unknown the migratory behaviour of this colonies.

The Hawksbill sea turtle - Eretmochelys imbricata.

Spanish : tortuga de carey.
Japanese : Tai mai.

In the mexican Pacific coast this species is the less common in adult stages but juvenile and preadults very often are captured and sold stuffed or as trinkets made with the shell. Nesting occur in the summer and autumn, principally in Islands, sporadically is recorded the nesting in the west tip of Baja California Sur and Jalisco State but in negligible numbers. The pick of the breeding season is unknown and also the total number of nesters, at least 60 nests were recorded by Marquez and Villa nueva, (1982). Also are unknown the migratory routes and feeding groups but commonly is observed in rocky shores and around Islands. specially in the states of Baja California Sur, Nayarit and Jalisco.

Loggerhead turtle - Caretta caretta
Spanish : tortuga jabalina, perica, cabezona o colorada.
Japanese : Aka umi game

This species in mexico has transient behavior and not nests in any Pacific mexican beach. Seasonally approaches the northwest coast of Mexico including the Gulf of california (Marquez 1969), forming small concentrations off the south west part of Baja California Sur, principally between Bahla Magdaalena and Cabo San Lucas. The loggerhead has been recorded from February to September with the pick between April to August. Because this species apparently do not nest in all the west coast of the Tropical America, it will be very important to know where they come from. With the idea that not any near nesting ground is known, they should come from the west Pacific nesting beaches. Other important fact is that juvenile and preadults are the more common sizes (29 - 85 cm) of curve carapace length) in these american colonies.

THE INP SEA TURTLES PROJECT

In mexico the Instituto Nacional de la Pesca, a dependence of the secretarla de Pesca (Fisheries Secretary), is the governmental branch responsible for the scientific study of the sea turtles and for the advisement for their management and conservation. A National Project has been organized since 1965 and from that time the study and evaluation of sea turtles was started. Under direct responsibility or supervision of the National Project numerous turtle camps had been settled every year. Up to now 63 nesting beaches in nine mexican Pacific coastal states has been detected and all together surpass the 300 km of nesting beaches, that must be covered with study, survillance, and conservation work, such kind of task must be prioritized to cover the more important beaches and all the species. The staff of the Project undertakes direct work in several turtle camps and recopile the information from others that are covered by different groups of the same Secretary, Universities, or other Secretaries (see next chapter).

The annual results are used for the administration to set the size catch and closed seasons, to protect different areas and to plan the work for the next year. That way an evaluation of each species is made as it is shown in the next Table.

Table I. - Summarized data for the 1987 season in the west mexican coast and percent of converture of the protection work.

STATE	CAMPS	NESTS	COVER	HATCHOUT	SPECIES
	#	#	#	#	
SINALOA	2	1,250	80%	87,000	Lo
NAYARIT	?	<500	?	?	Lo
JALISCO	7	1,044	20%	42,,000	Lo
COLIMA	2	100	60%	3,500	Lo
MICHOACAN	6	3,250	80%	160,000	Cm Lo Dc
GUERRERO	7	2,000	?	95,000	Lo Dc
OAXACA	5	201,500	80%	>4'000,000	Lo Dc
CHIAPAS	?	<500	?	?	Lo

Lo-Olive ridley, Cm-Black turtle,
Dc-Leatherback

Tagging work of all the species have been done from more than 10 years, some relevant results have been obtained from the annual tagging of over than 5000 turtles of the three more important species, quote in former chapters. So we have information on species nesting frequency, seasonal frequency, fecundity and migration data, e.g.: oliver ridley and black turtles after laid their clutches show a dispersive behaviour and some individuals can reach Central America and inclusive colombia and Ecuador. (Marquez et al., 1976; Alvarado and Figueroa, 1987) Nevertheless many gaps there are for the leatehrback and nearly every thing is unknown for the Pacific Loggerhead.

THE NONGOVERNMENTAL ASSISTANCE PROJECTS

At it was reported in the former chapter, the length of our Pacific beaches suggest an extraordinary logistic support that is difficult to attain for only one group of scientists of the Fisheries Secretary, so at the starting time (1966) the field work was assisted by cooperative fishermen, soon after mexican wild life associations join efforts and finally from about six year ago this task was integrated by numerous groups of University students and also national foundations as CONACyT and foreing wildlife associations given part of the financial support.

Nowadays some of the more important turtle camps are in charge of university projects, headed by school teachers and undergraduate students, with the best results.

THE PACIFIC FISHERY AND MANAGEMENT

As was explained in several papers (Cliffton et al., 1981; Marquez, 1976, 1983; Marquez et al., 1976, 1982) the exploitation of sea turtles, because of the nearly inexpensive and easy access, was developed suddenly and in less than five years the capture was increased more than ten times, from 1000 tons in 1963 to 14,600 tons in 1968, after this year the capture was decreasing, because of over exploitation, restrictions in the leather market and internal management of the fishery, controlled by annual quotas and closed seasons. During the middle of 1971 to the end of 1972 a total prohibition was proclaimed, to restructure the fishery, after that year only cooperative fishermen were allowed to catch and the settling of turtle protection camps must be established in the nesting beaches, supervised by pologists of the institute, as explained in the former chapter. Nowadays only the capture of Oliver ridley is permitted in two or three states of the west coast, Oaxaca (90%), Michoacan, Guerrero and Jalisco (10%), the other species are protected by law and also the egg exploitation is prohibited since 1965. The total capture is now under 1500 tons per year.

FUTURE ACTIONS OF THE NATIONAL PROJECT

Because it is a Project established to support the future of the fishery, hence that the more important goals are the enhancement of the abundance of the populations, not only to avoid the extinction of the species but to made good used of them, that way the next actions are planned for the Fisheries Institute:

- To increase the reproduction of sea turtles. Increase the recruitment in the nesting beaches through the improvement of the actual techniques of incubation and protection.

- Increase the coverture of nesting beaches through the installation of turtle camps using the support of fisheries cooperatives, universities, statal governments and groups of naturalists.

- Automatization of the data records, produced each year during and from the turtle field works.

- Support scientifically the management of the fishery, conservation works, natural reserves and educative tasks.

- Supervise and advise the turtle projects through the Pacific sea Turtle Commission, founded in 1987.

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THE MARINE TURTLES IN AUSTRALIA

1988 REVIEW

by

COLLIN JAMES LIMPUS

JULY 30 - AUGUST 3, 1988

PRESENTATION

"Preservation of Sea Turtles in Australia and Problems Being Encountered"

DR. COLIN JAMES LIMPUS

I bring you greetings from my government department in Queensland, the Queensland National Parks and Wildlife Service. I live in North Queensland near to Cairns, your sister city, and I bring you greetings from Cairns.

Australia is one of the few places in the world that still has large numbers of sea turtles. Sea turtles were abundant in many many areas throughout the world some centuries ago. Unfortunately, through lack of understanding, our forefathers have over-exploited the sea turtle numbers.

Australia, through its remoteness to western culture, escaped the heavy exploitation of her turtles last century, and now we can enjoy the benefits of those large numbers today while they are protected.

At the present moment we have active sea turtle research in Queensland and in Western Australia. The research centers on the nesting beaches where the nesting females are tagged, the hatching success of nests is measured. It also extends to research underwater, with turtles at courtship. I will not attempt to cover all of our research areas. I will give you some of the highlights. For example, during courtship the male turtle is sexually active for about one month and during that time he will mate with many females. The female, on the other hand, is sexually active for about five to seven days, and in that time she will mate with many males and she will store the sperm that she gets from those males to use in the later nesting season.

We are also involved in studies of the turtles in their feeding grounds on the coral reefs and in the sea grass pastures. In the feeding ground studies, we are describing the way the turtle population is structured. Each turtle that we catch in the feeding grounds is measured and tagged. It is examined internally, using a standard human surgery laproscope to examine the turtle internally so that we can determine what sex each turtle is. We can also determine whether it is an adult or an immature. We can also determine for the adult females which year she is breeding. And so from this type of study we are developing a description of the sex ratio, the maturity ratio, and the annual breeding rate of turtles in different feeding grounds.

To summarize it, the important message for us from this work is that we need vast numbers of turtles in the feeding grounds as immatures and adult turtles so that we can have just a few hundred nesting turtles each year.

Within Australia, the turtles themselves are protected from people like myself. I may not take a turtle and kill it. The only people who may do that are the indigenous natives living in reserves, and there are very few of those in the whole of Australia. And for those indigenous people who may take turtles, they may only take them for the use of their own family. They may not sell them. They may not engage in commerce with those turtles. And so for the major part of the human population in Australia, sea turtles are totally protected.

We have six species of sea turtles in Australia, one of them, the flat back turtle (Natator Depressor) is endemic to the Australian continental shelf. It is known to nest only within Australia. And we see here that there are five major breeding aggregation sites for the flatback turtle.

Those are listed in the Abstract. I will not attempt to name each of the sites. We are looking at many thousands of nesting female flatbacks each year.

The flatbacks, because they nest principally on islands that do not have large terrestrial animals living on them, therefore are not subjected to predation that some other sea turtle populations are exposed to. The flatback turtle does not have thick scales, so it is not harvested for Bekko, the tortoise shell. The flatback turtle doesn't taste very nice to eat, so the natives tend not to harvest the flatback turtle as meat. They do take some of the eggs. So the flatback is unusual as a sea turtle in that at the present moment very little use is made of it by humans that live near it.

The flatback turtle, however, lives in the inshore waters of our continental shelf, and its feeding grounds, its forage grounds are almost totally coincident with our shrimp, our prawn fishery of Northern Australia. And many thousands of flatback turtles are caught each year in the prawn fishery. At the present moment, very few drown in this fishery. It is however a threat for the future, because it will take only an increase in the length of fishing time for the trawl nets to cause a substantial increase in the mortality of the flatback turtle. And so we are concerned for the future of this turtle in Australia because of what we have seen happen in other countries as a result of drowning in the shrimp and prawn fisheries.

The Green Turtle (Chelonia mydas) is by far our most abundant turtle in Australia. It has been hunted widely by the indigenous people in the past, and is still taken in some small numbers, small by world standards in some of the remote areas.

If we look at the world distribution for major breeding locations for the Green turtle, and I offer no apologies for leaving off what I call the "small breeding aggregations" like Hawaii and the Hawaiian

Islands and some of the other places. I'm talking here of breeding aggregations of thousands of females per year. And that is what I'm trying to represent with those coloured dots. You will notice that we are blessed with a large number of very large breeding aggregations for Green turtles in Australia, and indeed for the West Pacific, Arafura sea (phonetic) region, we estimate that about 90 per cent of all of the Green turtle nesting for the region occurs within Australia.

However, when we look at where those turtles come from to breed within Australia our tag recoveries show us that the turtles which breed, for example, within the Great Barrier Reef of Queensland, are migrating from feeding grounds in the Indonesian island chain, Irianjaya (phonetic), Papua, New Guinea, the Solomon Islands, Vanu Atu (phonetic), New Caledonia, as well as Northern Australia and down through Eastern Australia.

When we look at how many Green turtles are being harvested in these neighbouring countries as well as within Australia, the estimate of the total slaughter of green turtles could be as high as 100,000 Green turtles per year within the feeding ground range of the turtles which breed within Australia.

We know that the majority of the turtles being slaughtered within this area are large, short tailed turtles. I use the term "short tailed" very intentionally because it will include some immature male turtles. It will include some immature female turtles, as well as adult female turtles.

I said that about 90 per cent of the nesting, the breeding by the Green turtles in this region occurs within Australia. But approximately 90 per cent of the harvest occurs outside of Australia. We are dealing with turtles that cross international boundaries, and as Dr. Bjorndal spoke this morning of the problem in the Atlantic of turtles that swim from one country to breed in another, the same applies here in the Pacific. Turtles which lay their eggs in Queensland in Australia come from feeding grounds in, say, Indonesia. They swim through Papua, New Guinea waters where a lot of courtship takes place and they lay their eggs in Australia. No one country has total control of these animals.

We need the international cooperation of the countries which share the resource. We can take it further. We have turtles being harvested in Northern Australia that we know lay eggs in Java in Indonesia. We have turtles that are being caught on the northern boundary of Australian territorial waters that lay their eggs in Sabah. So the whole of the Malaysian, Philippines, Indonesia, Australia, New Guinea, Solomon Islands group need to cooperate because they are sharing a resource that is being over exploited at the present moment.

I do not wish to criticize the government officials from Indonesia, but the reality is that we have the biggest Green turtle slaughter of any one location in the world centered at Bali. And that is utilizing turtles that originate from Australian nesting beaches, and from their own nesting beaches, and from the Malaysian nesting beaches.

There is a limit to the number of turtles which can be harvested and still have turtles there for future generations. The Papua, New Guineans, are also harvesting large number of turtles as they migrate through Tora Strait between the western feeding grounds up into Indonesia and the Great Barrier Reef nesting beaches.

Again, I make the plea. We must get together as nations sharing a resource which migrates across our boundaries, and we must pressure our politicians to take the action now. For many of you in your countries, you have already lost most of the green turtle populations that you had. You are down to a fragment of what you once had. The only large Green turtle nesting population in the world today is within Australia. We do not want to see that diminish to something where you have to wait nights to see a single turtle. That is an important resource for all of us.

The Loggerhead turtle (Caretta caretta), the same species which we watched nesting on the beach here last night nests also in Eastern Australia, and in Western Australia.

We have completed a study to address whether the individual nesting groups for the Loggerhead turtles are genetically distinct. We sampled muscle tissue, using a biopsy needle, electroforesis (phonetic) studies were carried out on the these tissues. And the result of this study have shown that individual small nesting aggregations are (by "small" I'm talking about on a beach like your beach here) is not the one breeding unit, but rather all of the beaches for Southeast Queensland, all of the beaches spread over hundreds of kilometres, are in fact part of the one breeding unit.

For us the message is we cannot preserve our Loggerhead turtles in South Queensland by concentrating our conservation efforts on a single small beach. We must look at the whole group of beaches together.

We have also been examining the sex ratio of the hatchlings that come from different temperature nests. This is from our control temperature incubation studies, and as with sea turtles that have been studied elsewhere, low temperatures give us all males, and high temperatures will give us all female hatchlings. We have found that the beaches of mainland Queensland are warm, normally 29 degrees to 31 degrees, and so those particular beaches give us

almost all female hatchlings for our Loggerhead turtles.

The Loggerhead turtles which nest on the offshore island 'though are nesting on beaches which are normally in the 26 to 28 degrees. And so those particular beaches give us almost all males. We didn't realize this when we established our early national parks because we had the islands made national parks, and the mainland beaches which would have cost us a lot of money to buy were left out of our national park system. We now know that we have protected those nesting beaches that produce mostly male hatchlings, and we failed to protect the beaches that produce mostly the female hatchlings. We are now trying to correct this. Unfortunately, what we now know is that on the mainland beaches, for about the last 30 to 40 years, almost every egg that has been laid has been destroyed by the introduced European fox. And so we have been losing the female hatchling production for this particular population, the South Queensland Loggerhead population. We didn't realize at the time how important the entire nesting population was. We were concentrating on individual small groups that were easy to manage in terms of looking after pieces of land or looking after individual beaches.

We cannot preserve our Loggerhead turtles by just protecting one or two beaches. We have to protect a whole range of beaches ensuring that we have the beaches that are producing the female hatchlings as well as those that are producing the male hatchlings.

If we look at the distribution of Loggerhead nesting within the Pacific Ocean, we see that there are only two places in the entire Pacific Ocean where there are large breeding aggregations of Loggerhead turtles: here in Japan and in Queensland in Australia.

It is my belief that most of the Loggerheads that are on the American Coast in the East Pacific that Rene Marquez sees along the Mexican coast, that people see in the United States, and down in South America, that those Loggerheads are coming from either Japan or from Australia. And I see in one of the displays in the back of the meeting room, the first tag recovery to indicate that turtles from Japan are in fact crossing the Pacific to the American coast.

Professor Carr's work has demonstrated to us that in the Atlantic Ocean, the turtles, the Loggerhead turtles from the United States do at least one full circuit of the North Atlantic Ocean before they return to the United States. And I believe the same is happening for our Loggerheads here in the Pacific, that your Loggerheads here in Japan are the breeding unit for the entire North Pacific, and our Loggerheads in Queensland are the breeding unit for the entire South Pacific ocean.

We also have large breeding aggregations of Hawksbill turtles (Eretmochelys imbricata). The Hawksbill nesting occurs principally in the northern part of the Great Barrier Reef, and in Tora Strait, the area between Australia and New Guinea. We have some large nesting aggregations where you can see perhaps 10-20 Hawksbills a night coming onto a small beach. We have many many islands where you can see two or three Hawksbills a night coming ashore to nest.

We know from the limited tagging that has been done on these turtles that we have migration at least between northern Queensland, northern Australia, and the Solomon Islands.

The tagging work that has been done with Hawksbills around the world has been very limited. And many people mistakenly believe that the Hawksbill turtle is a non-migratory species. I want to be very emphatic in my statement here and say the Hawksbill turtle in this part of the world is as migratory as the Loggerheads, as the Green turtles. And that the Hawksbills, like the Green turtles, cannot be managed by a single country.

We have no tortoiseshell industry, no Bekko export from Australia. We used to have last century, but at the moment we have none, and it's probably why we are the one remaining country that still has large undisturbed populations of the Hawksbill turtle. However, we are now becoming concerned because we have seen in the last two years or so a substantial increase in the trade in Bekko from the Solomon Islands to Japan, and we know that at least some of our turtles from the Great Barrier Reef are migrating into the Solomon Islands. We believe also that they will be migrating into Eastern Indonesia, where we know that there is a substantial harvest of tortoise shell, and again I must make a plea that we must consider international cooperation within this region to try and make some sense of this trade.

You cannot hope to harvest thousands of adult turtles on a regular basis and maintain a population when the animal you are harvesting from is very slow growing, is very slow to replace the lost adults out of the population. Each one of those bundles represents a single adult Hawksbill turtle. We are looking at, in there, several thousand adult Hawksbills that have been harvested. That particular company was exporting some, this is from Eastern Indonesia, that's a 1984 photo, the Manager of that company claimed to be exporting about 5,000 kilos of tortoise shell every two years to Japan, and that is beyond the carrying capacity for the Hawksbill populations in any area.

We also have within Australia the Olive ridley turtle (Lepidochelys olivacea). We have a strange situation for the ridley turtle in Australia. We have large numbers of ridley turtles that feed along our coastline in the continental shelf waters. We know that they include adult females and adult males. And, as I said, there are large number of them, and yet we have only isolated nesting by this species in northern Australia. We have never found the mass nesting aggregations of the ridley turtles in northern Australia.

And it would appear that there are no mass nesting ridley aggregations within the whole of the Australasian archipelago. It has us puzzled as to where these turtles are breeding, and whether they in fact come from the breeding aggregations in perhaps India. Or maybe across the Pacific.

We know of no threat to the Olive ridley turtles within Australian waters at the present moment.

We also have as our sixth species of sea turtle in Australia the Leatherback turtle (Dermochelys coriacea). We do not have many Leatherback turtles breed in Australia in any one year. The most we have ever recorded is three in one year, and yet we have along our eastern seaboard and in the west part of Australia as well, very large numbers of Leatherback turtles that feed along the edge of the continental shelf, along the deep water edge to the Australian continental shelf.

Where these Leatherbacks come from, we do not know. We believe they probably come from places like Irianjaya (phonetic), New Britain, maybe New Guinea. But, again, the possibility exists that these Leatherbacks could be coming from places like Teranganu in Malaysia for the west coast ones, or maybe from the Mexican coast for the ones along our east coast.

As far as we can tell, there is very little mortality of Leatherback turtles within Australian waters. We have not yet encountered the major problems that other countries are having with the ingestion of plastics causing high mortality with the mass drowning in discarded fishing gear. That's probably because we don't have lots of that at the moment. But the risk exists that we will have these problems in the future, and it would be wise for us to manage to keep it at a low level now.

We have six species of turtles in Australia. We have large numbers of four of those species that breed within Australia. And we have a range of conservation activities that we are presenting to the public. We have some beaches where we encourage the public to come and view the turtles, just like I was able to go on the beach here last night and join many hundreds of people and enjoy some nesting Loggerhead turtles.

And we, within the National Park Service, control the activities of the public so that they do not prevent the turtles from laying. As I said, we have some beaches where we encourage the public to come. At the same time, we have beaches (this is Rain Island in the Northern Barrier Reef). We have some beaches where the public is excluded from visiting. They may not visit without a special Permit, and those beaches are the special high density nesting beaches for their particular species.

Because we want the big nesting aggregations for the future, we want to ensure that there will be enough turtles, so that our indigenous communities in the remote areas of northern Australia will have some turtles available to those families that need them.

We want there to be the sea turtles nesting so that our children and our grandchildren will be able to come along and enjoy. But you just can't have preservation with no interaction with the public. You are going to have to go into an education programme, and so we are producing brochures. We are producing things like this Notice, which we've used in some of the tourist resorts to encourage the turning off of lights to reduce the distraction of the nesting turtles.

We have had to buy land that was critical for the particular nesting beaches, and prevent the building of hotels right next to the nesting beach, and to ensure that there would be a buffer zone between the nesting and where the public could gain access.

Our goal is that there will be turtles for future generations to enjoy.

I would like to close with a summary slide that outlines the life of a sea turtle, as we understand it. I want to start with turtles in the feeding grounds with the adult turtles. The adult males and females migrate towards the nesting beaches. This migration may cover some hundreds or thousands of kilometres. When they arrive in the area near the nesting beaches, they engage in courtship. At the end of the courtship time, the males go home. The females continue on to the vicinity of the nesting beach, and the female then, about one month after courtship begins visiting the nesting beach to lay eggs. And every two weeks she will visit the nesting beach to lay a clutch of eggs. The number of clutches that she will lay in the breeding season will vary. For many of the sea turtle species, it looks like it is about three to five clutches per female per breeding season that will be laid.

At the end of the nesting season, the adult female goes back home to her special feeding ground that she started from at the beginning.

It is some years before she will again return to her nesting beach. We are finding for our Green tur-

tles in Australia that the average is approximately 6 years between visits. There are some that come back on two or three years; there are some that come back on even longer. The same turtle does not breed every year, that is to come back to the eggs on the beach. Approximately eight weeks after they are laid, the eggs produce hatchlings which emerge without the help of the adult female. The hatchlings disperse into the ocean and are carried by ocean currents. We're not sure for how long, but probably for some years, they are out in the open ocean along the drift lines that Dr. Bjorndal spoke about this morning.

At the end of this undetermined time in the open ocean, the small turtles appear back in the shallow waters of the continental shelf where they begin feeding on the bentic organisms. For Green turtles, that's the seaweeds, the algae and the sea grasses. For the Loggerheads, they're feeding on the molluscs, the crustaceans, and so on. So they appear within the continental shelf waters and there continue to grow up. And the time that it takes from leaving the nesting beach as a hatchling to their first migration as a breeding adult, is many decades.

In Australia, it looks like it could be about 50 years for a green turtle from when it's born to when it first begins its breeding migration. Dr. Balazs spoke this morning of about 25 years for his, and this seems to be the picture, country after country, as the growth rate of wild turtles is studied: that we are looking at decades from the time a turtle is born to the time that it first breeds.

There is high mortality in this growth time. Very few are the turtles that begin as hatchlings, survive to make that breeding migration. Once they have reached adulthood, they have a high survivorship, and they are going to breed a number of seasons. They should breed a number of seasons. The turtles that should not be harvested at <u>any cost</u> within the population are the breeding adults. They are the most important that we should be protecting.

Thank you.

THE MARINE TURTLES IN INDONESIA

1988 REVIEW

by

ISUM SULANTO SUWELO

JULY 30 - AUGUST 3, 1988

PROTECTION AND UTILIZATION OF SEA TURTLE IN INDONESIA *)

By
Ismu Sutanto Suwelo **)

INTRODUCTION

Indonesia is one of the world's treasure houses of species diversity. Made up of some 13,000 islands stretching 6,000 km, the country covers a total land of 1,919,443 km^2 and about 5,000,000 km^2 of sea with spans two major biogeographical regions, the Oriental and the Australians. Over 1,500 species occur in Indonesia and the country has within its borders perhaps the most unusual mix of fanual elements anywhere on earth.

The survival of Indonesia's great species diversity is a matter of world as well as national concern, and with Indonesia's rapid population growth and speedy loss of forest and marine habitat, these valuable genetic resources, many of which are or could be used by man, are severely threatened.

The government of Indonesia has recognized the need for conservation in order to promote the cultural and economic development of the Indonesian people in harmony with their natural environment. Government policy states that all forms of natural life and examples of all Indonesia Ecosystems must be preserved for the benefit of future generations with special emphasis on the protection of air, water, soil, plant, fish and animal resources upon which people depend.

Conservation in Indonesia is under the jurisdiction of the Directorate General of Forest Protection and Nature Conservation which was established within the Ministry of Forest in 1983 and is based in Bogor. Conservation has been achieved through the maintenance of a system of Protection Forests to protect water sources and soils on steep or high land, the maintenance of the system of strict nature reserve and game reserve and the adoption of a number of laws, fish laws, protected species laws and others. It is now planed that 30 % of the land surface of Indonesia will be retained under permanent forest cover and nearly half of this forest will be in nature reserves. A further more than a hundred sites have been proposed for protection in the coming Five Year Development Plan, which cover 3 % of the Indonesian waters, while about 30 million hectares or about 10 % of territory waters are planned to be protected and will be managed as marine conservation areas. Protection and management of these areas would give Indonesia a system of marine and coastal protected areas which would adequately safeguard its marine resources for future generations.

SPECIES CONSERVATION IN INDONESIA.

Selection of new reserves is done with the intention of including viable large areas of all distinct habitat types in the country. Thus species will be conserved in situ by protection of their habitat. Geographical distribution and habitat preference data have been complied for all mammals, reptiles and bird species accuring in Indonesia and there is not a single species of bird, reptile and mammal which does not have a major reserve planned within its estimated distribution. Motor species will be contained within more than one reserve.

In the meantime the priority is on getting the reserve declared any physically established, paying attention at the species level only to those species which are not adequately protected by the protection of their habitat in reserves.

These species includes :

1. Migrating species, who spend only part of their time in Indonesia and whose survival therefore depends on many factors both out side Indonesia and its reserves e.g. migratory bird, whales, turtles, etc.

2. Resident but wide ranging species with large home ranges e.g. water birds who offer cannot be contained or restricted within reserve boundries.

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*) Presented at International Symposium on Sea Turtle, Hiwasa 30 July - 1 August 1988.

**) Marine Turtle Specialist Group, Directorate General of Forest Protection and Nature conservation, Bogor. INDONESIA.

3. Rate species which are represented at such low densities or which have such restricted distributions as to survive at dangerously low population levels.

4. Species endangered by changed ecological conditions particularly by newly introduced competitors, predators or petts.

5. Species endangered by over ploitation such as hunting or trade which could be exterminated despite protection of their habitat because of the impossibility of adequately guarding all the reserves.

6. Reverine species endangered by changes in water condition resulting from human development.

TURTLE SPECIES.

Six species of marine turtle occur in Indonesia. The least commonly encountered species are the leathery or leatherback turtle (local name : penyu belimbing), Dermochelys coriaceae, which has been protected under Nature Protection Laws since 1978; the olive ridley turtle (local name : penyu lekang), Lepidochelys olivaceae, and the Loggerhead turtle (local name : penyu tempayan), Caretta caretta both of which have been protected under Nature Protection Laws since 1980. All three species have limited distribution in Indonesia waters.

Two other species, the green turtle (local name : penyu hijau), Chelonia mydas and the Hawksbill turtle (local name : penyu sisik), Eretmochelys imbricata, have wide distribution and are not yet protected by law in Indonesia. However the capture of these species. and collection of their eggs are being reviewed by the government, so that they are not eliminated. The sixth species of sea turtle accurs in Indonesian is the flatback turtle (local name : penyu pipih), Natator depressa (previously known as Chelonia depressa). The occurrence of flatback turtle in Indonesian waters confirmed by Dr. C. Limps several years ago from the photograph and data identification supplied by Graham Usher (1984). The flatback pressume occurs in feeding ground of the Sunda shelf off the north coast of Java. This is the first time that the species has been positively identified from waters outside of the Australian continental shelf.

Loggerhead turtle are found sparsely scattered through out Indonesia with the nearest nesting beaches off West Serawak. Other species found throughout Indonesia and neighbouring seas, with leatherback turtles uncommon over the Sunda and Arafura shelves.

TURTLE POPULATIONS.

Range of discrete population poorly known. Indonesia evidently shares populations with the neighbouring countries where there may be protected e.g. green turtles of east Lesser Sunda Islands apparently shared with North Australia, those of Northeast Kalimantan (Semama Sangalaki Islands) with Sabah and the Philippines and those of North West Kalimantan with Serawak, and the Leatherback turtles of iran Jaya may shared with Papua New Guinea and those of North and West Sumatra with the Andaman Islands.

The total resident population of green turtles in Indonesia may be as high as 250,000 - 500,000 with many more nesting elsewhere but feeding in Indonesia. There are only about 65,000 - 120,000 nesting green turtles. Based on available, there are about 13,000 - 24,000 nesting hawksbill turtles, but there may be over two million in the total population. The range and uncertainty of these figures indicates how little is known about turtles. loggerheads occurs in low numbers, and there are probably only a few thousand olive ridleys and about 10,000 leatherback (R. Salm and M. Halim, 1984).

Sea turtle feeding ground are often far away from their nesting beaches. At the beginning of the breeding season about Females migrate to mate near the nesting beaches. Each turtle probably mates with several different partners. After mating the males depart, presumably to the distant feeding grounds; the females come ashore to nest, mostly at night. Each female usually pays several times at two weeks intervals during the nesting season.

Each female usually returns to the same beach for each repeated nesting during one nesting season, but same turtles may lay on more than a beach up within 100 km of the initial site. After the nesting season is over,

the females return to their often distant feeding ground. After one or more years some of these turtles will again breed, generally returning to nest on the same beach as the previous time. Based on this behavior people have assumed that a turtle returns to nest on the beach of its birth. This has yet to be proved.

UTILIZATION.

Although traditionally used as food sources by the majority of the littoral populations of Indonesia, the primary cause of decline in turtle populations is systematic commercial exploitation of eggs and adults. Local substance and local commercial exploitation have on increasing impact on sea turtle populations in entire Indonesia, as local cultures decline, modern technology speads, and human population explosively increases.

The previous low level subsistence harvest has risen to excess :

a. Turtle eggs of all species are collected throughout Indonesia for local and distant makets. In the areas of intensive harvest (around Kalimantan, West coast of Sumatra, Riua Islands, South Coast of Jave, parts of Sulawesi, Maluku and northern Iran Jaya) every egg laid is taken. The egg collectors don't miss an egg.

b. There is also a prolific domestic and export trade in turtle products. Green turtle are collected all over Indonesia to supply some 30,000 animals to Bali alone ; this volume makes Bali the centre of the world's largest trade in live green turtles. Indonesia has ever become a major supplier of turtle products in the world markets ; stuffed turtles appear to form the bulk of exports ; turtle shell (as rough scutes and as worked tortoise-shell) and leather are exported in smaller quantities. The export of turtle products now has been banned.

With such great demands placed on turtles and their eggs at is not surprising that populations are reported to be in the decline. Although data on population densities - let alone their variation in time - are so scant, an overall downward trend is confirmed by declining beach - nesting figures.

The green turtle, C. mydas and Hawksbill turtle, E. imbricata are the two most common species in Indonesia. Consequantly, the product of these two species are those most often encountered in the market place. The eggs of olive ridley, L. olivaceae and leatherback turtle D. coriaceae are also harvested and marketed near where they nest. Olive ridley are caught throughout Indonesia for their meat and some are stuffed for sale. leatherback turtle are hunted off the Kai Island and by the whaling communities of Lembata and Solor Islands.

CONSERVATION MEASURES.

All species of sea turtle in the world are considered in critical condition and need protection. Red Data Book category : Endangered for leatherback, olive - ridley, hawksbill and green turtles ; vulnerable for Loggerhead. international trade in turtle products is prohibited under the Convention on International Trade in Endangered Species Wild Flora and Fauna (CITES) to which Indonesia is a party.

Based in the increasing of the needs on slaughtered turtles for their meat and shell and their egg's consumption during the coming years caused the turtle problem in Indonesia on the special position, particularly on the two main subjects together, there are the wise - use of turtle sources based on the continuation of supply and protection of population and its breeding sites scaterred in the geographical range of the country of guarantee the existence of the species in future time.

In Indonesia there are some problems with turtle conservation. The first one is about the hunting of productive female and the other one is the harvesting of eggs without lefting any egg for hatching. There is no regulation to control the harvesting of turtle egg outside of protected areas. Peaching of eggs from protected beaches is a problem.

At present the turtle nesting beaches in 21 protected areas and further 37 are proposed for protection in the conservation areas (nature reserves, national parks and marine parks). Feeding grounds of turtle species are included in several protected

areas, although much more reefs potentially serve this purpose.

There are three species of turtles having limited distribution have been protected by law. These are leathery turtle, ridle turtle and loggerhead turtle. The green and hawksbill turtles which wider distribution range do not yet been protected by animal Protection LaW. Although these are not protected, the capture of turtle and collection of eggs are bee-ing reviewed by local government, so that they are not eliminated.

Recently the conservation of those two species have been started with several actions carried out by the government of Indonesia. The first action is prohibiting the turtle's hunting in their natural habitat. The Government has also obliged to all turtle breeding area contractors in carried out hatchery. The hatched turtle then must be released to the sea in order to maintain the wild population.

To overseen utilization and poaching of sea turtle, so that they don't become rare or are eliminated by the government has already taken some steps and hopes to expand further by :

1. Controlling illegal hunting.
2. Setting up more marine protected areas.
3. Proper management of turtle population in its habaitat.
4. Introducing ranching with the condition of releasing baby turtles.

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LIST OF SEA TURTLES IN INDONESIA

NO.	Scientific Name	Common Name	Status cats gory (IUCN)	Utilization
1.	Dermochelys coriacese	Leatharback Turtle	Endangered	Eggs are eaten. Flesh eaten by fisherman (occational).
2.	Chelonis mydas	Green turtle	Endangered	Eggs and flesh eaten. Famous for making - turtle soup. Its skin used for making lesths oils for casmatics, scales for jewellry and ornaments. Affal for fertilizer.
3.	Chelonis depressa	Flatback turtle	Endangered	Eggs and accationally adults eaten.
4.	Eretmochelys imbricats	Hawksbill turtle	Endangered	Eggs eaten. Fresh often regaeded as toxic. Thick scales of the shell called tortoise shell used to make - jewellry and ornaments. Stuffed specimens sold.
5.	Caretta ouratta	Loggerhead turtle	Endangered	Eggs and flesh are eaten (occational).
6.	Lepidochelys olivaceas	Olive Hidley	Endangered	Eggs and adults eaten (occational).

DEVELOPMENT PLAN OF MAPINE PROTECTED
A SYSTEM FOR IN .

		NUMBER OF	HAS BEEN INCUTLD IN THE	SIZE (
1.	Indian Occan	41	1	425.325
2.	Pasific Occan	24	-	1.338.000
3.	Java	32	2	490.430
4.	Bali Strait	2	2	10.000
5.	Sards Strait	2	2	33.000
6.	Malaka Strait	11	1	198.365
7.	Karimata Strait	14	1	267.010
8.	Flores Sea	19	2	809.000
9.	Sulawosi Sea	13	4	453.000
10.	Touini Bey	7	-	283.500
11.	Taluku Sea	8	-	350.000
12.	Falasar Strait	15	-	800.000
13.	Tole Bey	5	-	215.000
14.	Bone Bey	1	-	5.000
15.	Seram Bey	7	-	503.000
16.	Saru Sea	1	1	60.950
17.	Sinor Sea	2	-	21.500
18.	Randa Sea	12	3	260.500
19.	Arafura Sea	11	-	279.000
20.	Locbok Strait	3	-	3.500
21.	Furai Sea	1	-	2.000
	Total	231	19	6.555.630

- = pth/$_{r+}$ = -

THE HATCHINGS OF TRANSPLANTED
GREEN TURTLE EGGS FROM
SUKABUMI AT BALI (1981 - 1987)

Year	Incubated	Hatched	Hatchling %	Hatching Site	Remarks
1981	1.000	466	4,6	Serangan Island	All hatchilings were released to the sea.
1982	2.700	1.161	44,5	Idem	40 % were released
1983	1.727	615	25,4	Idem	Idem
1984	3.945	3.147	82,8	Idem	Idem
1985	4.500	3.700	82,0	Idem	Idem
1986	5.098	4.185	82,7	Idem	Idem
1987	2.005	1.800	90,0	Tanjung Benoa	10.000 hatchlings were released
	1.517	878	57,4	Serangan Island	-
	132	93	57,0	Gondol Fishery Research Station	-
	350	-	0	Banyuwedang Bay	-
Total	22.974	15.617	67,8		

THE MARINE TURTLES IN INDONESIA

1988 REVIEW

by

I. NJORMAN S. NUITJA

JULY 30 - AUGUST 3, 1988

PRESENTATION
"Preservation of Sea Turtles in Indonesia and Problems Being Encountered (Point of View from a Researcher at the University)"

DR. NORMAN S. NUITJA

At this time I would like to mention more information of the marine turtle in Indonesia, and one case of the nesting ecology of one of the Green turtle located in Indonesia.

One, Indonesia is the last area consisting of thousands of islands, five of them is the big island of Sumatra, Java, Kalemantan Sulawesi, and the west area, Iriengaya. We have many coral reefs along the Indonesian sea between Acha (phonetic) located in from northwestern of Indonesia until eastern Indonesia in Irengaya (phonetic).

This is a nesting ground of the three species abundant of turtle in Indonesia which of at least we have five species of seven sea turtles in the world. Only Lepidochelys kempi and... Caretta caretta we don't have, this is in the waters of Indonesia because the Lepidochelys kempi, its distribution is restricted only in the Atlantic Ocean, and Caretta caretta in the sub-tropical sea.

This is the Indonesian map where you can see all species of sea turtle from the west of Indonesia to eastern Indonesia, so very very large eggs distribution in Indonesia.

We can include in some areas Sumatra, Java and West Java, East Java, Colimantan (phonetic), South Sumatra, Djakarta, South Sulawesi.

You know, that Indonesia are consumers of the meat of the species of turtle, but in Indonesia also come many tourists from western and eastern. For example, from Europe, from America. So please don't confuse, not only Balinese or Indonesian people consume the meat of turtle, but also you can find the Westerners in the hotels consume the meat of the turtle.

This is some of the nautology to keep the turtle run in Indonesia. Upper is the spear, the traditional equipment used by the fishermen. And, second, is also the spear and another is a spear but more. This is a Balinese woman just piced the turtle from the sea, where the turtle run from Sulawesi and Kalemantan. You can find this activity in Bali Island, concentrated in Tanimunwa (phonetic). Meat and also the eggs of the turtle are consumed by the fishermen in Somfilet (phonetic) in Indonesia. For example, in Achat also (phonetic), and Bunkulu (phonetic), Java, and Kalimantan.

This is the market, the retailer of the fishermen who sell the eggs in the market, together with other food materials. After the slaughter of the turtle, the carapace is exported to other countries. For example the units of the meat of marine turtle slaughter consumed by Balines and other humans, this is the example of a small restaurant where you find in some places of site in Tanyumbwa (phonetic) at Bali. This is also the same, that's also the same (REFERRING TO SLIDES).

This woman is make the turtle stick in small house and sells to people in Bali. And this is the example of the stick, and other meats to be consumed by the people.

This example, I recorded in Udonpanang (phonetic). Udonpanan, the central market at Udonpanan, Sulawesi Island.

The carapace of the turtle to make some ornaments for the people and to sell in some handicraft in Bali.

In Bali many people consume the neck of turtles, and also use the carapace. The Indonesian and some scientists to support for the conserve and preserve of the turtle in some areas. For example, in the location is Brau (phonetic) in Kalemantan we make the rearing of the young turtle and after that to restocking in the sea. The same activity we have done in Panuman, also in Chitirum, and Chipatujia, and another place. For example, the fishermen rearing the Hawksbill in the Banka Islands in the north of Java and part of them rearing in the sea to restocking in the sea, and part of them to export to other countries.

But, year by year the rearing is decreasing because the turtle is attacked by some enemies, and some enemies, for example tuberculosis and hepatitis diseases.

This is my laboratory at Bogor Agricultural University to have the Indonesian government how to incubate and to make success of the hatchlings for the resource of the baby turtle and restocking in the sea.

The one case of my study about the nesting ecology in Indonesia at Sucamadi (phonetic). Sucamadi is located at East Java, East Java Island where Dr. Uchida, also Dr. Limpus maybe, Dr. Schulz already came to Sucamadi (phonetic). Sucamadi is very good place for humans, and also for animal, turtle. Sucamadi very near to Bali, only 3 or 4 hours from Denpasa.

This is the coastal area where the turtle nesting along the Sucamadi beach. If you look at the size of the Sucamadi beach, it's very, it's more size than the nesting size of the Hawksbill, about 40 until 80 kilometres from the high tide. This is another nesting beach at West Java Island. The name is Panumang Beach. Many turtles come to nest along this

beach. In 1984, Dr. Limpus and the staff of BAPA and me to train many people how to conserve this turtle in Panumang Beach.

If we compare the nesting site of another species, for example, Hawksbill, then Green turtle, most of the Hawksbill nesting site is located in small islands in the ocean. This island is located along the Suna (phonetic) shelf. But we fairly real, we find in the deep ocean like Sucomadi and Panuman south of Java fish of the Indian Ocean, but this is located in the Java sea, Suna Shelf.

This also is the Island Tucum, the name of this area, also located in the Java sea. We look at the area of nesting site of Hawksbill very short, not like Green turtle, only from 10 to 12 metres.

This one is a nesting site of Hawksbill also, located at Bali Barat National Park. This also is located at Java sea where the Hawksbill is fairly abundant, come ashore at west of Blitung. Dr. Uchida and I also already went there to study the ecology of Hawksbill in Indonesia.

This is a profile of Sucamodi beach where the Green turtle is fairly abundant, nesting in this beach. If we look at the beach forest formation in Sumamodi Beach, its composed by some vegetation. After the speculation of the important index, we found the Panenustec Torius (phonetic) is very dominant along the beach for the nesting site of Green turtle, around in Indonesia includes Scomadi (phonetic), Panuman and another place. So every construct or renovation of the nesting ground of Green turtle, so we are reprinting of the Panumas nextor tectorius (phonetic) at that area.

Maybe the Green turtle very concent in situation along the beach by Pandanusti Torius (phonetic). Along the beach of Sucamadi I found about 75 ten four per cent the Green turtle nest in open area near the Pananus tetorius and the remaining is only 24 ten six per cent no near in the Pananamus.

The size of the nest in Sucamadi Beach is very stable. Almost we found the small until moderate diameter size of Green size of sen. In two years along the beach of Sucamadi. You can look at this slide, this is the surface of the nest and followed by the bottom nest of four grand size for Green turtle.

The texture of sand nest composed by fairly small clay and also dust, but almost the same. And come from the most of the in por quartz of the sand, and other is stoney fragments. Stoney fragments, small stoney fragments almost from the infor quartz.

The presented of the uniformal murmur of Green turtle nesting in Sucamadi location in Panuman we look in that table. By two times, three times and five times the turtle comes at Sucamadi after we tagging. That also in Panuman we found almost two times 8410 thirty eight per cent come ashore at Panuman after taking.

The frequency between rearing between nine until sixteen, but the most important is eleven or twelve days after the first nesting. And also the fourteen days.

The time of Green turtle landing in Sucamadi we found this between 9:00 p.m. until 24:00 is the peak of the nesting. The second is 24:00 until 3:00 a.m.

Landing in Sucamadi Beach. This is the corelation between time and temperature, a record of the temperature, some depth in one nest we look at the stable temperature in the nest found in 60 centimetre in depth measured from the surface of the nest.

The egg size of the Green turtle we found is different by another location. If we compare, so almost green turtle, the ring diameter if its 40 millimeter. This graph is a correlation between carapace laying and number of eggs laid.

Most eggs of the turtle landing to nest in this beach so many eggs reduced. Not many eggs produced. That also we found more depth of the nest the turtles have more symmetry for to dig the nest.

This graph here is a beefer (phonetic) of the nesting beefer of the Green turtle in Sucamadi. We look efforts in searching process we found between 17 until 20 per cent by 20 until 40 minutes finish and laying process and others is mostly the same. Only I think only the laying process is about 30 minutes the turtle needs to produce the eggs.

You know, the predation of the turtle not only the human being but also pigs, sea fed cats and on. This is the wild pigs come from the jungle in the Sacamodi Beach because Sacomodi beach you find the jungle. Many pigs come to the beach. Horse crab also catch.

The success of the turtle nest. In this figure we look at the number of nests and the white mark is the destroyed nest by the pigs, also arussion (phonetic) and also other animals, so not so many.

Thank you very much ladies and gentlemen.

THE MARINE TURTLES IN SABAH, MALAYSIA

1988 REVIEW

by

GOERGE STANLEY DE SILVA

JULY 30 - AUGUST 3, 1988

CONSERVATION OF MARINE SEA TURTLE RESOURCES IN SABAH

G. S. DE SILVA

Introduction

The large land mass known as Borneo straddles the equator. Together, the East Malaysian States of Sabah, Sarawak and the independent Sultanate of Brunei comprises about a third of the island of Borneo. The remainder of the island is Kalimantan which is Indonesian territory. This paper briefly evulgates sea turtle resources in the East Malaysian State of Sabah. All rookeries mentioned in this paper have been regularly visited except Pulau Sipadan, a remotely situated Bird and Game Sanctuary, which has been infrequently visited due to the threat of piracy.

As very little was known about marine turtles in Sabah waters, a survey was undertaken during 1964 - 1965 to establish the status of the Green Turtle (Chelonia mydas) and the Hawksbill Turtle (Eretmochelys inbricata). To facilitate evaluation, visits coincided with the local nesting period. This was no easy task as travel by sea become hazardous due to rough seas and the threat of piracy. The survey made it abundantly clear that the Green Turtle and the Hawksbill Turtle were vulnerable while at sea and on the nesting beaches. Both species were in danger of extinction due to the complete removal of their reproductive efforts methodically from every nesting beach for over 50 years. Furthermore, the situation was aggravated by the slaughter of turtles in Sabah waters by fishermen. As a result of these two devastating factors, it was envisaged that the turtle population which existed had little change of survival.

In recent times it has not been possible to freely visit some rookeries remotely situated in the Sulu Sea, South China Sea and the Celebes Sea because of increased pirate activity. The writer has had several brushes with pirates and has no desire to receive a posthumous award. Although police and naval patrols have considerably increased, the seas have to be travelled with some trepidation.

Conservation policies

To obtain an idea of the existing state of affairs it is necessary to review past and present turtle conservation policies of the State which was formerly known as British North Borneo.

As for aback as 1927, colonial administrators made attempts to conserve the Hawksbill Turtle which was hunted for its shell. Conservation proposals commenced when the Board of Directors of the Chartered Company sent their officers in the colony a report by James Hornell on the Turtle Fisheries of the Seychelles. This report and subsequent action pursued by the administrators of the colony resulted in Gazette Notifications 227 and 228 of 1928. The lafter prohibited the capture of Turtles of 12 months from 1st January, 1929. Later, Morell studied the situation and submitted a report on the turtle industry of North Borneo and among their things recommended a closed season every alternate year for 6 years. According to records, the 1929 closed season was imposed and was partially successful. The other closed seasons were not imposed as the trade in sea produce was driven from Kudat to the Philippines and there were difficulties of control. In 1933, exclusive licences to collect Green Turtle eggs for 3 year periods were issued by the Resident, Sandakan. The licence was subject to cancellation at one year's notice and it prohibited the collection of Hawksbill eggs. It is extremely doubtful whether the successful tenderer abided by stipulated conditions.

On 26th June, 1948 the Government of the Crown Colony of British North Borneo handed over to the Philippine government the richest of the turtle islands situated in the Sulu Sea. The official document regarding the handing over cannot be found in the government archives. Prior to 1964, the Turtle Preservation Ordinance No. 5 of 1953 was laxly administered by the authorities concerned. Presumably, their main difficulty was to enforce the law on remote islands and beaches. The situation remains unchanged even in 1988 due to piracy.

When the Fauna Conservation Ordinance 1963 came into force in July 1964, the undisputed control of turtle farms

and all matters connected with turtle conservation passed into the hands of the Conservator of Forests and a conservation policy was recommended by the writer who was then Assistant Chief Game Warden. After the recommendations were accepted by government, the issue to Turtle Licenses for the purpose of killing turtles ceased immediately and the closed season in March for turtle egg collection on turtle farms and areas reserved for the collection of turtle eggs was to be strictly enforced. The former policy was implemented, but owing to the paucity of staff, inadequate transport and the threat of piracy in the Sulu Sea, the latter directive was not enforced. Batasara, an egg collector, was killed in 1964 by pirates while collecting turtle eggs and perhaps indulging in other illegal activities.

Native rights were safe-guarded under the ordinance and natives still collect without a licence all turtle eggs laid in native Reserves. After a conservation policy was formulated in 1964, the Resident, West Coast, indicated that an invidious situation had arisen in the Kota Belud District owing to the fact that natives in the district had to pay licence fees for collecting turtle eggs from traditional harvesting areas, whereas their coastal-brethren in other parts of the State were granted "native rights". After investigation,it was found that only small numbers of turtles nested seasonally in the remotely situated traditional native egg collecting areas. Due to difficulties of control, it was recommended that the Kota Belud District and the islands involved be declared native turtle egg collecting areas. After the establishment of this native reserve, no other concessions have been granted up to date. It appears that all ethnic groups claiming "native turtle rights" under the law have been placated.

Eight turtle farms were constituted under the Fauna Conservation (Turtle Farms) Regulations of 1964. Turtle farms under the Regulations are not marine culture facilities but island rookeries where licensees could harvest turtle eggs under supervision and control of the Chief Game Warden.

Out of the 8 islands - Palu Selingaan, Pulau Bakkungan Kechil, Pulau Gulisaan, Pulau Tegapil, Pulau Lankayan, Pulau Bilean, Pulau Koyan Koyan and Pulau Nunu Nunukan - only the first 3 were privately owned under title. However, as almost all the turtle eggs were laid within the government reserve on each island, the State permitted the collection of eggs under licence and exercised control. As the other farms were remotely situated in the Sulu sea and the haunt of pirates, little control was exercised. Visiting fishermen and others collected the eggs for domestic use and for sale on the mainland.

The seas around P. Bilean are heavily bombed by fishermen. Fish bombing in this area has gone on sufficiently long to exterminate marine fauna and at the same time adversely affect breeding turtles found there. On one occasion, the writer surprised a small boat near Pulau Bilean manned by a crew of 3. They were energetically collecting fish killed by explosives. When investigations commenced, the boat was deliberately capsized so that whatever was in it was sunk.

Egg collecting records from the Turtle Farms (P. Selingaan, P. Gulisaan and P. Bakkungan Kechil) for the period 1947 - 1964 are scantly and were haphazardly maintained. From the data collected and summarized from old files, it can be established that most of the eggs harvested from the islands were those of the Green Turtle. It can also be established that in 1947, the 3 islands yielded a harvest of 706,960 eggs. From 1950 to 1964, the exclusive rights to collect turtle eggs were given out by competitive tender and the price steadily increased from US$ 250 in 1950 to US$ 10,000 in 1964. It has to be appreciated that the demand in Sandakan for turtle eggs in insatiable, which is the main reason for the steady rise in the tender price for turtle eggs. when the effect of the tender system was examined, it was realised that the system (1) increased the price of eggs to the consumer, (2) caused tremendous dissatisfaction to the owners of islands and (3) encouraged the entry of a number of middlemen into the business whose principal function was to appropriate the profits. In 1965, the tender system was suspended and it was decided to assist the owners of the 3 islands by giving them the exclusive rights to collect turtle eggs without going through the customary tender procedure. Turtle egg collecting licence fees for the period 1965 - 1971 averaged about

US$ 6,000 per year and 290,000 to 680,000 eggs were harvested annually. The islands ceased to be turtle farms under Gazette Notification No. 882 on 13th November, 1971 but as licensees had paid a full years licence fees they were permitted to harvest turtle eggs until the licences expired in December, 1971. Furthermore, the licensees had to be given some time to remove their property and livestock from the islands.

Prior to 1972, Sandakan was supplied with eggs from the 3 turtle farms conveniently located in the Sulu Sea. At times, however, the supply was augmented with small harvests from the islands towards Kudat and the price was subject to fluctuation. During optimum laying months, a glut of eggs made the price fall and the suppliers quickly ceased flooding the market. When the 3 islands became Game Sanctuaries, egg harvesting ceased on 31st December, 1971 but Sandakan continued to be supplied by Filipino barter traders with harvests from the Philippine islands of Bakkungan Besar and Taganak. The price of Turtle eggs in Sandakan rose from US$ 0.05 cents each in 1971 to US$ 0.20 cents in 1972. From the information on harvest levels and prices, it is speculated that the 1971 harvest from the 3 islands could have been sold in Sandakan at US$ 25,000.00. Prior to 1972, Saburi, the egg collector on P. Selingaan profitably marked eggs in Sandakan. Even though the licenses were to some extent deprived of their harvests by dishonest employees, who were also their relatives, no one complained as everyone involved presumably profited.

This state of affairs went on happily for the purveyors of turtle eggs, but disastrously for the animals. Due to the heavy demand and the prevailing price of eggs it was impossible to get the islanders to co-operate. In 1970, the writer was informed that there was a demand for turtle eggs in Hong Kong's red light district, but the potency of turtle eggs as an aphrodisiac is as yet unproven. Occasionally, small quantities of turtle eggs are taken from Sandakan by Chinese travelling to hong Kong. These gifts are said to be highly appreciated by the recipients.

Turtle eggs are sold in Kota Belud during the season and cost about US$ 0.15 each. During the off season, eggs are sold at US$ 0.25 each. The sale of eggs collected from nearby beaches contributes to the welfare of the natives in those places as they have very little or nothing to sell from their remote and unproductive lands. Turtles are also slaughtered by the local inhabitants and the flesh is sold locally but the carapace, plastron and flippers are sold to Filipino barter traders as there is no local demand. It is now known that the egg harvest during the season has dwindled and fewer turtles come ashore to nest.

At present large quantities of turtle eggs are brought to Sandakan from the Philippine islands of Taganak and Bakkungan Besar by traders who report that the collection of eggs in their respective islands is not subject to control. Their imported consignments are distributed to retailers. In this regard it is interesting to note that competition was brisk even in colonial times and that in 1954 the late Hj. Sandukong complained to government that his sale of turtle eggs in Sandakan was affected by imports from Tanganak. Customs duty then charged for eggs from Taganak was 5%, i.e. the duty on sea produce. Repeated complaints compelled the Resident at Sandakan to recommend to government that the duty on turtle eggs be raised to 10%.

The massive harvest of 1967 (677,275). 1969 (650,330), 1970 (539,593) and 1973 (510,272) have not occurred since. From 1974 to 1980, the yearly harvest in the National Park has been in the region of 300,000+ eggs and the harvest for 1981 was 285,853. From 1982 to 1986 the yearly harvest has been in the region of 265,182+; and the harvest for 1987 was 223,897. Seventeen years of intensive conservation work have rolled by and with some reservations it can be said, if given the time, the populations may recover from the battering they received for over half a century.

Need for conservation

Even 20 years after the cessation of hostilities in the Pacific, the Japanese were blamed for the decrease of turtles in Sabah waters. Presumably, a convenient scapegoat was available as large numbers of turtles were indiscriminately slaughtered in the various rookeries when food was scarce during the occupation. No one can blame the

Japanese for this. The real reasons for the decline appear to have eluded notice:

(i) for 50 years or more i.e. up to 1970, the reproductive efforts of every turtle were methodically removed from every nesting beach for material gain;
(ii) illegal hunting in Sabah waters by local fishing vessels to surreptitiously supply the ever increasing demand for turtle meat on the mainland;
(iii) the slaughter of turtles outside the territorial waters of Sabah by Filipino fishing vessels;
(iv) frightening away of graved females approaching the nesting beaches by brightly illuminated fishing vessels;0
(v) killing of fish with explosives near islands
frequented by nesting turtles and
(vi) slaughtering of nesting turtles by local inhabitants without any inhibition whatsoever.

When it was realized that it was impossible for any species of turtles to survive under these critical conditions, conservation measures were adopted.

Conservation measures

When conservation policy was formulated, it was realised that although drastic measures were necessary to safeguard turtles, it was impolitic to antagonise ignorant islanders and coastal dwellers as the concept of totally exploiting an easily procurable resource was ingrained and, conservation of any sort was alien to them. In view of the fact that it was impossible to control every rookery in the state, it was decided to concentrate on the most important turtle rookery in the State, it was decided to concentrate on the most important turtle rookeries (P. Selingaan, P. Bakungaan Kechil and P. Gulisaan) in the Sulu Sea. Initially, a close season was imposed in March but it was very difficult to travel to the islands at this time of the year because of the prevailing northeast monsoon. When this problem arose, it was envisaged that if the islanders became actively involved in turtle conservation and observed what conservation measures were implemented, they would, in due course cooperate with the authorities and labour problems on the islands would also be eased or solved. On 1st August. 1966 in spite of opposition from the owners of P. Selingaan, a hatchery for experimental purposes was established on the island. Eggs were purchased from several licensees with great difficulty and there was a time when government tendered the collection rights to collectors and purchased eggs for conservation purposes. This situation went on for several years, with protests from licensees to persons of eminence and authority. Although government paid the prevailing market price for eggs in Sandakan for those purchased on the islands, the reluctance of the licensees to part with even a portion of their harvests was due to the fact that the whole year's harvest had been sold to Chinese middlemen, at the beginning of the year when licenses were issued. It was therefore obligatory for the licensees to hand over the entire year's harvest to middlemen in Sandakan.

As the 1966 experiment on P. Selingaan yielded the necessary information and provided newly recruited staff with the basic training in hatchery techniques, hatcheries were established on P. Gulisaan and P. Bakkungaan Kechil in March, 1968. During 1968 it was possible to utilise most of the eggs laid on P. Selingaan and P. Gulisaan for hatchery purposes at turtle egg collecting licences were not issued for administrative reasons. The islanders resented this and tampered with several thousand clutches on P. Selingaan which were eventually spoiled; some clutches were stolen on P. Gulisaan. The presence of rangers were also hotly resented as other illicit activities were observed and curbed. Apart from raping the nesting beaches, the collection of sand and coral for mainland construction projects were actively encouraged by the islanders for material gain. Sand was taken at all times of the year and the few feral nests which escaped the collectors were inadvertently dug up. The reefs surrounding the islands were heavily exploited and the coral sold in Sandakan to construction agencies. However, conservation policy was implemented without fear or favour and the law vigorously enforced.

As a result of the antagonistic attitude of the licensees during the period 1966/1971 only 14.2% (431.615) of 2,991,125 eggs were used to produce hatchlings. During this

period it was observed that egg collectors on the 3 turtle farms energetically harvested practically every egg l;aid on the beaches. They refused to even consider that their energies were directed toward the extinction of the turtles and disregarded the fact that the survival of turtles depended on mass egg production and conservation. Since 1966, trawler fishing close to the islands had considerably increased and a random check revealed that hatchlings and adult turtles were sometimes caught in nets. As uncontrolled operations posed a threat to the turtles, the State Fisheries Department in 1973 co-operated by prohibiting trawling operations within one mile of the islands. With few exceptions the trawler fishermen have honored the ban.

Acquisition of private property for turtle conservation

Oviviparous turtles must concentrate on rookeries at the same time of the year to ensure that a good portion of the hatchlings reach the sea. If only a small number of hatchlings are produced, avian and marine predators can exterminate them. As only a fraction of the eggs laid on turtle farms close to Sandakan were available for hatchery purposes, fewer hatchlings reached the sea. Numerical data indicate that only 286,803, hatchlings reached the sea in the 6 ears from 1966 to 1971. This was considered quite insufficient if the species was to be rescued from imminent danger and permitted to survive. Furthermore, there was the alarming and undisputable fact that overexploitation of eggs for over half a century, without permitting any opportunity for recruitment by allowing eggs to hatch had resulted in a population of aged animals. A stage would have been certainly reached when the old turtles started to die without replacement and the numbes would drastically drop. Clearly, it was impossible for any population to recover from such an onslaught. As it was not practicable to eliminate the other factors which had also contributed to the decline of the turtle population and at the same time protect their habaitat from commercial exploitation, the State Government agreed to acquire the islands of P. Silingaan, P. Bakungaan Kechil and P. Gulisaan for conservation purposes.

In 1972, by Gazette Notification No. 504 of 27th june, 1972 the 3 islands were constituted Game and Bird Sanctuaries by the Governor and remained so until 30th September, 1977. During the period 1972 to 1977, the islands were under the absolute control of the Chief Game Warden and all eggs laid on the rookeries were utilized for hatchery purposes. However, occasionally, thefts of egg occurred on all 3 islands. The culprits were from Pulau Liberan whose main traditional source of protein was restricted with the acquisition of the islands. The thefts usually took place at night when the staff were asleep. By Gazette Notification No. 490 of 18th August, 1977 the State Government constituted the 1,740.21 ha. Turtle Islands national Park on 1st October, 1977. The National Park not only encompassed the 3 islands but also the coral reefs between them. The move was imperative to protect the coral reefs from commercial exploitation for construction work and the surrounding sea from fish bombing. Apart from this, small but brightly illuminated fishing vessels frightened away turtles approaching the nesting beaches, and the discarded fish, offal and edible refuse into the sea attracted large numbers of sharks and predatory fish to the vicinity of the islands and these scavengers of the deep. attacked hatchlings when they entered the water after release on the natal beaches. In addition, survivors of the initial attack became disoriented and swam toward the brightly illuminated fishing vessels and were preyed upon by predators in the vicinity of the trawlers. Furthermore, the foul discharge of bilges and toilets and jettisoned cans, bottles and plastic containers contaminated to some extent the coral reefs and island beaches.

Poaching

In Sabah, the Parks Ordinance protects turtles of all species found within the boundaries of any marine park. In the writer's opinion, sufficient legislation, if properly enforced is available to protect turtles and their environment throughout the State. However, for the past 20 years or more poaching has existed and the manner in which turtles are captured and their eggs stolen are enumerated below:

(a) islands from the nearby island of Pulau Libaran, whose traditional source

of protein was restricted by the acquisition of the islands, make nocturnal forages, very often before islamic festivals, to steal eggs. The money obtained from the sale of turtle eggs permits them to purchase food and other necessities for festive occasions.

(b) fishermen who anchor their small boats for the night near the islands stealthily land and steal eggs.

(c) visitors to the islands with or without the connivance of the staff steal eggs.

(d) visiting senior officers of the Sabah park illegally appropriate for their personal use the entire egg harvest during their respective tours of duty on the islands. Not to be outdone, the junior staff stationed on the islands have begun to emulate the example of their superiors and are known to bring substantial quantities of turtle eggs to Sandakan for sale. Also, it is well known i Sandakan that on the islands turtle eggs are sold to visitors or bartered for a few cans of beer. "Quis custodiet ipsos custodes?"

(e) fish trawlers operating within Sabah territorial waters often catch turtles. The animals are not released but sold to caterers on the mainland.

(f) Filipino trawlers operating near P. Bakkungan Kechil are armed. Apart from capturing turtles, they use swimming or copulating turtles as targets. The carcasses of turtles so killed are occasionally found near the island.

(g) Filipino fishermen in small boats spear turtles. Caracasses of animals with neatly punctured carapaces are sometimes found on island beaches.

(h) processed carapaces of turtles are brought to Labuan FT which is also a free port by Filipino barter traders. It is difficult to ascertain the area of slaughter but it is presumed that the animals are killed on the Sulu Sea or Celebes Sea.

Remedial action

The activities of armed Filipino fish trawlers and their crews are impossible to curb as no one desires to receive a posthumous pension. It requires government intervention at the highest possible level. To curb the illegal activities of the islanders and fishermen, well supervised vigilance is necessary. As park staff and forest department staff are legally empowered to stop and search fishing vessels, they must exercise, their authority and not be content with only reporting the matter to 'higher authority'. There is no purpose in bolting the door after the horse has bolted. Constant beach vigilance is necessary by dedicated supervisory staff to prevent the theft of eggs and hatchlings by visitors. Although situated in Sabah waters, Pulau Liberan is Federal Territory and the Sabah Government exercises no jurisdiction over it. As it is a free port commonly used by barter traders from the Philippines the Federal Government should take action to ban or control the import and export of turtle shell and skin from P. Labuan FT

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THE MARINE TURTLES IN MALAYSIA

1988 REVIEW

by

KUAN TOW SIOW

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SAVING THE LEATHERY TURTLE (DERMOCHELYS CORIACEA) IN TERENGGANU, MALAYSIA

by
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1. introduction

1.1 The Leathery turtle (Dermochelys coriacea) is the largest of the 8 species of marine turtles in the world. It is one of the four marine turtle species found in Malaysia. In Malay, it is called Penyu Belimbing, which means literally the Starfruit (Belimbing) turtle (Penyu) because of its five ridges on the back (carapace), which make it easily distinguishable from other marine turtles.

1.2 Unlike others, the leathery turtle only nests along the 20 km beach at Rantau Abang, with only sporadic nesting north and south of this area on the East Coast of Peninsular Malaysia. In fact, Rantau Abang is one of the three main nesting rookeries in the world, the other two being the Pacific Coast of Mexico and the Northeastern Coast of South America.

1.3 It was reported in the Philippines that the leathery turtle (very rate there) meat is bitter and during the Second World War, out of hunger, a leathery turtle caught in the sea was slaughtered and, many who consumed it landed in hospital because of food poisoning. (The poisonous nature may be due to the feeding habit of the leathery turtle as its main diet is the jelly fish). It is very unlikely that the people in Terengganu in the early days consumed leathery turtle meat as there were other marine turtles in abundance in the those days. However, it is sure that the leathery turtle was partly protected with the introduction of Islam in this are some five hundred years ago as the Islamic religion prohibits the consumption of any aquatic animal that spends part of its life on land.

1.4 Though the eating of turtle meat is prohibited, the consumption of turtle eggs is allowed. The eggs, being readily available in abundance in the past, must have provided a major protein source for the inhabitants along the coast for centuries.

1.5 With the increase in population and the increase in demand for the turtles eggs, the Government of the State of Terengganu promulgated a Turtle Enactment in 195 to prohibit the killing of turtles and to control the collection of eggs. Under the Enactment the Terengganu beach is divided into 42 sections and every year the sections were tendered out and a licence for the exclusive right to collect eggs was granted to the successful bidder for each of the section. The total revenue collected reached the level of around $200,000 since 1978. The 20 km leathery turtle beach at Rantau Abang always contributed about half of the total revenue collected from the licences.

1.6 With the improvement of road and air transport since the Independence of Malaysia is 12957. Rantau Abang has become the focal point of tourist attraction in the State of Terengganu. An estimated 50,000 tourists, both local and foreign, flock here in the months of June to August to observe the leathery turtle lay eggs. In fact the whole village of Rantau Abang and the hotels round it depend solely on the leathery turtle for survival.

1.7 In short, the leather turtle is important scientifically and economically, and i a natural heritage. It ought to be protected from becoming extinct.

2. Past Conservation Efforts

2.1 The first record in the turtle conservation is the Turtle Enactment which was promulgated in 1951. The Enactment prohibits the killing of the turtle, and regulates (not prohibit) the collection of turtle eggs. It also has Provision to prohibit cruelty to the animal. However, due to lack of enforcement effort, only the part on regulating the collection of eggs was effectively implemented.

2.2 Realising the consequence of near 100% collection of turtle eggs and foreseeing the danger of extinction the Malayan Nature Society suggested in 1960 the setting up of a turtle hatchery. The hatchery a Rantau Abang was set up in 1961 and has since been operated yearly without fail by the Fisheries Department. The number of eggs planted per year also increased from 8,366 in 1961 to reach the peak of 85,922 in 1975. Unfortunately, since 1975, the number of eggs planted declined rapidly.

2.3 Although to date some 430,000 baby turtles have been released to the sea, the hatchery programme has not checked the decline of breeding females visiting the shore. The total leathery turtle eggs laid has decreased steadily from around 853,700 a year in 1961 to 294,000 in 1978 and to only 30,211 in 1987.

2.4 On 10th September 1975, the writer (then holding the post of Director of Fisheries for the State of Terengganu) submitted a proposal for the setting up of a sanctuary for the Giant Leathery Turtle in Terengaanu. The proposal called for setting aside two portions of the beach, namely 35th to 38th milestone and 39 3/4th to 41 3/4th milestone as a turtle sanctuary, and to limit the tourist activity in three areas outside the sanctuary i.e. at Jambe Bongkok, Rantau Abang, and Kuala Abang. The total sanctuary covers 5 miles (8 km) out of the 121 miles (20 km) leathery turtle nesting beach.

2.5 The proposal was accepted in principle by the State Government was then of the opinion that the matter could be enforced through administrative measures in which the District Officers of Marang and Dungun were directed not to give permission for land application in the designated sanctuary area. With the approval of the authorities, boundary fencing was then erected to demarcate the sanctuary area.

2.6 In response to the application submitted by the writer, the World Wildlife Fund provided funds for planting casuarina trees along the beach in the sanctuary area with the view or providing a light and sound barrier to minimize disturbance on the beach. Although a beach buggy was requested for patrolling the beach, WWF managed only to donate a pick-up van. Thought not able to perform the function as desired, the van came in handy and greatly facilitated the hatchery work.

2.7 The sanctuary proposal, though implemented in a limited scale, has not achieved its original objective. The reason it that there is no legislation to back it, and thus cannot be enforced.

2.8 In 21981, the writer submitted a proposal to the State Government for the setting up of a Turtle Information Center at Rantau Abang. The objective is to provide information to tourists and advise them what to do and what not to do while they are on the beach. It was also proposed that proper guided tours be organized through the centre so that, after watching the exhibits and the video programme, the tourists can be grouped and proper tourist guides be assigned. This is to avoid any act of cruelty to the leathery turtle on account of the tourists and also to prevent any exploitation by illegal turtle guides. Though money was allocated, and the contract specified completion in

April 1982, the building was not finished until 1983, well after the writer left on transfer to Kuala Lumper in August 1982. Unfortunately the centre, though operational after completion, was not able to perform the functions as originally designed. Complaints of misbehavior of tourists towards the turtles and of cheating by the tourist guides still appear often in newspapers.

3. Reasons for the Population Decline

The main reasons for the decline in the leathery turtle population in Terengganu are as follows:

(a) Consumption of Turtle eggs

As stated earlier, though Islam prohibits the consumption of turtle meat, the eating of turtle eggs is allowed. In the past turtle eggs were only collected and consumed by people living along the turtle nesting beach as a source of protein rich food. With the construction of a main road along the beach, however, turtle eggs were collected and transported for sale in markets near and far away.

The demand for turtle eggs increased with time as the eggs were considered delicacies with aphrodisiacal value. Egg collection had reached near 100 per cent since the late 40's. Hardly any eggs were spared for hatching baby turtles on the beach to replenish the population since then.

(b) Increases in Fishing Effort

Fishing in Terengganu before the 60's was conducted on a limited scale, mainly to feed the local inhabitants. However, with the improvement in road transportation. Terengganu fish finds market in the main consuming centers such as Kuala Lumper and Singapore. Since then, the fishing effort has increased rapidly and with that, more and more turtles were caught incidentally.

The introduction of the lengthy monofilamentous as well as the multifilamentous drift nets has sped up the rapid decline in turtle population. These nests stretch between 1 to 10 km in length and when set in the sea effectively block the passage of the migratory leathery turtle. Many turtles have been caught in the net, and they were either drowned due to inability to surface to breaths or were killed by the fishermen who do so in order to retrieve their nets.

The main culprits in the 60's were fishing boats coming from Japan operating the monofilamentous drift nets in the South China Sea, and in the 70's up to now, the local fishermen who operate the multifilamentous drift nets called pukat hijau or pukat tenggiri for catching spanish mackerel and bonito in offshore areas. Trawling, which was introduced in Terengganu in the late 60's, though the main killer of bottom-dwelling turtle species such as the green turtle, Ridleys, turtle and the hawksbill turtle, is not that damaging to the leathery turtle in view of the pelagic nature.

(c) Tourists' Behaviour

Watching the giant leathery turtle laying eggs on the beach has become the major tourist attraction in Terengganu. During the peak years, some 50,000 tourists a year flock to Rantau Abang to watch this wonderful animal. Unfortunately due to lack of knowledge and driven by curiosity, many of the tourists intentionally and unintentionally have caused suffering to the female turtles coming ashore, by carrying out the following activities;

(i) setting up campfire on the turtle nesting beach;
(ii) moving around the beach with torch lights and making a lot of noise;
(iii) shining torchlight directly on the eyes of the female turtles coming ashore to lay eggs;
(iv) taking photographs using flash lights;

(v) sitting on the turtles;
(vi) kicking sand onto the turtle;
(vii) preventing the turtles from going back to the sea.

(d) Beach Front Development

Due to increase in influx of tourists, many local people set up stores and simple lodging houses on the beach at Rantau Abang. These places are brightly lit at night, and with the movement of large numbers of tourists around, a section of the beach has been rendered unfavourable for the turtle to come ashore.

(e) Oil Exploration and Extraction

With the discovery of oil off the shores of Terengganu in the late 70's, a lot of activities were generated. Exploration and extraction platforms which are brightly lit up at night, were established, and they are situated in the migratory path of the leathery turtles. No assessment on the impact of these new structures has been made so far. But it is likely that these structures which are visible within an area of 40 - 50 nautical miles at night will distract the migratory turtles.

4. Conservation Measures Required

The decline in the population of leathery turtles reaching the shores of Terengganu is alarming. More effective measures should be taken to conserve this wonderful animal. Below are some of the measures recommended:

(a) Ban the Consumption of Leathery Turtle Eggs

All available eggs should be used for hatching baby turtles to replenish the population. A legislation should be promulgated to ban the collection, transportation, handling, keeping, sale and consumption of the leathery turtle eggs. The only exemption is for the operation of the hatchery under strict supervision.

(b) Improving the Efficiency of the Hatchery Operation

Areas to be looked into for improvement include the following:

(i) Better containers for the collection and transportation of eggs so that the orientation of the eggs (after the ovi-egg-laying position) is not disturbed. The present use of sugar sacks is to be discontinued.

(ii) Shorten the time between (ovi-egg-laying position) and the planting in the hatchery. This can be done by providing walkie-talkies to egg collectors and the use of vehicles capable of travelling on the beach to transport the eggs immediately to the hatchery without delay.

(iii) Careful placing of the eggs into the clutch hole is needed to reduce damage, and disorientation of the eggs.

(iv) The hatchlings are to be removed and released immediately upon hatching. The hatchlings should be released on the beach to allow them to crawl down the beach into the sea.

(v) The release should be spread out as much a possible along the entire nesting beach to avoid concentration of predators in a few fixed release points.

(c) Improving the sanctuary Set up

Legislation must be made on the establishment and the operation of the sanctuary. Sound and light barriers proposed earlier should be implemented effectively. Patrols should be conducted to prevent the entry of unauthorised persons.

(d) Improving the Display and the Operation of the Turtle Information center

The display and the operation can be improved to better educate the tourists. The proposal for organizing the tourists at the center should be implemented. This will avoid the cruelty to turtles and disturbance on the beach. Better display and the sale of souvenirs will eliminate the need of taking flash photographs on the beach.

(e) Control of Fishing Activity Near Nesting Beach

A legislation prohibiting fishing in waters 10 nautical miles along the entire 20 km beach from Jambu Bongkok to Kuala Abang should be made and enforced during the nesting season i.e. from May to September. This is to ensure that no incidental catch will occur in the area from the time the turtle reach the shore at the on wet of the season to the time they go away at the end of the season.

(f) Removal of houses on the Beach

The houses and stores on the nesting beach should be removed and reallocated to a place on the landward side of the trench.

(g) Cleaning up the Beach

The beach should be cleaned up regularly to remove drift logs, debris and rubbish left by the tourists. Plastic bags, which are so often used and discarded, when found floating in the sea can be mistaken as jelly and consumed by the turtles and cause indigestion and related illness. Logs and other debris obstruct passage of the turtles on the beach,m and should be removed.

(h) Minimizing the Distraction from the Oil Production Platforms

Elimination of the flare might be a difficult task, but provision of light shields to minimize the lateral transmission of light out of the platform can be done quite easily. PETRONAS and ESSO should be requested to do their best to eliminate possible distraction of migrating turtles.

(i) Stepping up Research

The last listed here but definitely not the least important is the research aspect. Research should be conducted to ascertain the migratory route of the leathery turtle and its habitat so that more effective conservation measures which need to have multinational cooperation, can be devised and implemented to enhance the chance of success. Research should also be conducted to look into the feeding in captivity of the turtle so that the pressure of tourists on the nesting beach can be relieved.

5. ADMINISTRATIVE SUPPORT

5.1 Under the Malaysian Constitution, turtle is a state matter. The Terengganu State Government has the sole authority on the turtles in the state. The present Turtle Enactment has given the authority to the State Administration, and the department of Fisheries has been given, administratively the task to carry out the conservation work without any enforcement power.

5.2 The Department of Fisheries, though a Federal Department, has state employed staff. The Department has the manpower, knowledge, financial and operational capability, and thus is most suitable to be entrusted with the full responsibility of taking care of the turtles.

5.3 A new state law, probably best be made under the Fisheries Act 1985, should be enacted to consolidate efforts to prevent the extinction of the leathery turtle.

6. FINANCE FOR THE CONSERVATION WORK

6.1 The Government of the State of terengganu is well aware of the importance of turtle conservation and is ever willing to contribute financially towards conservation efforts. Projects can be carefully drawn up and submitted to the State Government for approval.

6.2 The Federal Government through the statement made by the Deputy Prime Minister recently at Rantau Abang, has promised all out assistance towards conserving the marine turtles. Assistance in the form of manpower and finance is readily available.

6.3 Besides the Government, the private sector and international bodies are also anxious to contribute toward the

survival of this wonderful animal. In short, it is unlikely the conservation efforts will face any financial constraints.

7. CONCLUSION

The decline in the leathery turtle population in Terengganu is alarming. Past conservation measures, though able to slow down the decline, are insufficient to ensure the continued survival of the species. More effective measures must be taken as soon as possible. Cooperation between the Government, scientist and other organizations should be stepped up towards the common goal - the survival of the leathery turtle.