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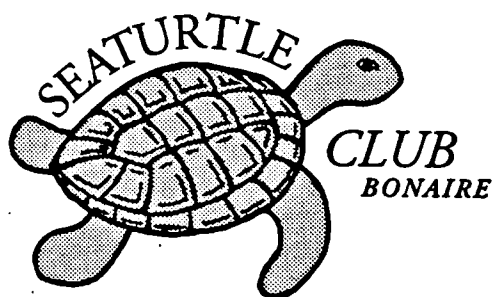
Instituut voor Systematiek en Populatie Biologie (Zoölogisch Museum)

Universiteit van Amsterdam

No. 76

Sea Turtle Conservation on Bonaire

Sea Turtle Club Bonaire 1996 Project Report



D.J.Norde & J.P. Van Rossum

Reviewed by T.J.W. Van Eijck

May 1997



WIDER
CARIBBEAN
SEA TURTLE
CONSERVATION NETWORK



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The Sea Turtle Club Bonaire is a non-profit, non-governmental organisation, and its main goal is the conservation of Bonaire's sea turtles. The STCB wants to realize this goal by creating public awareness about sea turtle conservation on Bonaire, and by biological research on the local sea turtle populations. To continue our work, your support is highly appreciated. You can send your donations to:

- Sea Turtle Club Bonaire, accountno. 10106273 of the Maduro & Curiëls Bank, Kralendijk, Bonaire, Netherlands Antilles;
- Sea Turtle Club Bonaire, accountno. 550391150 of the ABN-AMRO Bank, Hilversum, The Netherlands.

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Hawksbill turtle (*Eretmochelys imbricata*) by Donna Enunell © SICB 1997

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Reviewed by T.J.W. Van Eijck

May 1997

Preface

Imagine being a sea turtle. Your life, as it appears to human beings, would be a simple one. You wouldn't know your parents, so you wouldn't have to care about them. You wouldn't know your children, so you wouldn't have to care about them either. Would you know about yourself? In a way, probably. Nevertheless, as a sea turtle, you will for sure have to take care of yourself. Your mind, however, would not be filled by all your day-to-day considerations, but by instincts of millions and millions of years old. Especially when you are a turtle on your way to your favorite nesting beach, there would not be that much to worry about, besides from mating, growing about hundred eggs inside your body, nesting on a fine, quiet beach and then get back to the sea as fast as you can.

As a turtle, you wouldn't know which danger is ahead of you. Apart from the natural threats, such as sharks, there will be threats you wouldn't encounter in the past. Not being able to find your favorite nesting beach because of lights shining at the coast, for example. Being caught by a turtle-net or a shrimp-trawler. Your eggs, once laid, being dugged out and eaten. Those are the threats wich ruinize your offspring nowadays, and you can't do anything about it, except perhaps choosing another place to nest. A quiet place, without noise, lights, human beings, dogs, cars, and so on.

The advancement of modern biological science offers new explanations for old enigmas. Also in modern turtle-biology, many scientists try to unsolve the animal's mysteries. Do turtles actually return to the beach where they were born, or can they choose their own nesting ground? How do turtles find their way to a nesting beach? Do they ever choose another one? This must have been the case many times, since sea turtles do nest on tropical beaches around the whole world. However, the final answers to these questions still need to be answered. They are important, however, for explaining the results of the 1996 Project. Why was the number of nesting attempts on Bonaire almost three times higher than in former years? Is this the result of a 'good year' in the natural cycle, or is it a real increase?

We still don't know. What we do know, however, is that it is important to continue with our work. Several beaches on Bonaire still offer suitable nesting ground for adult sea turtles, while the coral reef and sea grass beds offer refuge and foraging ground for juvenile turtles. Over the years, we gained a better insight in where the turtles go and what they do around Bonaire. At the moment, we use this knowledge to optimize our conservation strategies. As a consequence, the cooperation with other local organizations has intensified, so that not only the sea turtle will benefit, but also the other endangered species that are part of Bonaire's rich wildlife.

Hereby I thank everyone who contributed to the succes of the STCB 1996 Project. Without you we could never keep up the good work!

Tom van Eijck, secretary Sea Turtle Club Bonaire

Acknowledgements

In realising the STCB 1996 project we are indebted to a lot of people. Without the help of them, we could never have reached the many and diverse goals. Therefore, we would like to thank the following persons:

First of all, our thank goes out to Drs. Tom van Eijck. He started the research and public awareness activities in 1993. Since then, he has been coordinating and assisting the 1995 and 1996 project, in which he invested a lot of time. Without his dedication, these projects could never have been realised. Also, we ought to thank our predecessors, Paul van Nugteren and Niels Valkering, and especially the latter, for helping us starting the project and introducing us in the world of Bonairian turtles.

Without the efforts of Albert the Soet the STCB would not have been founded in the first place. Also we thank him for assisting us in the 1996 project and giving us advice and help whenever needed.

Our supervisors, Eric Newton on Bonaire and Professor Bak from the University of Amsterdam we thank for assisting us. Eric Newton, with his excellent knowledge of Bonaire and its wildlife formed a indispensable factor for our work, and professor Bak for helping us writing the report and making the cooperation between the STCB and The University of Amsterdam possible.

Corine and Larry Gerharts have been receiving us in a very hospitable way and introducing us in the Bonairian society and giving comments on our work from a local point of view. Also, they gave us practical advice when needed. Corine has been very important for the STCB, by being the spokesman and organising various activities. Besides that, we were able to lent their camera every time when we needed it.

STINAPA has helped us through giving us free entrance to the Washington Slagbaai Park. The cooperation with its rangers, Norwyn and Hillario has been very pleasant. We want especially to thank George 'Cultura' Thode, for his everlasting enthusiasm in teaching us about the nature of Bonaire. We very much enjoyed the lectures we performed with him in the Centro di Barios. For us it was a real honour to work with him.

Also the STINAPA chairman, Hans Rietveld we would like to thank for his work on the recent developments towards a binding educational program. Cooperation with the Bonaire Marine Park has been very pleasant. The rangers George, Eeckie and Dean took us over to Klein once a week, and we appreciate the advice and assistance we delivered from the BMP manager, Kally the Meyer.

Working together with other NGO's was very important as well: Tene Boneiru Limpi (especially Diane Gevers), SELIBON and Amigoe di Terra (Christie Dovale). We enjoyed the cooperation with the Foundation for the

preservation of Klein Bonaire, and we cannot stress enough the importance of their goals.

Besides the BMP, other people assisted us with transportation to Klein: Jack Chalk (Habitat) arranged transportation every Saturday. Moreover, he gave us the opportunity to do our slide shows every Monday evening and letting us use the conference room for our first presentation on the island.

Buddy Dive also transported us weekly and provided us with additional transport whenever needed. We appreciate their efforts very much.

Stefan and Renee from sailing charter "The Woodwind" have been more than generous in taking us on their charter sail to Klein Bonaire every week, giving us the opportunity to inform the tourists about sea turtle biology, and providing us with a very pleasant mean of transportation. Besides that, we are indebted to Renee for her valuable source of information. The snorkel observations she made with a never ceasing dedication are very useful in our research. We wish them good luck and strength for the next year.

If no one was available to bring us over to Klein, Gerrie from Baka di Laman was always found willing to let us hitchhike on his comfortable boat.

Especially in the last part of our stay, Gerrie proved to be a very helpful force, and we enjoyed our talks about Amsterdam.

We owe a tremendous thanks to all dive shop personnel and to all divers who participated in the Sighting Network. Without the constant enthusiasm of tracing and reporting turtles, we would not have known so much now. We want to thank all the dive shop managers, and some enthusiastic individuals such as Mark (Dive Inn), Dave (Habitat), Bruce and Kitty (Carib Inn), Mary (Sunset dive), John and Ronald (Great adventures), Jean-Paul, Andre and Vonny (Buddy's) and especially Bart Snelders who was always there to help us.

Jerry Schnabel from Schnabel phototours never made a problem about us using his underwater photo equipment which was essential for our research. We appreciate his confidence very much.

The media have been covering our activity intensively during the 1996 project which, we think, is very important in raising public awareness. We would like to thank Boy Antoin from EXTRA for his enthusiasm and attention, which was very important to us. He also assisted us in printing and translating several texts. Aida (Algemeen Dagblad) for her interest, attention and press coverage. Ann Louise, for her radio interview in the beginning of the project. Laura and George DeSalvo from Port Call exceeded everybody in their press coverage, we thank them for that and for their friendship and sincere interest.

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All the schools we thank, especially Mrs Pourier from the Catholic School board and Mr Pourier from the SGB (Scholengemeenschap Bonaire) for their cooperation.

We were very happy to make unique footage of a nesting loggerhead that was nesting on Bonaire during the summer. We are indebted to Richard and Marissa, for letting us film on their property. We were also able to edit the footage we shot during the project and show some of the highlights during our last presentation. Janice and Denise from Dive Bonaire Dive&Photo let us work on their equipment for quite a lot of time, and Julie Morgan from Sand Dollar Dive&Photo for letting us use her equipment as well plus donating her beautiful underwater footage,

In making the 1996 newsletter Deborah Diggins edited the whole text for which we thank her, and Marc Jeuken for his beautiful lay out. Through them the 1996 newsletter was such a great success.

Finally, we thank those people who were found willing to continue various activities while no project assistants are on the island: Bart and Imre for doing the surveys on Klein on a weekly basis and Martin de Graaf for looking after the sighting network.

Joris van Rossum, Derk-Jaap Norde, May 1997.

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Summary

Bonaire, Netherlands Antilles (12°12'N, 68°77'W) is an island in the Caribbean sea, situated about 50 km east of Curacao and 80 km north of the South American continent (Venezuela). Its 288² km of land hold about 14,000 inhabitants. Bonaire has a strongly growing population, which is mostly due to immigrants settling on the island. The surrounding waters hold much tropical sea life, which attracts a lot of dive tourism. The present reefs and sea grass beds provide a suitable habitat for juvenile green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles. Seasonal nesting on Bonaire's beaches is accounted for mostly by the loggerhead (*Caretta caretta*) and the hawksbill turtle. Leatherbacks (*Dermochelys coriacea*) are only rarely encountered.

The Sea Turtle Club Bonaire (STCB) is a non-profit, non-governmental organisation, its main goal being the conservation of sea turtles around the island of Bonaire. The strong decline in the presence of sea turtles the past few decades is a result of the developing tourist industry, leading to a loss of potential nesting grounds. On the other hand the illegal capture and poaching of nests. Since the amendment of the Marine Environment Ordinance (A.B. 1984, no. 21) in 1991, which prohibits any handling or possession of turtles or turtle products, turtle fishing has dropped, but still continues on a small scale.

As in 1995, in 1996 the STCB appointed two graduate biology students as project assistants for The Sea Turtle Club 1996 Project. Research took place from June to December in cooperation with the University of Amsterdam. Housing and research facilities were all arranged by the STCB with the help of many sponsoring organisations. During the first month the project assistants were introduced to the Bonairian community by the former year's project assistant.

During the first two months a dramatic increase in the amount of crawls was obvious. Over the nesting season, the number of crawls found (116) almost tripled compared to the number found in former years (40 in '93 and 44 in '95). Much time was spent on the tracking and identifying of individual nesting turtles, in order to confirm the hypothesis about a returning nesting population (cohorts) on Bonaire. Six different nesting turtles were photo-identified in the course of the project. A new nesting ground was discovered on a hotel property beach (Harbour Village Resort), which was surprising, because of its artificial character and high human impact. The cycle of a nest being made and its subsequent hatching was filmed on location (probably for the first time on Bonaire). The most important nesting ground remains Klein Bonaire, especially for the hawksbill turtle. A total of 16 nests were excavated and determined for their hatching success.

The STCB 1996 Project had a number of objectives concerning the public awareness of sea turtles in specific and nature conservation in general. The campaign was targeting both the local and the tourist community. Various folders were distributed, posters were sold, information about sea turtle conservation was placed in the museum of the national park, and weekly slide shows were given. Also, regular press updates, radio and television interviews were published. More generally associated activities were the participation in the organisation of a "World Cleanup Day" and the coaching of "Turtuganan di Bonairu", an educational snorkel program for local children. On the initiative of the Foundation for the Preservation of Klein Bonaire, a promotional video on the different aspects that make this uninhabited islet so special has been produced. A separate part about the sea turtles was included, in which the disastrous consequences of the possible future developments are evaluated. The video will be broadcasted in various countries

For both research and conservation reasons, the diving community was confronted again with the sighting network which worked extremely well. A total of 889 turtle sightings were reported in 1996.

Furthermore, the project assistants engaged in a lot of side-activities such as dealing with stranded turtles, gathering information on illegal fishing and meetings with other NGO's.

In October, a three day long international platform meeting on conservation areas was organised on Bonaire. The STCB was presented its recent sea turtle nesting figures, and the importance of Klein Bonaire as main nesting ground was emphasized. The many attending parties (Dutch and Antillian government representatives, WWF and other NGO's, researchers and land owners) came some steps closer in the safeguarding of important nature areas on the Dutch Antilles and Aruba.

In November, representatives of different NGO's, including the STCB were able to discuss some recent problems with a delegation of chairmen of the main parties of the Dutch parliament. On this occasion, the threats that face the Lay Bay area were brought under the attention by the STCB. It is believed and hoped for that action on both the Klein Bonaire and Lac Bay issues will be undertaken.

Samenvatting

Bonaire, Nederlandse Antillen (12°12'N, 68°77'W) is een eiland in het caribisch gebied, 50 km ten oosten van Curaçao en 80 km ten noorden van het Zuid Amerikaanse continent (Venezuela). Het eiland beslaat een oppervlakte van 288 vierkante kilometer en heeft ongeveer 14.000 inwoners. Bonaire heeft een sterk groeiende populatie, wat voornamelijk te wijten is aan immigratie. Bonaire heeft een wereldwijde naam aangaande haar onderwaterfauna, wat vele duiktoeristen trekt. De aanwezige koraalriffen en zeegrasvelden vormen een leefomgeving voor juveniele groene (*Chelonia mydas*) en karet (*Eretmochelys imbricata*) schildpadden. Het seizoensgebonden nesten van adulte vrouwtjes komt voornamelijk voor rekening van de dikkop- en karetschildpad. De lederschildpad wordt slechts zelden rond Bonaire aangetroffen.

De "Sea Turtle Club Bonaire" (STCB) is een non-gouvernementele stichting zonder winstoogmerk, met als doel het behoud van de zeeschildpadden rond Bonaire. Een sterke afname in het aantal zeeschildpadden in de afgelopen decennia kan gezien worden als het gevolg van een zich sterk ontwikkelende toerisme industrie enerzijds, en het illegale vangen van schildpadden en het stropen van nesten anderzijds. Na het van kracht worden van het Verordening Marien Milieu (A.B. 1984, nr.21), een besluit dat het vangen en consumeren van zeeschildpadden verbiedt, is het jagen naar zeeschildpadden afgenomen, maar vindt nog steeds plaats op een bescheiden schaal.

Net als in 1995 heeft de STCB twee studenten van de universiteit aangesteld als project assistenten voor het Sea Turtle Club 1996 Project. Onderzoek werd gedaan van juni tot december in samenwerking met de Universiteit van Amsterdam. Onderdak en onderzoeks faciliteiten werden verzorgd met behulp van vele sponsors. De eerste maand werden de project assistenten ingewerkt door een van de project assistenten van het voorafgaande jaar.

In de eerste twee maanden werd een dramatische toename van het aantal nestpogingen waargenomen. Over het hele nestseizoen genomen, is het aantal pogingen bijna verdrievoudigd. Veel tijd werd besteed aan het volgen en identificeren van individuele nestende schildpadden, met als doel de hypothese van de terugkerende nestpopulatie (cohorten) te testen. Zes verschillende schildpadden werden gefotografeerd en geïdentificeerd. Het nesten van een schildpad is gefilmd (waarschijnlijk de eerste keer op Bonaire), en opmerkelijke nestpogingen werden waargenomen op het strand van Harbour Village, een artificieel strand in een dicht bevolkt gebied. Het belangrijkste nestgebied was net zoals in 1993 en 1995 Klein Bonaire, vooral voor de karetschildpad. In totaal zijn 16 nesten uitgegraven en onderzocht.

Het STCB 1996 Project had een aantal doelstellingen met betrekking tot het publieke bewustzijn omtrent zeeschildpadden en het natuurbehoud op

Bonaire in het algemeen. De campagne was gericht op zowel de lokale bevolking als de toeristengemeenschap. Het publiek werd voorgelicht door het verspreiden van folders, de verkoop van posters, het plaatsen van informatie over zeeschildpadden in het museum van het nationale park en door het geven van wekelijkse diavoorstellingen. Verder werden regelmatig persvoorlichtingen gegeven en zijn er radio en televisie interviews uitgezonden. Algemeen gerichte activiteiten waren de deelname in de organisatie van de "World Cleanup Day" en de begeleiding van 'Turtuganan di Boneiru", een leerzaam snorkel programma voor de lokale jeugd. Op initiatief van de stichting voor het behoud van Klein Bonaire is een promotie video-film geproduceerd over de verschillende aspecten van het natuurlijke karakter van dit onbewoonde eilandje. Een apart gedeelte over de zeeschildpadden is hierin opgenomen, waarbij de ernstige gevolgen van de eventuele toekomstige ontwikkelingen uitgebreid toegelicht worden. De video zal in verschillende landen worden uitgezonden. Aan de duikgemeenschap werd wederom medewerking gevraagd met betrekking tot het meldingsnetwerk, een systeem waarbij alle duikers geziene schildpadden rapporteren. In totaal 889 schildpadden zijn op deze manier gemeld. Dit systeem, geïntroduceerd in 1993, functioneert erg goed en de verzamelde, actuele informatie kan als richtlijn voor het onderzoek gebruikt worden. Daarnaast namen de project assistenten deel aan velerlei activiteiten, zoals het verzamelen van informatie over illegale vangsten, en bijwonen van vele bijeenkomsten met andere non-gouvernementele natuurbeschermings organisaties.

In oktober werd er een driedaagse internationale platform bijeenkomst op Bonaire gehouden, met de titel "Conserveringsgebieden, wat doen we ermee?". De STCB heeft haar recente onderzoeksgegevens hier gepresenteerd, en het het feit benadrukt dat Klein Bonaire als belangrijkste nestgrond fungeert.

In November was er een bijeenkomst met een delegatie van de fractievoorzitters van de tweede kamer. Afgevaardigden van verschillende non-gouvernementele organisaties, inclusief de STCB, kregen de mogelijkheid om recente problemen onder de aandacht te brengen. Van deze gelegenheid werd door de STCB gebruik gemaakt om enkele problemen rond het Lac Bay gebied onder de aandacht te brengen. De STCB hoopt en gelooft dat er in beide kwesties, Klein Bonaire en Lac Bay, spoedig vorderingen gemaakt zullen worden.

1. Introduction

1.1 Sea turtles of the world

During the course of evolution, reptiles were the first class of vertebrate animals that were fully adapted to a live on land. Most important features were the development of lungs and the capacity to lay eggs that are adapted to incubate in arid conditions. Turtles form a very old group. The oldest turtle fossils date from the Triassic (± 200 My BP). About 60 million years ago, some turtles got adapted to a life in the sea. Their shell became more hydrodynamic, and feet evolved into flippers. Next to the sea snakes, sea turtles are the only group of reptiles that live in the sea.

Two families of sea turtles exist, the Cheloniidae and the Dermochelyidae, consisting of 7 species.

The family Cheloniidae consist of 6 species:

Green turtle (*Chelonia mydas*);

Loggerhead (*Caretta caretta*);

Hawksbill (*Eretmochelys imbricata*);

Olive ridley (*Lepidochelys olivacea*);

Kemp's Ridley (*Lepidochelys kemp*);

Flatback (*Natator depressus*);

The family of Dermochelyidae has only one living representative, the Leatherback (*Dermochelys coriacea*).

On Bonaire, four species occur (for morphological descriptions see appendix 9). The green turtle and hawksbill turtle occur as juvenile turtles, and a small population of adult hawksbill and loggerhead turtles visit the island in the nesting season to lay their eggs on the sandy beaches of Bonaire and Klein Bonaire.

1.2 Overview of Species

Eretmochelys imbricata (Hawksbill turtle)

General

The hawksbill turtle is a typical tropical inhabitant, and travels less distance between its foraging and its nesting grounds compared to the other species. Its main diet consists of sponges, which it picks out of the coral reef with its hawk-shaped beak. On average, hawksbills make 3-6 nests in one nesting season, every 2-3 years, although much variation exists in the periods observed in different localities. Subsequent nesting is separated by an interval of 14-18 days (average 16) each. Hawksbills have produced the largest recorded clutches of all turtles, up to 221 eggs in one nest (Pritchard, 1984). Normally each clutch contains 90-180 (average 140) eggs, and has a mean incubation time of 60 (55-65) days. The hawksbill is famous for its beautiful shell, which serves to camouflage it in the coral reefs. For its beautiful shell, it has been harvested by men throughout the world, and the pressure on populations has caused widespread depletion of the species. Shells were mainly used for decorative purposes. A presently large threat is the loss of potential nesting habitat, due to increasing development. The hawksbill is now the most endangered sea turtle of the Caribbean region, and is listed as an Appendix I species by the Convention on Trade in Endangered Flora and Fauna (CITES).

On Bonaire

The local name of the hawksbill is 'turtuga karet'. In numbers it is the second most abundant species, however, it is the most commonly sighted turtle by SCUBA divers, as it lives mainly on Bonaire's leeward west coast. Here a limited number of juveniles live and grow up in the shelter of the coral reefs. Besides this juvenile population, Bonaire is a nesting ground for adult hawksbills. The nesting season runs roughly from June to November, with a peak in September, and occasional nesting almost throughout the year. The hawksbill is a very shy nester, and is very easily disturbed by human interference. On Bonaire, this is probably the reason that 98% of all hawksbill nests are made on Klein Bonaire, one of the few places where there are no people at night. Bushy, or otherwise seemingly inaccessible (due to high reef-flats), small sandy beaches are favoured nesting sites. This also might explain the nesting preference for Klein Bonaire, which has extensive near shore branching and fire coral reef formations.

Caretta caretta (Loggerhead turtle)

General

The name loggerhead refers to its disproportional large head. It possesses very powerful jaws, which it needs to crack the shells of large molluscs such as

conch shells. Furthermore, it has reported to feed on crabs, clams, oysters, fish, jellyfish, sea urchins and sponges.

The loggerhead turtle occupies a relative broad geographic range of latitudes. It is the only turtle that not only nests in the tropics, but also in more temperate regions, such as the Mediterranean, Florida and Japan. In the water it has been sighted even as far north as Newfoundland (Squires, 1954). The loggerhead travels long distances, while moving from its foraging area to its nesting ground. Nesting grounds in the Caribbean are scarce, and the most important nesting ground in the Atlantic is the coast of south-eastern USA, and the Brazilian coast on the southern hemisphere.

Nesting takes place mostly every 2-3 years, with up to 5 clutches every season. Incubation period under natural conditions lies around 60 days. Clutch size lies between 100-180 eggs typically, with some clues that a positive correlation exists between clutch size and the size of the nesting female, and between the number of nests made before by a given individual in a single nesting season.

On Bonaire

Local name is 'turtuga kawama'. It occurs in Bonaire as a nesting turtle. And although juveniles have been reported swimming in Lac Bay in the past, this is not supported by research.

The meat is not widely consumed, and is by some considered to be poisonous or at least distasteful. However, the species has been, and may still be, caught for its believed aphrodisiac properties. The loggerhead is not such a shy nester as the hawksbill. It nests also on the mainland of Bonaire, on more open beaches near human settlements. Lights do not seem to bother it too much (three nests were recorded on a artificial illuminated hotel beach in 1996), and it seems not to be easily disturbed. The nesting season runs from May to September. During this period, a gravid female can be encountered on a certain, more or less fixed spot, where she spends time between successive nestings.

Chelonia mydas (Green turtle)

General

Being the largest of the Cheloniidae, the carapace of the green turtle can become about 125 cm in length. Green turtles are found in all tropical seas and to varying degrees penetrate into sub-tropical waters, though less common and far than loggerheads and leatherbacks do. Geographic variation is extensive, but often too gradual to distinguish sub-species. Only one East Pacific local form is now being regarded as a separate subspecies, named either as *Chelonia mydas agassizi* (A. Carr, 1952) or just *Chelonia agassizi* (Pritchard, 1983), treating it as a separate species. After about two years of age, greens become completely herbivorous, some populations mainly feeding on algae, but most (Caribbean) populations feed primarily on the sea grass *Thalassia testudinum* (turtle grass).

The green turtles are highly migratory. The separation between feeding and nesting grounds may result in movements of thousands of kilometres. The females nest every 2-4 years. Productivity within a breeding season is high. Usually six or more nests with intervals of 12-14 days, often producing over a hundred eggs per nest.

Greens are long-lived, and in nature need an average of 25-35 years to reach sexual maturity. Greens continue to grow throughout their lives, but their growth rate is rather slow, especially after the first reproductive cycle.

On Bonaire

The green turtle ('turtuga blanku') is in number the most abundant species on Bonaire. It lives mostly at the Windward east coast, mainly in its juvenile or sub-adult stage. Occasional nests have been reported in the past, mostly from the Sorobon/Cai area, but no nesting has been recorded during the STCB projects. An interesting fact is that nesting colony on the neighbouring *Islas Aves* (Venezuela) is, although much declined, substantially large (approximately 22 nestings per night during the peak of the season, Brownell and Guzman, 1974). This may indicate that on Bonaire, a green turtle nesting population has existed, but has been driven to extinction already. The Bonairian people have historically captured green turtles for their meat, and probably have consumed the eggs as well. Over consumption is the main reason for its present threatened status, both locally and internationally. An important area for foraging greens is the Lac Bay region, which contains lush sea grass beds. The turtles are thought to migrate into Lac Bay at night, to feed on turtle grasses growing there in high densities. They occur on the whole east coast of Bonaire, and are more abundant there than on the west coast. The south-west coast is more inhabited than the north-west coast, which is predominated by hawksbills.

Dermochelys coriacea (Leatherback turtle)

General

The leatherback turtle is the only living representative of the Dermochelyidae (The soft-shelled turtles), and by far the biggest of all turtles. It has a thick, black skin covering its back in stead of a hard shell.

Seven tubercular ridges run over the entire carapace' length, and five over the plastron as well, often white-spotted.

It occurs throughout the oceans of the world, even up to the Arctic regions. Besides a lot of isolating fat, the leatherback is the only sea turtle that possesses a certain degree of thermo-regulation. The diet of the Leatherback mainly consists of jellyfish, which occurs most in temperate regions. It is famous for its diving behaviour. They are known to dive to approximately 200 meters, to a zone called the Deep Scattering Layer, which, in the tropics, holds a lot of plankton, which attracts a lot of jellyfish. Leatherbacks have been tracked to depths exceeding 1200 meters, but this is probably exceptional and serves as a strategy to escape predators such as big sharks. Because it has a

soft, flexible shell, the leatherback can resist these enormous depths without the carapace imploding with the increased pressure.

Growth rate is very high. In captivity a leatherback grows steadily with about 1 cm per week, so that maturity may be reached within three years (60 cm at one, 120 at two and 180 at three years of age.) Other research has confirmed these exceptional growth rates. The number of white spots on the black skin decreases with increasing age.

The nesting is restricted to the tropics. Leatherbacks prefer big open, dynamic beaches, which can be seen from their nesting behaviour; usually successive nests are made on different distances from the shoreline.

Nesting leatherbacks are disturbed relatively less easily than other sea turtles, also they rarely make false crawls. In a season it will nest 5-8 times, with an average period of 10 days in between. A large percentage of the eggs is undersized or yolkless. Average clutch size is 86 full-sized eggs, and a variable number (1 to 57) of eggs that contain no embryo. Incubation takes 60-68 days.

On Bonaire

In Papiamentu the leatherback is called 'turtuga driekiel', which means 'three ridges', which is derived from the fact that the upper three ridges stand higher than the others, and are the only ones visible when the turtle floats on the surface of the water. It can be confusing however, that juvenile loggerheads do have three standing ridges on their shell, and sometimes loggerheads are also called Driekiel in Papiamentu (Van Buurt, 1995) the Leatherback is only rarely sighted in coastal waters, and spends most of its time in the deeper, pelagic waters. The last leatherback nesting attempt on Bonaire was recorded in 1988, when fishermen tried to catch the animal when on land, but did not succeed (Sybesma, 1991).

Leatherbacks are sighted about a few times a year, mostly not by divers, but are seen from boats, while surfacing for air. These individuals probably do not have fixed territories near Bonaire's coast, but are passing along. Leatherbacks are the least edible of all sea turtles. Its meat is often believed to be poisonous. However, the eggs are used for consumption a lot.

1.3 History of the Sea Turtle Club Bonaire

1991 - The Sea Turtle Club Bonaire was founded as a reaction to the fact that sea turtles were still being caught and slaughtered at Lac Bay, and 'turtle sate' was still being consumed on a big scale.

On the same time, all species of sea turtles were legally protected on Bonaire by means of the Bonaire Marine Environment Ordinance.

1992 - The STCB organised a charity dinner on Bonaire, that was attended, among others, by the former prime minister of the Netherlands, Mr. Ruud Lubbers. The money raised by that dinner became a basis for further activities of the STCB. Besides this, Mr. Lubbers Wife, Mrs. R. Lubbers-Hoogeweegen became the patron of the STCB. Shortly after this, the STCB realised the re-introduction of some sea turtles from European zoo's. The transport of the turtles was sponsored by KLM, while Marcultura (a marine culture company) took care of the re-introduction itself.

1993 - The STCB appointed biologist Tom van Eijck as coordinator of a research and conservation project for the still existing sea turtles of Bonaire. Van Eijck based the development of this project on a shortly before released report of the United Nations Environmental Program (UNEP), titled: "Sea Turtle Recovery Action Plan for the Netherlands Antilles". With the assistance of the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) the project for Bonaire (the 'Sea Turtle Survey Bonaire 1993') was developed further, and started in May 1993. The main objectives of the project were an inventarisatie of the still existing sea turtle population, a public awareness campaign dealing with the conservation of sea turtles and their natural habitat, with special focus on the local population on Bonaire, especially children. Very soon it is found that Bonaire is still possesses a small population of nesting turtles of loggerhead and hawksbill turtles, and that the reefs and sea grass beds are being used by juvenile green and hawksbill turtles.

1994 - The results of the Sea Turtle Survey Bonaire were presented by Van Eijck on the International Sea Turtle Symposium in the United States. The activities of the STCB are receives international recognition and useful contacts were made. Shortly after this the first report of the STCB was released. With this report, the STCB was capable of getting support of important funds, for example the World Life Fund for Nature of the Netherlands and the Nationale Postcode Loterij. Together with the report this served as a basis for a follow-up project the next year.

1995 - The STCB continued her activities in cooperation with some Bonairian nature conservancy organisations, like the Bonaire Marine Park (BMP) and Tene Boneiru Limpi, and with the University of Amsterdam (UvA). Niels Valkering and Paul van Nugteren were being appointed as project assistants, who continued the conservancy activities of the STCB. In their research

activities they were supervised by Prof. Dr. Bak of the University of Amsterdam. Next to the research, a lot of activities were organised, like assisting in a snorkel project for Bonairian children ('Turtuganan di Boneiru') and the cleaning of some of the beaches of Bonaire during the International Cleanup Day in September. During their biological research new nesting beaches were found. In relation to 1993 the nesting population was found to be stable.

1996 - Again the STCB was represented on the International Sea Turtle Symposium, with two presentations: one about the research on sea turtles, and one dealing with the successful public awareness campaign in 1995. Shortly after this, the 1995 project report was released. A second print was being published in cooperation with the University of Amsterdam and was distributed internationally. To be able to give the work of the STCB more continuity, a long term proposal was included in the report, that started in June 1996 by means of the STCB 1996 project. Derk-Jaap Norde and Joris van Rossum were appointed as project assistants. Again, this project was partly financed by World Life Fund for Nature of the Netherlands and the Nationale Postcode Loterij.

1.4 The 1996 project

The objectives of the 1996 project were, based on the long term proposal, the following:

- Continuing to monitor all nesting grounds on Bonaire on nesting activity, and safeguarding nests in order to prevent disturbing or poaching.
- Identifying Bonaire's nesting population by means of the monitor results and the gathering of photo/video material.
- Extending the photo identification study on juvenile greens at the Lac Bay area
- Gathering video and photo footage which can be used for a educational film about the sea turtles of Bonaire.
- Intensify the cooperation with local and regional NGO's
- Obtaining support and sponsoring from the business community in order to continuation of the STCB's activity's.
- Informing the public, both the tourist and local population, about sea turtle conservation.
- Helping to implement educational programs on nature conservation on Bonairian schools.
- Making information and research results available to policy makers (such as the island government)

To attain these objectives, a 6-month work plan was outlined.

2. Research on Nesting Turtles

2.1 Introduction and Objectives

One of the main objectives of the 1996 Project was to monitor the nesting activity of sea turtles on Bonaire. Because hawksbill and loggerhead turtles come return for subsequent nesting after two or three years, the collection of data over successive years is essential in order to learn more about the nesting population. Also, monitoring is important for safeguarding all nests from poaching and predation. Therefore, a continuation of the monitor studies of '93 and '95 was required.

The period of most intensive monitoring was chosen to coincide with the Bonairian nesting season. The nesting season on Bonaire is long, and runs roughly from May until December, with a clear peak in August and September (Van Eijck et al.,1994, Valkering et al.,1996), but nesting attempts have also been recorded outside this period.

Since Bonaire possesses a relative small nesting population, the possibility exists that the population does not consists of yearly cohorts of nesting turtles that return to the same nesting grounds every 2-3 years. This could occur either through either 'natal homing' -birth ground will be future nesting ground- or 'social facilitation' -neophyte nesters follow experienced females from feeding grounds to nesting grounds.

Another possibility is that the nesting turtles on Bonaire are part of a much bigger continental (Venezuelan) nesting population (Sybesma, 1992). The turtles that visit Bonaire would then normally nest at Venezuela, but by accident hit the Bonairian coast, were nesting would occur only once.

The main question behind the hypothesis is whether the same individuals visit Bonaire every 2-3 years, in other words: "Does Bonaire hold a residential nesting population?"

In order to answer this question, tagging would be the best and most direct method. However, because tagging requires handling a turtle while nesting, a sufficiently large population with more or less frequent visits is needed for this method to pay off. Also any stress as a result of tagging nesting turtles is especially undesired when dealing with very small populations.

Indirect the hypothesis can be tested by identifying adult females in the water, during the nesting season, and comparing the results of different years.

Individual adult turtles are easily recognised by their shells, due to barnacles, colour variations and scars (Valkering et al.,1996).

By means of photo material, collected over the years via the sighting network or the Project Assistants, a database can be assembled enabling the STCB to test this hypothesis.

Comparing results with the results of former years is a valuable method. If Bonaire possesses a residential nesting population, nesting frequencies and distributions are expected to correlate to some extend every 2 or 3 years.

2.2 Methods

Monitoring was performed by the Project Assistants over the period of June 5th to November 26th. Methods used were similar to the those used by the STCB in previous years (see for more extensive description: Van Eijck & Eckert, 1994). The monitoring was performed in the morning, to minimise the chance of tracks being wiped out by either man or natural causes. A total of 21 potential nesting beaches were surveyed on a regular basis (see table 1 for survey schedule and beach characteristics). If crawls were found, the exact site was recorded and marked, tracks were characterised and measured, and the route, direction, number of body pits, and potential disturbances were recorded (appendix 2). After that, tracks and body pits were wiped out, thus disguising it for overcurious tourists or poachers. Nests were never moved, as the risk of poaching or trampling by man could not be predicted, and probable decreased hatching-success involved with relocation would have done more harm, especially more than six hours after oviposition, when any movement or rotation of eggs will damage or stop the development. One crawl was counted as all activity between coming from, and going back to the sea.

Approximately ten days after the estimated incubation period (50-60 days depending on species (Van Eijck et al.,1994)), or immediately after a witnessed hatching, all (potential) nests were excavated. Sometimes hatchling emergences were detected through pre- and post emergent pit formation, or by observing the tracks of the hatchlings.

Nest excavation was done manually, to avoid punctures or injuries in case of live turtles in the nest.

If a nest was found, all eggs were dug out one by one, and the nest's contents were categorised as follows: live or dead hatchlings, hatched-, undeveloped- (showing no embryonic development), or arrested in development eggs (resulting in small-, mid-, or full-term embryos).

Live and dead turtles encountered in the nest more than 24 hours after the main hatching were not regarded as successful hatchlings. Those alive were either released the following night or kept for observation. In this way, total clutch size was determined, as well as the species, possible diseases present, and the estimated incubation period (EIP). EIP was recorded as the time (in days) between the laying of the eggs and the emerging of the first hatchlings. Hatching success was determined by counting all empty egg shells larger than 50 % of the whole egg (minus the dead and non-emergent hatchlings), and dividing this number by the total clutch size number.

After analysis, all nest remnants were returned to the excavated pit and buried again.

The '93 and '95 research has shown that the nesting-behaviour on Bonaire results in a relatively high number of false crawls (a crawl without nesting (Van Eijck et al., 1994, Valkering et al.,1996.)). A rough distinction between

false crawls and nesting crawls was made when the crawls were encountered. If only open body pits were encountered, a false crawl was evident. However, turtles will sometimes dig a nest and subsequently cover it without having laid eggs (Pritchard, 1984). Therefore, most attempts were excavated, regardless of the shape of body pit encountered.

2.3 Results

1) Monitoring of Potential Nesting Beaches

A total number of 116 crawls (which may or may not have led to nesting) were recorded between May 23 and November 26 (appendix 8). In figure 1, the temporal distribution of these crawls is represented per week, which illustrates, for some periods, the 12-15 days interval over which subsequent nesting of individuals takes place. Of course these periods are not necessarily synchronous for all individuals, but to some extent seemed to be in certain periods (e.g. weeknumbers. 26-30 and 35-40, fig.1), where the frequency of crawls increased every other week.

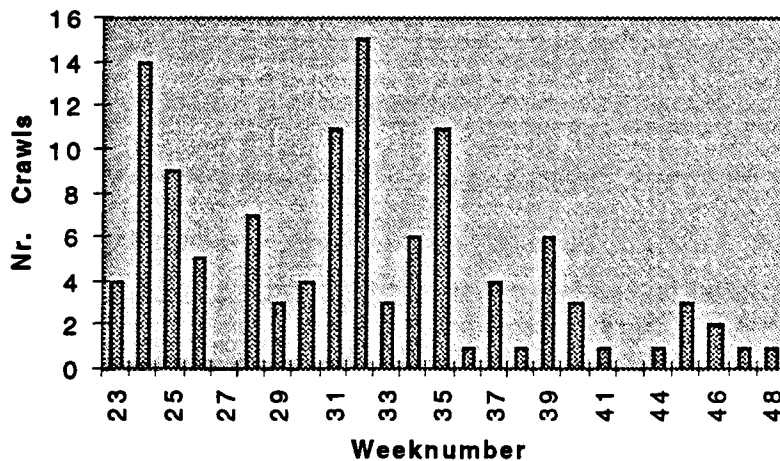


Figure 1. The temporal distribution of crawls in 1996, represented per week.

Of the 21 identified potential nesting beaches, crawls were found on 10 of them (table 1). The spatial distribution of crawls over the different nesting grounds is represented in figure 2.

A surprising new identified nesting beach was an artificial hotel-property beach (Harbour Village Resort), where lights are shining throughout the night.

Table 1. Habitat assessments and monitor schedule of potential nesting beaches on Bonaire.

Nr. Beach	Dimensions (l* w)	Monit. freq	Dynamics	Debris	Human Act.	Threats	Vegetation	Offshore St.	Earl. Act.	'96 Crawls
1 Playa Chikitu	110 x 20	2 x a week	high	moderate	low	humans; sea	bushes in dunes	sa, rocks, waves	yes	none
2 Boka Chikitu	12 x 30	2 x a week	moderate	moderate	very low	crabs	none	sa, fring, reef	unknown	none
3 Boka Catuna	10 x 4	2 x a week	moderate	very light	low	hu; crabs	none	sa(nd), reef	yes	none
4 Wayaka	8 x 3	2 x a week	moderate	very light	low	hu; ig; liz	none	sa, fring, reef	yes	1, nest
5 Playa Frans	33 x 10	1 x a week	low	light	high (settle)	hu; dogs	low grasses	sa, reef	yes	1, no nest
6 Playa Nukove	10 x 3	1 x a week	low	very light	moderate	hu; crabs	none	fring, reef	yes	none
7 Boka Dreifi	40 x 15	1 x a week	low	light	low	hu; cr; liz	bushes; cactae	reef	yes	none
8 Playa Lechi	90 x 10	daily update	low	light	high (s.)	hu; dogs	none	sa, rocks	yes	none
9 Harbour Vill.	75 x 10 (artificial)	daily update	low	very light	high (s.)	hu	none	rocks	unknown	3, 3 nest
10 Plaza Resort	60 x 8 (artificial)	daily update	low	very light	high (s.)	hu	none	rocks	no	none
11 Windsock	200 x 8	2 x a week	low	light	high	hu; dogs; liz	low bushes	sa, reef	yes	1, no nest
12 Punt Vierkant	20 x 5	1 x a week	low	light	high (s.)	hu	none	sa, reef	yes	none
13 Pink Beach	450 x 7	2 x a week	moderate	light	high	hu; dogs	none	sa, reef	yes	1, nest
14 S.W.P.B.	4-10 x 2-4	2 x a week	moderate	light	low	hu; do; birds	low bushes	sa, reef	yes	5, no nest
15 Chogogo	15 x 5	daily update	moderate	light	moderate (s.)	hu; dogs	none	sa, reef	yes	5, 3 nests
16 Sorobon Area	270 x 5	2 x a week	very low	light	high	hu; dogs	low bushes	sea grass, sa	yes	none
17 Lagun	84 x 10	1 x a week	moderate	heavy	moderate	hu	mangroves	sa, reef	yes	none
18 E.O.N.N.	1500 x 0-5	4 x a week	moderate	moderate	low	hu; cr; liz	bushes; trees	sa, reef	yes	56, 4 nests
19 No Name	530 x 7	4 x a week	moderate	light	moderate	hu; cr; liz; do	grass; bushes	sa, reef	yes	32, 4 nests
20 W.O.N.N.	4-15 x 2-5	4 x a week	low	very light	low	hu; cr; liz	low bushes	sa, fring. reef	yes	3, no nest
21 W.K.B.	4-30 x 2-9	4 x a week	moderate	very light	very low	cr; sea	none	sa, reef	yes	4, no nest

Table 2. Excavated Nests.

EIT= estimated incubation time; Und= undeveloped eggs; Mid= mid-term hatchlings; Full= full term hatchlings
H. shell= successfully hatched shells; Total= total nr. of eggs in nest; H%= percentage of eggs that hatched successfully.

Nr.	Date	Hatched	Excav.	EIT	Location	Und	Mid	Full.	Dead	H.shells	Total	H%	Sp.	Depth	Remarks
1	23-May	23-Jul	24-Jul		60 Chogogo	90	4	3	0	19	116	17%	Cc	40-50cm	
2	11-Jun	05-Aug	09-Aug		56 Wayaka	31	0	8	2	70	112	63%	Cc	20-30cm	Predation iguanas, nest in cave
3	23-Jun	20-Aug	20-Aug		58 Chogogo	39	3	6	0	105	153	69%	Cc		
4	23-Jun	23-Aug	24-Aug		61 Harb. Vill.	12	0	3	0	166	181	92%	Cc	50-60cm	Were captured and re-released
5	10-Jul	03-Sep	04-Sep		55 Chogogo	44	0	3	8	96	151	64%	Cc	40-50cm	8 dead(=not hatched)
6	±27-Jul	27-Sep	30-Sep	±60	Harb.Vill.	4	0	3	0	102	109	94%	Cc		
7	±7-Aug.	07-Oct	07-Oct	±60	Harb.Vill.	5	0	0	1	113	118	96%	Cc		
8	10-Aug ?		26-Nov		? EONN1	48	0	8	0	0	56	0%	Ei	20-40cm	Predation by crabs,
9	±18Aug	18-Oct	20-Oct	±60	Pink Beach	2	0	0	35	112	149	75%	Ei	32-48cm	A lot of dead turtles
10	11-Sep	09-Nov	09-Nov		60 NN-1	4	0	0	0	122	126	97%	Cc	30-40cm	In Beachhut, dirty sand, sig. butts
11	1-10 Ok	1-10 Dec.	(conf. Renee)		NN-2								Ei		Washed away
12	30-Okt.	End of	04-Jan	55-60	EONN 5	6	0	0	0	170	176	97%	Ei	75cm	Bart& Imre
13	11-Nov.	1-4 Jan	04-Jan		55 EONN 5	7	0	0	1	165	173	95%	Ei		Sp. identified by R.
14	±14 Nov	4-25 Jan	25-Jan	50-60	EONN 5	0	2	0	0	128	130	98%	Ei?		Same turtle as 13, 30 cm next to.
15	?		01-Feb		? NN-1	0	125	0	0	0	125	0%			Nest flooded, species not identified
16	6 Dec.	2-8 Feb	08-Feb	58-62	NN-1	6	0	0	0	165	171	96%	Ei		Same turtle as 23 Nov attempt.

A loggerhead succeeded to lay three subsequent nests on the property. The nests had high hatching successes (92%, 94% and 96%). The artificial lights clearly had a negative impact on the hatchlings. After emerging from the nest, most headed towards the lamps, in stead of going to open sea. This illustrates that seemingly small human disturbances, such as lights in the distance, can have a large impact on the survival of turtles. Because of this nesting, two other hotel property beaches can be considered potential nesting grounds and were checked regularly. However, no more crawls were encountered on hotel beaches in 1996.

The majority of crawls, 95 in total (82 %), were found on Klein Bonaire (Appendix 4b). Based on track characteristics and nesting behaviour, most are believed to be made by hawksbills (hawksbills typically nest under vegetation at more remote, small and inaccessible beaches whereas loggerheads tend to select more open, sandy beaches (Pritchard, 1984)). Of the beaches on Klein Bonaire, EONN is a typical hawksbill nesting beach (Van Eijck et al.,1994). Of the eight nests found on Klein Bonaire, four were hawksbill, and one was a loggerhead nest. Of the remaining three the species remained unidentified. The three nests found on EONN were all hawksbill nests. (For a comparison of the results with those of '93 and '95, see also section 2.5 'Comparing with former years')

All remaining 21 (18 %) crawls were found on the west coast of Bonaire, most of them in the south-west (19 out of 21, Appendix 4a). Only two crawls (one nest and one false crawl or poached nest) were found on the north-side of the island.

The number of body pits encountered per crawl varied between 0 and 16. The average amount of body pits found on Klein Bonaire was 2.37 (SD = 2.19), vs. 2.18 (SD = 2.43) on the mainland. (See section 2.4, discussion)

Between the 23rd of July and the 8th of February, 16 nests were confirmed (table 2).

15 nests were excavated and analysed (of which five were excavated by volunteers that were appointed by the STCBAfter the Project Assistants had left the island). These nests were also counted and the percentage of successful hatching was determined. No visible correlation between incubation period and hatching success could be demonstrated. One nest was washed away and only a few shells were found back.

Mean clutch size was 136,4 (range 56-181, n=15). Mean hatching success was 70 % (range 0-98 %, n= 15, including the two totally undeveloped nests) and 53 % of the nests had a hatching success higher than 92 % (n=15). The mean reproductive success of 8 loggerhead nests found on Bonaire was plotted in a chart. (Figure 3)

Spatial distribution of crawls

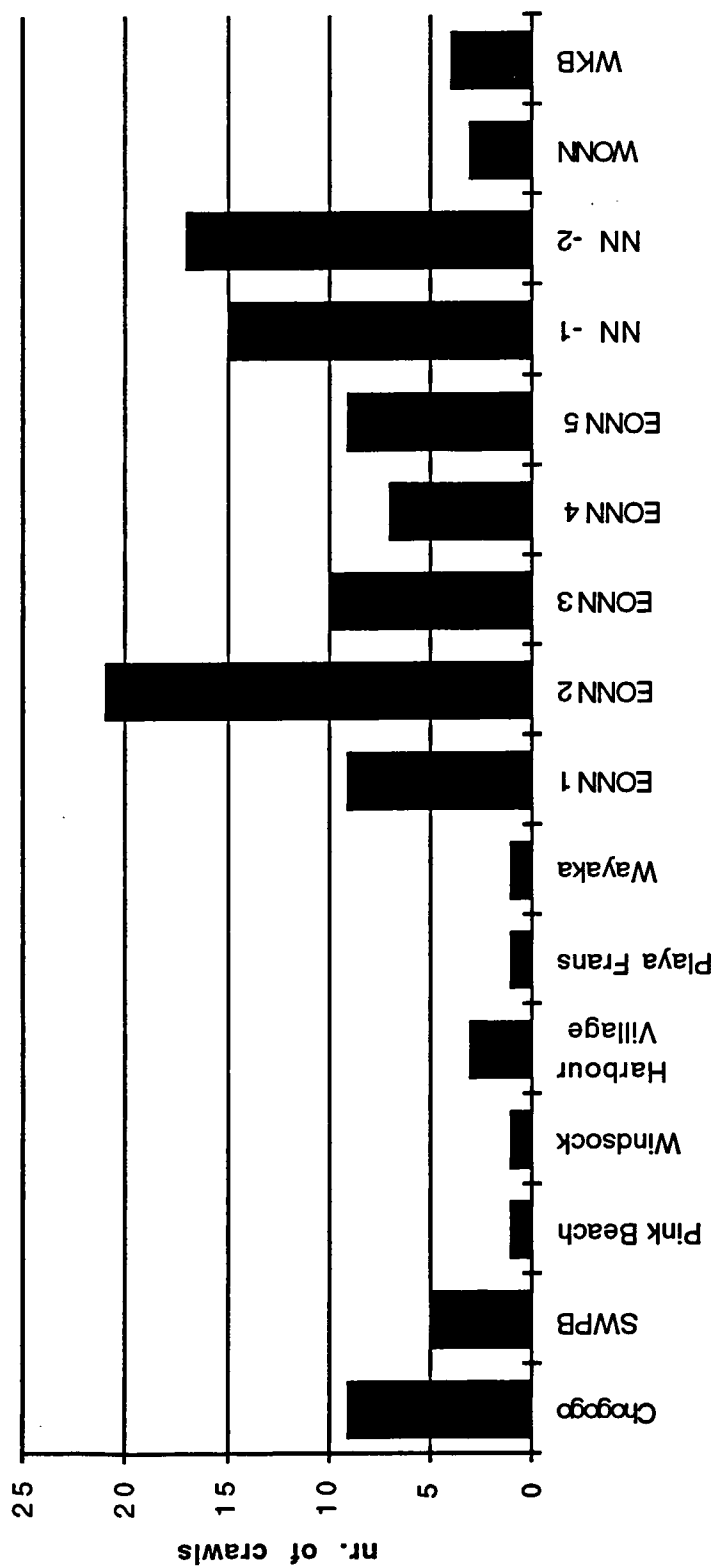


Figure 2. The spatial distribution of crawls in 1996. Column 1-7 is on Bonaire, column 8-16 on Klein Bonaire.

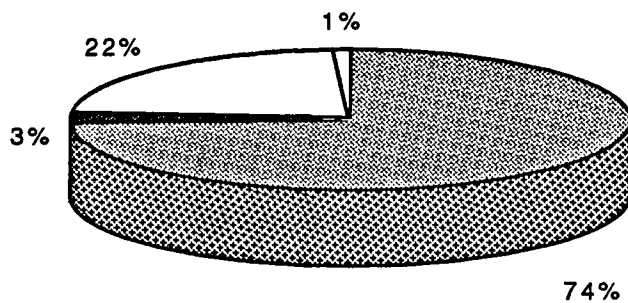


Figure 3. Loggerhead reproductive success (n=8).

22%= Undeveloped: no embryonic development visible. 3%= Not fully developed: egg development arrested with small, mid, or full term embryo. 1%= Non-emergent: live or dead hatchlings encountered in the nest. 74%= Emergent: successfully hatched.

Of these loggerhead nests, a mean hatching success of 74 % was calculated. This was also done for the hawksbill, although only 5 determined hawksbill nests were analysed, of which 1 was totally undeveloped, and contained only 56 eggs. This nest was probably flooded in an early stage of development (Figure 4).

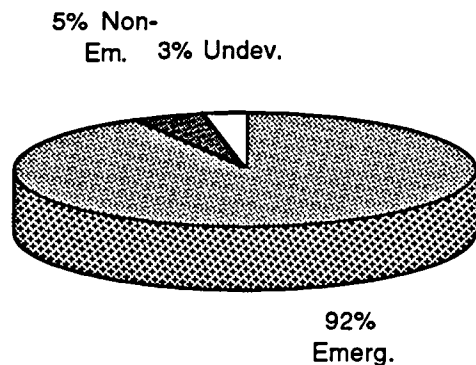


Figure 4. Hawksbill reproductive success (see figure 3 for legend).

Pink spots were present on the inside of the egg shells in the first nest excavated at Chogogo. This nest had a relative low hatching success (17 %). A large number of the affected eggs were undeveloped or rotten. In the two subsequent nests at the same site, the symptoms were encountered to a lesser extent (hatching success of 69 and 64 %). This could be due to bacteria, and is probably related to nesting site humidity and abundance of soil micro-organisms (Van Dam, personal communication, 1997).

This was not tested, since no cases were encountered on other nesting grounds

2) At Sea Data

Data on adult turtles was also collected by means of underwater sightings and photography. Much of these photographs were collected through divers participating in the sighting network. Exact location and time were always provided in these cases.

At least 6 different adult females were photo-identified during the research project (table 3).

Table 3. Identified adult sea turtles during the STCB 1996 Project. Photographic information available.

Location	Species	Gathered Footage	Date	Sighted at same place repeatedly	Characteristics
Forest	Cc	video + photos	May / June '96	yes	Barnacle pattern, cut on left side of carapace.
Chogogo (On land)	Cc	video + photos	June / July '96	yes	Barnacle pattern, cut on right side of carapace.
EONN (On land)	Ei	video + photo	August 2nd '96	no	Smooth, brown carapace, with black spots.
Ebo's Reef	Ei	video + photos	August / November '96	yes	Barnacle pattern, scratches.
Mi Dushi	Ei	photo	July 10th '96	yes	Smooth with scratches on carapace
Pink Beach	Ei	photo	August 18th '96	unknown	Dark and smooth carapace

These turtles were mostly sighted more than once by several divers during one or two months, after which they would disappear. These are therefore thought to be nesting turtles. A number of large turtles were regularly seen at the same site. This could indicate that during their inter-nesting interval turtles sometimes limit their mobility, and stay within a certain territory, which might or might not be close to their nesting ground, and in this way saving energy to produce successive clutches of eggs. (See also 2.4, discussion)

Comparing the data with future identification studies (in '98 and '99) should reveal if these same turtles will return to nest on Bonaire.

2.4 Discussion and Population Analysis

2.4.1 Nesting Behaviour

The number of body pits per crawl, and the percentage of false crawls can both be, given equal external factors, measures on how 'choosy' a turtle behaves while nesting.

If no body pits are encountered, this can be the result of some form of disturbance prior to nesting, which makes the turtle, at that point very sensitive to external stimuli, decide to stop the attempt. Large numbers of body pits encountered obviously have to do with dissatisfactory conditions for the nesting turtle, such as sub-optimal sand conditions, insufficient shelter, and/or other clues the turtle receives. On some occasions, crawls with 10 or more pits were recorded, probably without having resulted in a nest.

Although the difference between the mean number of body pits on Klein and on the mainland is small, it could indicate that the hawksbill places higher demands on a nest site than the loggerhead (hawksbills hardly come to the mainland for nesting). Since loggerheads nest at sites on the mainland with on average more disturbance factors, and less favourable sand conditions, a difference in site preference seems evident.

On the typical hawksbill nesting grounds on Klein Bonaire the proportion of false crawls seems higher than on the mainland nesting grounds, where a higher proportion of loggerheads nest (see also section 2.4.2). This cannot be completely proven because (especially on Klein Bonaire), probably not all nests were found. This also indicates that hawksbills are choosier than loggerheads in selecting the right nest conditions.

In literature males are known to mate with females near their nesting grounds, patrolling near shore areas in attempt to intercept females that are coming in to nest (Carr & Hirth, 1966). Therefore, it would be expected for males to be sighted in Bonaire's coastal waters. However, very few sightings of male adult turtles around Bonaire exist (adult male turtles are easily recognisable by their large tail, which can extend the length of the hind flippers). It could be concluded that only those nesting females visit Bonaire, that have mated somewhere else. However, mating was observed two times in coastal waters (table 4). Another reason for the apparent absence of males may be that they are more mobile and possibly stay further from the coast (Bjorndal et al., 1985). Therefore, the chance of a sighting is lower than if the turtle stays at a more or less fixed (dive-) location in the coral reef.

If suitable habitat is nearby, nesting females often stay close to their nesting ground during their inter-nesting period. Often they seek sheltered reef areas, where they rest and wait for their next nesting (van Dam, personal communication, 1997).

During the 1996 nesting season, at least four different locations inhabited by adult turtles were recorded. At these sites, turtles were sighted (and sometimes photographed) repeatedly. In these cases, it was very likely that the four different locations provided permanent shelter for different nesting turtles (turtles were seen at the same spot for at least five times independently). Turtles that were "fixed" to a specific site were mostly seen by divers for a period of 2-4 months in a row.

Table 4: Adult female turtles repeatedly observed fixed at dive sites. Data from the sighting network and the STCB Project Assistants.

Location	Species	First sighted	Last sighted	# Times sighted	Average depth (m)	Remarks
Forest	Cc	29-4	21-6	7	25	In cave
Mi dushi	Ei	1-7	21-8	5	10	
Calabas	Ei	29-7	30-11	6	12	
Ebo's reef	Ei	5-8	29-10	19	20	Seen mating twice

None of these sites were far from nesting grounds where crawls were reported (Appendix 4a/b, 5).

The hawksbill repeatedly sighted at Ebo's Reef was seen mating twice during this period independently. Although this would indicate that the turtle was nesting somewhere nearby during that period, some locals reported to have seen the turtle around for some successive years. This contradicts with what is known about sea turtle reproductive biology, because turtles very seldomly nest for two years in a row. Another possibility could be that some adult females use Bonaire as their foraging ground (at which they mate as well) and where they stay at least for some years in a row. In that case, the turtle reported mating did not nest on Bonaire. Another explanation is that "foraging" and "nesting" areas may overlap (Bowen et al., 1996). The hawksbill is the least migratory of all sea turtles, and sometimes a clear distinction between foraging and nesting habitat is hard to draw.

2.4.2 Estimating Size of the Nesting Population

By means of:

1) Beach monitoring

The false crawl ratio found is 1:7 (14 % nesting success) This nesting success is unusually low compared former years and with other data found in literature. Other studies revealed false crawl ratios of 1:1 up to 1:3, depending on local beach factors (Bjorndal et al., 1985).

The finding of nests and the post-hatching confirming of eggs proved difficult. One of the reasons is the fact that if a nest is made, the body pit is completely camouflaged by the turtle, and can be overlooked while monitoring. On the contrary, the nesting attempts which have not resulted in nests are more easily recognisable as they often leave clear, open pits. Probably, a number of nests present were not discovered, so that the found false crawl ratio is not representative of the actual situation.

A more realistic number of nests that were present can be obtained indirectly. Because Klein Bonaire contributes to 82 % of all crawls, it would

be expected that a proportional percentage of all nests were found there as well. However, only 33 % of all excavated nests were found on Klein Bonaire has a nesting success of 38 % (8 recorded nests out of 21 attempts). If we extrapolate this to Klein Bonaire, the islet would supposedly hold 36 nests (38 % of 96 crawls), significantly more than the 5 nests found (5 recorded nests out of 96 attempts gives 5 % nesting success). This illustrates that, despite the fact that on Klein Bonaire a higher contribution of hawksbill nesting attempts might result in more false crawls, still a higher number of nests is possible. However, due to various circumstances nests were difficult to locate (See also "nesting behaviour").

Analysing the beach monitoring data can result in an estimation of the size of the nesting population. From tagging studies of hawksbill turtles (Richardson et al., 1992), it has been shown that individual females show high site fidelity (returning to the same beach with each subsequent nesting) and that nest frequency is quite consistent at 4-6 per female per season. Coupling this information with the following criteria leads to a reasonable estimation on the size of the yearly nesting population.

- 1) period of nesting
- 2) species (if known from the hatchlings)
- 3) track characteristics
- 4) location of crawls (probability of crawls coming from the same turtle decreases with increasing distance)

This results in a *minimum* estimation of 12-14 nesting turtles in 1996. Of which 6 nested on Bonaire's mainland, and 6-8 on Klein Bonaire. Estimations from both 1993 and 1995 on the number of nesting females visiting Bonaire per year, using the same method, varied from 5-12. This was based on the number of crawls found in the '93 and '95 projects, which was lower than in 1996 (Van Eijck et al., Valkering et al., 1996).

If we assume the estimated minimum nesting population of 12 females, with a modest average of 3 nests per female per season (other studies yielded findings varying between 1.9 and 4.5 clutches for loggerheads (Richardson & Hillestad, 1978) and between 3.5 and 4.3 for hawksbills (Diamond, 1976)), this would yield a total of 36 nests. Because 116 crawls are recorded, then approximately one out of three attempts would have resulted in a nest, which is about average in literature (average false crawl ratios may vary from 1:1 to 1:3, (Ryder et al., 1989)). Although only 16 nests were found, a total of about 36 nests on Bonaire in 1996 is estimated.

2) *The Sighting Network*

The sighting network (see section 3.2 'The Sighting Network' for description) provided a lot of information about adult turtles. 94 sightings of the in total 892 scored (11 %), consisted of turtles over 1 meter in length. These data are used in order to estimate the number of adult females that visited Bonaire in 1996.

Because adult sea turtles are a highly desired object for divers, and as a consequence divers tend to look for them, the distribution of adult species calculated from the sighting network might be disproportional. For example, 18% of the sighted adults were sightings of one single hawksbill that was to be seen at Ebo's reef for a couple of months. In other words, the adult sighting network is biased towards certain "turtle-hot spots". In those cases, it is clear that only one individual is sighted. Sightings from different sites have to be analysed as well, because one turtle can be found over adjacent areas. To make a realistic population estimation, those sightings must be put together. A set of criteria is used to decide which sightings are likely to concern the same individuals.

Applied criteria are:

-Sightings that reported a turtle of the same species and length class at the same dive site within 2 weeks were taken as one.

-If at least 2 sightings are taken together for that reason, and, within that period one additional sighting reports an adult at the same dive site, but a different species, the species determination is regarded to be false, and these sightings are taken together as well (e.g. to determine a hawksbill for a green is a common mistake.)

-Sometimes, donated photo's help in determining individuals, and many times, additional characteristics (such as barnacles, scars and colour patterns) make identification possible.

If the data are corrected this way this results in a *maximum* number of:

13 Loggerheads,

18 Hawksbills,

8 Greens,

1 Leatherback and

6 unknown turtles in 1996.

This is a maximum estimation because other sightings could deal with the same turtle, only this can not be determined on objective grounds as stated above. Turtles can be very mobile, which makes it impossible determine if two sightings in very distinct areas concern one individual.

The sighted greens could be loggerheads or hawksbills mistaken for greens, since they were all sighted at the west coast and adult greens are not likely to occur there.

It is also possible to use the same criteria for analysing the number of individuals per month. In this way, a temporal distribution of adult sea turtles is obtained. (Figure 5)

Most of the sightings of adult turtles were collected from May till September, with a peak in August. The number of sighted adult individuals in August was 11 (5 hawksbills, 4 loggerheads, 2 unknown).

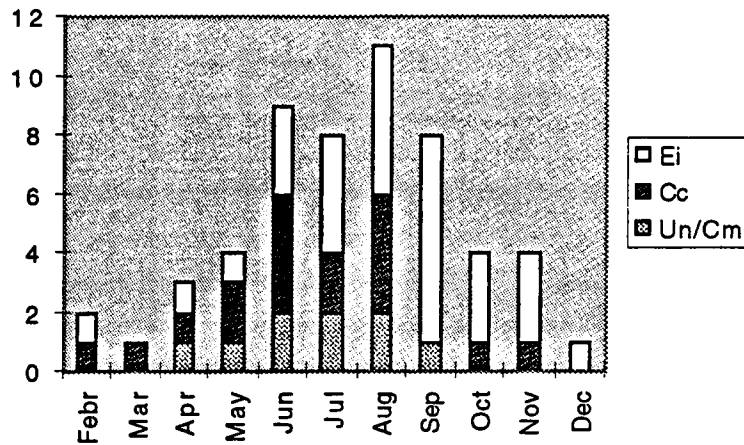


Figure 5. Adult turtles sighted per month. Sighting network data.

From figure 5, a difference in the temporal distribution of species is clear. Where sighted loggerheads have a peak (4 individuals) in June and August, hawksbills peak a few months later, in September (7 individuals). This is also evident from the nest-monitor data. Loggerhead nests were found hatched and were excavated between 23 July- 9 November. Hawksbill nests were excavated between 18 October- 8 February, which means that hawksbills are still nesting on Bonaire as late as December.

2.5 Comparing results with former years

In 1993, a total number of 40 crawls was found. Six nests were confirmed and excavated after the hatching (Van Eijck et al.,1994). In 1995 these numbers were 44 crawls and 12 nests (Valkering et al.,1996). The most remarkable change in 1996 is that the number of crawls found has almost tripled.

This difference could mean that the yearly nesting population is more or less constant, but that the amount of false crawls increased dramatically in 1996. The other, more likely explanation, is that in 1996, more turtles came to nest in Bonaire. Especially in small populations, large annual fluctuations in numbers of nesting turtles are not uncommon. Year-to-year fluctuations of 50 % are normal (Van Dam, pers. comm.)

When comparing these results for their spatial distribution it is obvious that Klein Bonaire remains the most imported nesting area, especially for the hawksbill turtle.

Research from '93 and '95 showed that of all recorded hawksbill attempts, (taken these two years together) 97 % (40 out of 41) were made on Klein Bonaire (Appendix 6).

Hawksbills were responsible for, in '93, at least 58 % (18 out of 31) and in '95 at least 56 % (22 out of 39) of the crawls on Klein ('at least' because crawls of which species remained undetermined were not included, but could also be made by hawksbills).

Annual fluctuations and bi- or tri-annual trends in the numbers, species and distribution of nesting attempts could provide insight in the nature of the population that may visit the next year.

Looking at Klein Bonaire, the proportion of nests found on Klein relative to the total amount does not differ much over 3 research years:

1993: 77.5 % (n=40);

1995: 89 % (n=44);

1996: 83 % (n=116) of all crawls were found on Klein.

These figures could indicate that the proportion of nesting loggerheads and hawksbills is constant over the years, assuming that nesting site preference is species determined.

Within Klein Bonaire, nesting sites are not visited to the same extent every year (table 5). Assuming that nesting ground conditions do not change substantially, the yearly difference in the distribution of nest sites might reveal that sites are not randomly picked, or judged on their quality each year. A strong (historically grown) site-fidelity of the population may then be the reason for yearly shifting distributions. This hypothesis predicts a cycle of 2-3 years.

Table 5: the spatial distribution of crawls found over 1993, 1995 and 1996.

Distribution	1993	1995	1996
EONN	55 %	7 %	49 %
NN	22.5 %	16 %	27 %
WONN+WKB	no data	66 %	6 %
Bonaire	22.5	11 %	18 %

Comparing the difference in the relative distribution of nests between the three monitored nesting seasons was performed using the Bray-Curtis coefficient (Wishart, 1978). The use of this (dis-) similarity index enables the distinction of different groups expressed by their similarity level. This measure was chosen because it shows the relatedness in relative distribution in a clear and illustrative way. Because actual numbers are compared both over space (spatial distribution) as over time (over the years), no averages and no variances are compared (no ranges are available). The dataset is thus not suited for a statistical analysis such as ANOVA.

S (= similarity index) of '93 and '96 = 0.90, which means 90 % similarity of the percentages. Using the average linking method for '93 and '96 gives: S (('93 + '96), '95) = 0.37, which is lower than expected with random numbers. The dissimilarity index (DIS=1-S) is plotted as a tree in figure 6.

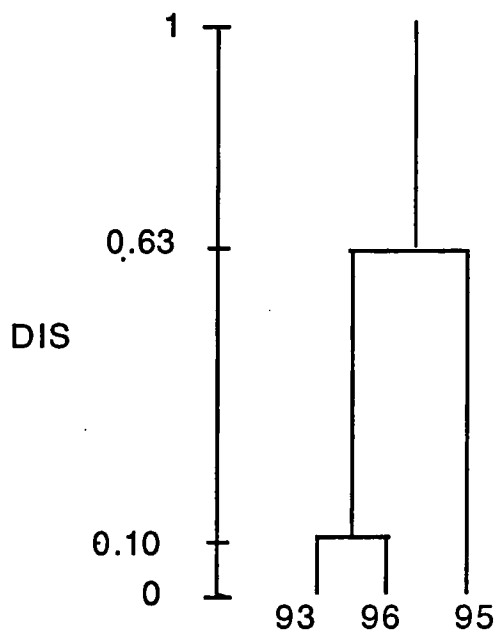


Figure 6: comparing the difference in spatial distribution of crawls over the years 1993, 1995 and 1996.

The data present EONN as the most favourable nest-site in 1993 and 1996, whereas in 1995 the majority of nesting was shifted towards the west side of Klein. The absence of the 1993 data on WKB and WONN makes it impossible to complete the similarity index for the number of crawls in 1996 in that area.

Comparing data of the seasons 1993 and 1996, a high similarity coefficient is found, which indicates the a high similarity in distribution. This could indicate a tri-annual recurrent population.

On the other hand, the data set is still too small for a thorough analysis. Monitor data from at least 6 subsequent years would be needed to back up any conclusions about the nesting intervals of populations. Also, the missing of the monitor-results from 1994 and the absence of 1993 data on WONN and WKB makes it risky to say that the spatial distribution of the 1993 population significantly correlates with the 1996 population. For a conclusion based on the idea of a tri-annual nesting population, at least monitor data from 1998 is needed, so that it can be compared with the 1995 data (for positive correlation) Also data from 1997 can be used to test for any possible deviations (negative control). However, one years' nesting population, may be constituted of individuals with different remigration intervals. Studies on a nesting hawksbill population revealed a remigration period of 2-6 years, with a peak at a 3 year interval (Bjorndal & Fowler).

The fact that almost three times as much crawls were found in 1996 than in 1993 remains unexplained. It could indicate that Bonaire possesses a non-specific nesting population, shared with other jurisdictions such as Venezuela. Here again, more consistent monitoring is required. However, the Venezuelan coast is mostly visited by green turtles, and Bonaire is not a nesting ground for greens. If nesting turtles on Bonaire would be a

completely random sub-sample of the Venezuelan population, greens would be expected to nest on Bonaire as well.

Other factors than predisposition or fixed preference determining the exact nest location are possible contributors to the choosing of a nest site. Those could be changing sand conditions, water movements, temperatures, (human) activities. Valkering et al. (1996) suggested the possibility of a cycle in nesting ground condition, whereby beaches on Klein Bonaire are degrading and regenerating continuously. However, more research has to be done in the future to confirm this hypotheses.

2.6 Recommendations

On land

The research done in 1993, 1995 and 1996 has shown that nesting can take place on most of the potential nesting beaches on Bonaire. Boca Chicitu, Boca Dreifi, Punt Vierkant and the beaches situated on the east coast were the only beaches on which no nesting has been recorded.

However, nesting on a regular basis seems to occur only on Klein Bonaire (in total, 83% of the nesting in 1993, 1995 and 1996). Since the monitoring of beaches is very intensive, it can be considered if beach monitoring should be restricted to Klein Bonaire in future research (with an exception maybe for the south-west of Bonaire, since nesting occurs here more or less regularly). In this way, the research can be concentrated towards Klein Bonaire, which has proven to be the main area for turtle nesting on Bonaire.

Problems regarding the finding of nests were encountered in the 1996 project (16 nests found on 116 attempts). Although this could be due to the fact that not more than 16 nests were made, it is more plausible that more were present but could not be found (see section 2.4, population analysis).

After 2 months, it was found difficult to relocate attempts, and if nests were found, it was often not on the exact spot where it was expected. Therefore, a more thoroughly examinations should take place immediately after the attempt has been observed. Searching for nests (although cautiously) should take place immediately after the first encounter of the attempt.

When no nest is encountered, examining track characteristics is the only way in which a species determination can be possible. Therefore, measuring of the tracks should take place more consistently. Moreover, track characteristics is a tool in identifying individual sea turtles as well. By means of this, a more thorough population analysis is possible.

Measuring the sand quality (percentage of stones, vegetation and debris, maximum depth, moisture) of all potential nesting beaches should also be a standard procedure. A significant correlation between the quality of the sand and the percentage of successful hatching can be investigated this way.

At sea

The sighting network has proved to be very successful in tracking down nesting turtles and identifying them. Making the dive shops aware of the

importance of collecting photos and sightings of adult turtles can be seen as the reason for the fact that six different turtles were identified and followed in the 1996 project. A continuation of this approach is highly desirable, since the data collected in 1996 is only valuable if photo's and data keep on being collected in ongoing projects.

Further recommendations and adjustments for the 1998 project are to be found in the STCB long term proposal (Van Eijck and Valkering, 1997).

3. Research on Juvenile Turtles

3.1 Objectives

An important source of information concerning the population dynamics of the Bonairian juvenile sea turtles is formed by the sighting network, which started out in 1993 in cooperation with the dive shops on Bonaire. By means of this sighting network, much has been learned about the population dynamics of juvenile sea turtles (van Eijck 1994, Valkering et al., 1996). With the data collected in 1996, it is tried to supplement this knowledge.

Besides collecting data about sea turtles by means of the sighting network, snorkel surveys were performed by the project assistants at spots around Bonaire and Klein Bonaire in order to follow individual sea turtles. These data have the advantage that they are from regular surveys during which individual sea turtles can be recognised. Since 1982, a lot of research had been done to clarify the residential behaviour of juvenile Hawksbill turtles (Kamezaki, 1987; Van Dam and Diez, in press). Until then, the data were still insufficient to establish whether the juvenile hawksbill is migratory (Meylan, 1982). With the data collected by means of the snorkel surveys, questions about site fidelity and home range (the size of the area in which turtles live) can be investigated.

Due to the different character of the data collected by the sighting network on one hand and the snorkel surveys on the other, these two data sets will be analysed separately.

3.2 The Sighting Network

3.2.1 Methods

Turtle sightings were reported by dive tourists and dive instructors through filling in a special sea turtle sighting sheet which is available in every dive shop on Bonaire (Appendix 1). The attention of the divers is attracted by 'turtle corners', which are placed in all dive shops since 1995 (Valkering et al., 1995). This turtle corner consists of a folder rack, with a sign attached to it that requests the divers to report a sighted turtle by means of the sighting network. Most dive instructors participate actively, and mention the sighting network in their dive courses.

The STCB provides all the dive shops with these forms by visiting the shops on a weekly basis to collect completed forms and provide replacements. On this sheet, information like species, size, depth and activity of the sighted turtle can be filled in.

3.2.2 Results

A total of 889 sighting sheets containing a total of 896 sighted sea turtles (on some sighting sheets more than 1 turtle was reported) were filled in and collected in 1996. Although the project assistants started collecting the sheets in June, sighting sheets were filled in the previous months as well, so that there was information available of 12 months.

Not only data of juvenile sea turtles was collected, but adult sea turtles, believed to belong to a different population (Van Eijck & Eckert, 1994), were sighted as well: 11% of the turtles that were bigger than 40 inch are regarded as adult turtles and are analysed separately.

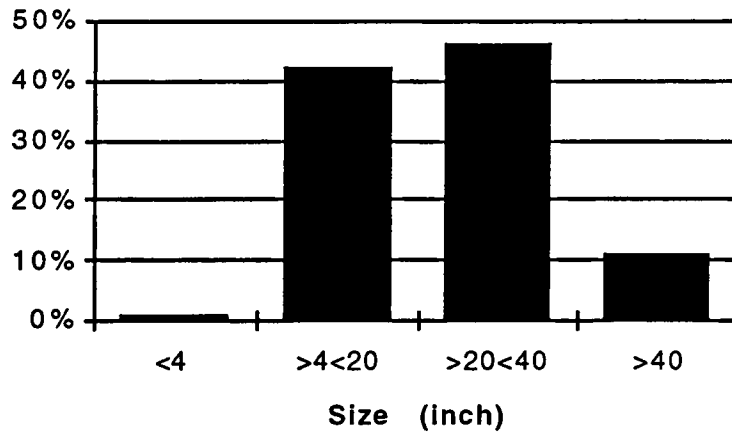


Figure 7. Size distribution of sea turtles sighted in 1996 (n=886). Sighting network data.

Of the 796 remaining sightings of juvenile sea turtles (i.e. smaller than 1 meter), 53% were identified as hawksbill turtles, 25.5% as green turtles, 5% loggerheads and 0.5% leatherbacks. Of 16% of the sighted sea turtles, the species could not be determined.

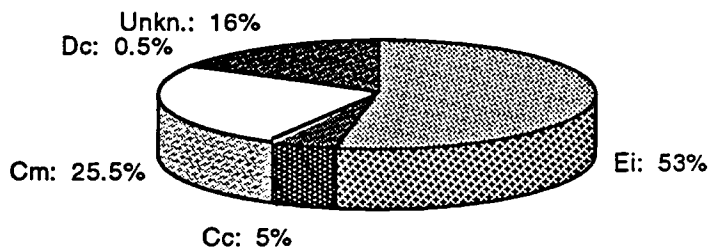


Figure 8. Species distribution of sighted turtles smaller than 40 inches in 1996 (n=796). Sighting network data.

Spatial Distribution

The spatial distribution of juvenile sea turtles is represented in figure 9. Since on Bonaire only the green and the hawksbill turtle occur as juveniles (Sybesma, 1992; Van Eijck & Eckert, 1994), other species scored in the juvenile length (i.e.<40 inch) class are regarded erroneous. For the analysis of the spatial distribution, these sightings were clustered in one

group (others).

Unfortunately, the distribution of sighted sea turtles is not only influenced by the distribution of sea turtles itself, but also by the distribution of divers over the different dive sites (Van Eijck et al,1994). This distribution of divers is not known, so that the figures can not be corrected for this bias. The dive sites corresponding to the numbers in figure 9 are represented in appendix 5.

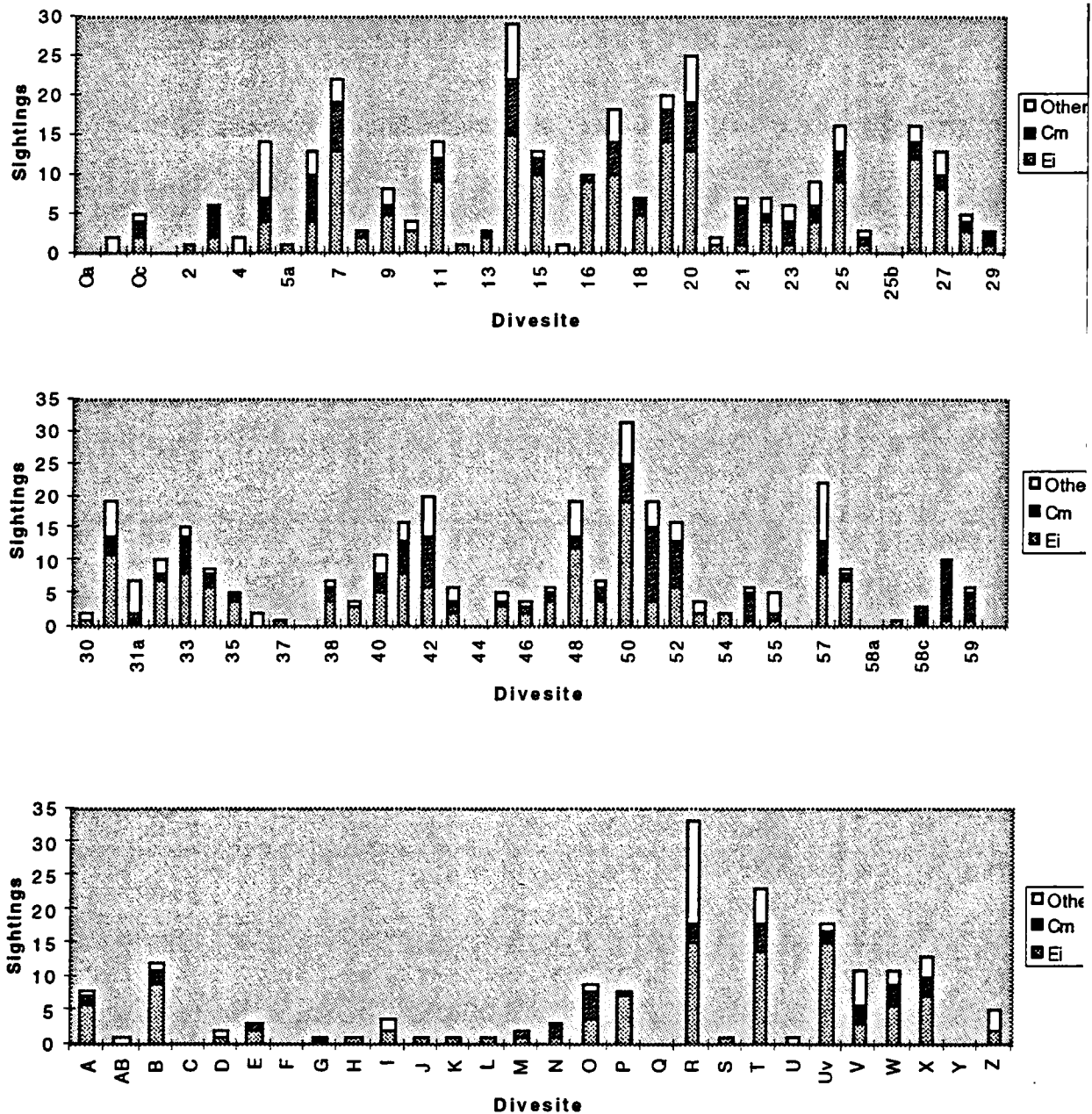


Figure 9. Number of sightings per dive site in 1996 (n=796). Sighting network data.

To determine if there is a difference in species distribution in relation to geographically distinct areas, the species ratio within 5 different more or

less equally sized geographic regions is determined. The following areas are distinguished on basis of habitat characteristics (see appendix 5 for location of areas):

- 1) Northwest area: Dive site 1-15, high density of head corals, low human impact.
- 2) West area: 15-45, less coral coverage, high coastal development, high diving frequency.
- 3) Southwest area: 45-58, high soft coral density, low coastal development,
- 4) East area: 58-60, sea grass beds, less coral coverage, windward side, high hydrodynamics, low coastal development, low diving activity.
- 5) Klein Bonaire area: A-Z, high coral density and diversity, no coastal development, high diving activity.

(Habitat characteristics based on: Fleur C. van Duyl, 1985).

The dive sites within these areas are clustered, and the total number of sighted hawksbills and greens are calculated. Other species were not included, since those sightings are rare and considered erroneous. The ratio between sighted hawksbills and greens is calculated for the regions and in total. The results are shown in table 6. With these data, the z-value is determined in table 7 (Meddis, 1975). The results show that the West, Klein and East have a significantly different species distribution when compared with the total: Klein and West areas hold more juvenile hawksbills, and East holds more greens.

Table 6. Numbers of sighted turtle species for different areas. Sighting network data.

<i>Area</i>	<i>E_i</i>	<i>C_m</i>	<i>Total</i>	<i>E_i/C_m</i>
Northwest	64	35	99	1.83
West	173	75	248	2.31
Southwest	75	42	117	1.79
East	6	44	50	0.14
Klein	94	30	124	3.13
Total	412	226	638	1.823

Table 7. Z-values and significance in 5 different geographical areas. For $\alpha=0.05$ (two-tailed), critical z value=1.96. Significance for $Z \geq 1.96$ s= significant, n.s.= not significant.

<i>Area</i>	<i>Z-value</i>	<i>Sign/Non sign</i>
Northwest	0.02247751	n.s.
West	2.64187803	s.
Southwest	0.16604661	n.s.
East	12.037057	s.
Klein	4.04877259	s.

Activity

The activity of the sighted juvenile sea turtles is represented in figure 10. Of the sighted turtles, 17% were resting, 74% were swimming and 9% were eating. Also, two juvenile turtles have been reported mating, although these observations are not to be taken serious, for obvious reasons.

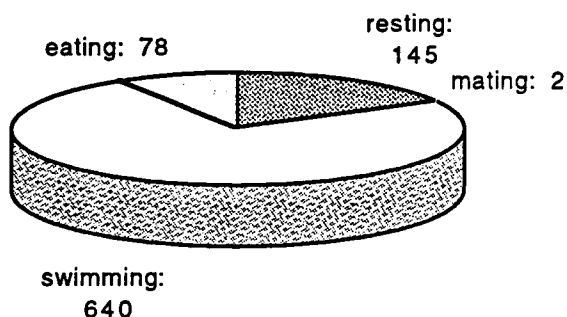


Figure 10. Activity distribution of juvenile sea turtles sighted in 1996 (n=865). Sighting network data.

Of the observed eating turtles, 60% were hawksbills. On 23 out of 47 sightings the object the turtle was eating was specified. The main food items reported were corals and algae (table 8). Of the 12 reported greens eating (whose general diet is thought to consist of sea grass) only three times the item could be specified.

Table 8. Objects juvenile sea turtles were eating. Sighting network data.

<i>Ei</i>	<i>Cm</i>
1 Jellyfish	1 Fish
1 Dead Coral	1 Algae
13 Coral	1 Coral
1 Bristle Worm	9 Unknown
1 Anemone	
5 Algae	
25 Unknown	

Depth distribution

If a turtle is seen swimming, it could be either ascending or descending from the surface, or swimming away from the observing diver. Due to this fact, the depth at which the sea turtles are seen is not always representative of its habitat preference. Therefore, only the reported cases

in which the turtle activity was scored as resting, sleeping or eating are taken as a measure for their general preferred habitat depth. Depth classes of 5 meters each were distinguished in figure 11.

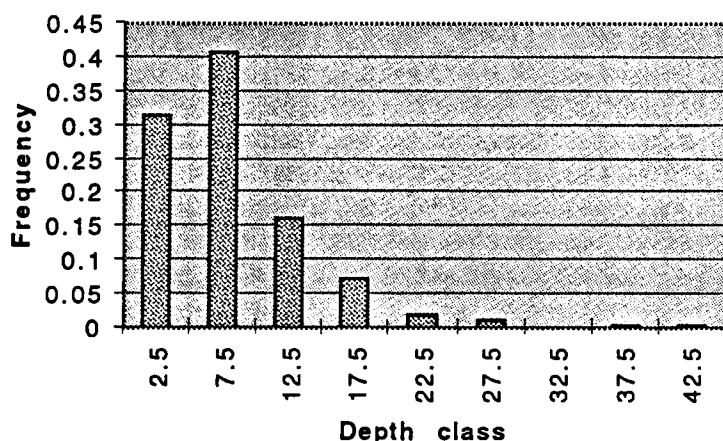


Figure 11. Depth distribution of juvenile sea turtles resting, sleeping or eating (n=228). Sighting network data.

Injuries

Four sightings of the 1996 sighting network consisted of injured turtles (table 9).

Table 9. Sighted injured turtles. Sighting network data

Date	Loc.	Spec.	Misell. Remarks
31/12/95	RedSlave	Ei	No right rear flipper
5/7/96	Leonor	Ei	Small piece of shell broken away
26/8/96	Calabas	Ei	Four inches broken from back scutes
25/9/96	Tori Reef	Ei	Missing part of rear left flipper

On 25 September a juvenile hawksbill with a left hind flipper from which a part was missing was sighted at Tori's reef. In 1995, a juvenile hawksbill with the same injuries was sighted at Red beryl (Valkering et al.,1995), which could very well be the same turtle.

3.2.3 Discussion

This year, more sighting sheets have been filled in than in previous years (312 in 1993 and 583 in 1995) (Van Eijck et al.,1994, Valkering et al.,1996) which reflects an increasing interest in sea turtle conservation from both the dive shops and divers.

Unfortunately, the data obtained this way have some biases and uncertainties.

As already mentioned, some dive sites are visited more than others, while some locations are never visited at all. This implicates that the sighting

network is not sufficient to determine the spatial density distribution of sea turtles. Moreover, when sightings sheets are compared with personal observations, it is found that mistakes in determining the species are often made (however, the distribution of species at dive sites is not affected by the fact that some dive sites are more visited than others, and the faults in determining species are supposed to be the same everywhere. Due to this, the difference in species distribution in relation to geographically distinct areas can be determined with the data from the sighting network).

Although this method does not provide 'hard' scientific data, the sighting network has proved to be quite useful in providing a general view of the population dynamics of Bonairian sea turtles. More so, the data have functioned as a guideline for the research of the project assistants. This year, the sighting network has been used in examining the adult population. Due to their residential behaviour, a reported adult sea turtle could often be tracked down and followed over a longer period, during which photo- and video material could be collected.

Comparing juvenile with adult population

Due to the fact that the sightings of turtles larger than 40 inch were separated from the turtles that were smaller, these two data sets can be compared. When comparing the proportion of each species in the two data sets, it is obvious that they show substantial differences, for some species mostly appear as either nesting (loggerhead) or juvenile (green) turtles. The difference in proportion of species is shown in table 10.

Table 10. Proportion of species in juvenile (n=796) and adult population (n=94). Sighting network data.

Species	Juvenile	Adult
Ei	53%	50%
Cc	5%	22%
Cm	25.5%	17%
Dc	0.5%	2%
Unknown	16%	9%

The differences in activity are apparent as well. 38% of the adult turtles were reported resting, in contrast to almost 17% of the juveniles, which corresponds with the idea that nesting turtles are less mobile and rest more during their nesting season. (Van Dam, pers. comm.) 9 % (78 sightings) of all juveniles were seen eating, and only 2 % (2 sightings) of all adults were reported eating. This tends to confirm that size class (\Rightarrow 1 m.) is a valid criterion in determining to which population, i.e. juvenile or nesting, the turtle belongs, since it is found that adult female turtles do not eat when they have their nesting season (Anderes & Uchida, 1994).

The diet of the Caribbean hawksbill consists mainly of sponges (Meylan, 1988). When looking at the objects that the hawksbills were reported eating (table 10), sponges are not mentioned at all, which again reflects the subjective value of the sighting network data. Coral and algae was mentioned the most.

The mean depth at which juveniles occur is 9 meters, whereas the adults occur at a mean depth of 16 meters. The two populations were compared with a two-tailed t-test assuming equal variances (Meddis, 1975). The difference in depth distribution is highly significant.

$|t| = 5.22$
 $P(|t| \geq 1.97) = 0.05$.
 $P(T \geq t) = 4.1 \text{ E-}07$
 (For data and explanation, see appendix 7)

If the frequency distribution in depth of juveniles vs. adult sightings is plotted with depth classes of 5 meters, it is clear that the distribution of juveniles is more skewed towards the shallower water when compared with the adult population (figure 12).

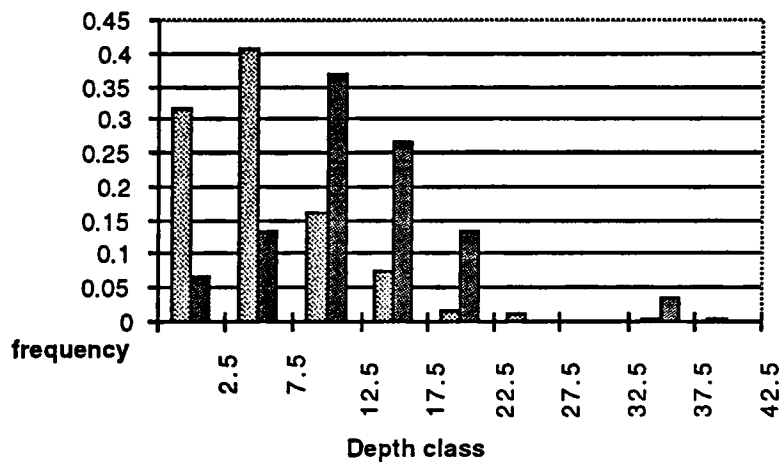


Figure 12. Depth class distribution at which juvenile (left bars, n=228) and adults (right bars, n=31) rest or eat.

Spatial Distribution

The spatial distribution of juvenile sea turtles in 1996 is the approximately same when compared with the distribution found in 1993 and 1995 (Van Eijck et al.,1994, Valkering et al.,1996). On the dive sites NoName, Karpata, 1000 Steps, Andrea, Pink Beach and Red Slave a relative high amount of sightings were collected. Since these dive sites are often visited by divers, this does not proof that more turtles are present.

3.3 Data from the Woodwind and Snorkel surveys

3.3.1 Methods

The project assistants performed snorkel surveys (30 in total, at least one time a week) between the eastern side of No Name beach (KB), further referred to as EONN, and Leonora's, a distance of approximately 1400

meters around Klein Bonaire (See Appendix 5 for location of dive sites. Since in this area only hawksbills were identified, another site (the area around Andrea), which is inhabited by greens as well was surveyed, though at a less frequent rate (once or twice a month).

Data were collected by the crew of the Woodwind (organisers of snorkel excursions around the area of Klein Bonaire) of the same locations, and thus provided reliable additional information. The frequency of the Woodwind surveys is high; at least 3 times a week the Klein Bonaire region (between EONN and Leonora's) was covered, and more irregularly the area of Andrea. Data from both sources are taken together for analysis.

3.3.2 Results

In 1996, a total of 91 of these sightings were collected.

Two different juvenile Hawksbills were observed on a regular basis, and identified : A turtle of 18 inches long, called 'Fuzzy' (due to its fuzzy carapace) and was sighted 25 times, and a turtle of 8 inches long, called 'Little One' was sighted 8 times.

In 1996, Fuzzy was seen from January 15th to December 30th.

It was located between four different places: EONN (6 times), NoName (further referred as NN) (17 times), Sampler and Leonora's (both 1 time). The turtle seemed to migrate between those places regularly, since the turtle was often sighted at a different place (NN and EONN) within two days.

'Little One' was sighted in Klein Bonaire's coastal waters the first time on May 26th, and is sighted regularly since then (data available until December 31st). It was found at EONN (2 times), NN (2 times), and Leonora's (4 times)

Late November, another juvenile hawksbill (24 inches), not encountered before, was sighted in this area. It was sighted three times, two times at NN, and once at Leonora's. Besides these three hawksbills that are seen regularly, the dive sites between EONN and Leonora's are visited by more than these three juvenile Hawksbills. Seven sightings consisted of turtles that could not be recognised as the former mentioned turtles: 4 sightings of an eight inch long Hawksbill, three of a 12, 18 and 24 inch long turtle respectively.

The area between EONN and Leonora's is not visited by juvenile green turtles. In order to know more about their behaviour at the west site, snorkel surveys were held at the dive site Andrea where a 18 inch long green was regularly seen. Between 15 July and 4 November, this green has been seen 5 times by the project assistants. Photos have been collected through the sighting network. An 18 inch Green turtle has also been reported by the crew of the Woodwind between 22 February and 11 October at the same site, which is probably the same as sighted by the project assistants.

3.3.3 Discussion

Unfortunately, it is not known if the identified hawksbills near Klein Bonaire visit other dive sites as well, so the exact home range cannot be determined (this would require a permanent tracking method).

However, snorkel surveys that were held (although not regular) between Mi Dushi and Jerry's Jam have not yielded sightings of the mentioned turtles. Moreover, an estimation of home range can be made, based on the fact that frequency of sightings become lower towards the periphery of the surveyed area. Of the 25 times that 'Fuzzy' was sighted, it was found between EONN and NN for more than 90% of the time (21 out of 25 sightings). Even more interesting is the fact that this turtle has been seen around the area of NN during six subsequent years by the crew of the Woodwind. 'Little One' was seen four times at Leonora's, two times at NN, and also two times at EONN. It was still sighted in the months after the Project Assistants had left the island (Renee 1997, pers. comm.)

The data from the juvenile hawksbill 'Fuzzy' tend to confirm the hypothesis that juvenile hawksbills show a strong site fidelity for periods of at least several years (Van Dam and Diez, in press)

Following the turtles at that dive site over longer years should reveal useful data in the research on home range and site fidelity of juvenile hawksbill turtles.

These data suggest that the area between EONN and Leonora's is visited by at least 4 different juvenile hawksbills (the sightings of the 8 inch, 18 and 24 inch long unidentified hawksbills could have been sightings of Fuzzy, Little One and New One respectively, but could at the time not have been recognised).

Since the surveyed areas are visited by more than one turtle, and the turtles were found scattered over different sites independently of presence of other turtles, there doesn't seem to be strong social behaviour among juvenile hawksbills.

3.4 Strandings

During the 1996 project, 3 strandings occurred.

A hawksbill turtle with a shell-length of 34 cm was found washed ashore near the dive site Rock Pile on the 31st of August. It was found stuck to a fishing line, and as a consequence, drowned.

Another dead hawksbill, also with a shell-length of 34 cm, was found washed ashore at Playa Grandi on the 8th of October.

Since it was probably lying there for a couple of days, and was partly decayed, the cause of death could not be determined.

Its head was partly eaten away, but it is not known if it must be seen as a cause for its death or it happened after it stranded.

On the 20th of November, divers encountered a juvenile green turtle floating on the water. Since it was obvious that it was sick, it was brought to the project assistants, but died before it arrived. Since the turtle showed no external damage autopsy was performed (with the help of a

veterinarian), but the cause of death could not be determined. After the examination, the turtle was stuffed, and will be used for educational purposes.

A juvenile green turtle that was caught by a fisherman was set free at the 24th of August. The turtle was taken to the fisherman's house and kept in a little tub of water after it was incidentally caught. Not knowing what to do with it, he agreed on freeing it eventually.

It is hoped that this incident is illustrative for the changing attitude of the Bonairian population towards sea turtle conservation and nature in general.

3.5 Recommendations

The data collected by the Woodwind and by means of the snorkel surveys forms a strong basis to continue the research on the residential behaviour on juvenile hawksbill turtles. Especially the fact that data are available over 6 years makes research in this area very interesting. For this reason, a lot of attention should be given to this area in the following years. Snorkel surveys should be held more frequently (two times a week), and the area that is surveyed should be larger, so that a more accurate estimation of the home range can be given. Tagging juvenile turtles should be considered, so that the individual turtles can be recognised by dive tourists as well.

In order to extend this research to juvenile greens as well, more attention should be given to the area around Andrea. The area that is surveyed must be larger, and surveys should be held two times a week as well.

Since a lot of information regarding the distribution of sea turtles in the Bonairian waters is collected by means of the sighting network, no more research by means of snorkel surveys by project assistants has to be done in this respect. Instead of this, more attention can be given in investigating the residential behaviour of juvenile sea turtles.

Due to the fact that the distribution of divers over the different dive sites is not known, the distribution of sea turtles can not be determined.

Therefore it is highly desirable that these data will be obtained in future research, possibly in cooperation with the Bonaire Marine Park.

These recommendations will be used for the STCB 1997 project, as outlined in the STCB long term project proposal (Van Eijck & Valkering, 1997)

3.6 Photo Identification at Lac Bay

3.6.1 Objectives

Lac Bay is an important mangrove and sea grass area at the south-eastern coast of Bonaire. Lac Bay received the status of a Marine Reserve and RAMSAR-site some years ago, but is still insufficiently protected against, for example, illegal turtle capture.

On the outside of Lac Bay, behind where the waves break against the shallow coral formations, a lot of green turtles can be sighted. Lac Bay has

proved to be an important foraging area for sea turtles, mostly juvenile and sub-adult greens. The turtles may gather and stay outside the bay, prior to entering the shallow bay at night, to feed on the 'turtle grass' (*Thalassia testudinum*).

One of the objectives of the STCB 1995 Project was to establish a database of identifications of greens residing at Lac Bay. This database would consist of sightings with information on time, place and length, together with a clear picture (slide) of the turtle's carapace. To find out if the same turtles reside in Lac Bay over more years, and to obtain a more accurate estimation on the number of greens present, the visual information can be analysed and coded, and subsequently compared over different years. If the same turtles are found present over numerous years (which is, at least for some turtles, the case), a relative small, stable population can be assumed.

3.6.2 Methods and Preliminary Results

In 1995, a few snorkel surveys on the outside of Lac Bay were held, and some photographic footage of residing greens was collected. In 1996, the intention was to extend this into a pilot study on photo-identification possibilities at the east coast. Because the best methods were not yet described, and diving circumstances are sometimes far from optimal (abundant sea urchins in shallow water, strong surge, and very shy turtles), both snorkelling and diving were tried for their results.

Snorkel and dive surveys in the area were performed 10 times during the Project. Because of own experience and of information from others, surveys were held either very early in the morning, or in the late afternoon, which is the optimum time for sighting greens. The two project assistants were equipped with a Nikonos 5 underwater camera and water-proof writing gear. Different techniques in following the turtles were used, but the best method proved to be spotting and tracking the turtles from the surface while snorkelling, and to perform short 'skin dives' towards the turtle (sometimes down to 20+ meters) and to shoot it as close as possible, while the other recorded the necessary information. Although this method yielded the best identifiable results, it is very intensive and difficult to maintain for longer periods at a time. A total of about 60 slides of greens at Lac Bay was collected during the project, varying in quality. These data will be analysed and coded together with the 1995 data in the future.

3.6.3 Recommendations

In order to obtain high quality slides of sea turtles under water, more time, effort, and more professional equipment are required. A underwater camera with a higher magnification or resolution would be no luxury. Because the diversity of activities of the STCB on Bonaire, research such as on the Lac Bay turtles has received too little attention. If this project is to be extended in the future, more time needs to be invested in the execution of the field methods and in the formulation and evaluation of the research objectives.

4. Public Awareness

As in any well-functioning conservation program, public awareness is crucial to the efforts to save endangered sea turtle populations. Therefore the STCB focuses on informing the public about sea turtle conservation and environmental care. In 1996, this was done in several ways.

4.1 Slide Presentations and Tourist Education

Like in the 1993 and 1995 project, weekly slide shows for tourists were held at Captain Don's Habitat dealing with sea turtle biology and conservation. After placing various advertising signs on the island, more people attended the presentations (an average of 25). Also the content of the slide shows was revised to focus on recent problems and on educating the public how to avoid disturbing sea turtles.

Besides this, slide shows were held for the residents of Bonaire in the 'Centro di bario's' (youth centres), in cooperation with George 'Cultura' Thode, a ranger of the Washington Slagbaai Park. A total of 3 of these slide shows were held. Although a lot of advertising was done (newspapers, radio, posters), less people showed up than expected. Nevertheless, the lectures got some people very interested.

Another opportunity to inform tourists was given by accompanying a weekly trip to Klein Bonaire with the Woodwind, a charter ship that organises daily sailing and snorkel trips to Klein Bonaire. During this trip, tourists were asked not to harass turtles, and to beware when walking on the beach of Klein Bonaire. Also, their cooperation with the sighting network was requested.

Many people that visit Klein Bonaire are being transported by the water taxi 'Baka di Laman'. A poster was developed and placed on the boat to make people aware of the problems of nesting turtles on Klein Bonaire.

By means of these actions, it is hoped that most of the tourists that visit Klein Bonaire will be reached by the STCB.

4.2 Educational Materials

Since 1991, the STCB has developed various educational materials. These include:

- a STCB folder
- a STCB poster (full colour)
- a little booklet about sea turtles written in papiamentu, 'Nos mundi di Tortuganan', made in cooperation with the newspaper 'EXTRA'
- the STCB newsletter (1995).
- two progress reports (about the 1993 and 1995 project)

In 1996, a second newsletter was written and was printed in October in a total number of 1.000 (two prints of each 500). The newsletter contained

preliminary results (until October) on research and other activities in a more or less popular style (appendix 10).

The newsletters were widely distributed around the island among officials, counterparts, and the interested public. Internationally they were sent to various involved organisations and persons.

In cooperation with WIDECAS, a in Dutch written miniposter was developed, which showed the six species of sea turtles that occur in the Caribbean with on the back a determination table. A total of 10.000 were printed. 2000 of them were send to Curaçao, Aruba, Sint Maarten, Sint Eustasius and Saba, 8.000 are used to distribute on Bonaire.

Besides these materials made by the STCB, other folders concerning nature conservancy were collected and hence distributed by the STCB: A 'Buyer Beware' folder, that informs tourists about the hazardous trade in endangered species, and warns not to buy certain souvenirs.

Also, a general WIDECAS folder and a WIDECAS miniposter were cdistributed by the STCB.

The 1995 progress report was presented and donated to all the organisations and persons that were involved in the 1995 project at the start of the 1996 project. A total number of 100 were printed. In July, a second print was made in cooperation with the University of Amsterdam in the series 'Verslagen en Technische Gegevens'. These reports were donated to counterpart organisations in Aruba, Curaçao and Venezuela and to various libraries.

During the slideshows, STCB posters were sold for 5 NAfl. or 3 US Dollars. Approximately, 60 of them were sold directly during the 1996 project. Furthermore, miniposters and STCB folders were offered to the public for free during slide shows.

The STCB folder, Buyer Beware and WIDECAS folder were distributed over the twelve different dive-shops of the island and placed in the 'turtle corners (see section 3.2.1.).

Apart form the use for collecting the sighting sheets, the turtle corners are also used to distribute educational materials.

In 1995, 5 extra turtle corners were produced, and two of them were placed in newly opened dive-shops.

The STCB has always given extra attention to the children. For this reason, extra attention with regards to distribution of educational materials was given to schools. A special evening was organised for the primary school teachers of the 5th and 6th grade together with the biology and 'world orientation' teachers of the secondary schools. All the teachers concerned were personally invited to attend the presentation. Eventually, 9 of them showed up. On this evening, the following materials were distributed:

- 35 STCB posters, written in Papiamentu and English
- 500 STCB miniposters, witten in Dutch
- 5 Booklets 'Nos Mundi di Turtuganan'

- 135 Folders 'Buyers Beware'
- 100 Folders 'WIDECAST'
- 35 STCB Newsletters (1996)

These materials were accompanied with didactic suggestions and examples for direct use in the classroom. All schools were represented by at least one teacher.

4.3 Press

Lot of press coverage was received during the 1996 project. In total, more than 20 articles about the STCB were published in the newspapers from June throughout December. EXTRA (biggest newspaper in Papiamentu, 4 articles) Het Algemeen Dagblad (Dutch, 3 articles) and Port Call (English, 8 articles) were the papers that gave the STCB most attention.

Columns by Tom van Eijck about sea turtle biology and occurrence on the Antilles were written and published in the EXTRA in 1993. These were printed again in the EXTRA during the summer of 1996.

Announcements for the slide-shows appeared in almost all the newspapers.

An article was written by the project assistants for 'Bonaire Affair', a magazine written for tourists on Bonaire. This article, with photo's, will appear in the magazine in the summer of 1997. 'Bonaire Holiday', also a magazine for tourists, advertised for the side shows that were held at Captain Don's Habitat.

A radio interview was given at a local radio station (Bon FM) at the beginning of the 1996 project, in which the results of last year were discussed and the project assistants had the chance to tell the public something about the plans concerning the 1996 project. The coastal cleanup, partly coordinated by the STCB received a lot of newspaper, radio and TV coverage.

Also, the project assistants were interviewed by the Travel Channel, a commercial broadcasting channel from the United States. Underwater footage and some turtle crawls on land were filmed.

In August, the Foundation for the Preservation of Klein Bonaire produced a professional video documentary about the recent problems concerning the threatened status of Klein Bonaire. The film was produced by an NBC television station in the USA. The film deals with the different elements that make Klein Bonaire unique, and why it should be preserved. A separate part of the film concerns the special status Klein Bonaire has for sea turtles. The project assistants were interviewed on location and their footage of a nesting turtle was used. Although the video was mainly made for promotional activities for the Foundation for The Preservation of Klein Bonaire, it is expected that the item will be broadcasted on the Antilles, the USA and Holland as well.

4.4 Gathering Video Footage

It was the aim of the project assistants to gather as much video footage of sea turtles as possible, especially of nesting turtles. This footage could then be used for a video on sea turtle conservation, for which a great demand exists on Bonaire. Especially the schools are very interested in a video that can be shown to the children.

The nesting of a turtle that visited the south of Bonaire on July 10th was filmed. The hatching of that same nest was filmed 59 days later, as well as the excavation and examination of the nest. These images were used for a video about the sea turtles of Bonaire, that has been shown to the public at the end of the 1996 project. These images are planned to be used for the professional video production as well. Beautiful, unique images of a swimming loggerhead and a hawksbill turtle were donated by Julie Morgan from Sand Dollar Dive&Photo. These also will be used for this production.

5. Local and International Cooperation

5.1 Non Governmental Organisations

It was the aim of the 1995 project to achieve more cooperation with other non-governmental conservation organisations on Bonaire.

First of all, the cooperation with STINAPA Bonaire should be mentioned. Free entrance to the park was arranged, and slide shows with the cooperation of George Thode, a ranger from the Washington-Slagbaai park, were held. The Bonaire Marine Park assisted the project assistants by providing them with transport to Klein Bonaire once a week. Furthermore, assistance was given by the STCB for 'Tortuganan di Boneiru', a snorkel program for children, organised in cooperation with the TCB.

In 1996, a new NGO was founded, the Foundation for the Preservation of Klein Bonaire (FPKB), with its main goal to prevent Klein Bonaire from being developed and to turn it into a national park. Since the goals of this organisation coincide with those of the STCB, the project assistants attended their meetings every month and offered their help where needed. A special folder was released, which was spread over the dive shops in the turtle corners, as well as an informative video.

During the weekly slide shows at Habitat, tourists were informed about this organisation and were asked to donate money.

As well as last year, the STCB assisted in the World Cleanup Day, which is organised by 'Tene Boneiru Limpi' ('Keep Bonaire Clean') and the

Tourism Corporation Bonaire (TCB). This year, it was held at the 21th and 22th of September. The STCB organised the coastal Clean up, with the help of Corine Gerharts. Within two days, a large part of the coast of Klein Bonaire was cleaned, with special focus on the sea turtle nesting area. A total number of approximately 250 bags of trash were collected, with the help of about 50 volunteers. Besides events like these, the nesting beaches were cleaned on a regular basis during the beach surveys.

5.2 The Business Community

STCB couldn't function without the cooperation received by various local commercial organisations. First of all, the Bonaire Trading Company offered office use for free, with the possibility to use their computers, fax and copy machines. Sunset beach Hotel offered a room for the project assistants for a reduced price. The various dive-shops were crucial for the research. All of them (12 in total) offered their assistance in placing turtle corners and asking divers to fill in sighting sheets. Besides this, some of the dive shops offered transportation to Klein Bonaire (Habitat, Buddy Dive). Baka di Laman and Woodwind transported the project assistants on a regular basis as well.

Jerry Schnabel from Phototours cooperated in offering the use of a underwater camera when available for free. Captain Don's Habitat offered the use of their conference room for the first presentation at the beginning of the 1996 report. The video that was made at the end of the project was edited at Dive Bonaire and Sand Dollar Dive&Photo. Flamingo communications assisted in developing the newsletter, by doing the layout and giving valuable advice.

5.3 Regional Cooperation

As the sea turtles and their problems don't stop at Bonaire's borders, further international cooperation is important. Working visits were made to Curaçao and Aruba, where various NGOs were visited. Gerard van Buurt (LVV, National Department of Fisheries), Dolfi Debrot (Carmabi), Paul Hoetjes (Seaquarium), and Nico Visser from VOMIL were visited on Curaçao, and were offered the 1995 report and the STCB newsletter. Furthermore, a visit was made to the Christoffel park, which has some important nesting beaches.

On Aruba, Tom Barmes (LVV) and Boerwinkel (StimAruba) were visited. A lot of information was being exchanged, as well as various public awareness materials, such as folders and school material.

In 1993, a visit to Venezuela was made by the STCB Project Coordinator, Tom van Eijck. Since the possibility exists that sea turtle stocks are shared with Venezuela, updates about illegal capture and trade and nesting figures are important. Therefore, a working visit was arranged in November.

The WIDECAST Country Coordinator, Mrs. Hedelvy Guada, received the project assistant very hospitable, and provided a lot of information and insight in the Venezuelan situation. FUDENA, the country's largest conservation NGO, was visited and problems were discussed. Furthermore, "Fundacion Cientifico Los Roques", a privately financed research centre based in Caracas was visited. This organisation performs its research on the "Los Roques" islands, small pristine coral islands about 80 km east of Bonaire. A visit to the Marine Biological Station, located on the island of Dos Mosquises Sur, was arranged. The STCB was particularly interested in the "sea turtle farm" which successfully bred more than 5000 sea turtles over the years, and to which extend this would operate satisfactorily. A lot of information was exchanged, but unfortunately, the field trip was cancelled due to unforeseen circumstances.

5.4 Official Meetings

Several important meetings were held with regard to sea turtle conservation during the 1996 project. On October the 2nd, 3rd and 4th, a 'platform meeting' was held on Bonaire with the title 'Conserveringsgebieden, wat doen we ermee' (Conservancy area's, what do we do with them). On this meeting, several NGOs, authorities and interested people from Holland and the Dutch Caribbean were invited to talk about the safeguarding and management of important natural areas in the Netherlands Antilles. The project assistants were asked to hold a presentation to explain the importance of Klein Bonaire for nesting turtles and Lac Bay for green turtles (both areas with a high priority concerning protection). Furthermore, during an excursion to Klein Bonaire, the project assistants were given the possibility to show some turtle nests and to explain the disastrous consequences building on Klein Bonaire would have.

On November the 12th, a delegation of the Dutch parliament, consisting of the chairmen of the major Dutch political parties, visited Bonaire. Their explicit wish was to speak with nature-conservancy organisations. The STCB was also officially invited to introduce itself. Again, this opportunity was used to focus attention on the importance of both Klein Bonaire and the Lac Bay area for Bonaire's eco-systems.

6. Sponsors

The following organisations sponsor the STCB:

World Wide Fund for nature (the Netherlands); Stichting Doen/Nationale Postcode Loterij; WIDECAST; Dierenrampenfonds; Bonaire Trading Company; KLM; Paul Huf Studio's; G. van Lennep Productions; Villapark Ooghduyne; Sunset Beach Hotel; Biodermal Baarn Holland; ING Bank Central America and Caribbean; Van Lindonk Special Projects B.V.; Buddy Dive Centre; Woodwind; Baka di Laman; Jerry Schnabel Phototours; Consales; Maduro & Curiels Bank; EXTRA.

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APPENDIX 1

Copy of a 1996 Sighting Sheet

Sea Turtle Sighting Sheet



Thank you very much for your willingness to participate in this survey! Because sea turtles are endangered throughout the Caribbean, research is done in order to plan and implement effective conservation and management programs. You can help the sea turtles by filling out this form. Thank you!

Name: _____ Date: day ___ month ___ year ___

Location / Dive site: _____ Time: _____

Dive Shop / Dive Master: _____

Water depth: ___ feet metres ; Was the turtle seen: on the surface
 in the mid-column
 at the bottom

Was the turtle: alive; injured; dead

If injured, how was the turtle injured?: _____

What was the turtle doing? Was it: resting; mating; swimming; eating

If eating, what was it eating?: _____

What was the turtle's shell length? Was the length: less than 4 inches (<10 cm)
 between 4 and 20 inches (10-50 cm)
 between 20 and 40 inches (50-100 cm)
 more than 40 inches (>100 cm)

If the shell was longer than 40 inches, did the turtle's tail extend more than 6 inches (>15 cm) beyond the shell?:

Yes; No; I don't know

Could you determine the species of the turtle?: Yes; No

If yes, was the turtle a: Green turtle
 Hawksbill turtle
 Loggerhead turtle
 Leatherback turtle

What was the immediate environment? Was it: sand; sea grass meadow; coral reef,
 rocks; other (cave, wreck, etc)

Did you notice anything else?: _____

Did you make a good picture of the turtle? If so, could you provide us a copy along with this sighting sheet? These can be used for scientific and/or educational purposes. Thank you very much!!!

The Sea Turtle Club Bonaire can be contacted through the Bonaire Marine Park, Postbus 368, Bonaire (NA), Tel.: (599 7) 8444, or by contacting Sea Turtle Club Bonaire, Madurastraat 126 hs, 1094 GW Amsterdam, The Netherlands, Tel: (3120) 6684782.

APPENDIX 2

Copy of a Beach Survey Data Sheet.

BEACH SURVEY DATA SHEET

Stichting Turtle Club Bonaire

Date: _____ Time: _____ No. _____
Beach: _____ Observer: _____
Activity: Nest Crawl False crawl Undetermined Hatch None
Species: _____ Track Width: _____ m. Symm. Asymm.
Nest: Disturbed Undisturbed;
if disturbed, how: _____
Nest disguised: Yes No Eggs moved: Yes No
If so, why: _____
Triangulation landmarks: _____ (....m.) _____ (....m.)
Nest profile:

Nest fate: _____ Date: _____
Hatch data: Hatch date: _____ Excavation date: _____
No. undeveloped _____ Comments: _____
Midterm embryos _____ _____
Full term embryos _____ _____
Dead hatchlings _____ _____
Hatched shells _____ _____
TOTAL _____ _____
% Hatch success _____ _____

APPENDIX 3

Bonaire Marine Environment Ordinance, as amended in 1991

On 27 June 1991, the Island Council of Bonaire amended the Marine Environment Ordinance (A.B. 1984, no. 21) to include the total protection of all sea turtle species. Article 14 reads:

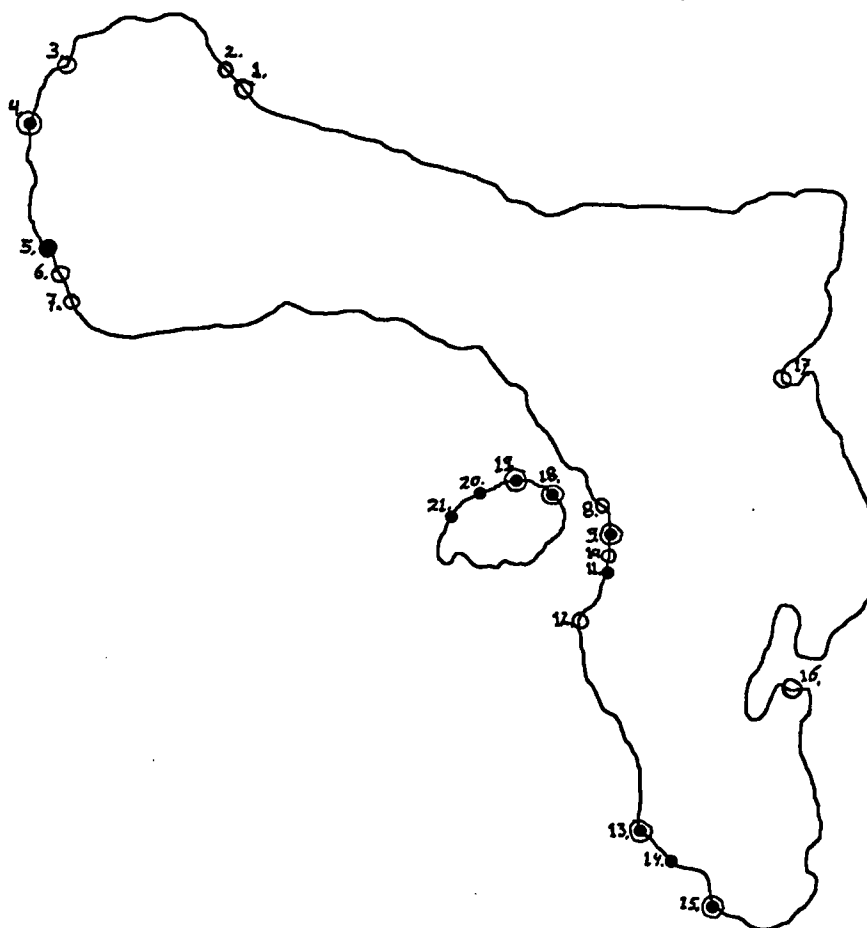
1. It is prohibited to disturb or destroy sea turtle nests or to remove eggs from the nests; it is prohibited to be in possession of, to have for sale or delivery, to offer for sale, to sell, to buy, to trade in, to donate or to transport eggs of sea turtles.
2. It is prohibited to kill, catch or be in possession of sea turtles.
3. It is prohibited to offer for sale, sell, buy, trade in, donate, or offer as a dish in any way in public, sea turtles, sea turtle meat or other products of sea turtles.
4. Sea turtles are understood to comprise the following species: Chelonia mydas (tortuga blanku), Caretta caretta (kawama), Eretmochelys imbricata (karet), Dermochelys coriacea (drikil), and Lepidochelys kempfi.
5. The prohibition as meant in paragraph 2 can be suspended for periods of up to one year (renewable as necessary), after a hearing by the Marine Environment Commission and provided that the condition of the sea turtle population permits such a measure. This action would be administered through an Executive Council decree, which would provide regulations for the catch of sea turtles, the species, the season, quota, and minimum and maximum sizes.

The penalty for convicted violators is a maximum of NAfl. 5000,- and/or one month in jail; relevant equipment (spear gun, car, boat) can be confiscated.

APPENDIX 4a

Sea Turtle Nesting Beaches on Bonaire

- Potential nesting beaches
- Crawls in 1996
- ⊙ Nest(s) excavated in 1996

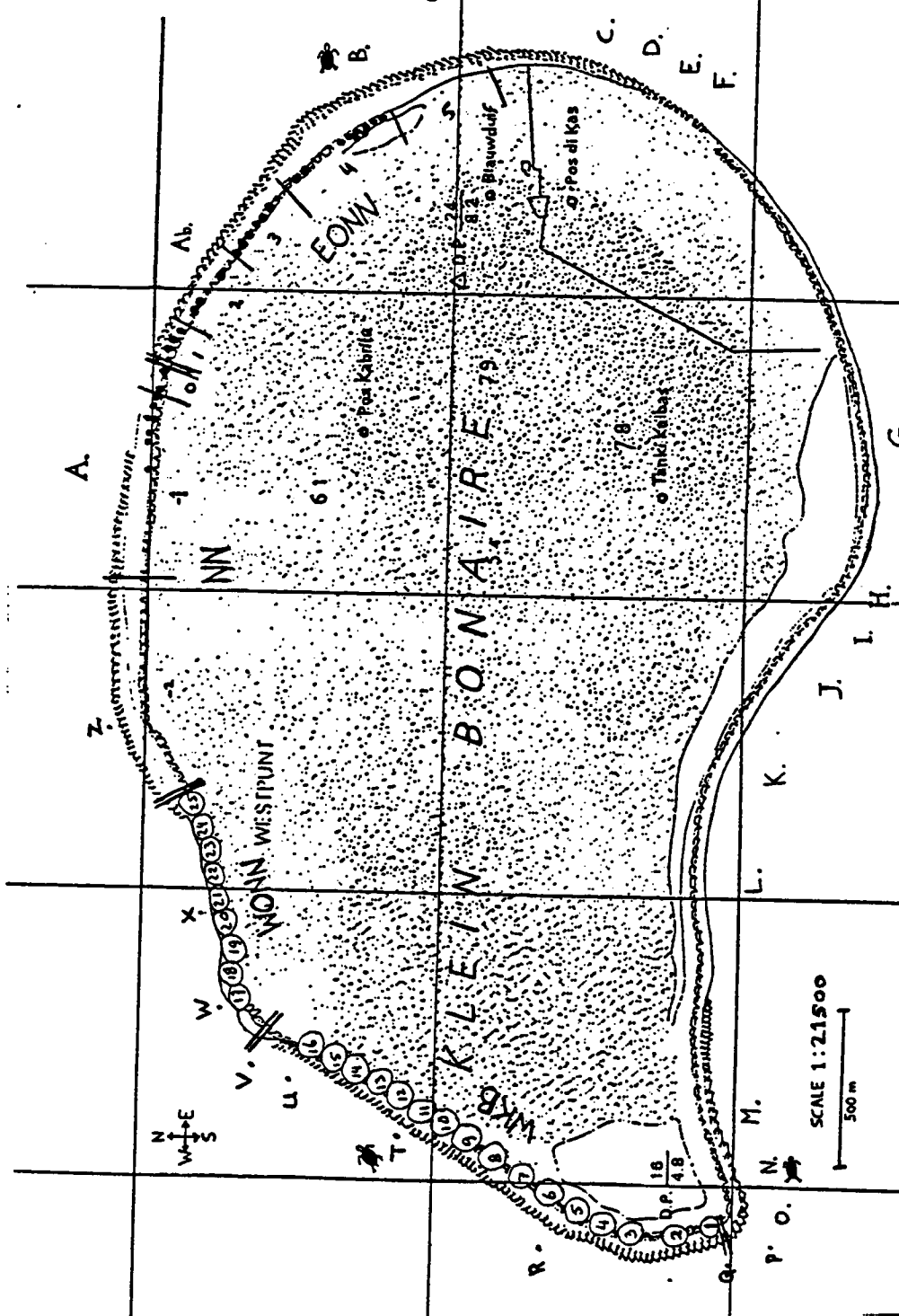


1.Playa Chikitu 2.Boka Chikitu 3.Boka Catuna 4.Wayaka 5.Pl.Frans 6.Nukove 7.Boka Dreifi 8.Pl. Lechi 9.Harbour Vill. 10.Plaza Resort 11.Windsock 12.Punt Vierkant 13.Pink Beach 14.S.W.P.B. 15.Chogogo 16.Sorobon 17.Lagun. On Klein Bonaire: 18.EONN 19.NoName 20.WONN 21.WKB

See table 1 for beach characteristics

APPENDIX 4b

Klein Bonaire: Nesting Beaches and Dive Sites



Potential sea turtle nesting beaches on Klein Bonaire. WKB= West Klein Bonaire, beaches 1-16. WONN= West of NoName, beaches 17-25. NN= NoName, sectors -2 to 0. EONN= East of NoName, sectors 1-5.

APPENDIX 5

Dive locations of the Bonaire Marine Park.



Lagoon	0a	BL Resort	37		
Boca Onirna	0b	Beaths Bungalows	37a		
Boca Bartol	0c	Punt Vierkant	38		
Boca Caruna	1	Lake	39		
Playa Benge	2	Hilma Hooker	40		
Playa Fungi	3	Angel Cirv	41		
Bise Morro	4	Alice in Wland	42		
Slagbaai	5	Aquarius	43		
Playa Frans	5a	Larry's Lair	44		
Nukove	6	Jeanies Glory	45		
Karpata	7	Salt Pier	46		
La Dania's Leap	8	Salt City	47		
Rappel	9	Invisibles	48		
Bloodlet	10	Tori's Reef	49		
Old Blue	11	Pink Beach	50		
Country Garden	12	White Slave	51		
Bon Bini Na Kas	13	Margate Bay	52		
1000 Steps	14	Red Beryl	53		
Weber's Joy	15	Johnny's Hut	54		
Witches Hut	15a	Atlantis	54a		
Jeff Davis	16	Vista Blue	55		
Oil Slick Leap	17	Sweet Dreams	56		
Barcadera	18	Red Slave	57		
Andrea II	19	Light House	58		
Andrea I	20	Stingray City	58a		
Black Durgon	20a	Piedra Pretu	58b		
Petries Piliar	21	Baby Beach	58c		
Small Wall	22	Sorobon	58d		
Cliff	23	White Hole	59		
La Machaca	24	Cai	60		
Habitat	25	No Name	A		
Reef Scientifico	25a	EONN	Ab		
Coral Regency	25b	Ebo's Reef	B	SouthWest Corner	O
Buddy's Reef	26	Jerry's Reef	C	Munk's Haven	P
Bari Reef	27	Just A Nice Dive	D	Twixt	Q
Sunset	27a	Nearest Point	E	Sharon's Serenity	R
Front Porch	28	Keepsake	F	Valerie's Hill	S
Something Special	29	Bon Aventure	G	Mi Dushi	T
Town Pier	30	Divi Tree	H	Carl's Hill Annex	U
Calabas Reef	31	Rock Pile	I	Yellow Man	Uv
18th Palm	32	Joanne's Sunchi	J	Carl's Hill	V
Windsock	33	Capt Don's Reef	K	Jerry's Jam	W
North Belnem	34	South Bay	L	Leonora's Reef	X
Bachelors Beach	35	Hands Off	M	Knife	Y
Chez Hines	36	Forest	N	Sampler	Z

APPENDIX 6

Nesting figures of 1993 and 1995.

Crawls (nests):	Klein Bonaire		Bonaire		Total	
	'93	'95	'93	'95	'93	'95
Hawksbill (Ei)	18 (2)	22 (4)	1 (0)	0 (0)	19 (2)	22 (4)
Loggerhead (Cc)	0 (0)	10 (5)	4 (3)	1 (1)	4 (3)	11 (6)
Unknown	13 (1)	7 (1)	4 (0)	4 (1)	7 (2)	11 (2)
Total	31 (3)	39 (10)	9 (3)	5 (2)	40 (7)	44 (12)

Total number of crawls from '93 + '95:

Of which on Klein Bonaire:

Hawksbill	41	40 (97 %)
Loggerhead	15	10 (66 %)
Unknown	28	20 (71 %)
Total	84	70 (83 %)

APPENDIX 7

Statistical data on the depth distribution of adult vs. juvenile turtles.

To test whether the two divided groups have a difference in their depth distribution, a student t-Test for equal variances was performed (the t-Test is used to determine whether two samples' means are equal):

t-Test: Two-Sample Assuming Equal Variances

	<i>Juveniles.</i>	<i>Adults.</i>
Mean	9.19761905	15.7741935
Variance	41.6987981	52.5806452
Observations	210	31
Pooled Variance	43.0647204	
Hypothesized Mean Difference	0	
df	239	
t	-5.2085987	
P(T<=t) one-tail	2.0529E-07	
t Critical one-tail	1.65125357	
P(T<=t) two-tail	4.1058E-07	
t Critical two-tail	1.96993824	

Equal depth was assumed, and can be rejected on on two sides (two-tailed test):

$P(T \leq t) = 4.1 \times 10^{-7}$ (Chance that Juv. and Adults have no difference in depth distribution)

This is a tiny chance, and way smaller than the standard 0.05 limit, so the hypothesis is rejected.

Conclusion: _ Adult sea turtles generally occur (eat, rest and sleep) at greater depths than do juvenile sea turtles around Bonaire.

APPENDIX 8

1996 Crawls ordered on date.

S/B= sector or beachnumber; TW= track width O/F= crawl old or fresh (fresh= from previous night). BP= nr. of body pits

Nr.	Location	S/B	Date	Time	Act.	Sp.	TW	O/F	BP	Miscellaneous Remarks
1	Chogogo		23-May	4:00 AM	Cr,Ne	Cc		F	1	
2	Chogogo		05-Jun	22:00		Cc		F	0	Same turtle as nr. 1
3	Chogogo		06-Jun	22-4:30	Cr,Bp	Cc		F	4	Same turtle as nr. 1
4	Chogogo		07-Jun	3:00 AM	Cr	Cc		F	0	Same turtle as nr. 1
5	Wayaka		11-Jun	11:50	Ne,Bp	Cc		O	2	Excavated on Aug. 9 th
6	EONN		12-Jun	10:00	Cr,Bp		73cm		1	
7	EONN	2	12-Jun	10:00	Bp				1	
8	EONN	2	12-Jun	10:00	Cr,Bp				1	
9	EONN	3	12-Jun	10:00	Cr,Bp		70cm		3	Lots of stones
10	EONN	4	12-Jun	10:00	Bp				2	
11	EONN	4	12-Jun	10:00	Bp				1	
12	EONN	4	12-Jun	10:00	Bp				2	Not found back
13	EONN	5	12-Jun	10:00	Bp				2	
14	NN	-1	15-Jun	10:00	Bp			F	1	Crawl wiped out
15	NN	-2	15-Jun	10:00	Bp			F	1	
16	NN	-2	15-Jun	10:00	Bp			F	2	
17	NN	-2	15-Jun	10:00	Cr, Bp			F	1	
18	WKB	5	19-Jun	10:00	Cr, Bp		70cm	F	1	Big body pit
19	WKB	15	19-Jun	10:00	Bp			O	3	
20	WKB	13	19-Jun	10:00	Bp			O	1	
21	SWPB		21-Jun	10:45	Cr,Bp		80cm	F	2	
22	EONN	5	22-Jun	10:00	Cr,Bp			F	1	
23	EONN	5	22-Jun	10:00	Bp			F	1	On a dune
24	EONN	2	22-Jun	10:00	Cr,Bp		73cm	F	2	
25	Chogogo		23-Jun	0-2:30	Cr,Bp,Ne	Cc		W	1	
26	Harb. Vill.		23-Jun	2:00am	Ne	Cc		F	1	
27	EONN	3	26-Jun	10:00	Bp			F	2	
28	EONN	3	26-Jun	10:00	Bp				2	
29	NN	-2	27-Jun	12:00	Cr, Bp			F	1	Big track+pit
30	NN	-2	27-Jun	12:00	Cr, Bp		80cm	F	1	
31	NN	-2	27-Jun	12:00	Cr,Bp		75cm	W	1	Big pit
32	Chogogo		08-Jul	1:30am	Cr,Bp	Cc		W	1	
33	EONN	1	08-Jul	10:00	Cr,Bp			F	3	1 large, 2 small pits
34	NN	-2	08-Jul	11:00	Cr,Bp			F	2	
35	Chogogo		09-Jul	1:30am	Cr	Cc		W	0	Landed on stones
36	Chogogo		10-Jul	3:00am	Cr,Bp,Ne	Cc	78cm	W	2	Process filmed
37	EONN	2	11-Jul	10:00	Bp			F	1	
38	SWPB		12-Jul	12:00	Cr,Bp		67cm	F	1	Track 80m. long
39	EONN	2	18-Jul	10:00	Bp			F	1	

40	NN	-1	18-Jul	10:00	Bp			O	1	Big pit
41	WONN	21	18-Jul	11:50	Cr,Bp	75cm		F	2	Many stones
42	Chogogo		23-Jul	23:00	Cr,Bp	Cc		W	1	
43	Playa Frans		25-Jul	16:00	Bp			O	2	Poached?
44	Harb. Vill		27-Jul?						1	
45	WONN	25	27-Jul	11:00	Bp			F	3	
46	SWPB		29-Jul	11:00	Cr	70cm		F	0	
47	SWPB		29-Jul	11:00	Cr,Bp	70cm		F	2	Same as 46, 53m long
48	EONN	3	29-Jul	10:00	Cr,Bp	70cm		O	7	Many pits
49	EONN	1	30-Jul	10:00	Cr,Bp			F	1	
50	EONN	4	30-Jul	10:00	Bp			O	2	
51	NN	-2	30-Jul	9:00	Cr,Bp			F	4	
52	NN	-1	31-Jul	8:00	Cr,Bp	75cm		F	2	
53	EONN	2	01-Aug	8:00	Cr,Bp	75cm		F	15	Many pits
54	SWPB		02-Aug	10:00	Cr,Bp	70cm		F	3	
55	EONN	1	02-Aug	3:00am	Cr,Bp	Ei		W	1	Attempt filmed
56	NN	-2	03-Aug	10:00	Cr,Bp			F	5	
57	EONN	2	05-Aug	10:00	Cr,Bp	65cm		F	1	Very good sand
58	EONN	2	05-Aug	10:00	Cr,Bp			F	1	
59	EONN	2	05-Aug	10:00	Cr,Bp	65cm		F	1	
60	EONN	2	05-Aug	10:00	Cr,Bp	65cm		F	1	Open attempt
61	NN	-2	05-Aug	10:00	Cr,Bp	70cm		F	2	Emerged from water twice
62	NN	-2	05-Aug	10:00	Cr,Bp	70cm		F	4	
63	EONN	2	07-Aug	10:00	Cr,Bp			F	4	Track up&down
64	EONN	4	07-Aug	10:00	Bp				1	Lot of stones
65	NN	-2	07-Aug	10:00	Cr,Bp			F	9	
66	NN	-2	07-Aug	14:00	Cr,Bp	70cm		F	5	Filmed by NBC
67	Harbour Village		08-Aug		Ne	Cc			1	Hatched 7-Aug
68	EONN	1	08-Aug	10:00	Bp			F	2	
69	NN	-2	08-Aug	11:00	Cr,Bp	70cm		F	3	
70	EONN	1	10-Aug	10:00	Cr,Bp,Ne			F	1	Predation by crabs
71	EONN	2	10-Aug	10:00	Cr,Bp			O	4	
72	EONN	3	15-Aug	10:00	Bp			O	1	
73	EONN	1	15-Aug	10:00	Bp				1	
74	EONN	4	17-Aug	16:00	Cr,Bp			O	1	Track hardly visible
75	Pink Beach		20-aug (?)		Ne				1	Hatched 18-10
76	EONN	4/5	20-Aug	12:00	Cr,Bp			O	3	Track hardly visible
77	EONN	2	21-Aug	10:00	Cr,Bp			F	2	Track hardly visible
78	EONN	2	22-Aug	10:00	Bp			F	1	
79	NN	-1	24-Aug	16:00	Cr,Bp	89cm		F	2	
80	NN	-1	24-Aug	16:00	Cr,Bp	89cm		F	2	
81	NN	-1	26-Aug	10:00	Cr,Bp	90cm		F	9	
82	EONN	3	27-Aug	13:00	Bp			F	3	
83	EONN	3	27-Aug	13:00	Bp				3	
84	EONN	2	27-Aug	13:00	Cr,Bp	68cm		F	3	Looked like nest
85	EONN	2	28-Aug	10:00	Cr,Bp			F	3	Track up anddown
86	NN	-1	28-Aug	10:00	Cr,Bp	80cm		F	6	Total attempt 75m long
87	WKB	8	28-Aug	10:00	Bp			O	1	

88	EONN	2	31-Aug	10:00	Cr,Bp			F	1	
89	EONN	3	31-Aug	10:00	Cr,Bp			F	7	Lots of stones
90	EONN	1	31-Aug	12:00	Cr,Bp		80cm	F	5	
91	NN	-2	31-Aug	11:00	Cr,Bp		70cm	F	1	
92	EONN	2	03-Sep	16:00	Cr,Bp			F	3	Track rained away
93	EONN	5	09-Sep	11:00	Cr,Bp			F	2	Bushy area
94	NN	1	11-Sep	11:00	Cr,Bp,Ne	Cc		F	1	Hatched 9 nov.
95	EONN	-4	12-Sep	11:00	Cr,Bp			F	2	Tracks hardly visible
96	EONN	3	14-Sep	11:00	Bp			F	5	Bushy area
97	EONN	5	20-Sep	10:00	Cr,Bp			F	4	On hillside
98	EONN	2	23-Sep	15:00	Cr,Bp		68cm	F	1	Looked like nest
99	EONN	2	25-Sep	10:00	Cr,Bp		65cm	F	2	
100	NN	-1	25-Sep	11:00	Cr		75cm	F	0	No body pits
101	NN	-1	26-Sep	10:00	Cr		75cm	F	0	No pits
102	NN	-1	26-Sep	10:00	Cr			F	0	No pits, same as 101
103	NN	-1	26-Sep	10:00	Cr,Bp		75cm	F	1	Same as 101
104	EONN	2	02-Oct	10:00	Cr,Bp			F	1	Track up+down, big pit
105	NN	-2	02-Oct	10:00	Cr,Bp		85cm	F	1	Looked like nest
106	EONN	5	05-Oct	13:00	Cr,Bp			O	1	On far beach
107	NN	-1	12-Oct	13:00	Cr,Bp			O	1	
108	EONN	1	24-Oct	10:00	Cr,Bp		75cm	F	1	
109	EONN	5	30-Oct	10:00	Cr,Bp			F	1	Track up&down
110	NN	-1	07-Nov	11:00	Cr,Bp		82cm	F	3	Next to hut
111	Windsock		08-Nov	10:00	Cr,Bp			O	11	
112	WONN	25	08-Nov	10:00	Cr,Bp			O	4	End of NN, bushy
113	EONN	5	11-Nov	10:00	Cr,Bp			F	1	
114	NN	-2	11-Nov	11:00	Cr,Bp		75cm	F	2	On steep hill
115	NN	-1	23-Nov	11:00	Bp			F	1	No track
116	EONN	-1	26-Nov	11:00	Cr,Bp			F	2	

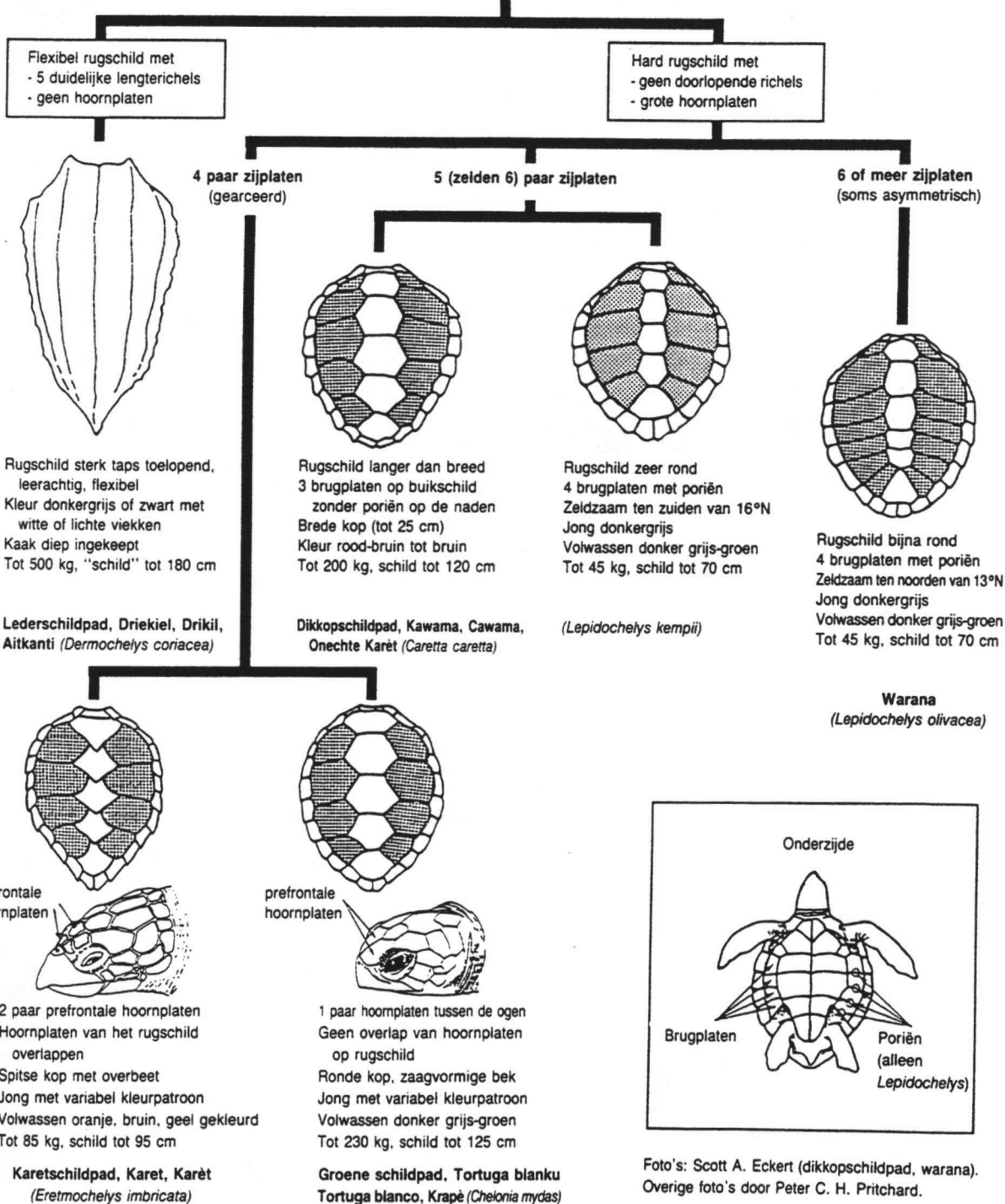
APPENDIX 9

Determination table of Caribbean Sea Turtles.

Dutch version, especially printed for the Netherlands Antilles.

Caribische Zeeschildpadden

DETERMINATIE TABEL



News Letter

News from the Sea Turtle Club Bonaire.

October 1996

PROJECT 1996: SIGHTING THE FUTURE!

Four months into the Sea Turtle Club Bonaire (STCB) 1996 Project, more than double the amount of nests from previous years' recordings have been sighted and documented. Officially launched on June 3rd, the project is a conti-

nuation of the conservation activities of the STCB, which started in 1991. This year the biological research and conservation program was undertaken by project assistants Joris van Rossum and Derk-Jaap Norde, under the academic supervision

of Prof. Dr. R.P.M. Bak from the University of Amsterdam (UvA).

Unusually high nesting activity combined with the STCB *Sighting Network* account for the increase in recorded sightings.

S C I E N T I F I C R E S E A R C H

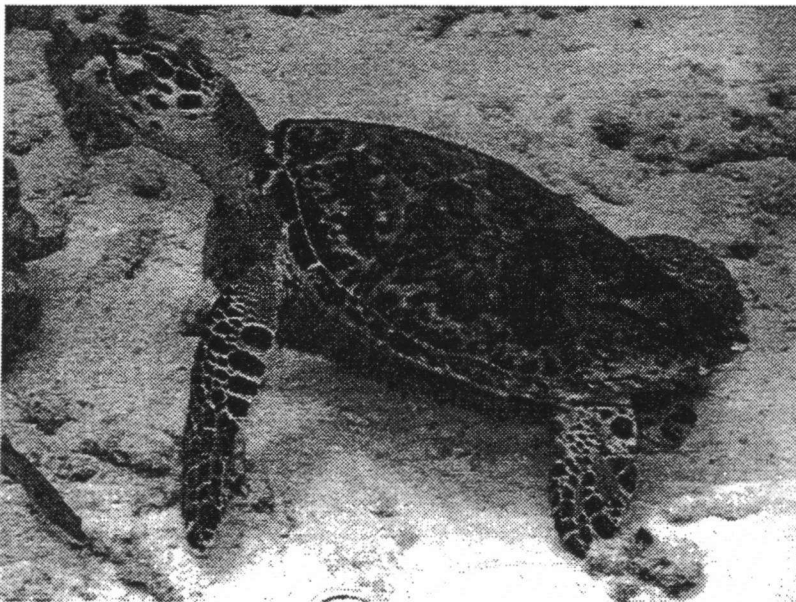


PHOTO: LESLIE A. WARNER

'Little One' a juvenile Hawksbill, residing in the waters surrounding Klein Bonaire.

Results from former years

Results from the research of the 1993 and 1995 projects showed that nesting of Hawksbill and Loggerhead turtles still occurs on Bonaire. Crawls documented in 1993 totaled 40 and increased to 44 in 1995.

About 90% of all crawls documented were on Klein Bonaire, once again demonstrating the importance of Klein Bonaire as a turtle nesting ground.

Nesting also occurs on the mainland, but due to sand mining and increased tourism, suitable breeding grounds have become scarcer over the years.

Research has also shown that Bonaire is a home for juvenile turtles.

Through the STCB *Sighting Network*, we now can confirm that a relative small but stable population of juvenile Hawksbill and green turtles reside in the waters of Bonaire. Over the years, we have also learned much more about the behavior of these young turtles, which use Bonaire's waters as a place to forage and to seek shelter.

1996 Project: The Nesting Population

Four months into the 1996 Project and more than 90 crawls have been documented, more than twice the amount of the 1993 and 1995 recordings.

Although the figures may simply

CONTINUED ON PAGE 2

KLEIN BONAIRE

In the past, sea turtles that visited the mainland of Bonaire were much more numerous than today.

Unfortunately, increasing development has changed Bonaire and has made it less and less suitable for nesting sea turtles. However, one of the few places that have not changed much is Klein Bonaire, the uninhabited islet off the west coast. Due to its uninhabited and unspoiled character, Klein Bonaire can be seen as the last resort for the nesting turtles of Bonaire (the majority of sea turtle nesting—especially of the highly endangered Hawksbill—occurs on Klein). The general reef and bird life is more concentrated here as well, as the area is relatively sheltered from disturbance and pollution.

However, the islet is continually the focus of private developers. The STCB again wants to make clear that any development of Klein will have a devastating impact on the nesting turtles of Bonaire, and will probably make them disappear forever.

For this reason, the STCB fully supports the activities of The Foundation for the Preservation of Klein Bonaire and the foundation STAAN whose main objectives are purchasing the islet from the private owners to preserve its natural state.

The STCB fully supports this goal and will cooperate whenever possible.



reflect an unusually good nesting year, it may also indicate an overall increase in Bonairian sea turtle breeding stock.

Surveys of the 41 potential nesting beaches continue on a daily to weekly basis, depending on the probable nesting activity.

At least one turtle decided she had roughed it long enough and checked into Bonaire's upscale Harbour Village Resort beach to nest. A female Loggerhead made her way to the resort's man-made beach and deposited her eggs. Two months later, more than 100 hatchlings crawled from the nest onto the beach. The only problems the young ones had was they were scurrying towards a deceiving light instead of heading towards the sea!

The resort, constructed less than 10 years ago, is located in an urban area adjacent to the island's marina. Lights shine throughout the night on the beach to guide resort guests through the property.

The hotel was quick to inform the STCB of their unusual guests, enabling a speedy recovery of the hatchlings. The hotel agreed to switch off all the lights on beach property, and the hatchlings were re-released into the sea giving them a chance at survival.

The nest itself was found under a relatively hard layer of packed sand, and contained 181 eggs, of which 156 had successfully hatched.

Although this incident illustrates the negative impact of lights on breeding grounds, it also points up the value of educating the public as to its responsibility in protecting sea turtles.

The STCB encourages all beach resorts to use 'turtle friendly' lamps that produce special wave lengths and which cannot be detected by sea turtles. For more information, please contact the STCB.

Bonairian Home?

It is estimated that 5 to 12 female turtles visit Bonaire every year. The key question about the nesting turtle population is: Do the same individuals visit Bonaire regularly?

If they do, then they regard Bonaire as their home nesting ground, an important factor to consider in scientific interpretation and regional cooperation.



Fortunately, individual adult turtles are easily recognized by their shells, due to barnacles, color variations and scars. Through the collection of photographs assembled via the *Sighting Network* and the beach-monitoring, we believe that a sufficiently large database of the nesting turtles can be assembled, with which we can test this hypothesis.

Through regular snorkel and dive surveys, an attempt is being made to

Please contact the STCB should you have such photos to donate.

Juvenile population

In addition to the visiting adult nesting population, Bonaire is also home to juvenile turtles who remain here all year round. Young Hawksbills are seen mainly on the coral reefs where they pick out the sponges with their sharp beaks. The juvenile green turtles, living and fee-



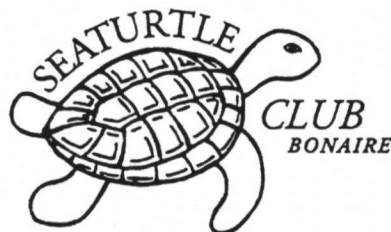
PHOTO: BOY ANTOIN (EXTRA)

The just hatched Loggerheads waiting to be released.

determine the length of time a particular nesting turtle resides on Bonaire. Also the turtle's behaviour between nestings (the interesting interval) needs to be studied.

During the first four months of the 1996 project, six adult female turtles have been observed and photographed in such a way that they can be identified individually through these photographs. It is expected that more identifications will be collected in the months to come.

Also your photos of sea turtles can be beneficial toward building a useful database, and will be greatly appreciated.



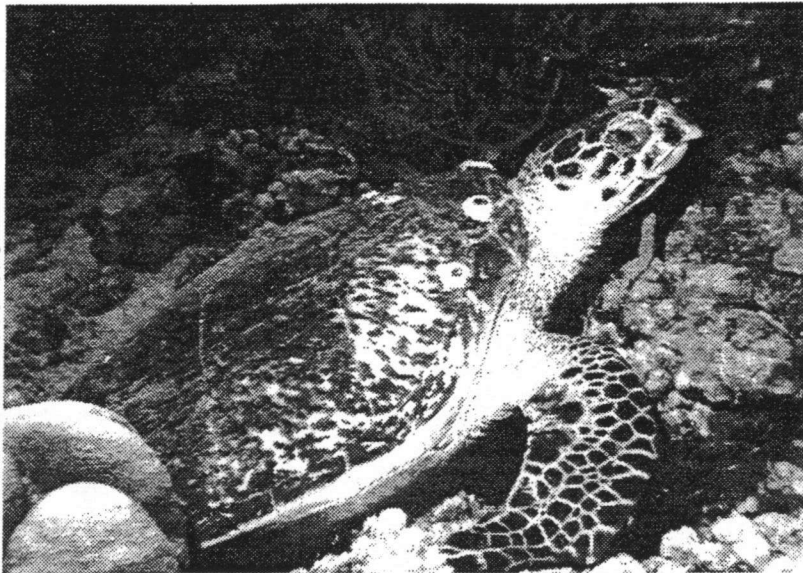
ding on sea grass beds, are found more on the east coast of Bonaire.

A wealth of information is collected by means of the *Sighting Network*. During the first four months of the 1996 project, more than 600 sighting sheets were completed and gathered in cooperation with the dive shops, all of which were provided with a 'Turtle Corner' display to draw the attention of tourists to our efforts. Thanks to the dive shops' enthusiasm, information is constantly available for research.

Photo identification is performed on juveniles as well, primarily in the Lac-Bay area, which is thought to be a feeding area for green turtles.

A limited number of identified Hawksbills will be followed during the 1996 project, in order to learn more about their individual behaviour. This is recorded through regularly but randomly sampled snorkel-surveys on a number of reef sites along the Bonairian coast.

PHOTO: PHILLIPE COUSTEAU



Adult female Hawksbill, repeatedly observed in the waters surrounding Klein Bonaire.

AWARENESS ACTIVITIES OF THE STCB

Although sea turtles became a fully protected species on Bonaire in 1991, most problems concerning sea turtles continue to be the result of the human activities.

As in any well-functioning conservation program, public awareness is crucial to efforts to save the endangered sea turtle populations. Therefore the STCB is focused on informing the public about sea turtle conservation and environmental care. This is done in several ways.

Spreading the Word

First of all, the STCB issues regular press releases about our activities and provides informative radio and TV to make our concerns more visible. A special item about the recent problems with Klein Bonaire will be broadcast in the USA, in order to increase international interest and funding.

STCB was able to get unique video-footage of a Loggerhead turtle nesting on the Bonairian coast which will be used in a professionally produced STCB video on the sea turtles of Bonaire for educational purposes. A homemade documentary on the mother and hatchling turtles will be presented on Bonaire at the end of the nesting season. Also the Dutch television

AVRO plans to broadcast the footage in a program about the Bonairian wildlife.

In order to inform the public, a weekly slideshow on sea turtle biology is shown every Monday night at Captain Don's Habitat at 8.45 p.m. Tourists are asked not to harass turtles or enter the nesting areas on regular trips to Klein Bonaire. More Turtle Corners, consisting of a folder rack which attracts the attention of divers and contains sighting sheets and various folders, will be placed in locations other than the dive shops. The displays are supplied with new folders and sighting sheets on a weekly basis.

As was the case in 1995, the Bonairian schools are provided with various educational materials. In cooperation with the *Tourism Corporation Bonaire* (TCB), lessons are planned to be incorporated in an annual environmental project for the fifth and sixth grades at the end of the school year.

The secondary school on the island will also be supplied materials and informed about sea turtles and reef ecology in general, during biology or environmental orientation courses.

Because we think that teaching children about the fragility of reef life is

CONTINUED ON PAGE 4

HISTORY OF THE STCB

The Sea Turtle Club Bonaire, founded in 1991 by Albert de Soet, is a Bonairian-Dutch non-profit organization of which the main goal is to save from extinction the sea turtles that visit Bonaire. The first comprehensive sea turtle conservation project of the STCB was executed by Tom van Eijck in 1993, using recommendations made by the Wider Caribbean Sea Turtle Conservation Network (WIDECAST).

WIDECAST, an international organization sponsored by the United Nations, published Sea Turtle Recovery Action Plan for the Netherlands Antilles in 1992 (STRAP; Sybesma, 1992). The STRAP is a guide for project development and the implementation of field conservation priorities. The beach monitoring results, as well as sighting reports from the dive school network established by the STCB, indicated that Bonaire was still visited by juvenile, sub-adult and adult turtles of several species. The results were made available to the public, including policy makers, educators and the media.

Apart from the monitoring and sightings database, an extensive public awareness campaign was undertaken, targeting schools, law enforcement agencies and the general public (Van Eijck & Eckert, 1994).

In 1995, a first follow-up project was organized and two project assistants, Niels Valkering and Paul van Nugteren, were appointed. The research activities of the project assistants were supervised by Prof. Dr. Bak from the UvA. The project was sponsored by the World Wide Fund for Nature-Netherlands and the Dutch National Postcode Lottery, and activities were organized in cooperation with a consortium of local nature conservancy organizations, including the *Bonaire Marine Park* and *Tene Boneiru Limpi*. Although the number of nests documented did not differ appreciably from 1993, new nesting beaches were identified. Moreover, a promising pilot project on photo identification of juvenile green and hawksbill turtles was initiated. Apart from the research, the STCB focused once again on public awareness.

CONTINUED ON PAGE 4

FINALLY, WHAT CAN YOU DO TO HELP THE TURTLES?

You can do your share of turtle protection as well. If you happen to see a sea turtle, don't harass or ride it, and if you are lucky to see one coming on land, please don't shine lights or make noise, and keep good distance: the turtles are very shy when planning to nest. Please report any sightings to the nearest dive shop. If you are at a beach such as Klein Bonaire, which is frequently nested upon, beware where you walk. Trampling or sitting on a nest will make the sand on top too dense, preventing oxygen from reaching the eggs, and killing the growing hatchlings. Protect feeding areas by keeping the sea clean of plastic or other waste. A plastic bag ingested by a turtle will be lethal for the animal. If you notice any illegal activity, such as the capture of turtles, destruction of nests, or the sale of turtle eggs, please report this to Bonaire Marine Park (8444) or the police (8000).

To continue our work, both your financial and practical support will be

AWARENESS ACTIVITIES (CONT.)

a very powerful tool in raising awareness of environmental issues, the STCB focuses on special programs reaching the young. Educational snorkel trips to Klein Bonaire with groups of children participating in 'Turtuganan di Boneiru' started again last month in cooperation with the Bonaire Marine Park and the TCB.

In cooperation with George 'Cultura' Thode, a ranger of the Washington-Slagbaai National Park, the STCB will give slide and video presentations in the youth centers (Centre di Barrios), starting the 17th of October at Antriol. After almost 20 years of looking after the park, Mr. Thode knows many interesting facts about the park, its wildlife and nature in general.

World Clean-up Day

Because clean beaches are very important to sea turtles, the STCB participated again in the yearly 'World Clean-up Day' organized by *Tene Boneiru Limpi* (Keep Bonaire Clean). The STCB coordinated the coastal clean-up, in which the objective was to try to collect as much trash as possible on the weekend of September 21-22. Besides other areas, the

highly appreciated. Send your donations to the Sea Turtle Club Bonaire.

Bonaire: Maduro & Curiel's Bank
account number 10106273,
Kralendijk, Bonaire (N.A.)
Netherlands: ABN-AMRO Bank
account number 550391150
Hilversum, The Netherlands.

Also contributions of pictures of Bonairian sea turtles are very welcome. Volunteers willing to devote time and effort to monitoring activities are certainly welcome, especially for the period of December to June, when no project assistants are available on the island.

Contacts can be made at:

STCB, P.O. Box 333, Kralendijk,
Bonaire. Tel. 599 7 5300,
room# 213, fax. 599 7 8118

STCB, Madurastraat 126 hs,
1094 GW Amsterdam, Netherlands
E-mail: tvaneyck@bio.vu.nl

entire east side of Klein Bonaire was cleaned. Stretches of that coast had clearly never been attended before, appearing to be a coastal landfill of which 99% seems to have blown across the water directly from Kralendijk-center. More than 200 bags of trash were collected by the very enthusiastic and hard-working volunteers. The STCB deeply appreciates the devotion of all the people who helped to make the 1996 World Clean-up such a great success.

Without the full support of local Non Governmental Organizations (NGO) such as the *Bonaire Marine Park* and *Tene Boneiru Limpi*, the STCB's outreach efforts would be greatly diminished. Our association is important both logistically and for well-coordinated policy. As the sea turtles and their problems don't stop at Bonaire's borders, further regional and international cooperation will also be important. Working visits will be made to various NGO's in the Antillian region. A visit to Venezuela is important since sea turtle stocks are probably shared between our jurisdictions.



WIDER
CARIBBEAN
SEA TURTLE
CONSERVATION NETWORK



HISTORY OF THE STCB (CONT.)

The 1993 Project had revealed a large demand for educational materials suitable for local schools; thus, the 1995 campaign held as a priority the development and distribution of such materials (Valkering & van Nugteren 1996).

Much progress has been made on Bonaire since 1991, but although the turtle fishery (including egg collection) have been forbidden by law on Bonaire since 1991, a small quantity of sea turtles is still harvested illegally. The hunting is pursued by a small group of fishermen who have traditionally hunted sea turtles for their meat. The hunt threatens remaining populations, but the major concern is not this clandestine market, but rather the continuing development of the tourism industry. In the near future, the STCB would like to expand its focus on other endangered species, such as the parrots, flamingos and iguanas inhabiting the island.

SPONSORS OF THE STCB:

World Wide Fund for Nature (the Netherlands); Stichting Doen/Nationale Postcode Loterij; WIDECAST; Dierenrampenfonds; Bonaire Trading Company; KLM; Grand Hotel Amsterdam; Hotel Barbizon Centre GT; Paul Huf Studios; G. van Lennep Productions; Villapark Ooghduyne; Sunset Beach Hotel; Biodermal Baarn Holland; ING Bank Central America & Caribbean; Van Lindonk Special Projects B.V.; Buddy Dive Centre; Captain Don's Habitat; Sunset Dive Centre; Woodwind; Baka di Laman; Jerry Schnabel Phototours; Con-sales; Maduro & Curiel's Bank, EXTRA. Special thanks to: Corinne Gerharts, Deborah Diggons, Marc Jeuken.

Publications of the STCB:

- 1993 STCB Folder, STCB Poster
- 1994 STCB 1993 Report
Nos mundi di Turtuga
- 1995 1st STCB Newsletter
- 1996 STCB 1995 Report
STCB/WIDECAST miniposter
2nd STCB Newsletter

To be expected soon:

STCB Folder (full color), STCB Video



