STINASU

WWF-Guianas

The Sea Turtles of Suriname, 2000

Prepared by:

M.L. Hilterman

With contributions by E. Goverse and J. de Bres

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1. INTRODUCTION

1.1 General introduction

During the past decades, the coastal area of the Guiana Shield Region, of which Suriname forms part, has become one of the most important nesting areas for sea turtles worldwide. All seven species of sea turtles are on the IUCN Red List of Threatened Animals. Four species nest on the Surinam beaches: the leatherback (*Dermochelys coriacea*), green turtle (*Chelonia mydas)*, olive ridley (*Lepidochelys olivacea*) and, sporadically, the hawksbill (*Eretmochelys imbricata).* A fifth species, the loggerhead (*Caretta caretta*) is sometimes observed in the offshore waters of the Guianas or washed ashore. The sea turtles of the Guyana Shield Region are threatened by a number of factors such as egg poaching, incidental catches, beach erosion and tourist activities.

After years of highly fluctuating but low numbers of leatherbacks, the past two years a strong increase in nest numbers of this species was found, with an estimated number of 10.000 nests in 1999, and 14.000 in 2000. Because of the importance of the area for the leatherback turtle, the main research activities focussed on this species. An understanding of nesting beach dynamics, population size and trends, local reproduction and nest ecology, and sources of mortality is essential for management and recovery of sea turtle stocks. In designing or improving a conservation program, factors such as population demographics, hatchling recruitment and nesting habitat quality should be monitored. Conservation activities should be focussed at sites where high levels of reproductive success can be realized.

Although the research focussed on the leatherback turtle, baseline data were also gathered for the other species of nesting sea turtles. The olive ridley population of Suriname has strongly declined during the past decades due to egg poaching and shrimp fisheries. In 30 years time, the numbers of nests dropped from over 3000 to little more than 100 in year 2000. The green turtle population can be considered stable, varying around 5000 nests per year.

The aim of the Biotopic project, in close collaboration with STINASU, is to protect the sea turtle nesting populations and their habitat in Suriname and the surrounding countries, by means of research in order to develop better conservation strategies, public awareness building, local and international collaboration and capacity building.

1.2 Project activities

Assessment of size and trends of the different rookeries:

- Identification of (old en new) nesting sites: mapping by use of GPS, aerial surveys, expeditions by boat and by foot.
- Quantification of nesting activity and observed mortality for all species: nightly and daily monitoring; measuring carapace length and width of leatherback females.

Population dynamics:

- PIT-tagging (leatherbacks), assessing recruitment rates.

Assessment of nesting beach suitability and recruitment success:

- Research on hatching success, embryonic mortality, egg- and hatchling predation, average fecundity, sex ratios, etc.; research on factors influencing hatching success, research on improvement of nest relocation methods.

Identification of main threats, direct conservation activities:

- Identify and quantify natural and anthropogenic threats on each of the nesting beaches (such as predation, nest inundation, beach erosion, egg poaching).
- Reduce egg poaching by presence on the beaches, beach patrolling.
- Assess mortality rates and damage to sea turtles as a result of coastal fisheries.
- Relocate nests that are threatened with beach erosion or expected poaching to a hatchery.
- Regular beach patrolling, checking hatched nests for non-emerged hatchlings, set free trapped hatchlings, (if possible) reduction of predation.

Population identification:

- Genetic study on leatherback and olive ridley turtle populations.

Coordination and standardisation of our research activities with those conducted in French Guiana and Guyana, regional exchange of PIT-tag- and other data.

1.3 Research area

The fieldwork was carried out on Baboensanti, Samsambo and Matapica. On Baboensanti, the main activity was PIT tagging, while on the other two beaches the focus was on nest ecological research. On Samsambo, monitoring nesting activity was another priority.

Baboensanti is situated in the Galibi Nature Reserve, at the mouth of the Marowijne River. The beach was divided into 7 beach sections, from south to north: Pruimeboom III, II, I (PB-III, PB-II, PB-I), Baboensanti I, II (BS-I, BS-II), Baboensanti Noord (BS-N) and Thomas. Our daily activities were restricted to PB-I and BS-I&II, a total length of approximately 3-km.

Matapica is situated some 4 km east of the estuary of the Surinam River. It is separated from the main land by a narrow lagoon that is exposed during low tide. Total length of the beach is approximately 10 km. The beach is moving from east to west along the coast of Surinam. Beach erosion takes place on the east side while accretion occurs on the west side. Matapica beach is divided into sections by STINASU. Our research was done from station “De Rode Ibis", situated on the border of Bottom Section 3 and Top section 4. A transect line was made that stretched one km to the east of the hut. The transect can be divided into two different parts. The first 500m, most towards the east, were severely eroded during the field-period. More than 25 meter of the width of the beach was lost in some places. In this section of the beach several nests were washed away by the sea. The erosion processes also caused the formation of a steep flood cliff. The westerly part of the transect, 500m to 1000m was almost erosion free and had an even slope. One km to the west was monitored as well.

Samsambo is a newly formed beach, situated just outside the Marowijne River estuary, with a total length of approximately 8.5-km. It was formerly known as Eilanti-Spit or the Spit. It started as a sandbank in front of Eilanti beach. In about five years time it developed into one of the major nesting beaches for leatherbacks in Suriname.

Towards the land there is a mangrove swamp. Towards the sea a mud flat extends several hundred meters into the sea. At the beginning of the season the mud flat did not extend along the full length of the beach. During the season it did not only increase in length but it also appeared to extend further into the sea. This mud flat protects the beach from the eroding forces of the sea.

Samsambo beach was divided into seven sections. From east to west these are: East, Parwa, Mid I, Mid II, West, Far Section West (BGW). The research station was situated on the border of the sections Mid I and Mid II. Each section was approximately 1 to 1.5 km long. A transect line was made stretching approximately 1.4 km west from the field station.

Section East

Section East extends from the most easterly point of the beach towards the west up to the point where the vegetation grows to the water. It is very sparsely vegetated and separated from the swamp by a creek through which swamp water flows into the sea. The east point of east is a very dynamic area. An old fishing camp is situated at section East. This was used a few times during the season by fishermen. More frequently it was used by poachers as a collection point.

Section Parwa

Section Parwa is a section of the beach where the swamp forest has grown up to the mud flat. The vegetation consists mostly of dead *Avincennia* trees. Since there is little open sand for the turtles to nest in this section very few nests were laid here.

Section Mid-I

The section Mid I starts at the point where a stretch of open sand is visible again and ends at the field station. This part of the beach consists mainly of open sand dotted with small patches of trees. It is higher above the tidemark than the other sections and has a relatively steep slope.

Section Mid-II

Section Mid II extends from the field station towards the west with a length of approximately 1300 m. Between the beach and the swamp there is a stretch of open water. The beach itself consists mainly of open sand with small dunes. In some parts it is covered by beach creepers *Ipomoea pes-caprea* and *Canavalia maritima.*

Section West

Section West starts at the point where the open water that separates Mid II from the swamp ends. The beach characteristics are basically the same as in Mid II; a wide, open, sandy beach with small dunes forming on the landward side.

Section BGW

The Far West Section, or in Dutch Buitengebied West (BGW), can be divided into two parts. Just after the border with section West a stretch of parwa-forest is found. This part looks the same as the section Parwa; *Avincennia* trees that have grow across the beach to the mud flat and are dying or dead. Through this stretch of parwa a small creek runs into the see. At low tide it is possible to cross this creek and walk out onto a part of wide and open beach. This part of Samsambo is different fom the other beach sections. For a large part of the field period BGW was not protected by the mud flat. Consequently, the waves eroded the beach. This caused a steep slope leading from the edge of the mud onto a flat sand area. At the back of the beach the sand is covered with beach creepers after which the swamp begins. In this part of BGW the swamp is older and more developed than along the back the other beach sections of Samsambo. It consists mostly of *Rhizophora* trees. This can be an indication that the water behind BGW is less salty than behind the other beach sections.

1.4. Nest relocation

Nest relocation has been considered an effective direct conservation measure in Suriname for the past few years. Nest relocation is done in case of expected beach erosion, in case of expected inundation or poaching. At Baboensanti, since 1995, all nests located more than 2 meters below the STL were relocated to a hatchery or transferred to a higher position on the beach because it was believed these nests were otherwise doomed. Since 1999, this work has been done by Oceanic Society volunteers. Evidence was found, however, that these "low" nests may still hatch well. In addition, because sex ratios are determined by sand temperatures and especially nests that are regularly inundated are cooler and therefore have a higher chance of producing males, nest relocation may disturb natural sex ratios. Therefore, in 2000 we have adopted a more conservative approach towards nest relocation, which is described in section 2.4.5.

2. METHODS AND MATERIALS

Data were collected between April 23 and August 20, 2000 in the Galibi Nature Reserve, Samsambo and on Matapica beach.

2.1 Monitoring nesting activities

Nightly beach patrolling was done by STINASU and Biotopic on Samsambo (beach sections Mid-II and West); Biotopic, STINASU and Oceanic Society on Baboensanti (beach sections PB-I and BS-I/II); and STINASU and Biotopic on Matapica (Biotopic: Bottom Section 3 and Top Section 4) from at least two hours before the high tide to at least two hours after high tide or until the last turtle had returned to sea. During the nightly monitoring, activities included (for leatherbacks): PIT tagging, size measurements, nest marking and nest mapping, nest relocation in case of threat of beach erosion. Turtles were checked for cuts, wounds and scars. During early morning beach patrolling, a complete nest count was done on all beach sections either by STINASU or Biotopic or both *(see below, "nest counts")*. In order to get a picture of spatial distribution of nests across the beach, the distance towards the spring tide line was estimated by Biotopic members for each nest. During early morning monitoring, hatched nests were also recorded and checked for non-emerged hatchlings. Hatched nests were marked and three days later excavated (*see section "nest ecology*").

2.1 1. Nest counts

Nest counts were performed both by STINASU and Biotopic. Nest counts were done in the early morning by patrolling a certain beach section and counting newly laid nests. False crawls were noted down separately. After a nest was recognised and recorded, a line was drawn by foot through the turtle track to avoid double counting.

- At Samsambo, daily nest counts were performed on all beach sections by either STINASU or Biotopic or both so that the entire beach length of approximately 8-km was covered. The information was shared afterwards. More remote beaches, like 'BGW-III" were monitored once every two weeks or sometimes less.
- At Baboensanti, daily nest counts were done at PB-I and BS-I&II, an area of approx. 3-km. However, due to lack of manpower, on several occasions early morning nest counts were not performed. These gabs in data were filled in a later stage by interpolation of data (see below). For the same reason, on more remote beaches, like Thomas, nest counts were only done on several occasions. The beaches south of PB-I, i.e. PB-II, PB-III and Galibi, were monitored by STINASU members at the post PB-III. Also here, monitoring data show several gaps.
- At Matapica, beach section "Bottom section III" and " Top Section IV" were monitored by Biotopic, all other beach sections by STINASU. Like on the other beaches, the information was shared afterwards.

Filling data gaps: interpolation of data

The number of nests for the missing days have been estimated based on the Lagrange Interpolation (Girondot and Fretey 1996). This estimate has been shown to be very effective to produce a reliable estimate. The nest distribution of the best-monitored beach section over the season has been used as a reference for other beach sections that have been less intensively studied. The ratio on the number of nests in the reference sector and the number of nests in the studied sector were established using least square difference. Then this ratio was used to estimate the number of nests when the data were missing. A Lagrange interpolation has been carried for leatherback nest numbers at Samsambo and Baboensanti.

2.1.2. Surveys and expeditions

An aerial survey was held in a one-propeller GUM-air plane on July 10 along the coastline from Braamspunt to Galibi and back. The average height was 100 m, the weather was predominantly sunny but alternated by cloudy weather with rain showers. Estimates were made of numbers of nests on the different beaches. Pictures were made of existing nesting beaches and newly developing or degrading beaches. Because the GPS of the plane was out of order, no exact registrations of beach positions could be made.
Remote beaches were monitored on an irregular base by boat or foot in order to track nesting activities and count nests. A potential nesting beach approximately 5 km west of Samsambo was discovered and subsequently visited three times. Between Braamspunt and Matapica beach, Diana beach was monitored several times by STINASU members.

2.1.3. Additional observations

During the daily nest counts, the beaches were also checked for strandings - turtles that are drowned in a fishing net or killed otherwise and subsequently wash ashore. An estimate was made of the time the turtle had been dead and the cause of death.
Poaching activities were monitored by recording poached nests and by recording observed poaching. A poached nest can be recognised by footsteps, signs of probing with a probe stick and the small yolkless ('false') eggs of a clutch that are left just outside the nest hole, which is usually left open.
Illegal fishing activities by mostly Guyanese drift net fishing boats were recorded.

2.2 Measurements of body size (CCL/CCW)

Sea turtles are measured on nesting beaches in order to be able to relate body size to reproductive output, to determine minimum size at sexual maturity, and to monitor nesting female size for a particular rookery. The size frequency distribution of a population is an important parameter of that population's demographic structure.

Of leatherback females nesting at Samsambo, Baboensanti and Matapica, Curved Carapace Length (CCL) and Curved Carapace Width (CCW) were measured during nightly beach patrolling. Measurements were done with a flexible tape measure. CCL was measured alongside the vertebral ridge. CCW was measured at the widest point, spanning from ridge crest to ridge crest. Measurements were done at all stages of the nesting process.

2.3 PIT tagging of leatherbacks

PIT tagging can yield information on population size, internesting intervals, remigration intervals and nest site fidelity of females. In addition, growth rates and individual recruitment success of leatherback females can be determined. In a regional context, the major goal of PIT tagging is to estimate the rate of exchange of leatherback females between the different beaches in the region.

Passive Integrated Transponder or PIT tags are small inert microprocessors sealed in glass that can transmit a unique identification code to a hand-held reader. In the Guyana Shield region the TROVAN LID-500 is used. PIT tags are implemented in the right shoulder of the turtle. During nightly beach surveys, all leatherback females encountered were scanned with the PIT reader for PIT tags. If a PIT tag was already present, the number was recorded and if the turtle had no tag, a PIT tag was applied with a PIT implementor. Turtles were also checked for external flipper tags.

Most PIT tagging was done on Baboensanti at the beach sections PB-I and BS-I/II. Due to problems with - and shortage of PIT readers, on Samsambo and Matapica only small numbers of leatherbacks could be scanned and tagged. A total of 501 leatherbacks were scanned, and 390 new tags were applied. Leatherbacks were scanned during all stages of the nesting process because it didn't appear to disturb them in any way, but tagged only while they were in the last stage of digging the nest chamber, actually laying eggs or closing the nest.

2.4 Nest ecology

2.4.1 General

In the daily research area of Samsambo and Matapica all nests were marked at night during laying or the morning after. The research areas were marked by a transect line (TL). Numbered stakes were placed at 10 m or 20 m intervals along the TL. At Samsambo, the TL was situated at section Mid-II and part of West with a length of 1250 m and following the spring tide line (STL). At Matapica, the TL was situated at Bottom Section 3 and had a length of 1 km. Here, the TL followed the vegetation line, which is above the STL. The exact position of the nest related to the TL and nest location across the beach (related to the STL) were recorded. After hatching, these nests were marked again, as were nests outside the daily research areas. Incubation times were recorded. At Baboensanti, no nests were marked after laying but hatched nests were marked and excavated.
Along the transect lines, all nests were excavated three days after hatching in order to determine hatching- and emergence success and clutch size. Non emerged live hatchlings were released. Non-hatched eggs were opened in order to determine the fraction of undeveloped eggs, embryonic mortality and predation by mole cricket and ghost crab. For the leatherback, small, yolkless eggs (also known as "false eggs") were counted as well.
A fraction of the hatched nests outside the daily research areas was excavated in order to have a control group and overview of recruitment success along the different beaches and beach sections. Results on reproductive success and embryonic mortality are compared for the different beaches and beach sections.
In order to define better criteria for nest relocation, results are compared for the position of the nest across the beach, and to the fate of relocated nests.

2.4.2 Precipitation and sand temperatures

Sex determination of sea turtle hatchlings is highly determined by sand temperatures at nest depth. The pivotal temperature for leatherbacks is estimated at 29,5 ^{0}C (Mrosovsky *et al*.1984, Rimblot-Baly *et al*. 1987). At the pivotal temperature, 50% males and 50% females are produced per nest. The more the temperature rises above the pivotal temperature, increasingly more females are produced.
At Samsambo, 3 dataloggers for recording sand temperatures were placed at 60 cm depth, on the spring tide line, and 1 m and 2 m above the spring tide line. The datalogger data were processed by M. Godfrey in Paris and further presented by us in 3 day clusters.
Sand temperatures are partly determined by rainfall. Daily precipitation was measured on Samsambo and Matapica with a plastic cylindrical rain gauge.

2.4.3 Marking nests

In the daily research areas, nests were marked with a piece of driftwood on top of the actual nest chamber. A plastic flag was attached with Turtle Activity Date (TAD), species and PIT code (if present) written on it ("Outside Nest Tag"). A nest tag (ribbon or plastic flag) with the same information was put inside the nest, separated from the eggs by a layer of sand ("Inside Nest Tag"). Of all these nests, the distance across the beach, i.e., the distance from the nest to the Spring Tide Line (STL), and the exact location along the transect line were recorded. For both measurements, a plastic 30 m measuring tape was used.
If the exact nest position was not known (had not been observed during laying) probing was done very carefully the next morning with a probe stick. After probing, the nest was always dug for by hand to check if no eggs were broken. Broken eggs and eggs contaminated with egg yolk were removed to avoid rotting and increased predator attacks.

Nests located landward of the STL are referred to as: + STL
Nests located seaward of the STL are referred to as: - STL
So, -3 STL means that the nest is located 3 meters seaward perpendicular to the STL.
For each beach, the STL was determined by the highest deposition of driftwood.

Hatched nests were marked with a piece of driftwood with a washed-up bottle on top, with emergence date (ED) and species written on it.

2.4.4 Nest excavations

Hatched nests were excavated no earlier than 48 hours after first emergence in order to give non-hatched eggs a chance to hatch. Empty shells, small yolkless eggs, non-emerged hatchlings (alive and dead) and pipped hatchlings were counted. All non-hatched eggs were opened and the developmental stage of the embryo analysed. Egg damage by mole cricket (*Gryllotalpa sp., Scateriscus*) and predation by ghost crab (*Ocypode quadrata*) were recorded.

Non-hatched egg contents were divided into one of the following categories:

- Undeveloped: no embryo or blood spot visible, a clear distinction between egg white and yolk.
- Early embryo: blood spot to early embryo of about 3 mm with eyes. No body pigmentation present.
- Mid embryo: all embryos with body pigmentation with the size of approximately 3 mm to full term.
- Late embryo: full term embryo, ready to hatch.
- Unidentified rotten: the egg content was either dry or wet rotten and egg contents could not be identified to one of the other categories.
- Empty egg: no egg contents (not to be confused with empty shell, which means hatched egg).
- Damaged by mole cricket (for all above categories): presence of one or more small holes of diameter approximately 1-5 mm with notched edges.
- Predated by ghost crab (for all above categories): presence of torns and sharp, scissors-like cuts.
- Damaged by mole cricket and predated by ghost crab: presence of both above mentioned characteristics

Empty shells have been encountered which apparently had been ripped by ghost crabs. Because it appeared impossible to always clearly distinguish "Empty shell" (ES) which had produced a hatchling from "Predated empty" (PE), eggs of which the entire contents was eaten by presumably a ghost crab, these two categories were added. So, the category ES also includes PE. This means that hatching percentages, based on ES, may be over-estimated.

Hatching % = Empty Shells (ES+PE) / total number of eggs (empty shells + pipped eggs + all non hatched eggs; small yolkless eggs not included).

Records were made of embryo deformations, twinning and albinism.

Data were analysed using Excel (descriptive statistics) and SYSTAT for statistical tests. Data were tested for normality and subsequently a Kruskal-Wallis or Mann-Whitney U test was used.

2.4.5 Nest relocation

In 2000, relocation was done by Biotopic only on Matapica, in case of expected beach erosion or when nests were laid so close to the water line that they would be totally inundated during almost every high tide. All nests laid within the transect line area were left *in situ*, except for above mentioned nests. STINASU employees carried out nest relocations on the other beach sections.

Relocation was done within 12 hours of oviposition. The eggs were either caught during egg deposition or carefully dug up by hand afterwards. The eggs were placed in a plastic bucket and transported to either the hatchery or to a location higher up the beach. The hatchery was a plot high up the beach, next to the camp-site entrance and totally cleared from vegetation and roots. A new nest hole was dug by hand, with the bottom of the egg chamber at 80 cm depth following Schulz (1975). Eggs were carefully placed inside the nest with the small, yolkless eggs on top.

On Baboensanti, Oceanic Society volunteers have been relocating eggs to a hatchery. Many of these nests have been excavated by Biotopic for analyses of egg development.

Nests translocated to the hatchery are hereafter referred to as RELOCATED nests, nest translocated to a higher position on the beach as TRANSFERRED. Nests left *in situ* on the beach are referred to as NATURAL.

3. RESULTS

3.1 Monitoring nesting activities

3.1.1 *Dermochelys coriacea*

The estimated nest numbers were obtained after interpolation of actual nest count data, which showed several gaps. On Samsambo, a total of 1985 leatherback nests were estimated compared to over 4588 nests in 1999, 1500 in 1998, 400 in 1997 and 275 nests in 1995. A likely cause for this recent decline is the formation of extensive mudflats along the entire length of the beach, which make it hard for leatherbacks to actually reach the beach. Figure 1 shows the nesting activity pattern for the 2000 nesting season on Samsambo. The daily height of high tides is also presented, the spring tides (full moon and new moon) can be clearly distinguished. t is seen that a strong periodicity exists - in general, peaks of nesting are seen just before or during spring tides. When the tide is not high enough, leatherback turtles can not easily pass the mud flats. Only on BGW there is a steeper shelve, more surf and less influence of mudflats.

On the newly discovered beach "BGW-III" some 5 km west of Samsambo we estimated a total of 2200 leatherback nests.

On the Galibi beaches, hereafter grouped as "Baboensanti", a total of 7783 leatherback nests were estimated. This is an explosive increase compared to former years, e.g., 2000 nests in 1999, 1470 in 1998, 2516 nests in 1997 and 1176 nests in 1995 (Source: STINASU). Figure 2 shows the nesting activity pattern for 2000 on Baboensanti. The periodicity in nesting is not as strong as on Samsambo because of the nesting females are not hindered by large mudflats.

On Matapica, 1849 leatherback nests were counted in the period March to July (Source: STINASU). This number is yet incomplete. At Diana Beach and Katkreek area, situated a few km west of Matapica, 320 leatherback nests were found on only several occasions. It can be stated that real numbers for Matapica are significantly higher.

The number of leatherback (*Dermochelys coriacea*) nests laid in Suriname was estimated to be at least 14.100

3.1.2 *Chelonia mydas*

On Samsambo, 5 green turtle nests were recorded. In the area between Samsambo and BGW-III, another 16 were counted (source: Biotopic).
On the Galibi beaches, 2625 green turtle nests were recorded (source: STINASU) This is surely a large under-estimate because in almost the entire month of April, no regular monitoring took place while this month is a peak month for green turtle nesting.
At Matapica and surroundings, 1829 green turtle nests were recorded.

The number of green turtle (*Chelonia mydas)* nests laid in Suriname was estimated to be at least 4475.

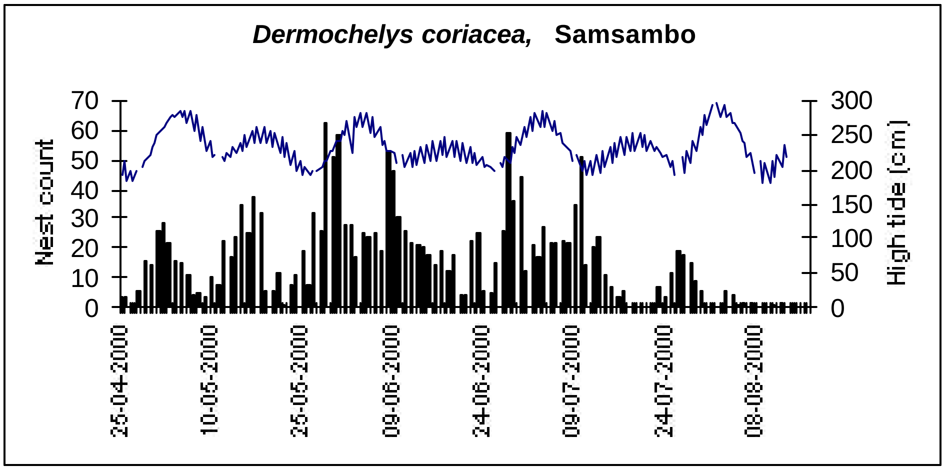

Fig.1: Leatherback nesting at Samsambo during the 2000 nesting season

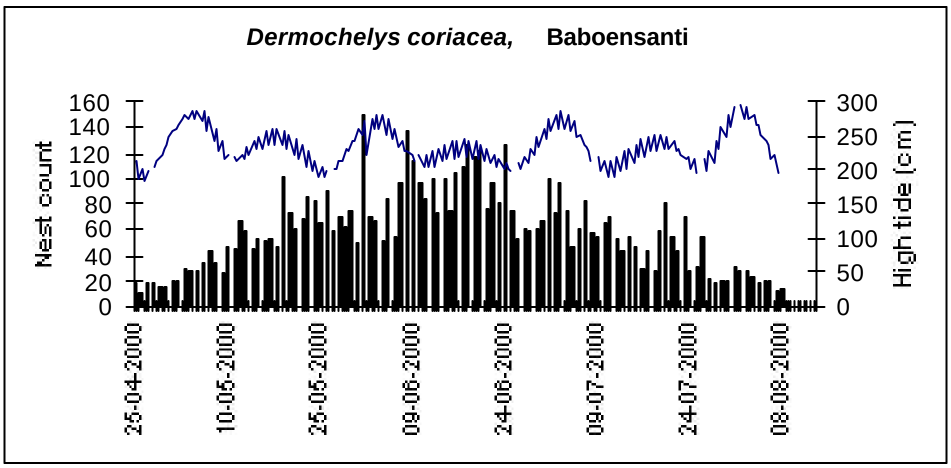

Fig. 2: Leatherback nesting at Baboensanti during the 2000 nesting season, data for April are missing

3.1.3 *Lepidochelys olivacea*

The number of olive ridley or *warana* nests recorded on Samsambo was 30. More than 60% of these nests was laid on section East.

On Baboensanti, this number was 18 (source: STINASU). Because Thomas section was only visited several times, and there are strong indications that most olive ridleys nest here, the real number may be much higher, probably even double (data may be incomplete).

On Matapica and surroundings, 61 olive ridleys were recorded (data may be incomplete).

The number of olive ridley (*Lepidochelys coriacea*) nests laid in Suriname was estimated to be at least 109.

3.1.4 General nesting features Samsambo and Galibi

From 1995 to 1999, only weekly or monthly nest counts were performed on Samsambo. In 2000, a camp was built on Samsambo by STINASU and for the first time more intensive monitoring was done. The beach was from east to west divided into 6 beach sections, all of approximately 1-1,5 km length.

At present, only leatherbacks visit Samsambo in significant numbers. However, when looking at overall numbers of olive ridley nests in Suriname, Samsambo takes an important place as well. The present importance of Samsambo for green turtles can be ignored.
Figure 3 shows the distribution of leatherback- and olive ridley nests over the different beach sections.

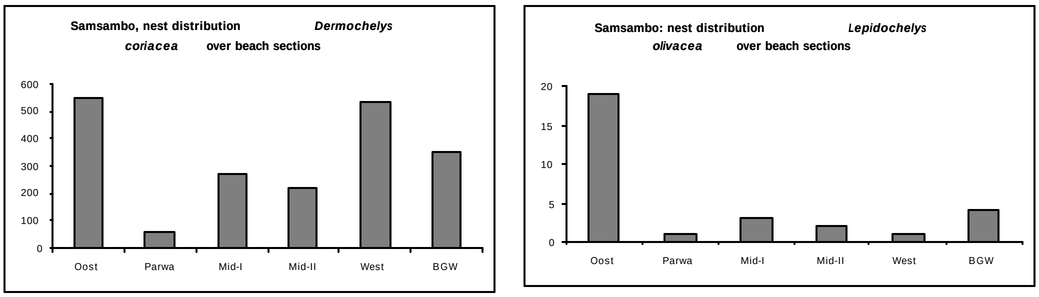

Fig. 3a&b: Nest distribution of leatherback nests (n=1985) and olive nests (n=30) over the 6 beach sections at Samsambo.

The mudflats formed an obstacle for leatherback females in reaching the beach. During the nesting season, 54 leatherbacks were observed to be stuck in the mud. Leatherback females got stuck generally after nesting, when the tide was already getting low at the moment they returned to sea. Only the period between one hour before and one hour after high tide, leatherback females could get over the mudflats. Although we first feared that these leatherbacks were lost and would die in the hot sun, we observed all of them to release themselves with the next high tide and swim away. There is no evidence that they still died afterwards. Over 50% of the turtles stuck were found in sections East and Mid-II. No turtles were observed to be stuck in front of BGW. The mudflats here were narrow and the shoreline was steeper.

At Samsambo, a total of 128 false crawls were counted during the nesting season. This is 6.4% of all leatherback nesting attempts on Samsambo. No significant difference exists for the fraction of false crawls between the beach sections.

3.1.5. Nest site selection: nest distribution related to the spring tide line

The distribution of leatherback nests across the beach is shown in figures 4 & 5. Of the leatherback nests laid on Samsambo, 20% is estimated to be on or below the spring tide line. This is low compared to values estimated for Matapica and Baboensanti (see below) and values found by Schulz (1975) on Bigisanti and Galibi.

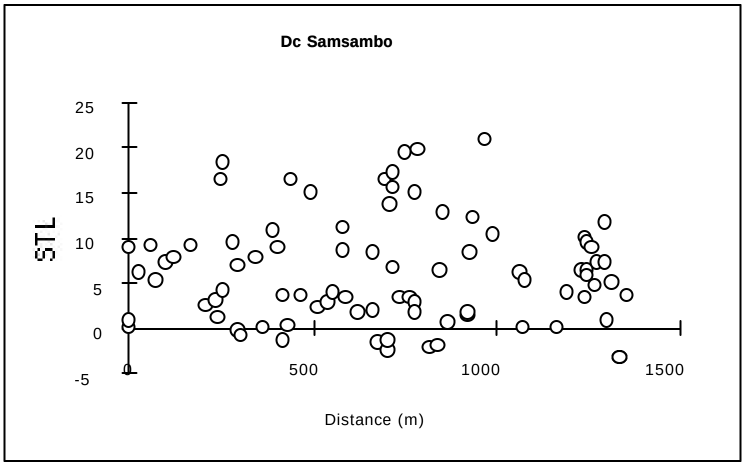

Fig.4: Scattering of leatherback nests across the beach along the transect line, estimated in metres from the spring tide line (STL): > 0 means landward from the STL, <0 means situated seaward from the STL. n=89. The x-axis represents the transect line.

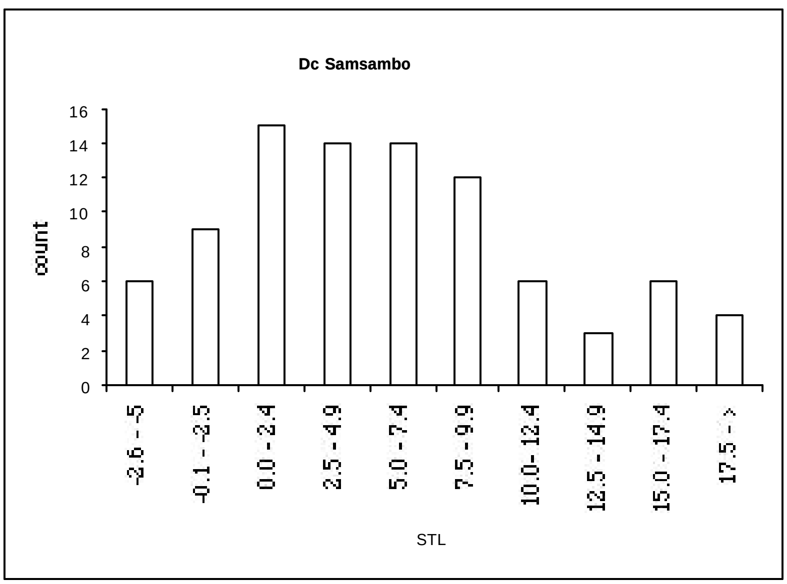

Fig.5: Frequency distribution of the distance from the spring tide line for leatherback nests along the transect line at Samsambo. n=89. The x-axis shows the distance from the STL

Figure 6 & 7 show the distribution of leatherback nests related to the spring tide line along the transect line at Matapica. The distribution of leatherback nests with regards to the distance from the nest to the spring tide line clearly differs from the distribution seen on Samsambo. At Matapica, approximately 84% of all leatherback nests are laid below the spring tide line.

7 Nests, or 13% of the leatherback nests laid within the transect line, were lost to the sea due to beach erosion. 6 of these nests were situated more than 13.5 m below the STL. This cannot be directly translated to the situation along the whole beach, because beach erosion is more severe on the eastern end of the beach where the transect line was situated.

For the 2000 nesting season, no STL-distribution of nests is available for Baboensanti.

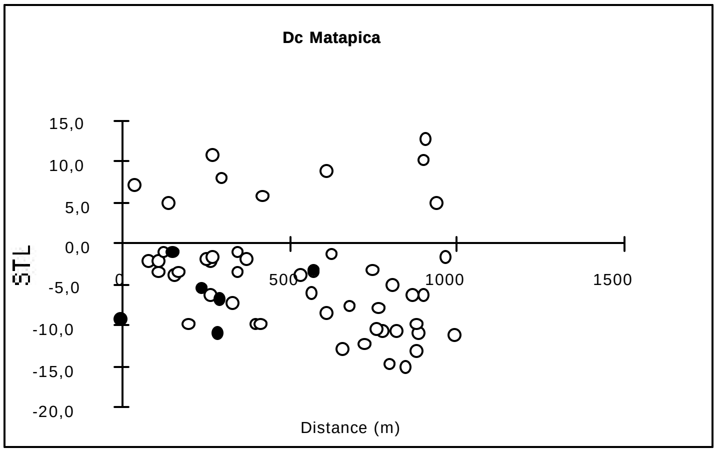

Fig.6: Scattering of leatherback nests across the beach along the transect line, estimated in metres from the spring tide line (STL): > 0 means landward from the STL, <0 means situated seaward from the STL. n=55. The x-axis represents the transect line.

Black dots indicate nests lost to the sea by beach erosion.

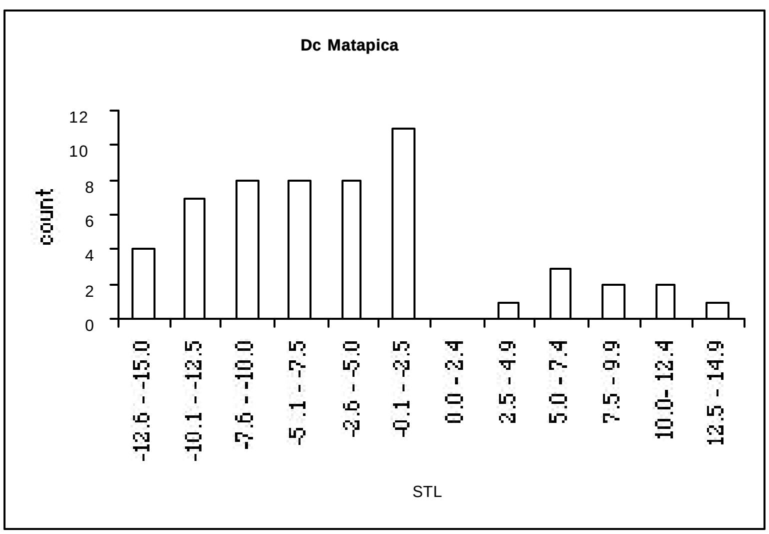

Fig. 7: Frequency distribution of the distance from the spring tide line for leatherback nests along the transect line at Matapica. n=55. The x-axis shows the distance from the STL

Green turtles generally nest above the spring tide line. However on Matapica, 19% of the green turtle nests along the transect line are laid below the spring tide line. Figure.8 & 9 show the nest distribution related to the STL along the transect line at Matapica. 9% of the green turtle nests were lost to the sea due to beach erosion. This can be explained by the fact that the majority of the nests were laid at the easternmost point of the transect line, where beach erosion was most severe.

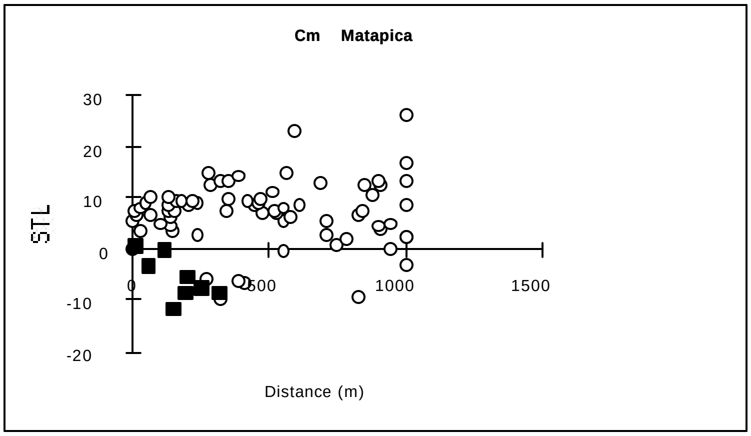

Fig.8: Scattering of green turtle nests across the beach along the transect line, estimated in metres from the spring tide line (STL): > 0 means landward from the STL, <0 means situated seaward from the STL. n=81. The x-axis represents the transect line.
Black dots indicate nests lost to the sea by beach erosion.

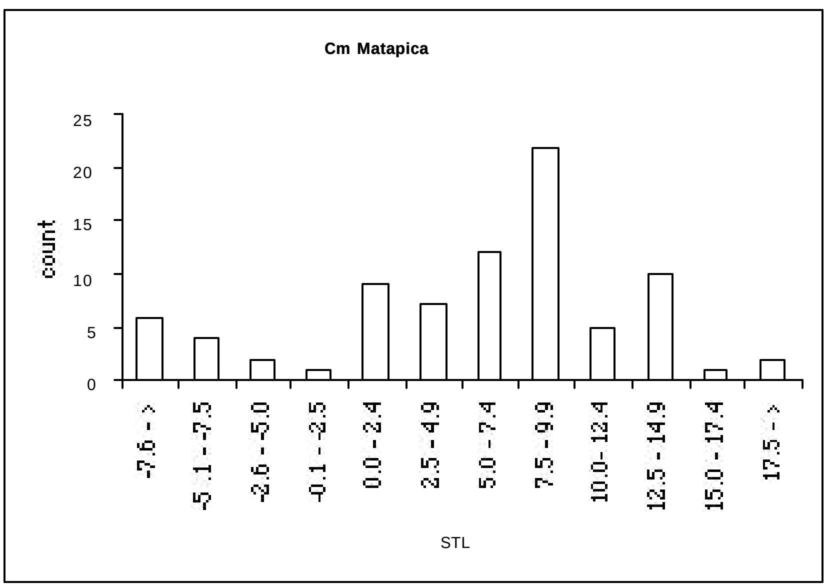

Fig. 9: Frequency distribution of the distance from the spring tide line for green turtle nests along the transect line at Matapica. n=81. The x-axis shows the distance from the STL

3.1.6. Commercial fishing activities, strandings

Fishing activities in front of the shoreline of Samsambo and Matapica were recorded. From April 24 to August 8, we observed 1 to 4 Guyanese boats on a daily base along the coast of Samsambo and on average 1 boat per week at Matapica. Distance from shore varied between 200 m and approximately 2.5 km. Boats tended to fish much closer to shore at Matapica than at Samsambo. At Matapica the slope of the shelve is much steeper and boats can at all tides fish close to the beach. In most cases these fishermen used driftnets with an estimated length of 1-2 km. Fishing activities were observed during both day and night. On 2 occasions, leatherbacks were observed to be entangled in a net.

During nightly beach patrolling, many leatherback females were encountered with large cuts, wounds or scars especially in the shoulders or arm pits. It can be assumed that these leatherbacks were cut out of fishing nets with a machete.

A total of (at least) 37 dead leatherback females washed ashore. We recorded 16 dead stranded leatherback females on Samsambo, 17 at Matapica and 4 at Baboensanti. One green turtle was stranded dead on Matapica. One loggerhead (*Caretta caretta*) was stranded at section east on Samsambo. Some of the dead turtles showed machete marks.

3.1.7 Egg poaching

At Samsambo large scale egg poaching took place at the two far sections of the beach, section East and BGW. Also the more remote beach BGW-III was subject to severe egg poaching. Poaching was observed on numerous occasions. Especially on section East systematic egg poaching took place and over 70% of all nests was poached, on BGW this was approximately 40%. Since 46% of all leatherback nests and 76% of all olive ridley nests were laid on sections East and BGW together, the impact of egg poaching was large. Of all leatherback nests laid on Samsambo alone, approximately 30% (595 nests, or 49.000 eggs) were poached.

Given the fact that 63.3% of all olive ridley nests on Samsambo (19 nests) was laid on section East, the large scale poaching on East is even more disastrous for the already highly endangered olive ridley population.

At Baboensanti, we regularly (weekly) observed poachers on section Thomas, where no regular beach patrolling took place. We know that numerous nests were poached on other beach sections as well but don't have the exact record.

3.1.8 Surveys and expeditions

For a selection of aerial survey photographs refer to Appendix 7.2. The aerial survey results are presented in separate report

Several promising new nesting beaches were found. Approximately 5 km west of Samsambo, a beach of approximately 2 km length was found. This beach was temporarily named: Buitengebied West-III or BGW-III. The beach is separated from section BGW at Samsambo by a stretch of mangroves and dead trees with a narrow, eroded sandy beach behind it which is totally inundated at all high tides. BGW-III has a wide (30-50 m) sandy beach platform. Behind the beach there is a swampy area with small pools where lots of birds can be observed. The beach is largely covered with driftwood.

BGW-III was visited 4 times, 3 times in May and once in August. An average of 46 newly laid leatherback nests were found on each occasion, and 160 nests in May alone for 3 visits. It is hard to extrapolate these data to an estimate of number of nests during the whole season. However, after statistical analyses, we consider it likely to assume that over 2200 (min. 1565, max. 2883) leatherback nests were laid on BGW-III. Based on our observations it can be assumed that the majority of these nests were poached (see section 3.1.7). Also during the aerial survey, on July 10, numerous leatherback nests were observed on this beach.
Although BGW-III seemed to be a growing beach, it was still largely inundated during high tides. In August we found a shallow sand bank in front of the beach separated from it by a small lagoon. No nests were observed on this bank, but it was likely that the bank was totally flooded during all high tides and therefore not used by turtles for nesting. Apparently leatherback females did not consider it an obstacle for visiting the actual beach behind it. The future development of BGW-III cannot easily be predicted. The beach has a high potential as a successful nesting beach and needs more intensive monitoring in 2001.

Diana beach and Katkreek, both situated between Braamspunt and Matapica, were monitored irregularly by STINASU members. On these few occasions, a total of 316 leatherback nests were counted. Furthermore, 235 green turtle nests were counted and 26 olive ridley nests. It may be assumed that real numbers are much higher and more intensive monitoring and protection is needed.

3.2 Measurements of body size

Curved Carapace Length (CCL) and Curved Carapace Width (CCW) were measured for nesting leatherback females on three beaches. Table 1 presents the results for CCL and CCW. Figure 10 shows the size frequency distributions for CCL on the three beaches. Although the mean CCL does not significantly differ for the different beaches, there seems to be a slight difference between the size-frequency distributions. This difference is however not significant. Also the mean CCW does not differ between the beaches.

	CCL	SD	min	max	CCW	SD	min	max
Samsambo	155.1 n=96	7.4	136	174	111.5 n=89	5.0	101	124
Baboensanti	154.2 n=400	7.5	122	178	112.3 n=367	4.9	99	124
Matapica	154.6 n=81	8.2	136	175	112.5 n=70	5.2	102	124

Table1: Mean CCL and CCW (expressed in cm) with standard deviation on the three Surinam beaches in 2000.

Table 2 shows a comparison of CCL found in Surinam in 2000 and CCL measured in French Guiana in 2000 and before. In 2000, CCL measured in Surinam and Yalimapo, French Guiana, are similar. For French Guiana in 1987-88 and 1977, SCL (straight carapace length) was measured instead of CCL. It can be assumed that SCL is smaller than CCL. Tucker & Frazer (1991) give a linear regression relating CCL measurements to SCL: CCL = 2.04 + 1.04 SCL. If this is used to roughly calculate CCL from SCL, CCL in French Guiana in 1987-88 would be 162.8 cm and CCL in French Guiana 1977, 175 cm. This is remarkably larger than CCL measured in 2000 in Surinam and French Guiana and may indicate that mean size, and thus age of nesting leatherback females, has decreased through the years.

	year	CCL	SCL	n
Surinam (Baboensanti), (Biotopic, 2000)	2000	154.2 ± 7.5		400
French Guiana (Yalimapo) (Godfrey, pers. comm.).	2000	156.2 ± 7.6		218
French Guiana (Yalimapo) (Girondot & Fretey, 1996)	1987-88		154.6 ± 8.9 (est.CCL: 163)	1328
French Guiana (Yalimapo) (Fretey, 1998)	1977		167 (est. CCL: 175)	834
French Guiana (Pritchard & Trebbau, in Tucker & Frazer 1991).	1984	158.5		-

Table 2: Indication of mean CCL or SCL for Surinam and French Guiana

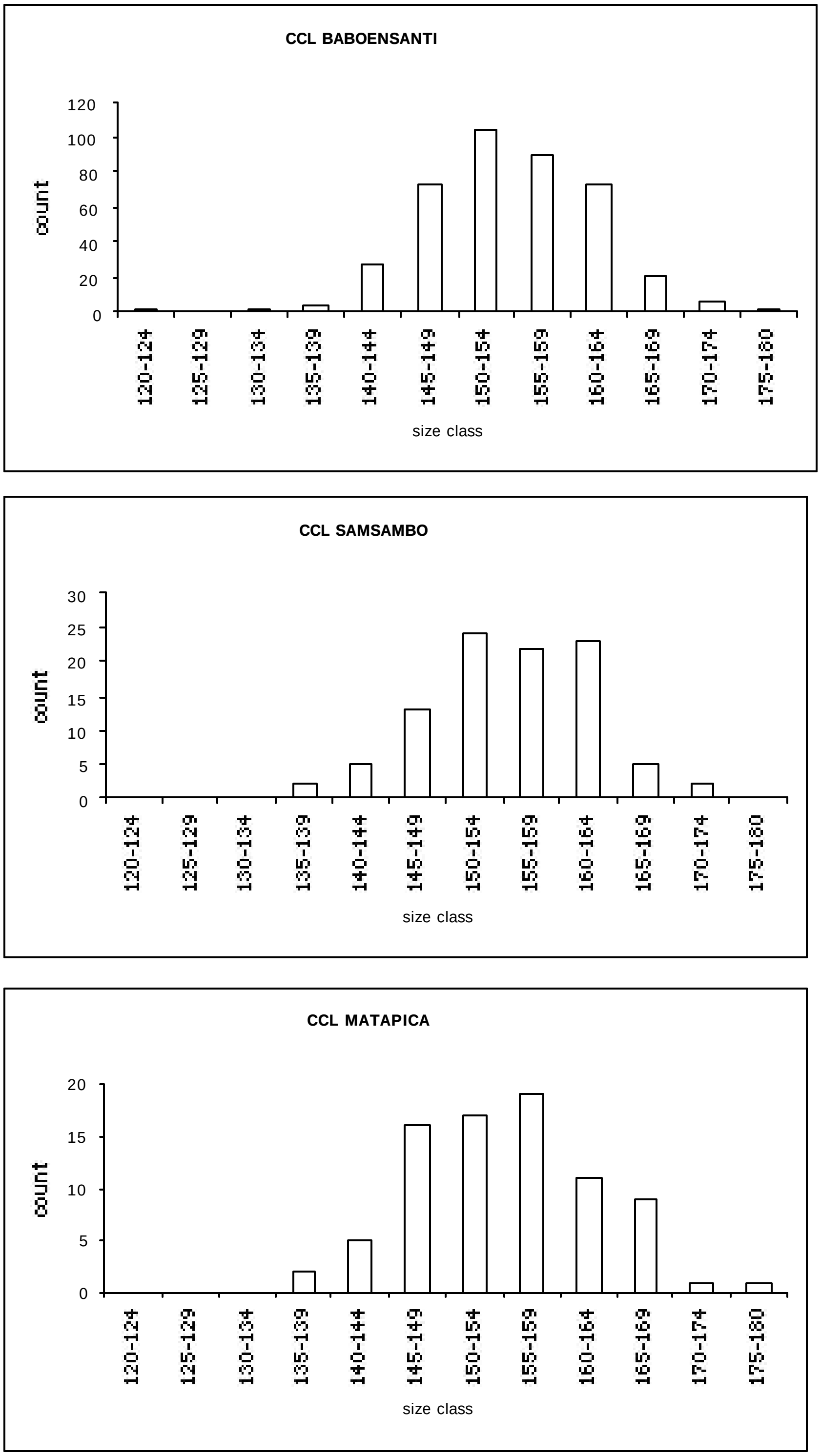

Fig: Size frequency distribution for CCL (cm) of leatherback females, measured at the geographically separated beaches Samsambo (n=96), Baboensanti (n=400) and Matapica (n=81).

3.3 PIT tagging

A total of 390 leatherback females were PIT tagged: 342 on Baboensanti, 28 on Samsambo and 20 on Matapica. Of these, 31 leatherbacks were recaptured one or more times (35 readings). One leatherback that had been tagged on Samsambo, PIT code 00-01E2-9874, was two months later encountered while nesting on Baboensanti. This indicates shifting of nesting beach within a nesting season in Suriname. Recapture data were not sufficient to elucidate behaviour within the nesting season, such as the mean number of nests per female, the mean number of days between two nestings and nesting beach fidelity within a nesting season.

Of the total of newly applied tags, 342 were applied on Baboensanti on the beach sections PB-I and BS-I. Tagging was done from May 1st to the end of July, with a few short interruptions. During this period, on these two beach sections together, an estimated number of 3000 nests was laid. If we assume a mean number of 7.5 nests per female within the nesting season (Girondot and Fretey 1996), we can assume that approximately 400 females nested on these beach sections. A fraction of these females was tagged in French Guiana, but still we can roughly estimate that 80% of the females that came to lay their eggs on Baboensanti, were PIT tagged. When looking at the total number of leatherback nests and thus nesting females for Suriname, however, this number is much smaller.

Of the 31 recaptured leatherback females, female 00-0125-7A2A was encountered 4 times. She was tagged on June 14 at Baboensanti, and seen again on July 8, July 23 and August 5.

We encountered 69 leatherbacks (76 readings) with PIT tags that had not been applied in Suriname. This is 15% of the scanned individuals (either tagged by us or elsewhere) that nested on the Suriname beaches. The far majority of these 69 leatherbacks had been tagged in French Guiana. However, for some of the codes the country of origin is still unclear.
When looking only at the so called "old tags" or recaptures (n=111), even 68% of the animals had been tagged elsewhere.

Some examples of shifting of nesting beaches between Surinam and French Guiana are presented in table 3. The table is based only on observations of French turtles recovered in Suriname, we have no data yet on Surinamese turtles recovered in French Guiana. It is observed that there is shifting within the nesting season but also over the years.

For a overview of all PIT codes applied and recovered in Suriname 2000/1999, refer to Appendix 7.4.

PIT tag number	Nesting dates in Surinam(data may be incomplete)	Nesting dates in French Guiana (data may be incomplete)
00-01CD-C0E8	12-5-2000	13-4-2000
	23-5-2000	
00-01CE-66EF	09-5-2000	20-6-2000
	04-7-2000	28-4-2000
00-01CF-1B5D	19-6-2000	3-6-2000
	10-7-2000	
00-01D9-1557	13-6-2000	23-7-2000
(=G48172/G46676/G4667#)		1998: 2X
		1994: 1X
00-01D9-1F09	10-7-2000	1998: 2X
00-01DF-038B	23-5-2000	20-6-2000
		19-4-2000
		1998: 3X
00-01DF-49A2	03-7-2000	1998: 1X
(=G35441/G48139/G42694/		1996: 3X
G46512)		1994: 4X
		1991: 2x
00-01DF-4AD2	18-6-2000	1998:1X
00-01FC-CC24	27-5-2000	1998:1X
00-05FD-DB4E	29-5-2000	10-5-2000
00-05FD-FF86	03-7-2000	18-6-2000
		17-6-2000
00-05FE-034B	11-7-2000	13-6-2000
		5-6-2000
00-05FE-047E	06-7-2000	20-7-2000
		13-6-2000
00-05FE-1B1F	03-7-2000	21-6-2000
00-05FE-2D0F	13-6-2000	5-6-2000
00-05FF-A144	03-7-2000	13-6-2000
		5-6-2000
00-0601-1CEA	13-6-2000	5-6-2000
00-0601-2B93	9-6-2000	9-5-2000
00-0601-3666	04-7-2000	6-6-2000
00-0601-3B6E	04-7-2000	13-6-2000
00-0601-4772	27-5-2000	9-6-2000
00-0601-54DE	11-7-2000	8-6-2000
		7-6-2000
00-0601-5FFB	30-5-2000	9-6-2000
		9-5-2000
00-0601-740D	20-5-2000	13-6-2000
		2-6-2000
00-01DC-F337	30-5-2000	20-6-2000
(=G42643/GG42644)		5-5-2000
		1996: 4x
		1994: 1x

Table 3: Examples of shifting of leatherback females between nesting beaches in Surinam and French Guiana

3.4 Nest ecology

3.4.1. Precipitation

Figure 11 presents the daily rainfall measured for Samsambo and Matapica during the nesting season. Several data are missing. A total of 602 mm was recorded for Samsambo and 533 mm for Matapica.

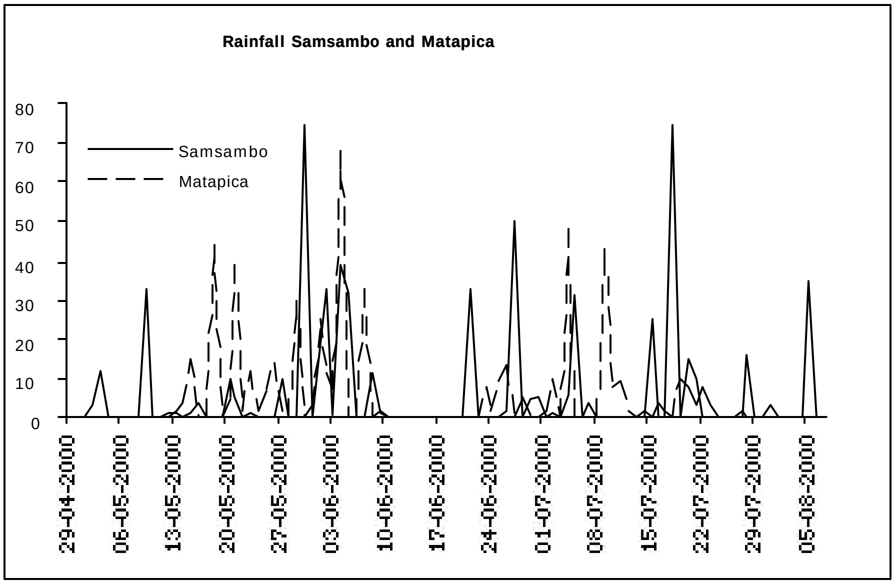

Fig. 11: Daily measured precipitation during the nesting season.

3.4.2. Sand temperatures

Figure 12 presents sand temperatures measured on Samsambo at three different distances to the spring tide line: 0 STL (temp 1), +1 STL (temp 2) and +2 STL (temp 3).

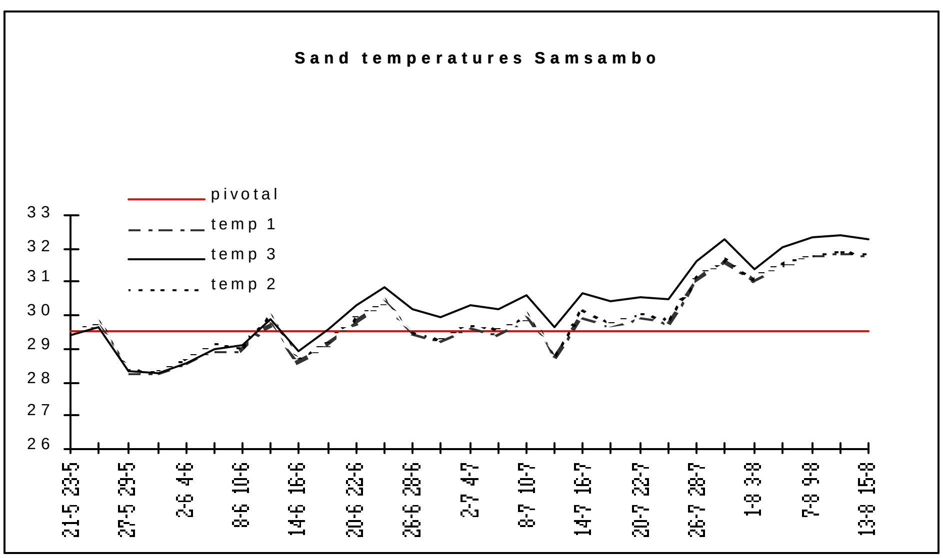

Fig. 12: Sand temperatures (^oC) averaged per 3-day cluster for Samsambo, depth 60 cm.

It is seen that from mid June onwards, the sand temperature at nest depth is above the pivotal temperature for leatherbacks. The critical period for sex determination with incubating leatherback eggs lays between day 20 and day 40. When not taking metabolical warming of the incubating egg clutch into account, it can be stated that for Samsambo, only nests laid before half May would produce predominantly males. Nest laid hereafter will have produced increasingly more females.

Sand temperatures are highly determined by rainfall. The first half of the nesting season was exceedingly wet. Datalogger 3 was buried higher above the spring tide line than 1 and 2 who were buried on 0 and 1 m above the spring tide line. It is seen that when rain is of less influence on the sand temperatures (because the air temperatures rise, the weather is sunny and thus more evaporation occurs), the sand temperatures measured by datalogger 3 (2m above the STL) rise more than temperature measured by the two other data loggers. This can be explained by the influence of the high tides and wave action on dataloggers 1 and 2.

3.4.3 Clutch size

Clutch size, or number of eggs per nest, varied between the beaches. For leatherbacks mean clutch size was 84.3 ± 17.9 on Samsambo (n=216) and 82.8 ± 15.6 on (n=107) Matapica, but the difference was not significant (t-test for pooled variances, p=0.549). On Baboensanti, mean clutch size for Dc was higher, 92 ± 21.1 eggs (n=27). This difference was not significant, but this may be due to the small sample size at Baboensanti.

For green turtles, on Baboensanti mean clutch size was 102 ± 37.4 (n=17) and on Matapica 121 ± 24.6 (n=44). No data are available for Samsambo because numbers were too low.

For the olive ridley only few nests were excavated. Mean clutch size was 119 ± SD 26.9 (n=2) eggs on Baboensanti and 125 ± 28.8 (n=6) on Matapica

The number of yolkless eggs (or *false eggs*) per leatherback clutch does not differ between the beaches. On Samsambo, the mean number of yolkless eggs per leatherback clutch was 27.1 ± 18. On Matapica this was 28.3 ± 14.5 and on Baboensanti 27.1 ± 18.6.

3.4.4 Incubation periods

Incubation times are known only for natural nests at Samsambo (Dc) and Matapica (Dc and Cm); and for transferred and relocated nests at Matapica. Incubation time is defined as the number of days between egg laying and hatchling emergence on the beach surface. Incubation time is correlated to nest- and sand temperature, and is thus also relevant for sex ratio determination.

Incubation intervals differed significantly for natural nests at Samsambo and Matapica. For leatherbacks on Samsambo, mean incubation time was 61.1 ± 2.1 days, while this was 65.5 ± 3.1 days on Matapica. The incubation interval is significantly higher (Mann-Whitney U test, p=0.000) at Matapica than at Samsambo.

On Matapica, furthermore, a significant difference (Mann-Whitney U, p=0.041) exists between leatherback nests situated above and nests below the STL. Nests below the STL take longer to hatch than nests above the STL (67 and 64 days respectively). At Matapica, no significant differences were found between nests in the hatchery, nests transferred to a higher position on the beach and natural nests.

Mean incubation time for natural green turtle nests at Matapica was 58.4 ± 2.2 days.

Figure 13 presents the frequency distribution for incubation times at Samsambo and Matapica for *Dermochelys coriacea*. It is seen that, not only for the mean value but also the frequency distribution, a difference exists between Samsambo and Matapica.

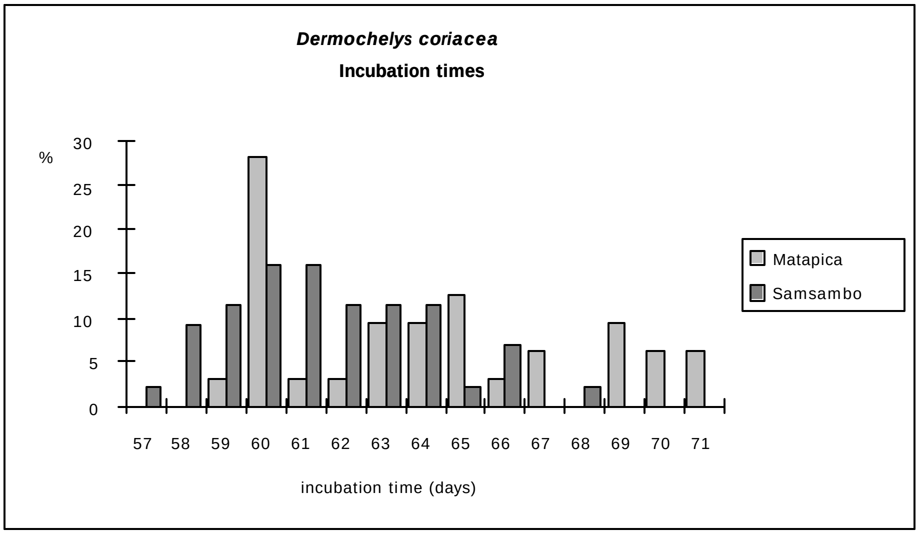

Fig. 13: Frequency distribution of incubation times for leatherback nests at Samsambo and Matapica.

3.4.5 Hatching success and egg development

Hatching success for natural nests (nests left *in situ*), relocated nests and transferred nests is shown in table 4. For natural nests, a distinction is made between overall H% on the beach, and nests above and below the spring tide line (STL). Nests with 0-emergence were not included in the hatching percentage. At Samsambo in the transect line, 9 nests did not hatch, this is 9% of the total number of nests (n=97). At Matapica in the transect line, 4 nests did not hatch, this is 9% of the total number of nests (n=43). For Baboensanti, we have no data on the percentage of nests that did not hatch. For comparisons between H% above and below the STL, for Samsambo only the nests in the transect line were used, whereas for Matapica, marked nests in the transect line and in Top Section 4 were used.

H%	Samsambo	Matapica	Baboensanti
Dc natural overall	41.2 ± 22.3 (n=202)	44.7 ± 22.8 (n=65)	34.8 ± 19.2 (n=27)
Dc natural above STL	43.3 ± 24.0 (n=83)	49.0 ± 21.8 (n=31)	38.3 ± 22.3 (n=10)
Dc natural below STL	10.2 ± 13.0 (n=5)	39.7 ± 23.5 (n=31)	33.6 ± 17.7 (n=16)
Dc hatchery	-	38.7 ± 24.9 (n=15)	40.8 ± 21.4 (n=43)
Dc transferred	-	20.2 ± 12.8 (n=69)	-
Cm natural overall	-	85.5 ±14.7 (n=44)	84.1 ± 14.5 (n=17)
Cm hatchery	-	66.9 ± 13.2 (n=6)	72.9 ± 11.1 (n=4)
Cm transferred	-	69.9 ± 17.7 (n=11)	-
Lo natural	56.5 ± 0.7 (n=2)	76.9 ± 3.7 (n=2)	66.2 ± 31.4 (n=2)
Lo hatchery	-	28.4 (n=1)	-
Lo transferred	-	70.2 ± 23.6 (n=3)	-

Table 4: Mean hatching percentage with standard deviation for Dc, Cm and Lo on the three beaches.

For the leatherback, mean overall hatching success of natural nests is highest at Matapica with 44.7%, whereas based on the transect line data, it was estimated that 9% of the nests did not hatch. At Samsambo, mean H% is 41.2, it was estimated that 9% of the nests did not hatch. For Baboensanti, we have no data on the number of nests that did not hatch, but the mean overall H% for Dc was 34.8.

When comparing hatching success for nests laid above and below the spring tide line, the results of the different beaches can not simply be compared or translated from one beach to another due to the different beach characteristics and morphology.

As can be seen in section 3.1.5., at Samsambo 20% of all nests is estimated to be laid on or below the spring tide line. At Matapica, this is 84%. For Matapica, mean H% for leatherback nests below the STL is 39.7%, versus 49.0% above the STL. Although H% below the STL is somewhat lower, this difference is not significant and we have no indication that the nests laid up to 7 m below the STL are doomed. Only nests laid right below a flood cliff or at the eastern erosion point can be considered doomed.

At Samsambo, however, mean H% below the STL is significantly lower than for nests above the STL (10.2% and 43.3% respectively), which is in large part due to the shape and characteristics of the beach.

At Baboensanti mean hatching success for nests below the STL was lower (33.6%) than for nests above the STL (38.3%) but the difference is not significant. Two nests were excavated which were 3 and 4 m below the STL. These nests had a hatching success of 38.8% and 37.8% respectively, which, together with data from 1998, forms a clear indication that nests further than 2 m below the STL are not per definition doomed.

The overall hatching success of natural nests of *Chelonia mydas* is 85.5% at Matapica and 84.1% at Baboensanti. Because most green turtles nest right up against the vegetation and thus above the STL, no data are available for nests laid below the STL.

Figure 14 shows the hatching success and developmental stages of non-hatched leatherback eggs at the different beach sections at Samsambo. No significant differences were found for any of the categories between the beach sections. Mean overall hatching success was 41.2 ± 22.3%. The overall mean percentage of undeveloped eggs per nests is 16.4 ± 16.3, overall mean embryonic mortality per nest is 8.3 ± 9.2 and mean fraction of predated (ruptured) eggs per nest was 29.9 ± 16.6%. Predation on eggs is done by mole cricket and ghost crab. A mean of 3.6 ± 5.1% of the non-hatched eggs content was classified as unidentified rotten.

Figure 15 gives an overview of embryonic mortality in leatherback nests on Samsambo. The fraction of late embryos is remarkably higher at section east than in the other section. This may be due to the fact that nests laid at section East are more often washed over. Full term, ready to hatch hatchlings need more oxygen and thus regular inundation may be lethal.

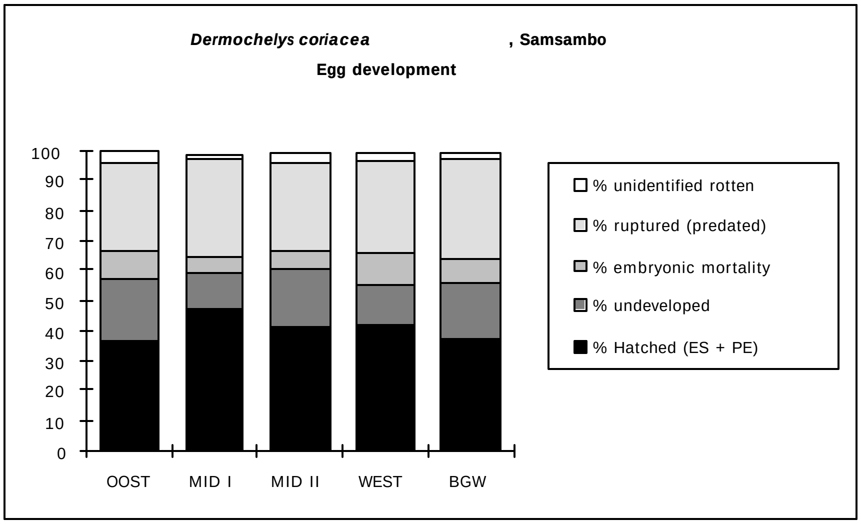

Fig. 14: Comparison of egg development between the different beach sections at Samsambo

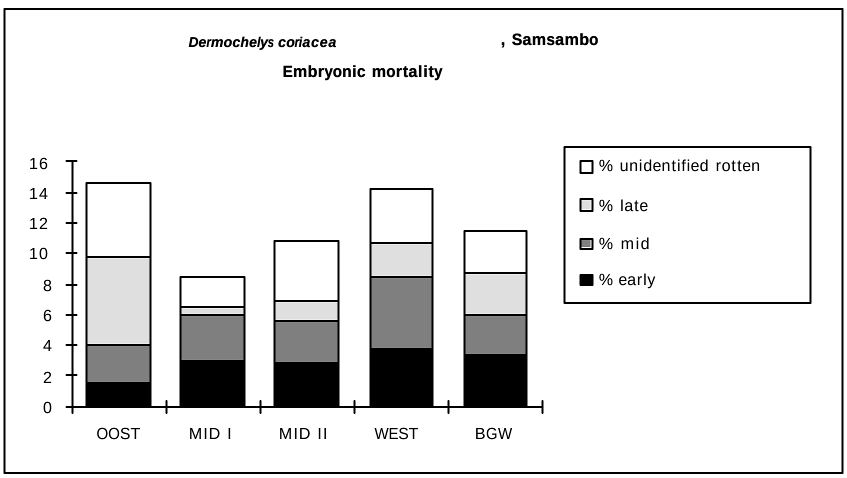

Fig. 15: Embryonic mortality, divided into mid, early, late and decomposed stages of non-hatched leatherback eggs for the different beach sections at Samsambo

Figure 16 shows egg development of nests laid above and below the STL at Samsambo and Matapica. On Samsambo, hatching percentage is significantly lower below the STL than above the STL, 10.2% and 43.3% respectively (Mann Whitney U, p=0.001). Predation is also significantly higher below the STL than above, 46% and 27% respectively (Mann Whitney U, p=0.005).

On Matapica, there is no significant difference in hatching success between nests below and above the STL (39.7% and 49.0% respectively). Like on Samsambo, predation is higher in nests below the STL than nests above the STL, 29% and 19% respectively (Mann Whitney U, p=0.034).

Embryonic mortality for nests laid above and below the STL is shown in figure 17. Embryonic mortality is significantly higher for nests below the STL (14%) than for nests above the STL (7%) (Mann-Whitney U, p= 0.034). This is mainly due to differences in the 'late embryo" category. Mortality of late embryos above the STL is significantly higher (8%) than below the STL (3%) (Mann-Whitney u, p=0.01).

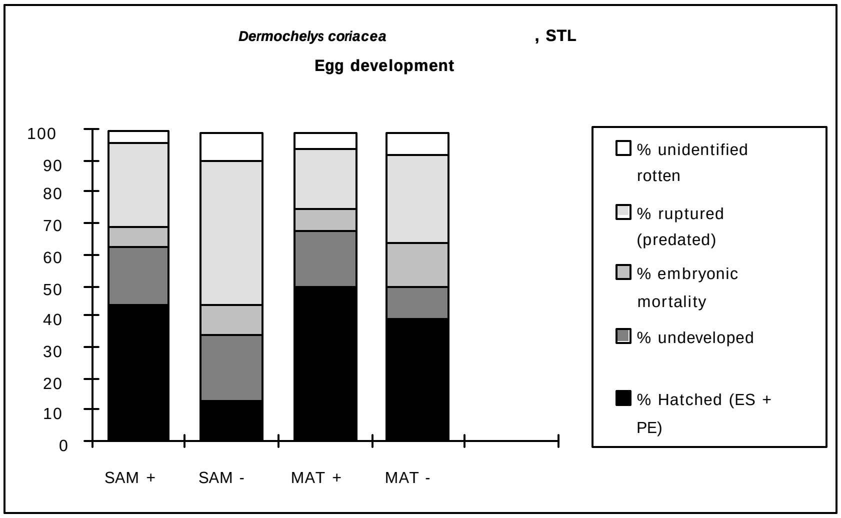

Fig. 16: Comparison of egg development between nests laid below (-) and above (+) the STL at Samsambo and Matapica

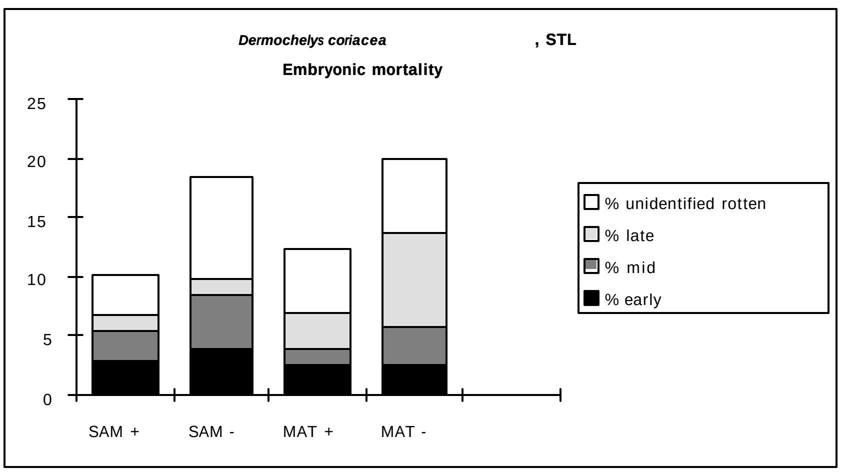

Fig. 17: Embryonic mortality, divided into mid, early, late and decomposed stages of non-hatched leatherback eggs laid below (-) and above (+) the STL at Samsambo and Matapica.

3.4.6 Nest relocation

In 2000, relocation of nests in case of expected inundation was not done in the research areas on Samsambo and Matapica. It was decided to leave the nests *in situ* in order to get an insight in the viability of nests laid below the STL (see above).
To compare the different techniques of nest relocation, only nests that were under severe threat of being washed away completely were used. This threat was present only on Matapica. Because of this, the relocation research was done only on that beach.

Figure 18 shows egg development for natural, transferred and relocated nests at Matapica. Transferred nests show a lower hatching success than nests from the hatchery or natural nests, 20% as opposed to 38% and 40% respectively. Statistical analysis shows this difference to be highly significant (Kruskal-Wallis (K&W), p = 0.000, 2df).

Hatchery nests have a higher percentage of undeveloped eggs than the natural and transferred nests, 40%, 15% and 16% respectively. Statistical analysis shows this difference to be highly significant. (K&W p=0.000, 2df)

In the category predation, the hatchery nests show the lowest, natural nests intermediate and the transferred nests the highest percentage, 11%, 23% and 48% respectively. Differences between the three categories are highly significant. (K&W, p=0.000, 2df)

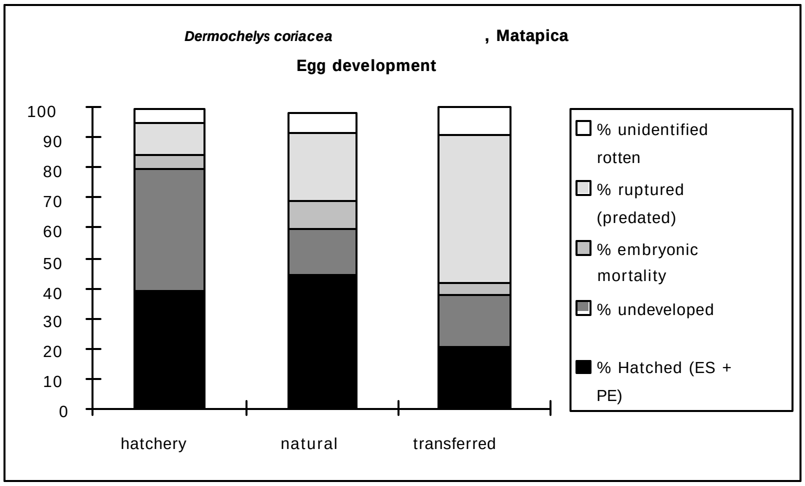

Fig. 18: Comparison of egg development between natural nests, nests transferred to a position higher on the beach, and nests relocated to a hatchery at Matapica.

The category embryonic mortality, as shown in figure 19 did not show any significant differences (K&W, p=0.259, 2df) but within this category the percentage of late embryos was significantly higher in natural nests than in transferred or hatchery nests, 1.7% and 1% respectively as opposed to 4.5% for natural nests (K&W, p=0.018, 2df).

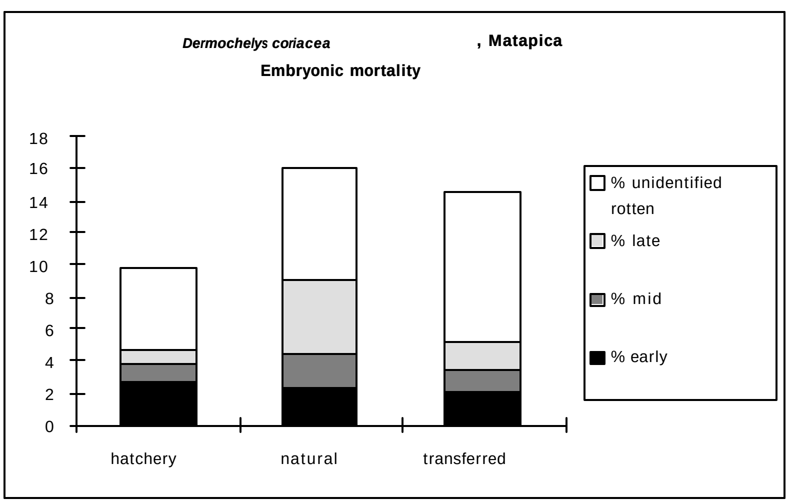

Fig. 19: Embryonic mortality, divided into mid, early, late and decomposed stages of non-hatched leatherback eggs laid below (-) and above (+) the STL at Samsambo and Matapica.

3.4.7 Twinning, albinism and embryonic deformaties

During nest excavations, we encountered several deformed embryos. Embryonic deformities vary from albinism, twinning, lack of eyes, nostrils, egg tooth, jaws or even lack of the entire head, to a combination of these categories. In most cases, albinos are found in the late "mid" or "late" category, they are (nearly) full term, mostly still alive embryos. They seldomly hatch, because of lack of the egg tooth, their deformaties or lack of strength. Twinning was observed on several occasions. In most cases the embryos shared one yolk sack. Twin composition varied between a late and a mid embryo, two late embryos, two mid embryos and a mid, late or early embryo with another early embryo. On two occasions, twins with one yolk sack each were found. Table 5 & 6 give an overview of observed deformities found during the 2000 nesting season.

Dermochelys coriacea	**Total % clutches with deformed embryos**	**%clutches with twins**	**%clutches with albinos**	**remarks**
Samsambo				
natural (n=202)	5.4% (n=11)	4% (n=8)	0.5% (n=1)	7 clutches with 1 egg with twins; 1 clutch with 3 eggs with twins
Matapica				
natural (n=69)	7.2% (n=5)	1.4% (n=1)	2.9% (n=2)	albinos heavily deformed
transferred (n=69)	4.3% (n=3)	1.4% (n=1)	2.9% (n=2)	
hatchery (n=15)	0	0	0	
Baboensanti				
natural (n=27)	7% (n=2)	7% (n=2)	0	
hatchery (n=46)	6.5% (n=3)	2.2% (n=1)	2.2% (n=1)	

Table 5: embryonic deformaties observed in leatherback clutches

Chelonia mydas	**total % clutches with deformed embryos**	**%clutches with twins**	**%clutches with albinos**	**remarks**
Matapica				hatchery: 2 eggs with 2 or 3 albinos, and 1 egg with albino twins
natural (n=98)	10.2% (n=10)	1% (n=1)	9.2% (n=9)	
transferred (n=11)	45.5% (n=5)	0	3% (n=3)	
hatchery (n=6)	83% (n=5)	1.7% (n=1)	1.7% (n=1)	
Baboensanti				
natural (n=17)	0	0	0	
hatchery (n=4)	50% (n=2)	0	50% (n=2)	

Table 6: embryonic deformities observed in green turtle clutches

4. Discussion

4.1 Status of nesting sea turtle populations and suitability of beaches

Figure 20 shows the estimated nest numbers for leatherback-, green and olive ridley turtles from 1970 to 2000. Data are from Schulz, STINASU, Biotopic, the French Kawana team and Université Paris. The number of leatherback nests on the Surinam beaches has increased significantly in 1999 (7000 nests) and 2000 (14.100 nests) when compared to the period 1993 - 1998. However, whereas in 1999 Samsambo attracted the highest numbers of leatherback nests, in 2000 this was Galibi/Baboensanti. Present numbers for Suriname are comparable to those found in French Guiana. When looking at the entire period 1970 - 2000, however, it is seen that nesting peaks occur every few years. It has to be awaited whether the increase will continue or numbers will drop again. The recent high numbers may be recruitment of young adults from either Suriname or French Guiana, rather than a result of adults shifting nesting beaches. Given the high rate of exchange between the beaches on the French and the Surinamese side of the Marowijne river, as was shown by this years PIT tag data (see section.4.3), it can be assumed that we are dealing with one large population for the Marowijne estuary rather than two separate ones.

The green turtle population appears to be stable. The number of nests counted in 2000 (4475) is likely to be an under-estimate and does not per definition mean a decline in numbers compared to 1999. Green turtles nested in high numbers on the Galibi beaches and Matapica, but not on Samsambo. However, some green turtle nesting activity was found in the area westward of Samsambo. This is however not a suitable nesting area because it is inundated at all high tides and mangrove roots and dead mangrove trees form an obstacle for nesting turtles.

The olive ridley population has decreased dramatically since 1970 and kept on doing so in 2000, with a total nest count of 109 nests, spread over Matapica and the former Eilanti area. It is remarkable that on Galibi and Samsambo, the majority of nests was found in this former Eilanti area. These are section Thomas at the Galibi beaches and section East on Samsambo. Over 50% of all olive ridley nests was found on Matapica.

Figure 21 shows the leatherback nest distribution for the period 1997-2000 in Suriname over the 3 beaches Galibi, Samsambo and Matapica. A clear shift as compared to 1999 can be seen in 2000 from Samsambo as the main nesting beach to the Galibi beaches (mainly PB-I-II & BSI-II). Also Matapica shows an increase in leatherback nests. However, as the new beach BGW-III attracted similar nest numbers as Samsambo and Matapica, the picture is not complete. The cause of the decline in nest numbers on Samsambo is likely due to the extensive mudflats that has formed along the entire length of the beach. The mudflats had a width of 200-400 m and were totally exposed during low tides. It is expected that these mudflats will shift westwards. However, if the mudflats shift westwards they no longer protect the beach from wave action, which may result in beach erosion on the eastern side (Augustinus 1978). The beach may start moving in a westerly direction like Matapica. Matapica has attracted higher numbers of nesting sea turtles than in previous years. Nests laid on the easternmost 2 km of the beach are generally lost due to beach erosion, but in these sections, nest density is lower than in the other beach sections.

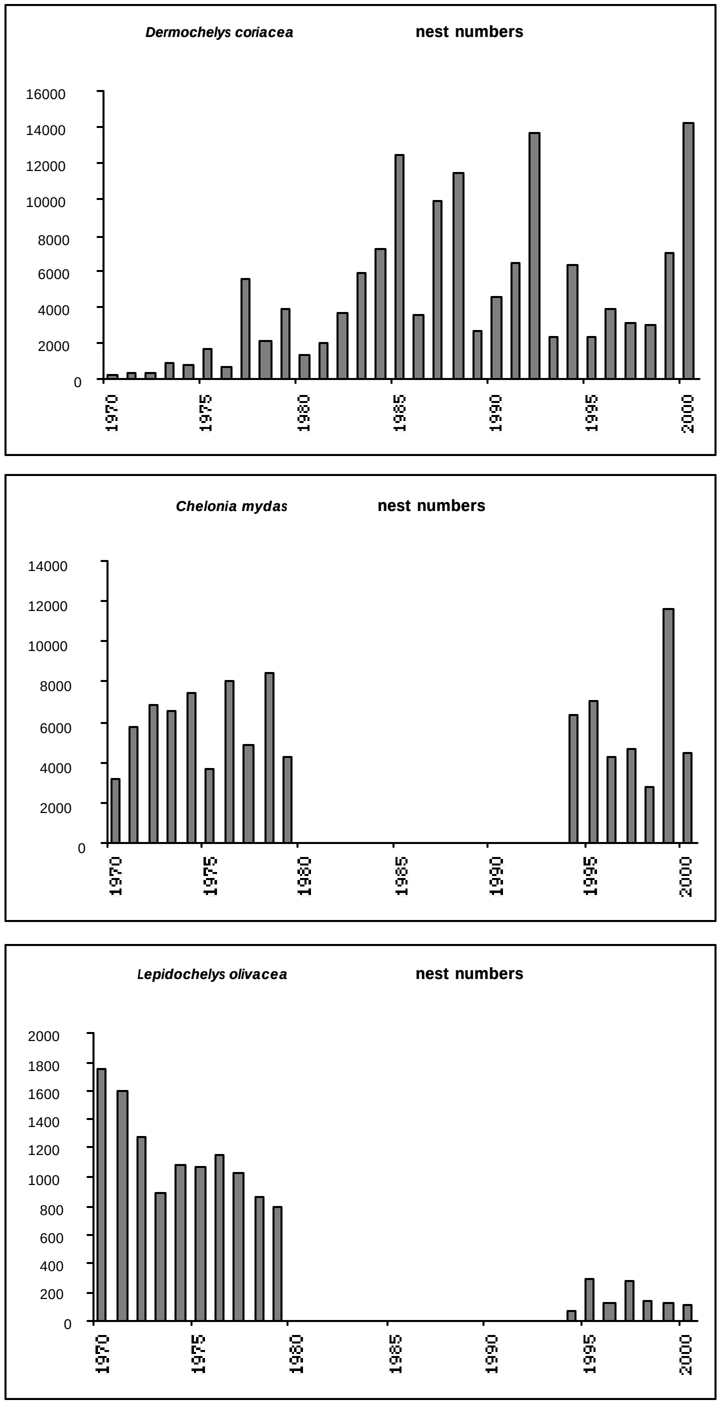

Fig. 20: Estimated number of nests laid in Suriname for the leatherback, green turtle and olive ridley turtle from 1970 to 2000. For the leatherback, data are from STINASU, Biotopic, the French Kawana team and Université Paris. For 1979-83 and 1990-94 data are absent or incomplete and interpolations based on nest numbers in French Guiana were used. For the green turtle and olive ridley, we do not have the data for the period 1980 - 1993.

The new beach "BGW-III", few km west of Samsambo, is a very promising nesting beach. More than 2000 leatherback nests were estimated here; which is approximately the same nest number as found on Samsambo and Matapica. The beach was not yet a stable beach, but may well develop into a suitable leatherback nesting beach like Samsambo has done for the past few years also. This years data also confirm again that leatherbacks are the first turtles to exploit newly created beaches, as was described by Pritchard (1973). Because at BGW-III all nests were doomed, BGW-III did not (yet) add to the reproductive success of the population.

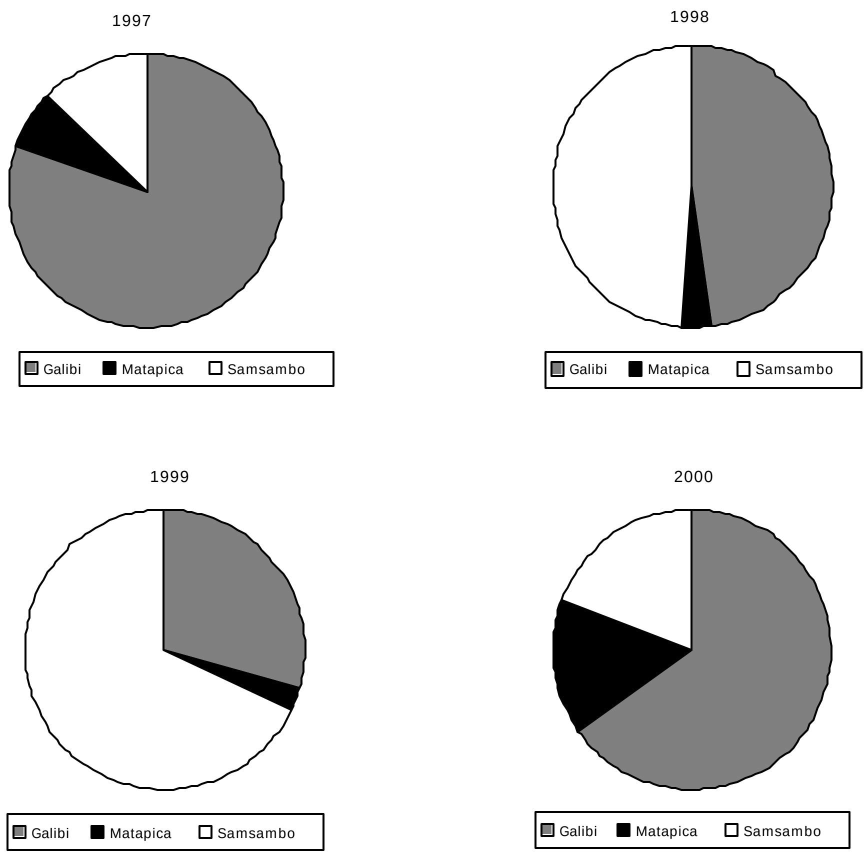

Fig. 21: Fraction of leatherback nests laid on Matapica, Galibi and Samsambo for 1997-2000.

4.2 Threats facing nesting sea turtle populations

In the Regional Sea Turtle Conservation Program and Action Plan for the Guianas (Reichart *et al*. 2000), a distinction is made between natural threats and man-induced threats. Beach erosion, entanglement in prop roots of mangroves and getting stuck in mud flats, straying into inland swamps and predation by jaguars are mentioned as the main natural threats, whereas egg poaching, feral dogs and disturbance by tourists are referred to as the main man-induced threats.

In 2000 we identified egg poaching, coastal fisheries and beach erosion as the main threats for the sea turtle populations nesting in Suriname. Egg poaching is a problem mainly on the Galibi beaches and Samsambo, especially on the more remote beach sections such as section East and BGW on Samsambo, and section Thomas and PB-II on Baboensanti. Eggs of all species are wanted, but the olive ridley eggs apparently are favourite. Because the olive ridleys predominantly nest on the more remote beach sections of Baboensanti and Samsambo, more than 50% of the nests of this already highly endangered population is being poached. However, at Samsambo, on the beach sections that could be overlooked from the campsite, no or very little poaching took place, showing the importance of the permanent presence of either researchers or STINASU personnel on the beach.

The high number of strandings and turtles with machete marks found on the Surinam beaches may well be a result of the coastal fisheries, that are dominated by Guyanese vessels. Results of a study by J. Chevalier (2000) show that there is a high mortality amongst leatherback turtles caused by fisheries in the Marowijne estuary region. Further study on causes of death of stranded turtles is needed but our data may support the findings of J. Chevalier. Tourism on the Surinam beaches is small-scale and well managed. Tourist activities so far form no threat to the nesting sea turtle populations.

It has become clear that potential natural threats such as the mudflats and mangrove roots form no significant threat to the nesting sea turtle populations in Suriname. Beach erosion causes the loss of nests at the eastern side of Matapica and occasionally on other beaches. Seen on a national scale the number of nests lost by beach erosion is however only a fraction of the total number of nests. From a conservation point of view it is therefore recommended to focus on measures that mitigate egg poaching and coastal fisheries.

4.3 PIT tagging and body size measurements

In 2000, we tagged 390 turtles. This is considerably more than in 1999, and we estimate that by the end of the nesting season, approximately 80% of the nesting females on Baboensanti was tagged. However, with our small team and lack of sufficient equipment, the chance that a certain female was encountered several times was minimal. Therefor we could not estimate the mean number of nests per female within the nesting season and the mean number of days between two nestings. PIT tag recapture data show that there is a high level of exchange of nesting leatherback females between the French and Surinamese nesting beaches. This is an indication that we are dealing with one large population rather than two separate ones. Therefor we can safely assume that demographic data, such as internesting intervals (9 to 10 days) and number of nests per female (7.52), found in French Guiana (Girondot and Fretey 1996) are also applicable to the situation in Surinam.

Shifting of nesting beach in the Guianas is a frequent event, as our PIT data have shown. This is contrary to the information available in 1996 (Girondot and Fretey), but this may be partly explained by the fact that in that period, predominantly titanium tags were used, which are lost very easily. Schulz (1971) and Pritchard (1973), however, also found some evidence that leatherbacks migrate between distant nesting beaches in the Guianas, and are the first turtles to exploit newly created beaches. We found that some leatherback females hop over between French Guiana and Suriname several times within the season. Also, we encountered some females that were first tagged in French Guiana in 1991 or 1994. Apparently, straying from the nesting beach of initial choice to another nesting ground, is quite common, as was also described by Eckert *et al.* (1989) for leatherback turtles nesting on St. Croix and Puerto Rico. However, Eckert found that once the switch was made, the turtle did not subsequently return to the beach of initial choice. This is contrary to our preliminary findings.

Because of the high rate of exchange between the two countries and the fact that the exact rate of shifting between nesting beaches is still unclear, it is not possible to make a population estimate based on nest numbers for Suriname only. First, more information is needed on the exact level of exchange, between beaches in the region but also between Surinam beaches. Because little tagging was done on Matapica and Samsambo, the level of exchange between the Surinam beaches is still not known. Only if this information is obtained, proper population estimates can be made and better management actions can be taken in a regional context.

In the present situation, saturation tagging of leatherbacks is not an option in Suriname because of the high numbers of nesting turtles spread over a large area, combined with a shortage of equipment and manpower. Although data are insufficient to elucidate strong demographic data, PIT tagging is highly important and useful for revealing the rate of shifting between nesting beaches in the region and in the country. Therefor a quick and regular exchange of PIT data between French Guiana, Suriname and Guyana is of uttermost importance.

Body size measurements suggest that present mean size of nesting leatherback females may be smaller compared to 10-20 years ago in French Guiana. This may mean that the present nesting population is younger of age than the one in the past, but alternatively it may also mean a higher adult mortality. When combining PIT data and body size measurement data over a number of years, we can obtain interesting data on the fraction of young recruits (first nesters) and population structure on the different beaches in the region.

4.4 Recruitment success, egg development and incubation times on the different Surinam beaches

Overall recruitment success per beach is determined by factors such as clutch size, hatching success, clutch frequency and hatchling predation and strength. On the two latter factors we have no data yet. For the leatherback we have data for all three beaches on the first two factors. Clutch size did not differ significantly between the beaches and is 84.3±17.9 eggs for Samsambo, 82.8±15.6 on Matapica and 92±21.2 eggs on Baboensanti. Hatching success is divided into the fraction of nests that did actually hatch and the mean hatching percentage per nest. For Baboensanti, the first is not known. On Samsambo, we estimated that 9% of the nests did not hatch, on Matapica this was also 9%. Of the nests that did hatch, the mean hatching percentage for Samsambo was 41.2±22.3% and 44.7±22.8% on Matapica. On Baboensanti this was 34.8±19.2%. So, mean hatching success on Matapica was highest, but because the mean clutch size on Baboensanti was higher (although not significant) the total number of produced hatchlings may have been equal. When comparing the 2000-results to those of former years, only Baboensanti data are available.

On Baboensanti, in1995, mean hatching success was 31±23%, in 1997 this was 10±10%, 24.6±?% in 1998, and 38.8±?% in1999. Hatching success thus varies through the years, and amongst beaches. Whitmore and Dutton (1985) found values of 52.4±4.5% on Krofajapasi beach in Suriname, which is rather high compared to results of the past few years, however, in their study washed-over nests were not included. It was shown by Tucker and Frazer for Puerto Rico (1991) that clutch frequency showed a significant positive correlation with body size, but there was no significant correlation between clutch size and body size. Also, there may be seasonal variation in clutch size (Tucker and Frazer 1994), with clutches deposited later in the season being smaller. When determining overall recruitment success for a beach, all these factors should be taken into consideration.

For leatherback nests, the mean cause of embryonic mortality seems to be predation by ghost crabs and, more important, mole crickets. Predation equalled 30% per nest, which is higher than described by Whitmore and Dutton (1985) and higher than in green turtle nests.

The pivotal temperature for leatherbacks in the Guianas is 29.75^{o}C, with 100% females being produced at temperatures above 30^{o}C and 100% males being produced at temperatures below 29^{o}C (Rimblot-Baly 1987). Incubation times are influenced by, and are therefore also an indicator of sand temperatures. Incubation times varied amongst the beaches and through the season. Combined with sand temperature data, it can be concluded that different beaches have different sand temperatures at nest depth, and thus may have different sex ratios. For Suriname, with at least three important but geographically separated and topographically distinct nesting beaches, all beaches (with different nest numbers, distributed differently across the beach) therefor have to be taken into account for sex ratio determinations. Nest temperature is highly influenced by soil moisture, and differs between different beach zones. Nests higher up the beach are warmer than nests on or below the STL, as was shown on Samsambo. As the thermosensitive period for sex-determination occurs between day 20 and 40 of the incubation, probably all nests laid above the STL after the first weeks of May all produced females, for nests below the STL the period in which males were produced was a little longer. Since mean incubation periods at Matapica were significantly longer than on Samsambo, we can assume that sand temperature was lower and more males were produced. This shows the importance of looking at more than one beach.

Green turtle mean hatching success was 85.5±14.7% at Matapica and 84.1±14.5% at Baboensanti. Again, hatching success varies through the years (Baboensanti): 76±16% in 1995, 64±23% in 1997, 81.6±?% in 1998, and 83.2±? in 1999.

4.5 Nest site selection, nesting below the spring tide line: the influence of tidal inundation

Because leatherback turtles frequently nest in places where their nests are inundated by high tides, they are often accused of poor nest-site selection. There is, however, evidence that leatherbacks in fact have adopted a successful nesting strategy, ensuring that at least some of their nests will be appropriately sited (Mrosovsky 1983). From an evolutionary point of view, it can be assumed that the selective pressures of natural threats, e.g. inundation, on sea turtles have shaped biological mechanisms to mitigate them and that nesting in locations that seem risk prone may actually provide a fitness advantage to developing hatchlings (Witherington 1999, in Eckert, *et al*., 1999). For example, hatchlings that hatch closer to the sea may have more chance of reaching the sea without being depredated by birds or ghost crabs. In addition, sea finding by the newly hatched hatchlings may be more difficult if nests are situated too far away from the sea. Nest scattering or dispersal on the beach as leatherbacks do, spreads possible risks and reduces the prospect that a high proportion of reproductive effort will be lost with the destruction or unsuitability of any particular zone of habitat (Eckert 1987). Dispersal on the beach (over higher and lower beach zones) also gives some assurance that excavation of a nest chamber will not destroy eggs laid previously.

The sex ratio of sea turtle hatchlings is determined by sand temperature at nest depth (Mrosovsky (*et al*) 1980, 1984, 1994; Godfrey *et al*. 1995, 1997). Nests laid lower on the beach are cooler as a result of the regular inundation by sea water. It is these low nests that may be the only male producing nests on a beach that is furthermore predominantly producing females. Nest relocation may mix up natural sex ratios. From a conservation point of view, it is therefore questionable to withdraw these nests from the population by relocating them to a hatchery, especially because also hatching success in hatcheries is usually lower than that on the beach.

We found that on Matapica, there is no significant difference in hatching success between nests laid below the spring tide line and nest laid above the spring tide line (see also appendix 7.3.2). These results are highly interesting, especially because 84% of all leatherback nests is laid below the spring tide line. Only nests laid further than 8 m below the STL could be considered doomed. On Samsambo, only 20% of the nests was laid below the STL, but here also hatching success below the STL was lower. This is likely due to a difference in beach topography in terms of beach shape, sand grain size and sand type, water drainage characteristics and different soil profiles (mud layers, sand, shells).
On Baboensanti, in 2000, but also in 1998 and before, evidence was found that even nests laid 3 to 6 meters below the STL, can hatch really well or even better than nests higher on the beach. This is opposing the assumption that all nests laid more than 2 m below the STL are doomed. We found strong evidence that regular tidal inundation is not per definition harmful to

the hatching success of leatherback nests and may even be profitable. Only nests laid below a beach cliff, or at an erosion point, can be considered doomed and nest relocation should focus only on these nests (see also section 4.6).

4.6 Nest relocation

Hatching success in hatcheries is usually lower than in natural nests even when hatcheries are constructed in a very professional way (Mortimer 1999 in Eckert, *et al*., 1999, Eckert 1990, Wyneken *et al.* 1988). Apparently, moving eggs increases the number of undeveloped eggs in a clutch, and the different conditions of a hatchery (e.g., lower moisture content) may also have a negative impact on the embryonic development.

Furthermore, hatchling sex ratios are often skewed towards one sex or the other, depending on conditions in the hatchery (Godfrey and Mrosovsky, var.). Moreover, improper methods of hatchling release produce high rates of mortality. When hatchlings are released at the same place each day, fish feeding stations are created. Also, it was shown by Schauble *et al*. (2001) that hatchling quality in terms of size, weight and strength is lower for hatchlings produced in a hatchery than for undisturbed hatchlings incubated on the beach.

Even though on Matapica hatching success for relocated leatherback nests was not significantly lower than for natural nests, and on Baboensanti hatching success for nests in the hatchery varies over the years, above mentioned factors are highly important in any sea turtle conservation program. Therefore it is recommended to relocate nests only if they are positively doomed, e.g. in case of beach erosion or expected poaching, or if nests are laid below a flood cliff. We found that on Matapica nests laid below the STL are not doomed, and even hatch very well, unless they are laid below a flood cliff or more than 8 m below the STL. Also on Baboensanti, there is sufficient evidence that nests laid further than 2 m below the STL are not per definition doomed. A certain amount of inundation is apparently not harmful to leatherback nests. The situation is different for each of the beaches and cannot be simply translated from one beach to another. Based on hatching results of nests that suffer regular inundation, on Baboensanti we would recommend to relocate only those nests laid further than 4 m below the STL.

We found that on Matapica, nests transferred to a higher position on the beach have a lower hatching success than nests relocated to a hatchery. This is mainly due to a higher egg-depredation by ghost crabs and mole crickets. This confirms results found in 1998 on Baboensanti. We therefore recommend that *if* nests have to be moved, they should be moved to a protected hatchery rather than a higher position on the beach.

5. Conclusions and recommendations

The leatherback nesting population showed a recent explosive increase, but when looking at the trend of the past 3 decades, it cannot be predicted whether this increase will continue. Samsambo was replaced by Baboensanti as the main leatherback nesting beach.

The green turtle nesting population appears to be stable, nesting occurs on the Galibi beaches and Matapica, not on Samsambo.

The olive ridley nesting population is highly endangered. Nest numbers in 2000 were again lower than those in 1999. A high proportion of the olive ridley nests is still being poached. More control should be carried out on the beach sections where olive ridley nesting occurs.

A new and promising leatherback nesting beach was identified approximately 5 km west of Samsambo. Of the estimated 2200 leatherback nests laid on this beach, the majority was poached. This beach deserves more intensive monitoring and protection.

The main man-induced threats for nesting sea turtles are identified as egg poaching and coastal fisheries. Natural threats such as mudflats, mangrove roots and beach erosion are of minor importance.

The main goal of PIT tagging in Suriname is gaining insight in the rate of exchange of nesting leatherback females within the region, but also of nesting movements of females within Suriname. It was proven that there is a high rate of exchange between Suriname and French Guiana. Therefore, a close collaboration and sharing of PIT tag data within the region is of uttermost importance.

Samsambo is a successful nesting beach in terms of recruitment success of leatherback turtles. So is Matapica, though on the eastern side nests are lost due to severe beach erosion. We have no recent data on the fraction of nests that did not hatch on Baboensanti. Hatching success was lower than on Samsambo and Matapica. However, since Baboensanti is at present the most important leatherback nesting beach, more research is needed on the recruitment success of natural nests and the fraction of nests that does not hatch.

Nest site selection of leatherbacks differs between the beaches. On Matapica, the large majority of leatherback females nests below the spring tide line. This does not have negative consequences for recruitment success. We recommend to only relocate those leatherback nests that are threatened by beach erosion or poaching, that are laid below a flood cliff or more than 8 m below the STL.

On Baboensanti, we recommend to relocate only leatherback nests that are laid more than 4 m below the STL, as we found evidence that nests between 0 and 4 m below the STL, do hatch well.

If nests are to be relocated, they should be relocated to a hatchery and not to a higher location on the beach, as hatching successes are better in a hatchery.

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7. APPENDICES

7.1 Map of Suriname and beach locations

7.2 Picture gallery

Aerial pictures Samsambo.

Aerial pictures Matapica.

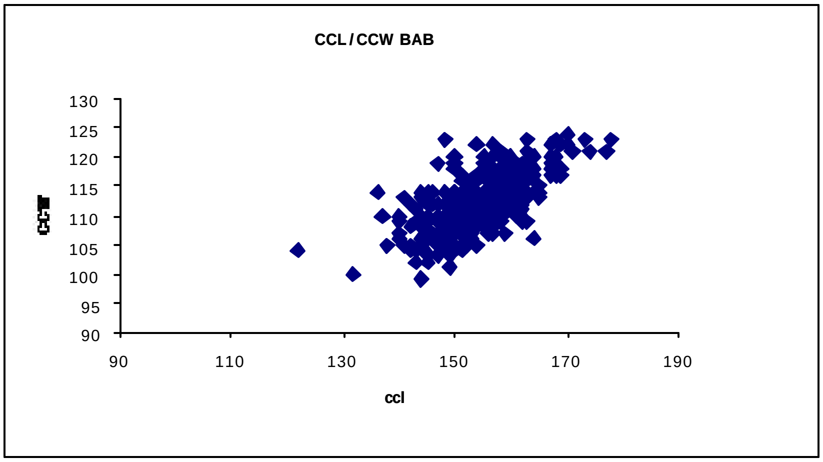
Aerial pictures Baboensanti.

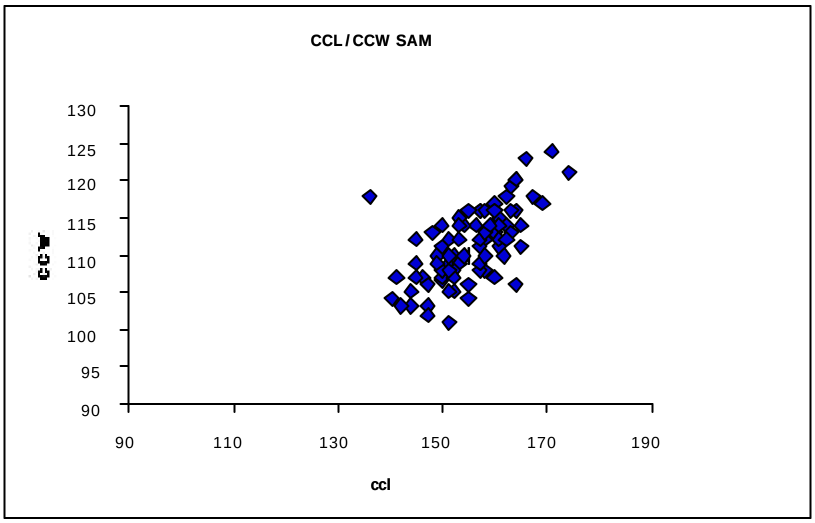
The new beach :"BGW-III"and scanning of a leatherback female.

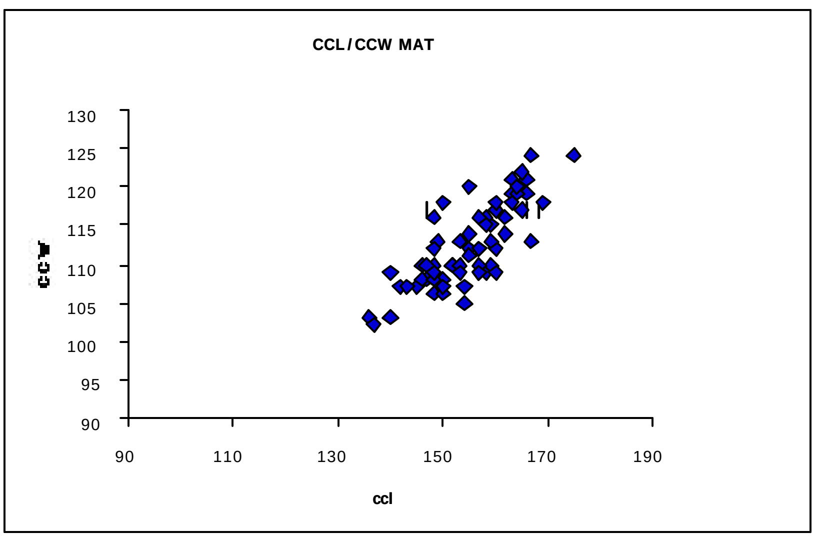
Leatherback twins and stranded leatherback on Samsambo

7.3 Additional graphs

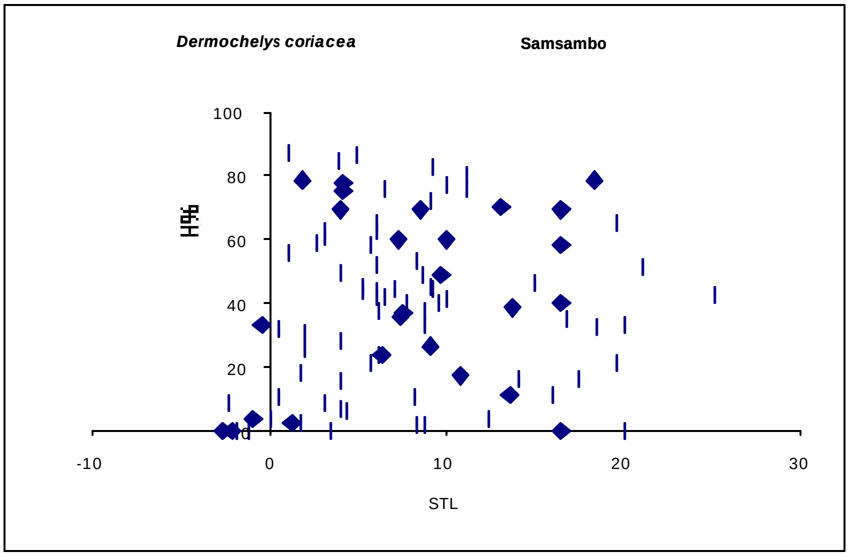
7.3.1 Correlation between leatherback body length (CCL) and width (CCW)

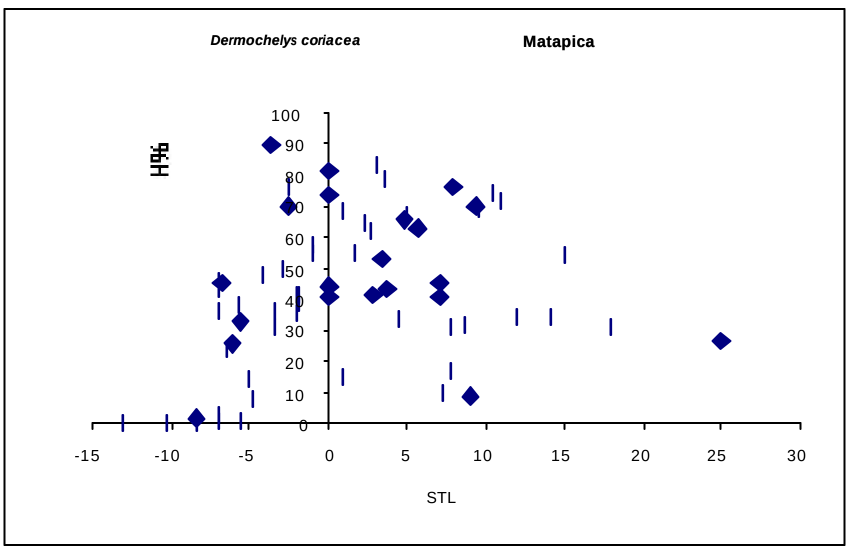






7.3.2 Correlation between nest location (distance from the STL) and hatching success





7.4 List of PIT tag codes

PIT code	Date	Beach	Beach section	Origin
00-01F0-8491	10-05-2000	BAB	PB-I	Sur
00-061B-2F0D	30-05-2000	BAB	PB-I	Sur
00-0601-7C6B	03-07-2000	MAT	TL	Sur
00-0601-75A7	08-07-2000	BAB	PB-I	Sur
00-0601-7351	12-07-2000	MAT	TL	Sur
00-0601-6C0F	11-06-2000	BAB	PB-I	Sur
00-0601-6C0F	27-05-2000	BAB	BS-I	Sur
00-0601-6976	10-07-2000	BAB	PB-I	Sur
00-0601-6679	16-06-2000	BAB	BS-I	Sur
00-0601-662C	06-07-2000	MAT	TL	Sur
00-0601-5B30	14-07-2000	BAB	PB-I	Sur
00-0601-5AB3	08-07-2000	MAT	TOP-S4	Sur
00-0601-589F	18-06-2000	BAB	PB-I	Sur
00-0601-5739	12-07-2000	BAB	PB-I	Sur
00-0601-5712	18-06-2000	BAB	BS-I	Sur
00-0601-56F9	18-06-2000	BAB	BS-I	Sur
00-0601-4FCA	06-07-2000	BAB	PB-I	Sur
00-0601-4F12	10-07-2000	BAB	PB-I	Sur
00-0601-4DBB	04-07-2000	MAT	TOP-S4	Sur
00-0601-4CF4	03-07-2000	MAT	TOP-S4	Sur
00-0601-4904	04-07-2000	MAT	TOP-S4	Sur
00-0601-464C	06-07-2000	BAB	PB-I	Sur
00-0601-444D	29-05-2000	BAB	PB-I	Sur
00-0601-4030	14-07-2000	BAB	PB-I	Sur
00-0601-3E66	08-07-2000	BAB	PB-I	Sur
00-0601-3DC5	18-06-2000	BAB	BS-I	Sur
00-0601-36A3	05-07-2000	MAT	TOP-S4	Sur
00-0601-322B	09-06-2000	BAB	BS-I	Sur
00-0601-3051	17-06-2000	BAB	PB-I	Sur
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00-0601-1903	20-06-2000	BAB	BS-I	Sur
00-0601-1407	14-07-2000	BAB	PB-I	Sur
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00-0601-1271	29-05-2000	BAB	PB-I	Sur
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00-0601-09A0	04-07-2000	MAT	TOP-S4	Sur
00-05FF-0D47	18-06-2000	BAB	BS-I	Sur
00-05FF-BF50	12-07-2000	BAB	PB-I	Sur
00-05FE-0EE7	09-06-2000	BAB	BS-I	Sur
00-05FE-0236	27-05-2000	BAB	BS-I	Sur
00-05FE-9ADE	22-07-2000	MAT	TOP-S4	Sur
00-05FE-95E4	06-07-2000	BAB	PB-I	Sur
00-05FE-7D80	08-07-2000	MAT	TOP-S4	Sur
00-05FE-7A97	06-07-2000	BAB	PB-I	Sur
00-05FE-2FE1	06-07-2000	BAB	PB-I	Sur
00-05FE-2E52	27-05-2000	BAB	PB-I	Sur
00-05FE-2D98	27-05-2000	BAB	BS-I	Sur
00-05FE-2D49	11-06-2000	BAB	BS-I	Sur

PIT code	Date	Beach	Beach section	Origin
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00-05FE-2BCE	16-06-2000	BAB	PB-I	Sur
00-05FE-2A73	13-06-2000	BAB	PB-I	Sur
00-05FE-28BC	30-06-2000	MAT	TOP-S4	Sur
00-05FE-271C	13-06-2000	BAB	BS-I	Sur
00-05FE-25C2	16-06-2000	BAB	PB-I	Sur
00-05FE-2580	12-06-2000	BAB	PB-I	Sur
00-05FE-22C9	29-05-2000	BAB	BS-I	Sur
00-05FE-214F	08-06-2000	BAB	BS-I	Sur
00-05FE-2045	28-05-2000	BAB	PB-I	Sur
00-05FE-1F0B	08-07-2000	BAB	PB-I	Sur
00-05FE-1ED0	02-06-2000	BAB	PB-I	Sur
00-05FE-1E7F	19-07-2000	BAB	PB-I	Sur
00-05FE-1E7F	06-07-2000	BAB	PB-I	Sur
00-05FE-1DF5	18-06-2000	BAB	PB-I	Sur
00-05FE-1D69	16-06-2000	BAB	PB-I	Sur
00-05FE-1C03	12-06-2000	BAB	PB-I	Sur
00-05FE-1B68	06-07-2000	BAB	PB-I	Sur
00-05FE-1B68	29-05-2000	BAB	PB-I	Sur
00-05FE-1A94	18-06-2000	BAB	PB-I	Sur
00-05FE-1A2C	27-05-2000	BAB	BS-I	Sur
00-05FE-1A13	29-05-2000	BAB	BS-I	Sur
00-05FE-1860	10-07-2000	BAB	PB-I	Sur
00-05FE-1860	18-06-2000	BAB	BS-I	Sur
00-05FE-180D	27-05-2000	BAB	BS-I	Sur
00-05FE-1806?	18-06-2000	BAB	PB-I	Sur
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00-05FE-13FB	29-05-2000	BAB	BS-I	Sur
00-05FE-13EC	13-07-2000	MAT	TOP-S4	Sur
00-05FE-1359	16-06-2000	BAB	PB-I	Sur
00-05FE-1131	29-05-2000	BAB	PB-I	Sur
00-05FE-0F92	05-07-2000	BAB	PB-I	Sur
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00-05FE-079B	12-06-2000	BAB	PB-I	Sur
00-05FE-0692	05-07-2000	MAT	TOP-S4	Sur
00-05FE-063F	05-07-2000	MAT	TOP-S4	Sur
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00-05FE-0271	29-05-2000	BAB	BS-II	Sur
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PIT code	Date	Beach	Beach section	Origin
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00-05FD-F8D0	08-06-2000	BAB	BS-I	Sur
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00-01F1-5243	30-06-2000	BAB	PB-I	Sur

PIT code	Date	Beach	Beach section	Origin
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00-01F1-3789	18-06-2000	BAB	PB-I	Sur
00-01F1-376B	23-05-2000	BAB	PB-I	Sur
00-01F1-3610	06-06-2000	BAB	PB-I	Sur
00-01F1-35BD	07-06-2000	BAB	PB-I	Sur
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00-01F1-2E3F	03-07-2000	BAB	BS-I	Sur
00-01F1-2E1C	30-04-2000	SAM	WEST	Sur
00-01F1-2DE7	19-05-2000	BAB	BS-I	Sur
00-01F1-2D15	01-07-2000	BAB	PB-I	Sur
00-01F1-2C77	30-05-2000	BAB	PB-I	Sur
00-01F1-2C06	22-05-2000	BAB	PB-I	Sur
00-01F1-2B74	11-06-2000	BAB	PB-I	Sur
00-01F1-2AE3	14-05-2000	BAB	BS-I	Sur
00-01F1-2ABB	24-06-2000	SAM	WEST	Sur
00-01F1-2A43	21-06-2000	BAB	PB-I	Sur
00-01F1-2A43	08-05-2000	BAB	PB-I	Sur
00-01F1-29C9	27-07-2000	BAB	PB-I	Sur
00-01F1-29C9	18-06-2000	BAB	PB-I	Sur
00-01F1-2959	07-06-2000	SAM	WEST	Sur
00-01F1-28D0	06-07-2000	BAB	PB-I	Sur
00-01F1-28D0	10-05-2000	BAB	PB-I	Sur
00-01F1-2740	30-04-2000	SAM	WEST	Sur
00-01F1-2713	12-06-2000	BAB	PB-I	Sur
00-01F1-2466	01-07-2000	BAB	PB-I	Sur
00-01F1-2411	17-05-2000	BAB	PB-I	Sur
00-01F1-23B9	20-05-2000	BAB	PB-I	Sur
00-01F1-2275	15-05-2000	BAB	PB-I	Sur
00-01F1-221D	07-06-2000	BAB	PB-I	Sur
00-01F1-00A6	01-07-2000	BAB	PB-I	Sur
00-01F0-F89B	03-05-2000	SAM	MID-II	Sur
00-01F0-D6BB	14-06-2000	BAB	PB-I	Sur
00-01F0-9E6E	04-07-2000	BAB	PB-I	Sur
00-01F0-924D	14-06-2000	BAB	PB-I	Sur
00-01F0-924D	05-06-2000	BAB	PB-I	Sur
00-01F0-9201	12-05-2000	BAB	PB-I	Sur

PIT code	Date	Beach	Beach section	Origin
00-01F0-8F1D	18-05-2000	BAB	PB-I	Sur
00-01F0-8D57	04-07-2000	BAB	PB-I	Sur
00-01F0-8ADD	20-05-2000	BAB	PB-I	Sur
00-01F0-8AC1	01-07-2000	BAB	PB-I	Sur
00-01F0-8AAB	03-05-2000	SAM	MID-II	Sur
00-01F0-89BF	07-05-2000	BAB	PB-I	Sur
00-01F0-87C3	29-05-2000	BAB	PB-I	Sur
00-01F0-86E4	29-06-2000	BAB	PB-I	Sur
00-01F0-86E4	18-06-2000	BAB	PB-I	Sur
00-01F0-8353	18-05-2000	BAB	PB-I	Sur
00-01F0-7E91	29-05-2000	BAB	BS-II	Sur
00-01F0-6659	19-05-2000	BAB	PB-I	Sur
00-01F0-6564	02-05-2000	SAM	MID-II	Sur
00-01F0-6493	30-05-2000	BAB	PB-I	Sur
00-01F0-63F3	14-07-2000	BAB	PB-I	Sur
00-01F0-63F3	03-07-2000	BAB	BS-I	Sur
00-01F0-63AA	17-05-2000	BAB	PB-I	Sur
00-01F0-62D5	01-07-2000	BAB	PB-I	Sur
00-01F0-62D5	22-06-2000	BAB	PB/BS	Sur
00-01F0-6100	18-06-2000	BAB	PB-I	Sur
00-01F0-60E3	21-05-2000	BAB	PB-I	Sur
00-01F0-60BC	04-05-2000	SAM	MID-I	Sur
00-01F0-6008	14-06-2000	BAB	PB-I	Sur
00-01F0-5E52	13-05-2000	BAB	PB-I	Sur
00-01F0-5D89	15-05-2000	BAB	PB-I	Sur
00-01F0-5CCB	04-05-2000	SAM	MID-I	Sur
00-01F0-5C41	15-05-2000	BAB	PB-I	Sur
00-01F0-5BA1	03-05-2000	SAM	MID-II	Sur
00-01F0-5B99	12-05-2000	BAB	PB-I	Sur
00-01F0-5AE7	29-05-2000	BAB	PB-I	Sur
00-01F0-5AE7	17-05-2000	BAB	PB-I	Sur
00-01F0-5A3D	29-06-2000	BAB	PB-I	Sur
00-01F0-5919	03-05-2000	SAM	MID-II	Sur
00-01F0-556A	12-07-2000	BAB	PB-I	Sur
00-01F0-556A	15-05-2000	BAB	PB-I	Sur
00-01F0-5568	07-05-2000	BAB	PB-I	Sur
00-01F0-54B8	04-07-2000	BAB	PB-I	Sur
00-01F0-5473	01-07-2000	BAB	PB-I	Sur
00-01F0-53F8	04-07-2000	BAB	PB-I	Sur
00-01F0-52AB	20-05-2000	BAB	PB-I	Sur
00-01F0-527B	19-06-2000	BAB	PB-I	Sur
00-01F0-525D	18-05-2000	BAB	PB-I	Sur
00-01F0-5224	18-05-2000	BAB	PB-I	Sur
00-01F0-51DE	14-06-2000	BAB	PB-I	Sur
00-01F0-3814	20-06-2000	BAB	BS-I	Sur
00-01F0-3732	23-05-2000	BAB	PB-I	Sur
00-01F0-36B2	08-05-2000	BAB	PB-I	Sur
00-01F0-354C	28-06-2000	BAB	PB-I	Sur
00-01F0-34C8	20-06-2000	BAB	BS-I	Sur
00-01F0-3379	29-05-2000	BAB	BS-II	Sur

PIT code	Date	Beach	Beach section	Origin
00-01F0-3356	04-07-2000	BAB	PB-I	Sur
00-01F0-32DA	07-06-2000	SAM	WEST	Sur
00-01F0-32BB	20-06-2000	BAB	PB-I	Sur
00-01F0-32B1	22-05-2000	BAB	PB-I	Sur
00-01F0-3067	13-05-2000	BAB	PB-I	Sur
00-01F0-2F95	23-05-2000	BAB	PB-I	Sur
00-01F0-2E95	07-06-2000	SAM	MID-II	Sur
00-01F0-2E65	11-06-2000	BAB	BS-I	Sur
00-01F0-2E38	18-06-2000	BAB	PB-I	Sur
00-01F0-2D1B	21-05-2000	BAB	PB-I	Sur
00-01F0-2D1B	12-05-2000	BAB	PB-I	Sur
00-01F0-2C1A	18-06-2000	BAB	PB-I	Sur
00-01F0-2BFF	03-07-2000	BAB	PB-I	Sur
00-01F0-2BFD	08-07-2000	BAB	PB-I	Sur
00-01F0-2BFD	08-06-2000	BAB	BS-I	Sur
00-01F0-2BF1	07-06-2000	SAM	WEST	Sur
00-01F0-2BC6	19-06-2000	BAB	PB-I	Sur
00-01F0-2B5F	16-05-2000	BAB	PB-I	Sur
00-01F0-2B0B	02-05-2000	SAM	MID-II	Sur
00-01F0-2953	08-05-2000	BAB	PB-I	Sur
00-01F0-223C	21-05-2000	BAB	PB-I	Sur
00-01F0-21FF	18-06-2000	BAB	PB-I	Sur
00-01F0-21FF	19-05-2000	BAB	PB-I	Sur
00-01F0-20C1	06-06-2000	BAB	PB-I	Sur
00-01F0-1E33	01-07-2000	BAB	PB-I	Sur
00-01F0-1DC9	30-05-2000	BAB	PB-I	Sur
00-01F0-1DC9	17-05-2000	BAB	PB-I	Sur
00-01F0-1A36	04-07-2000	BAB	PB-I	Sur
00-01F0-192E	07-06-2000	SAM	WEST	Sur
00-01F0-16B2	03-07-2000	BAB	PB-I	Sur
00-01F0-16B2	20-06-2000	BAB	BS-I	Sur
00-01F0-12D6	18-05-2000	BAB	PB-I	Sur
00-01F0-11E8	12-06-2000	BAB	BS-I	Sur
00-01F0-11E8	25-05-2000	BAB	PB-I	Sur
00-01F0-116C	20-05-2000	BAB	PB-I	Sur
00-01E5-0C18	20-05-2000	BAB	PB-I	Sur
00-01E5-0817	28-06-2000	BAB	PB-I	Sur
00-01E4-FF82	10-05-2000	BAB	PB-I	Sur
00-01E2-AE81	19-06-2000	BAB	PB-I	Sur
00-01E2-AA4B	18-06-2000	BAB	PB-I	Sur
00-01E2-A820	13-06-2000	BAB	BS-I	Sur
00-01E2-98AD	15-05-2000	BAB	PB-I	Sur
00-01E2-9874	03-07-2000	BAB	PB-I	Sur
00-01E2-9874	02-05-2000	SAM	WEST	Sur
00-01E2-985F	11-06-2000	BAB	BS-I	Sur
00-01E2-9804	30-05-2000	BAB	PB-I	Sur
00-01E2-9724	03-07-2000	BAB	BS-I	Sur
00-01E2-9577	18-06-2000	BAB	PB-I	Sur
00-01E2-94BA	10-05-2000	BAB	PB-I	Sur
00-01E2-92A4	06-06-2000	BAB	PB-I	Sur

PIT code	Date	Beach	Beach section	Origin
00-01E2-9286	30-05-2000	BAB	PB-I	Sur
00-01E2-9264	20-05-2000	BAB	PB-I	Sur
00-01E2-9117	02-05-2000	SAM	MID-II	Sur
00-01E2-9029	19-06-2000	BAB	PB-I	Sur
00-01E2-8EE2	29-06-2000	BAB	PB-I	Sur
00-01E2-8DB4	12-05-2000	BAB	PB-I	Sur
00-01E2-8A84	19-05-2000	BAB	BS-I	Sur
00-01E2-8532	27-07-2000	BAB	BS-I	Sur
00-01E2-8446	06-06-2000	BAB	BS-I	Sur
00-01E2-83D3	02-05-2000	SAM	MID-II	Sur
00-01E2-7DDA	11-06-2000	BAB	BS-I	Sur
00-01E2-72B6	04-06-2000	BAB	PB-I	Sur
00-01DF-7FED	16-06-2000	BAB	PB-I	Sur
00-01DF-7BE4	14-06-2000	BAB	PB-I	Sur
00-01DF-799F	19-07-2000	BAB	PB-I	Sur
00-01DF-7777	16-06-2000	BAB	BS-I	Sur
00-01DF-6F31	19-07-2000	BAB	PB-I	Sur
00-01DF-2441	16-06-2000	BAB	PB-I	Sur
00-01DF-0E1F	19-05-2000	BAB	PB/BS	Sur
00-01CF-FD37	23-05-2000	BAB	PB-I	Sur
00-01CF-FA4F	04-07-2000	BAB	PB-I	Sur
00-01CF-EECB	30-05-2000	BAB	BS-I	Sur
00-01CF-ED5A	30-05-2000	BAB	PB-I	Sur
00-01CD-2E58	01-07-2000	BAB	PB-I	Sur
00-01CD-1E2B	11-05-2000	BAB	BS-I	Sur
00-01C8-0081	11-05-2000	BAB	PB-I	Sur
00-01C8-77A7	23-05-2000	BAB	PB-I	Sur
00-01C8-2F27	19-05-2000	BAB	PB-I	Sur
00-01C8-2E1E	19-06-2000	BAB	PB-I	Sur
00-01C8-2D90	11-05-2000	BAB	BS-I	Sur
00-01C8-2BB9	29-06-2000	BAB	PB-I	Sur
00-01C8-2B8C	19-05-2000	BAB	BS-II	Sur
00-01C8-2843	19-05-2000	BAB	BS-I	Sur
00-01C8-2517	11-06-2000	BAB	BS-I	Sur
00-01C8-188B	18-06-2000	BAB	PB-I	Sur
00-01C8-029F	24-05-2000	BAB	PB-I	Sur
00-01C8-0293	07-06-2000	BAB	PB-I	Sur
00-01C8-0251	22-05-2000	BAB	PB-I	Sur
00-01C8-0181	18-05-2000	BAB	PB-I	Sur
00-01C8-00C5	23-05-2000	BAB	BS-I	Sur
00-01C8-0057	22-05-2000	BAB	PB-I	Sur
00-01C7-FECB	30-06-2000	BAB	PB-I	Sur
00-01C7-FEA6	23-05-2000	BAB	PB-I	Sur
00-01C7-FB44	07-06-2000	SAM	MID-II	Sur
00-01C7-FAS9	12-05-2000	BAB	BS-I	Sur
00-01C7-FA80	20-05-2000	BAB	PB-I	Sur
00-01C7-F9A6	05-05-2000	SAM	WEST	Sur
00-01C7-F941	03-07-2000	BAB	BS-I	Sur
00-01C7-F6BA	29-06-2000	BAB	PB-I	Sur
00-01C7-F56F	22-05-2000	BAB	PB-I	Sur

PIT code	Date	Beach	Beach section	Origin
00-01C7-F360	09-06-2000	BAB	PB-I	Sur
00-01C7-F317	23-05-2000	BAB	PB-I	Sur
00-01C7-F2BF	23-05-2000	BAB	PB-I	Sur
00-01C7-F197	18-06-2000	BAB	PB-I	Sur
00-01C7-EE6B	01-07-2000	BAB	PB-I	Sur
00-01C7-EE6B	24-05-2000	BAB	PB-I	Sur
00-01C7-D482	19-05-2000	BAB	BS-II	Sur
00-01C7-C0DB	07-05-2000	BAB	PB-I	Sur
00-01C7-073F	21-06-2000	BAB	PB-I	Sur
00-01BF-18F5	13-06-2000	BAB	PB-I	Sur
00-01BF-0A29	29-05-2000	BAB	PB-I	Sur
00-01BE-A956	13-06-2000	BAB	BS-I	Sur
00-01BD-D87A	19-05-2000	BAB	BS-I	Sur
00-016B-3B37	18-06-2000	BAB	PB-I	Sur
00-016B-3B35	03-07-2000	BAB	BS-I	Sur
00-016B-3B35	12-06-2000	BAB	PB-I	Sur
00-016B-3B35	08-05-2000	BAB	PB-I	Sur
00-016B-3A0C	08-05-2000	BAB	PB-I	Sur
00-016B-3A53	18-05-2000	BAB	PB-I	Sur
00-016B-3874	18-06-2000	BAB	PB-I	Sur
00-016B-383F	12-05-2000	BAB	PB-I	Sur
00-016B-3802	05-07-2000	BAB	PB-I	Sur
00-016B-3802	12-06-2000	BAB	BS-I	Sur
00-016B-3699	20-06-2000	BAB	BS-I	Sur
00-016B-32FC	18-06-2000	BAB	PB-I	Sur
00-016B-326A	02-05-2000	SAM	WEST	Sur
00-016B-2710	18-06-2000	BAB	PB-I	Sur
00-016B-25D7	18-06-2000	BAB	PB-I	Sur
00-016B-2516	11-06-2000	BAB	BS-I	Sur
00-016B-1F82	19-05-2000	BAB	PB-I	Sur
00-0169-D98E	16-06-2000	BAB	BS-I	Sur
00-0169-D94A	11-05-2000	BAB	PB-I	Sur
00-0169-D85A	18-06-2000	BAB	PB-I	Sur
00-0169-D5A4	06-07-2000	BAB	PB-I	Sur
00-0169-D5A4	19-06-2000	BAB	PB-I	Sur
00-0169-D5A4	12-05-2000	BAB	BS-I	Sur
00-0169-D4BB	01-07-2000	BAB	PB-I	Sur
00-0169-D4BB	12-06-2000	BAB	PB-I	Sur
00-0169-D29D	30-06-2000	BAB	PB-I	Sur
00-0169-D207	10-05-2000	BAB	PB-I	Sur
00-0169-CF11	30-05-2000	BAB	PB-I	Sur
00-0169-CDCF	03-06-2000	BAB	PB-I	Sur
00-0169-CCD3	10-05-2000	BAB	BS-I	Sur
00-0169-CAF4	11-06-2000	BAB	BS-I	Sur
00-0169-CA23	29-06-2000	BAB	PB-I	Sur
00-0169-C839?	04-06-2000	BAB	PB-I	Sur
00-0169-C839?	11-05-2000	BAB	PB-I	Sur
00-0168-269B	14-05-2000	BAB	BS-I	Sur
00-0126-E386	16-06-2000	BAB	BS-I	Sur
00-0126-E29C	11-07-2000	BAB	PB-I	Sur

PIT code	Date	Beach	Beach section	Origin
00-0126-E141	30-06-2000	BAB	PB-I	Sur
00-0126-E141	29-05-2000	BAB	PB-I	Sur
00-0126-DF98	16-06-2000	BAB	BS-I	Sur
00-0126-DC98	16-06-2000	BAB	BS-I	Sur
00-0126-D440	16-06-2000	BAB	BS-I	Sur
00-0126-D17F	14-06-2000	BAB	PB-I	Sur
00-0126-B5E7	11-05-2000	BAB	PB-I	Sur
00-0126-0610	14-06-2000	BAB	PB-I	Sur
00-0125-893A	15-07-2000	BAB	PB-I	Sur
00-0125-8780	13-06-2000	BAB	PB-I	Sur
00-0125-870A	18-06-2000	BAB	PB-I	Sur
00-0125-830A	13-06-2000	BAB	PB-I	Sur
00-0125-7FC1	14-06-2000	BAB	PB-I	Sur
00-0125-7EFC	13-06-2000	BAB	PB-I	Sur
00-0125-7E20	11-07-2000	BAB	PB-I	Sur
00-0125-7D0C	29-05-2000	BAB	PB-I	Sur
00-0125-7A49	19-07-2000	BAB	PB-I	Sur
00-0125-7A2A	05-08-2000	BAB	PB-I	Sur
00-0125-7A2A	23-07-2000	BAB	PB-I	Sur
00-0125-7A2A	08-07-2000	BAB	PB-I	Sur
00-0125-7A2A	14-06-2000	BAB	PB-I	Sur
00-0125-79CE	23-07-2000	BAB	PB-I	Sur
00-0125-7873	21-07-2000	BAB	PB-I	Sur
00-0125-7773	16-06-2000	BAB	BS-I	Sur
00-0125-75FB	05-08-2000	BAB	BS-I	Sur
00-0125-7340	29-05-2000	BAB	BS-I	Sur
00-0125-72B6	05-08-2000	BAB	PB-I	Sur
00-01CD-0087?	11-07-2000	BAB	PB-I	Fr. Guiana
00-01CD-C0E8	12-05-2000	BAB	PB-I	Fr. Guiana
00-01CD-C0E8	23-05-2000	BAB	PB-I	Fr. Guiana
00-01CD-C306	12-06-2000	BAB	BS-I	Fr. Guiana
00-01CE-2E1B	11-06-2000	BAB	PB-I	Fr. Guiana
00-01CE-3180	04-07-2000	BAB	PB-I	Fr. Guiana
00-01CE-3D6C	10-07-2000	BAB	PB-I	Fr. Guiana
00-01CE-4662	29-06-2000	BAB	PB-I	Fr. Guiana
00-01CE-4954	15-06-2000	BAB	PB-I	Fr. Guiana
00-01CE-49D7	10-07-2000	BAB	PB-I	Fr. Guiana
00-01CE-66EF	09-05-2000	BAB	PB/BS	Fr. Guiana
00-01CE-66EF	04-07-2000	BAB	PB-I	Fr. Guiana
00-01CE-7BB3	06-07-2000	BAB	PB-I	Fr. Guiana
00-01CE-9345	01-07-2000	BAB	PB-I	Fr. Guiana
00-01CE-98BA	18-06-2000	BAB	BS-I	Fr. Guiana
00-01CE-A482	14-06-2000	BAB	PB-I	Fr. Guiana
00-01CE-A794	09-05-2000	BAB	PB/BS	Fr. Guiana
00-01CE-A794	19-05-2000	BAB	PB-I	Fr. Guiana
00-01CE-DB0B	10-05-2000	BAB	PB-I	Fr. Guiana
00-01CE-E553	09-06-2000	SAM	MD-II	Fr. Guiana
00-01CE-E872	29-06-2000	BAB	PB-I	Fr. Guiana
00-01CF-1B5D	19-06-2000	BAB	PB-I	Fr. Guiana

PIT code	Date	Beach	Beach section	Origin
00-01CF-1B5D	10-07-2000	BAB	PB-I	Fr. Guiana
00-01CF-4EB8	12-06-2000	BAB	PB-I	Fr. Guiana
00-01CF-4FFD	12-05-2000	BAB	PB-I	Fr. Guiana
00-01CF-5BC8	23-05-2000	BAB	PB-I	Fr. Guiana
00-01CF-623D	30-06-2000	BAB	PB-I	Fr. Guiana
00-01CF-62D3	14-07-2000	BAB	PB-I	Fr. Guiana
00-01D9-1557	13-06-2000	BAB	PB-I	Fr. Guiana
00-01D9-1F09	10-07-2000	BAB	PB-I	Fr. Guiana
00-01DF-038B	23-05-2000	BAB	PB-I	Fr. Guiana
00-01DF-49A2	03-07-2000	BAB	PB-I	Fr. Guiana
00-01DF-4AD2	18-06-2000	BAB	PB-I	Fr. Guiana
00-01ED-A87D	09-05-2000	BAB	PB/BS	Fr. Guiana
00-01FC-CC24	27-05-2000	BAB	BS-I	Fr. Guiana
00-05FD-5618	15-07-2000	BAB	PB-I	Fr. Guiana
00-05FD-5ED1	14-07-2000	BAB	PB-I	Fr. Guiana
00-05FD-79C1	29-05-2000	BAB	PB-I	Fr. Guiana
00-05FD-79C1	08-06-2000	BAB	BS-I	Fr. Guiana
00-05FD-7D82	03-07-2000	BAB	PB-I	Fr. Guiana
00-05FD-DB4E	29-05-2000	BAB	PB-I	Fr. Guiana
00-05FD-F6B4	30-06-2000	BAB	PB-I	Fr. Guiana
00-05FD-FF86	03-07-2000	BAB	BS-I	Fr. Guiana
00-05FE-034B	11-07-2000	BAB	PB-I	Fr. Guiana
00-05FE-047E	06-07-2000	BAB	PB-I	Fr. Guiana
00-05FE-1A1F	03-07-2000	BAB	PB-I	Fr. Guiana
00-05FE-1B1F	03-07-2000	BAB	PB-I	Fr. Guiana
00-05FE-24E1	17-06-2000	BAB	PB-I	Fr. Guiana
00-05FE-2D0F	13-06-2000	BAB	PB-I	Fr. Guiana
00-05FE-92D7	21-06-2000	BAB	BS-I	Fr. Guiana
00-05FF-A144	03-07-2000	BAB	PB-I	Fr. Guiana
00-0601-07DC	29-05-2000	BAB	PB-I	Fr. Guiana
00-0601-15A4	15-07-2000	BAB	PB-I	Fr. Guiana
00-0601-1CEA	13-06-2000	BAB	PB-I	Fr. Guiana
00-0601-2B93	09-06-2000	BAB	PB-I	Fr. Guiana
00-0601-2C69	29-06-2000	BAB	PB-I	Fr. Guiana
00-0601-2FBA	19-06-2000	BAB	PB-I	Fr. Guiana
00-0601-330E	03-07-2000	BAB	BS-I	Fr. Guiana
00-0601-3666	04-07-2000	BAB	PB-I	Fr. Guiana
00-0601-383A	03-07-2000	BAB	PB-I	Fr. Guiana
00-0601-3B6E	04-07-2000	BAB	PB-I	Fr. Guiana
00-0601-4772	27-05-2000	BAB	BS-I	Fr. Guiana
00-0601-4C6F	25-05-2000	BAB	PB-I	Fr. Guiana
00-0601-4C6F	12-06-2000	BAB	PB-I	Fr. Guiana
00-0601-4CE6	08-06-2000	SAM	MID-II	Fr. Guiana
00-0601-54DE	11-07-2000	BAB	PB-I	Fr. Guiana
00-0601-5FFB	30-05-2000	BAB	PB-I	Fr. Guiana
00-0601-642C	13-06-2000	BAB	PB-I	Fr. Guiana
00-0601-642C	05-07-2000	BAB	PB-I	Fr. Guiana
00-0601-740D	20-05-2000	BAB	PB-I	Fr. Guiana
00-0601-7476	13-06-2000	BAB	PB-I	Fr. Guiana
00-0601-7C53	29-05-2000	BAB	PB-I	Fr. Guiana

PIT code	Date	Beach	Beach section	Origin
00-0E27-C466	03-05-2000	SAM	MID-II	Fr. Guiana
00-01DC-F337	30-05-2000	BAB	PB-I	Fr. Guiana

1999 data

PIT code	Date	Beach	Beach section	Origin
00-01F1-5CC4	23-07-1999	BAB	PB-I	Sur
00-01F1-5CC4	03-07-1999	BAB	BS-I	Sur
00-01F1-58BC	25-05-1999	BAB	BS-I	Sur
00-01F1-37E8	29-05-1999	BAB	BS-I	Sur
00-01F1-37E0	01-06-1999	BAB	PB-I	Sur
00-01F1-31AC	09-05-1999	BAB	BS-I	Sur
00-01F1-2DBD	22-06-1999	BAB	PB-I	Sur
00-01F1-2D3E	29-06-1999	BAB	PB-I	Sur
00-01F1-2327	28-05-1999	BAB	PB-I	Sur
00-01F0-F3C8	10-06-1999	BAB	PB-I	Sur
00-01F0-8E92	21-06-1999	BAB	BS-I	Sur
00-01F0-8D28	27-06-1999	BAB	BS-I	Sur
00-01F0-8BFD	25-07-1999	BAB	PB-I	Sur
00-01F0-8580	18-06-1999	BAB	BS-I	Sur
00-01F0-8173	11-06-1999	BAB	PB-I	Sur
00-01F0-6652	21-06-1999	BAB	PB-I	Sur
00-01F0-64D9	05-07-1999	BAB	PB-I	Sur
00-01F0-64D9	03-07-1999	BAB	PB-I	Sur
00-01F0-64D9	25-06-1999	BAB	BS-I	Sur
00-01F0-64D9	16-06-1999	BAB	PB-I	Sur
00-01F0-62E2	11-06-1999	BAB	PB-I	Sur
00-01F0-607F	29-06-1999	BAB	PB-I	Sur
00-01F0-5F02	26-06-1999	BAB	PB-I	Sur
00-01F0-5D52	01-07-1999	BAB	PB-I	Sur
00-01F0-54C0	25-06-1999	BAB	BS-II	Sur
00-01F0-2F93	19-06-1999	BAB	BS-II	Sur
00-01F0-2BD0	22-06-1999	BAB	BS-I	Sur
00-01F0-2B7D	06-07-1999	BAB	BS-I	Sur
00-01F0-2962	21-07-1999	BAB	PB-I	Sur
00-01F0-27EB	21-07-1999	BAB	BS-I	Sur
00-01F0-263A	26-06-1999	BAB	BS-I	Sur
00-01F0-1DFA	06-07-1999	BAB	PB-I	Sur
00-01F0-104D	27-05-1999	BAB	PB-I	Sur
00-01F0-0B08	28-05-1999	BAB	PB-I	Sur
00-01E5-30B0	22-06-1999	BAB	BS-II	Sur
00-01E2-88BB	10-07-1999	BAB	BS-II	Sur
00-01E2-8389	29-06-1999	BAB	PB-I	Sur
00-01E2-8376	25-07-1999	BAB	PB-I	Sur
00-01E0-C92D	24-07-1999	BAB	PB-I	Sur
00-01CF-F88C	25-06-1999	BAB	BS-I	Sur
00-01CD-2D86	25-07-1999	BAB	PB-I	Sur
00-01C8-247D	08-05-1999	BAB	PB-I	Sur
00-01C8-1EC7	03-07-1999	BAB	PB-I	Sur

PIT code	Date	Beach	Beach section	Origin
00-01C7-FE80	24-07-1999	BAB	PB-I	Sur
00-01C7-FA2C	03-07-1999	BAB	BS-I	Sur
00-01C7-F9A4	22-06-1999	BAB	PB-I	Sur
00-01C7-F6DE	11-06-1999	BAB	PB-I	Sur
00-01C7-F36A	11-05-1999	BAB	PB-I	Sur
00-01C7-F1D7	01-06-1999	BAB	PB-I	Sur
00-01C7-F172	27-06-1999	BAB	BS-I	Sur
00-01C7-EDA9	11-05-1999	BAB	PB-I	Sur
00-01C7-C95E	03-07-1999	BAB	BS-I	Sur
00-01C7-31E9	29-06-1999	BAB	PB-I	Sur
00-01C7-153F	24-07-1999	BAB	PB-I	Sur
00-01C7-07E6	01-07-1999	BAB	BS-I	Sur
00-016B-39CA	25-07-1999	BAB	PB-I	Sur
00-016B-39CA	20-06-1999	BAB	PB-I	Sur
00-016B-35CC	23-06-1999	BAB	PB-I	Sur
00-016B-32A0	21-06-1999	BAB	BS-I	Sur
00-016B-2A85	30-07-1999	BAB	PB-I	Sur
00-016B-2A7E	01-07-1999	BAB	BS-II	Sur
00-016B-2841	10-07-1999	BAB	PB-I	Sur
00-016B-26A2	26-06-1999	BAB	BS-I	Sur
00-016B-1369	09-05-1999	BAB	BS-I	Sur
00-016B-12D7	27-06-1999	BAB	BS-I	Sur
00-016A-FE13	09-05-1999	BAB	BS-I	Sur
00-0169-C6F9	20-06-1999	BAB	BS-I	Sur
00-0142-0E2E	25-06-1999	BAB	BS-I	Fr. Guiana
00-01CD-C790	22-06-1999	BAB	PB-I	Fr. Guiana
00-01CE-DED8	26-06-1999	BAB	PB-I	Fr. Guiana
00-01CF-1755	28-07-1999	BAB	PB-I	Fr. Guiana
00-01E2-E5A8	20-06-1999	BAB	BS-I	Fr. Guiana
00-01ED-A333	29-05-1999	BAB	PB-I	Fr. Guiana
00-01F0-5A09	26-06-1999	BAB	PB-I	Fr. Guiana