

TURTLE FOUNDATION

Protecting Sea Turtles and their Habitats

Project Report Cape Verde 2016

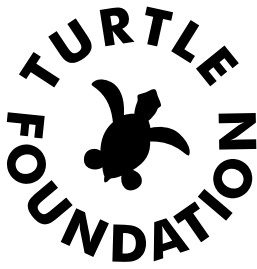


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Cover: Loggerhead sea turtle resting on sea floor (Shutterstock – Leonhard Gonzales). **Images:** Turtle Foundation (if not mentioned otherwise)

1. Summary

The Islands of Cape Verde comprise the world's third largest nesting rookery for the endangered loggerhead sea turtles, with about two third of the nesting activity occurring on the Island of Boavista. However, various threats caused by human activities heavily endangers the existence of this population, most of all intensive poaching of nesting turtle females. The Turtle Foundation started a beach monitoring and protection program in 2008 on Boavista in response of an emergency call of the local sea turtle protection organization Natura 2000 reporting about 1,200 turtles slaughtered on Boavista's beaches alone in 2007.

In 2016, the core project of Turtle Foundation included eight nesting beaches with a total length of about 30 km. Additional 5 km of beach in the Southwest of the island were monitored by a community-based project financed and advised by Turtle Foundation. The beaches of the core project were monitored via three on-site field stations during the loggerhead turtle nesting season from mid June to end of October. Beaches were continuously patrolled at night by teams of local rangers and local and international volunteers. During night patrols and subsequent morning surveys, a variety of data of the nests and nesting turtles were collected for gaining conservational relevant information about the biology of the local sea turtle population. In 2016, we recorded a record number of 4,062 nests counted by our teams and by the community-based project, which correspond to about 1,000 individual female turtles that in majority could be protected from poaching by Turtle Foundation's engagement on Boavista.

Through our measures turtle mortality on beaches protected by Turtle Foundation could be reduced by more than 90%. However, poaching pressure increased again during the last two years, and on the beaches monitored by Turtle Foundation alone we documented evidence of 25 poaching cases, which is significantly more than the average of 5–10 cases per season in earlier years. Further, poaching still occurs rampantly on beaches not yet covered by any of the conservation initiatives active on Boavista. Thus, intensive beach protection will be necessary to be continued in the following years along with closing the remaining conservational gaps.

In addition to direct conservation and protection measures, the Turtle Foundation conducted flanking measures for environmental education, awareness, and outreach in order to ensure the sustainability of our conservation projects. For the first time, in 2016 a community coordinator was employed to implement social programs and to improve relationships between conservation groups and village communities on Boavista. A broad social survey resulting in over 900 filled questionnaires was conducted to explore awareness and valuation of ongoing conservation and protection programs for sea turtles; this survey is currently being evaluated. We continued our proven education project *School in Nature*, whereby local children and youths can get in direct touch with the nature of their island in our beach camps. This project has been conducted five times with 71 participants. Further activities included presentations, mural painting actions, exhibitions, beach cleaning, football matches, and an art workshop conducted by the German artist Odo Rumpf. Lobbying with governmental authorities and other stakeholders was also an important part of our work.

2. Project Background

Five species of sea turtles roam the waters around the Islands of Cabo Verde: Green turtles (*Chelonia mydas*), Leatherback turtles (*Dermochelys coriacea*), Olive Ridley turtles (*Lepidochelys olivacea*), Hawksbill turtles (*Eretmochelys imbricata*), and Loggerhead turtles (*Caretta caretta*). Only the loggerhead turtle (Fig. 1) nests regularly on the islands, however, the local





Fig. 1: Loggerhead turtle female on Boavista returning to the sea after nesting

nesting population of loggerhead sea turtles is the third largest population in the world after the nesting populations of Oman and Southeast Florida, and is the largest nesting population in the Eastern Atlantic. The Cape Verde loggerheads are referred by the International Union for the Conservation of Nature (IUCN) as the North East Atlantic subpopulation, which is redlisted by the IUCN as “Endangered” and denoted by SWOT (State of the World’s Sea Turtles) among the world’s 11 most threatened marine turtle populations. It is estimated that around two thirds of the nesting activity on Cape Verde occurs on the Island of Boavista.

Although all species of sea turtles are officially protected under the laws of Cape Verde, they are heavily exposed to a variety of threats. The primary threat is the slaughter of female loggerheads when they come ashore to nest. Additional threats include the destruction of nesting beaches by uncontrolled vehicle traffic as part of rapid tourism development, nest poaching, light pollution, trash accumulation in the water and on the beaches, targeted catch and by-catch of turtles at sea, and boat collisions.

On Boavista, the nesting females were heavily exploited by poachers for their meat as they came ashore to nest. The vulnerability of the turtles on land in combination with the easy accessibility of the nesting beaches, rapid increase of the local population since the early 2000s, and the lack of will and/or capability to enforce existing laws by the authorities further exacerbated the problem. The slaughter is particularly brutal and cruel, with flippers cut off and turtles sliced open to remove meat and internal organs while still alive. This is usually done before the females even nest by which all her progeny is killed as well. This situation has resulted in the United Nations Environment Program identifying Cape Verde as the conservation priority for loggerhead turtles (UNEP, 2002).

A special situation on Boavista is created by increasing tourism activities; according to official figures, over 1.6 Million overnight stays were recorded on Boavista alone in 2016, representing more than 40% of all overnight stays of Cape Verde. Mass tourism is resulting in a variety of additional problems for the sea turtles including nesting beach destruction by development projects, light pollution, motorized traffic on the beaches (quad bike tours), and poorly managed turtle watching activities.

The Turtle Foundation started its conservation project on Boavista in 2008 after being informed in 2007 by a local NGO about more than 1,200 turtles slaughtered on Boavista’s beaches in that year, and after being asked for help in this desperate situation. In 2008, as a result of Tur-



Fig. 2: Poached loggerhead turtles at Cruz do Morto, a so far unprotected beach section in the east of Boavista. **Fig. 3:** On a loggerhead turtle carcass, the Turtle Foundation team is documenting a case of poaching at the beach of Cruz do Morto. Particularly sad: This animal was already registered and carried a tag given to it by the Maio Biodiversity Foundation, a sea turtle conservation organization active on the neighboring Island of Maio.

tle Foundation's patrols and protection, the number of animals killed on Porto Ferreira Beach alone was reduced from 600 in 2007 to 60 in 2008. In 2009, total mortality on Boavista was estimated at 220 animals. By including further so far unprotected beaches was reduced even more in the following years. On beaches protected by Turtle Foundation generally not more than 10 turtle mortalities were recorded. However, these figures do not reflect the true extent of the situation, because they do not include major beaches monitored by other NGOs, and remaining beaches not yet monitored at all (Figs. 2, 3), and only consider documented poaching incidents. Turtles taken away from the beaches and slaughtered elsewhere were not included. Further, general poaching activities started again to increase during the last few years.

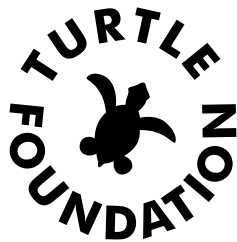
Since the beginning of its beach patrolling activities on Boavista the Turtle Foundation took increasing efforts to create accompanying programs to drive sustainability of its conservation project. These programs include environmental education activities for local children ("School in Nature"), adults, and international tourists; public events, presentations, and exhibitions to promote environmental awareness; programs to identify and to create alternative income opportunities; and lobbying activities among the local government and other stakeholders. However, the recent resurgence of poaching activities demonstrate that there is still a long way ahead of us until the loggerhead sea turtles can nest safely on Boavista's beaches and the depleted turtle population can recover.

3. Project Outlines

3.1. Turtle Foundation and Fundação Tartaruga

The project was operated by the Turtle Foundation and by Fundação Tartaruga. The Turtle Foundation is an international group of closely linked wildlife conservation organizations, dedicated especially to the protection of sea turtles and their habitats. The Turtle Foundation currently includes five national bodies, registered as nonprofit, tax-exempt organizations under the local legal requirements: Turtle Foundation Germany (since 2000), Turtle Foundation Switzerland (since 2006), Turtle Foundation United States (since 2006), Turtle Foundation Cape Verde (since 2012; local name: Fundação Tartaruga Cabo Verde), and Turtle Foundation Liechtenstein (since 2014). In addition, in Germany the Turtle Foundation Friends e. V. is registered as a nonprofit, tax-exempt membership corporation. The Turtle Foundation primarily

conducts operational activities and currently runs, besides the Boavista project, a further conservation project in the Derawan archipelago off the east coast of Borneo, Indonesia. While the Turtle Foundation subsidiaries Europe and USA are mainly concerned with general program organization, strategic planning, public relation on national and international levels, and fundraising, the Cape Verdean Fundação Tartaruga is implementing the conservation project on Cape Verde. It is aimed for the future that Fundação Tartaruga increasingly gains organizational and financial autonomy to foster its role as an independent, well recognized, effective, and powerful Cape Verdean nature conservation organization.



3.2. General project objectives

- Protection from poaching of the nesting sea turtles coming ashore
- Promoting the participation of local and national authorities in the conservation and protection of the sea turtles
- Improving the scientific and general knowledge of marine turtles in the project area
- Environmental education of the public in general, especially about sea turtle and marine conservation
- Creation of alternative livelihoods for people affected by conservation measures, especially through participation in tourism development and direct employment in conservation

3.3. Project location

The Cape Verde islands form the independent archipelagic state Republic of Cabo Verde located in the central Atlantic Ocean approximately 570 km (350 mi) off the coast of Senegal, West Africa (Fig. 4). The archipelago consists of 10 islands of volcanic origin, of which nine are permanently inhabited, and of several islets. Boavista is the easternmost island of the archipelago covering an area of about 620 square kilometers, mostly consisting of semi-arid or deserted landscapes with opportunities for some agricultural activities in a few areas. The coasts consists of sandy beaches reaching from several meters up to several kilometers, and rock formations. The island is inhabited by about 15,000 people in 2016 (according to the National Institute for Statistics of Cape Verde), a majority of them living in Sal Rei and Rabil. The island's capital is Sal Rei, where the office of Fundação Tartaruga, the local partner branch of the Turtle Foundation, is situated.

In 2016, the project included eight nesting beaches (Água Doce and the western half of Boa Esperança in the northern part of Boavista; Norte, Gatas, and Canto in the Northeast; Curral Velho, Ponta Pesqueira, and Lacacão in the South) with a total length of about 30 km. A community-based project financed by Turtle Foundation monitored the beach Varandinha in the Southwest.



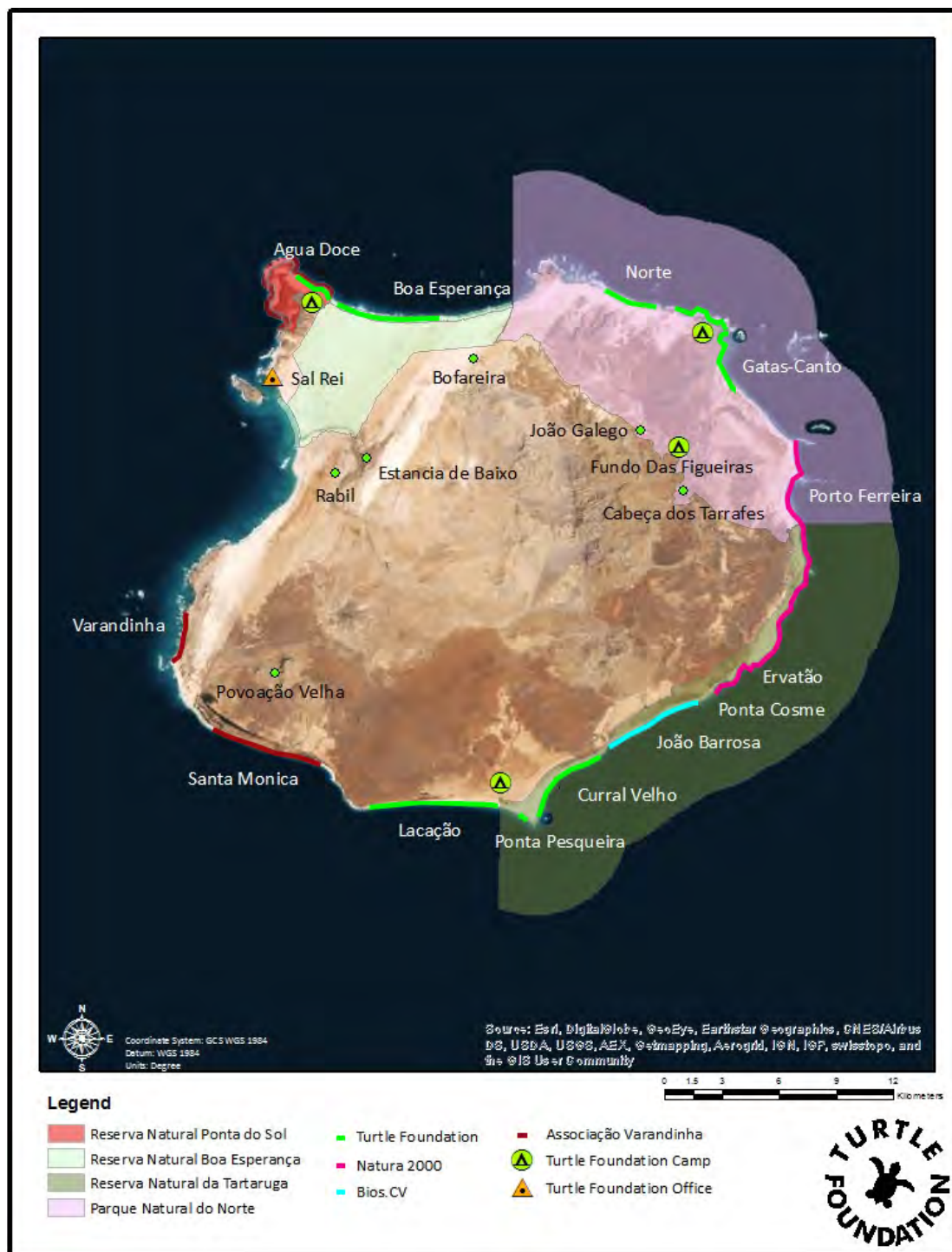


Fig. 4: Map of Boavista with beaches protected by the organizations Turtle Foundation, Varandinha Association, Natura 2000, and BIOS.CV during the nesting season 2016. Map: Google

3.4. Vision & Mission

Our vision is a future where sea turtles and their habitats are sustainably protected, healthy, and safe from the threat of extinction and destruction.

Our mission is to contribute to sea turtle conservation at our own project sites by cooperating with local communities to create a future where both sea turtles and people can thrive.

3.5. Team

Management:

- Program director Turtle Foundation: Dr. Hiltrud Cordes (Germany)
- Project manager Fundação Tartaruga I: Euclides Resende (Cape Verde)
- Project manager Fundação Tartaruga II: Joana Nicolau (Portugal)

Supply and logistic:

- Carlos Varela (Cape Verde)
- Ivanildo Gonçalves (Cape Verde)
- Artemisa Andrade (Cape Verde)

Special tasks:

- Community coordinator: Cintia Lima (Cape Verde)
- Data collection supervisor: Derek Aoki (USA)
- Volunteer coordinator: Nuno Cardoso (Portugal)
- Scientific advice: Thomas Reischig (Germany)

Field station management:

- Boa Esperança camp coordinator: Cristina Ferrando (Spain)
- Boa Esperança field coordinator: Martinho Cá (Cape Verde)
- Canto camp coordinator: Domingos Dias (Cape Verde)
- Canto field coordinator: Davilson Gomes (Cape Verde)
- Lacacão camp coordinator: Camilo Carrasco (Brasil)
- Lacacão field coordinator: Laura Sánchez (Spain)

Rangers:

In 2016, 26 Cape Verdean rangers (Fig. 5) were employed to perform beach patrols, data collection, and general tasks in the field stations.

While management team and officers for supply and logistic were employed during the whole year, officers for special tasks (except the community coordinator), field station management teams, and rangers were employed during the nesting season from beginning of June until end of October.

3.6. Field stations

Monitoring and protection of the beaches were conducted from three temporary on-site field stations (Boa Esperança camp, Canto camp, and Lacacão camp; Figs. 6–8), each led by a team of one camp coordinator and one field coordinator (Fig. 9). The camps were erected in mid June at the beginning of the nesting season and taken down by end of October after turtle nesting activity stopped. All camps consisted of several large living tents for rangers and volunteers, smaller tents for the camp management team, and a large open cooking and community tent. Each camp was equipped with an electronically controlled, battery buffered



Fig. 5: Rangers erecting the field station Boa Esperança in June 2016. **Fig. 6:** Boa Esperança field station



Fig. 7: Canto field station. **Fig. 8:** The Lacacão field station receives a water supply.



Fig. 9: The coordinator of the Boa Esperança camp, Christina Ferrando, during the daily disposition of personnel for the night patrols. **Fig. 10:** One of the three solar power stations that were purchased for the electricity supply of our field stations; here at Boa Esperança.

200 pW solar power station (Fig. 10) for basic electricity supply (computers and communication devices), a gas fridge, and all necessary equipment for cooking and general housekeeping to make living and working in the remote and difficult conditions as tolerable as possible. The solar power stations were newly introduced in 2016, thus allowing us for the first time to permanently fulfill all electricity requirements of our work equipment and means of communication without using gas-operated generators. To alleviate patrolling the long Curral Velho beach that is controlled by the Lacacão camp, additionally for the first time a provisional satellite camp was build on the northeastern end of the beach.

3.7. Volunteer program

Turtle Foundation runs a volunteer program from June to October every year. Along with our local rangers, volunteers (Fig. 11) represent our main work force for patrolling the beaches, for collecting nesting data, and for general duties in the camps. In 2016, in the camps of Boa Esperança and Lacacão together we accommodated 55 volunteers with 13 volunteers coming from Cape Verde, and 42 volunteers joining from international destinations. In the Boa Esperança camp we had 14 volunteers from abroad, with the majority coming from Portugal. Boa Esperança registered a higher number



Fig. 11: Camp life with rangers and volunteers in the Lacacão field station

of girls over boys, and an average length of stay of 28 days. In Lacacão, of the 23 volunteers, most came from the UK and Germany, with a better balance between boys and girls, and an average length of stay slightly longer: 42 days. During this season all of our volunteers joined us from Europe with the exception of one who came all the way from Mexico. We had four volunteers returning after joining us on previous seasons. There was a good balance between short term volunteers (two to eight weeks stays) and long term volunteers (stay longer than two months and have responsibilities for special duties). Our international volunteers paid a fee that covered their food, accommodation, transfers on Boavista, and logistic support. The Cape Verdean volunteers joining us in 2016 (highest number so far) got to us through friends, School of Nature, and other community activities. We promoted inter-camp interaction during our anniversary party that took part in the Boa Esperança camp. Volunteers and rangers from the other camps gathered in Boa Esperança where they took part in football games and other activities. The volunteers and staff in the camps organized several island tours that in addition to get to know the island promoted team building and interaction between the camps.

4. Activities and Outputs

4.1. Nesting beach protection

4.1.1. Beach patrolling

In 2016, the project included eight loggerhead turtle nesting beaches (Fig. 12) with a total length of nearly 30 km. The beaches were monitored by Turtle Foundation teams from the adjacent field stations:

- Boa Esperança camp: beaches Água Doce, western half of Boa Esperança (north of Boavista, totaling ca. 10 km)
- Canto camp: beaches Norte, Gatas, Canto (northeast of Boavista, totaling ca. 7 km; the hard-to-reach, about 600 m long beach section of Gatas was in 2016 the first time completely included in the daily patrols)
- Lacacão camp: beaches Curral Velho, Ponta Pesqueira, and Lacacão (south of Boavista, totaling ca. 12 km)

In addition, the Turtle Foundation, as in previous years, allocated financial resources to enable the group *Projeto Varandinha* from the community of Povoação Velha to regularly monitor



Fig. 12: Part of Curral Velho beach, which was patrolled every night during the nesting season 2016 as were all of our project beaches.

the nesting beach of Varandinha, which is about 5 km long – as well as to patrol sporadically the beach of Santa Monica in the Southwest of the island. Thus, in total about 35 km of nesting beaches on Boavista were covered. Other beaches of the island with a high rate of nesting activities were monitored – as in previous years – by the NGOs Natura 2000 (beaches Ervatao and Porto Ferreira at the east coast) and BIOS.CV (beach João Barrossa in the Southeast).

The direct protection work was carried out by the rangers and the volunteers. The patrols began at all beaches monitored by Turtle Foundation at the onset of the nesting season in mid-June. The date on which the patrolling activities ended varied between different nesting beaches and was dependent on nesting activities. Generally, monitoring stopped after for a certain time no more nesting activity could be recorded, which occurred by end of October.

The beach patrols were conducted every night during the nesting season with teams consisting of at least two people patrolling allotted beaches or beach sections. Each beach or beach section was patrolled in two shifts which covered the first and the second half of the night, respectively. Each turtle is monitored and protected until she returns safely to the water. Additionally, daily morning surveys were conducted on the nesting beaches (“morning census”) where all signs of turtle activities were recorded. This allowed us to record total numbers of nests, including nests that were not encountered during the nightly patrol, and also to find evidence of poaching that might have been overlooked at night.

On some beaches, depending on the availability of people, occasionally special patrols were conducted with the objective to cover the ends of the beaches, which were more susceptible to poaching. This was caused by the high density of activities during the season, which often completely engaged the regular patrols in the more central parts of the beaches. These special patrols started before the main patrols. At the northern end of Curral Velho beach it was even necessary to set up a satellite camp, after evidences of turtles taken at the end of the beach were recognized. The satellite camp was prepared to accommodate two to three people who were responsible to protect the northern end of the beach until the main patrol arrived there.

All members of the fieldwork teams received intensive training while stationed in one of the three field camps (Fig. 13). The training includes track identification, nest location, turtle marking, recording of data, and first aid. In 2016, the Turtle Foundation continued with its special ranger training program that was paused in 2015. This training was offered to 11 Cape

Verdean participants who received an intensive training enabling them to become patrol leaders.

In 2016 we decided, not to pursue the allocation of military personnel on the nesting beaches anymore. Even though this cooperation was very successful in the first years of our project, in recent years it turned out to become an increasing risk. As long as the poachers were discouraged to go the beaches by the sheer presence of the soldiers, the military presence helped a lot to reduce poaching, but the approach started to lose its impact with poachers realizing that no law enforcement action could be taken by the soldiers. On the other hand, the soldiers didn't have any special training in conflict resolution, so concerns were raised that conflicts with poachers might escalate to unwanted physical violence.

The local national park agency *Áreas Protegidas* (Protected Areas) recruited and paid some local people and sent them for training and helping in beach patrols to the camps, but these rangers do not have any law enforcement authority.

Towards the end of the season, when poaching went out of control on some beaches, local policemen were sent to the most problematic beaches on the east coast to accompany night patrols. But once again this approach did not aim to implement law enforcement and arrest poachers, but to keep poachers away from the beaches for a while. Since the presence of the police was well communicated, this was successful so far, but on the long run, only law enforcement and legal prosecution can make a real change beyond temporary deterrence.

4.1.2. Community-based project “Projeto Varandinha”

In 2016, Turtle Foundation again funded the community-based project “*Projeto Varandinha*”, a beach protection project organized by the association *Associação Varandinha* based in the village of Povoação Velha (Fig. 14) in the southwest of the island. The members of “*Projeto Varandinha*” monitored, in rotating shifts, the Varandinha beach in the Southwest of Boavista, and occasionally also Santa Monica beach in the South. In 2016, 394 nests were reported by the Varandinha project, and data collection standards were further improved to meet with that of Turtle Foundation.



Fig. 13: Hatched nest excavation demonstration for rangers and volunteers



Fig. 14: Aerial image of Povoação Velha at the base of the mountain Rocha Estância in southwestern Boavista

4.1.3. Poaching report

Poaching is a very serious threat for the sea turtle populations on Cape Verde, which was significantly reduced through the joint commitment of the four conservation organizations on Boavista. However, we noticed again increasing poaching activities on all beaches of Boavista in the last two years. On our monitored beaches alone we documented evidence of 25 cases

of poaching (remnants of slaughtered turtles and other clear traces), which is significantly more than the average of 5–10 cases per season in earlier years. Moreover, together with Natura 2000 we conducted investigations on one particular beach – named *Cruz do Morto* (“cross of death”) – in the Northeast of Boavista, as well as in some adjacent areas that so far were not yet monitored by conservation organizations (Fig. 15). There, we counted over 30 slaughtered turtles or clear evidences of slaughter. Further, 90 cases were reported by Natura 2000 from adjacent beaches. A conservative estimate of 100% undetected cases of turtle killings on guarded and unguarded beaches would thus indicate at least 300 slaughtered sea turtles by poaching on Boavista, which is more than 7% of this year’s nesting female turtle population. On the neighboring Island of Sal, the documented cases alone reached over 200. Unfortunately, this shows that after the first lull in poaching the threat is far from being over, and that also in the upcoming years intensive beach monitoring including extension of



Fig. 15: Poaching incidents recorded by Turtle Foundation (TFxxx) and Natura 2000 (NATxxx and APxxx) between the Canto field station and Ponta do Forno de Cal in the Northeast of Boavista. Due to spatial restriction only a part of the marked incidents is named; however, the concentration of poaching on uncontrolled beach sections, especially at Cruz do Morto, is clearly visible. Green line: beach protected by Turtle Foundation; pink line: beach protected by Natura 2000. Map: Google Earth

monitored areas will be necessary for containment of poaching. As one of the most important immediate measures, the Turtle Foundation will include the beach stretches around Cruz do Morto into the existing protection program, which will require the setup of an additional field station along with associated logistics.

On several occasions during the season, Turtle Foundation patrols met people from the nearby villages especially at the northern beaches. Suspicious activities were reported to the police. Generally, we noticed a significant change in the behavior of poachers towards aggressiveness and impudence compared to previous years. This shift in behavior is a result of the lack of law enforcement which has led the poachers to be confident that prosecution and conviction is not happening. Moreover, it shows that local people are aware that laws for the protection of sea turtles are still weak. We need to intensify our efforts to improve this situation.

In 2016, for the first time local people from one of the northern communities reported illegal sales of turtle meat in their village to the police. The police reacted quickly and confiscated 38.1 kg of turtle meat, 10.2 kg of turtle eggs, and 5.8 kg of turtle intestines (Fig. 16). The people involved in that case were taken to the police station. No information is available yet if measurements of legal prosecution have been initiated.



Fig. 16: Confiscated turtle meat

4.1.4. Nest management on Lacacão beach

Turtles coming ashore often abort the nesting procedure prior to the actual egg-laying, which to certain extent is a natural behavior. For all beaches, except for Lacacão, in 2016 we calculated nesting rates (numbers of counted nests compared to numbers of found turtle traces) between 28.9% and 41.1% with an average of 34.9%. However, for Lacacão, where since 2010 a huge hotel (RIU Touareg providing about 2,000 beds; Fig. 17) and a water treatment plant are located, the nesting rate was only 18.7%, thus showing a significantly higher nesting abort rate (compare table 1). The main cause is the much too intensive, unregulated nighttime illumination of the nesting beaches by the hotel and plant facilities, scaring the turtles off. In addition to the disturbance of nesting female turtles, this inappropriate illumination of both facilities leads to adverse effects on the nightly hatching of turtle hatchlings from those nests that were still laid nearby. As a result of the artificial light, the hatchlings are misdirected away from the water towards the lights and end up dying in the heat of the following day. In a scientific study of the University of Freiburg (Germany), which has been conducted on site by Derek Aoki within the framework of his master's degree, the adverse effects of

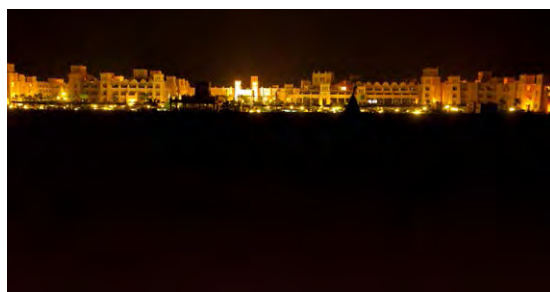


Fig. 17: Brightly illuminated hotel "RIU Touareg" on Lacacão beach, seen from the beach site during night time



Fig. 18: Hatchery at Ponta Pesqueira beach near the Lacacão field station. **Fig. 19:** The camp coordinator of Lacacão, Laura Sanchez, digs out a nest that was laid near the RIU/TUI hotel the night before, in order to relocate it to our safe hatchery. Each egg has to be handled very carefully – it even has to be strictly avoided that eggs are turned until they are finally placed in their new location.

artificial illumination on nesting turtle females as well as on turtle hatchlings were analyzed, quantified, and finally confirmed (see “4.2.2. Effect of artificial light on nesting behavior and hatchling orientation”).

Unfortunately, there currently remains for us little more than to collect the facts and to consistently point out those deficiencies to the responsible entities. In spite of the overwhelming evidence of these adverse effects, the hotel facilities are being further expanded in 2016. In order to reduce the adverse effects at least to some extent, most nests around the hotel facilities were relocated into a fenced hatchery or to the adjacent beach of Ponta Pesqueira (in total 124 nests; Figs. 18, 19). For 7,734 eggs of 92 relocated nests in the hatchery we observed a hatching success rate of ca. $86.9\% \pm 14.1\%$ SD, which corresponds to the normal hatching rate of in situ nests undisturbed by predators. The mean incubation time for the nests was $59.2 \text{ days} \pm 2.3 \text{ days}$ SD (minimum 55 days, maximum 73 days). The high hatching rate demonstrates successful implementation of the relocation measures by our on site personnel.

4.1.5. Turtle rescue

Occasionally, turtles do not find their way back to the sea after nesting, get stuck in the dunes and would eventually swelter in the heat of the day. If such turtles are discovered they are rescued by the combined efforts of the nearest Turtle Foundation team. The turtles were cooled with water and carried to the sea. In 2016, one turtle was rescued this way on the beach of Curral Velho.

4.1.6. Sign posting

The focus of the mass tourism development on Cape Verde lies on the Islands of Sal and Boavista. Especially on Boavista tourism development is generally expanding beyond any sustainability and environmental compatibility. Sea turtles are threatened by beach development, excessive lighting of the beaches, destruction of nests by unregulated car and quad bike driving on the beaches, and disturbance of nesting turtles by unprofessionally guided turtle watching tours. The posting of signs depicting prohibited vehicle traffic and information on nesting beaches and the marking of legal pathways for motorized vehicles – as started in 2014 – was expanded in 2016 to further areas with additional 16 signs. The signs were designed by Turtle Foundation, produced in Germany, and posted at selected locations.

4.2. Data collection and research

4.2.1. Basic nesting and tagging results

In addition to the beach protection patrols, data are collected on the nests and nesting turtles, e.g., numbers and exact locations of nests, numbers of unsuccessful nesting attempts, numbers of dead turtles found on the monitored beaches, and biometrical data from nesting turtles (Fig. 20). Following a cautious start, overall, 2016 was a record year in terms of landed sea turtles and nest numbers: On all beaches of the core project we counted in total 3,668 nests – which was significantly more than 2015 (1,652 nests) and slightly more compared with the former record year 2012 (3,618 nests; table 1 depicts beach landing and nesting activity for every project beach along with nesting rates while table 2 compares nest numbers from the years 2009–2016). In addition, 394 nests were counted by the Varandinha project, resulting in a total of 4,062 nests recorded throughout Turtle Foundation’s engagement on Boavista. Together with the data collected by the other NGOs, on all monitored beaches of Boavista about 20,500 nests were recorded, of which about 20% were protected by Turtle Foundation and the Varandinha project.



Fig. 20: Under red light, from which the animal is not disturbed, a loggerhead turtle is marked and measured after egg laying.

The combined data of the last few years so far do not clearly indicate a decrease of the local nesting loggerhead turtle population, although the observation period is too short to make statistically valid statements in this respect. Figure 21 shows the combined nest numbers on the beaches of Canto, Norte, Curral Velho, and Lacacão from 2009–2016. These beaches were observed by the Turtle Foundation from 2009 on, whilst Ponta Pesqueira, Boa Esperança and Água Doce were added to the protection program in the following years. The trend of the graph roughly reflects the overall nesting trend on Boavista since 2009, provided that the trend

Beach	Tracks/landings without nesting	Nests	Totals activities	Nesting rates (%)
Água Doce	547	303	850	35.6
Boa Esperança	1,196	486	1,162	29.9
Norte	955	527	1,480	35.5
Gatas	131	67	198	33.8
Canto	638	359	997	36.0
Curral Velho	2,136	1,127	3,290	34.3
Ponta Pesqueira	807	540	1,347	40.1
Lacacão	1132	261	1,393	18.7
Totals	7,569	3,668	11,237	

Table 1: Summary of the nesting activities on beaches monitored by Turtle Foundation during the season 2016

Beach	2009	2010	2011	2012	2013	2014	2015	2016	Mean
Água Doce	n/a	n/a	n/a	232	263	168	104	303	214
Boa Esperança	n/a	267	189	537	555	221	303	486	365
Norte	329	398	122	436	283	132	179	525	301
Gatas	n/a	n/a	n/a	n/a	n/a	n/a	n/a	67	67
Canto	411	164	66	282	212	170	218	359	235
Curral Velho	558	422	259	1,320	754	466	534	1,127	680
Ponta Pesqueira	n/a	161	116	421	283	160	188	540	267
Lacacão	304	208	85	390	193	114	126	261	210
Totals	1,602	1,620	837	3,618	2,543	1,431	1,652	3,668	

Table 2: Numbers of nests on beaches protected by the Turtle Foundation from 2009 to 2016. n/a: Beach was not yet in the protection program of the Turtle Foundation in the given year.

behaves proportionally on all beaches, which is suggested by common experience. However, it is important to note that the impact of increased poaching during the 1990s and 2000s will only become clear with some delay due to the long generation time of the sea turtles.

Besides the documentation of pure nesting activities of sea turtles, during our patrols we also collect additional biological data of encountered nesting turtles. Individual animals are marked or identified by existing markings. For 2016, in total 662 nesting turtles were newly

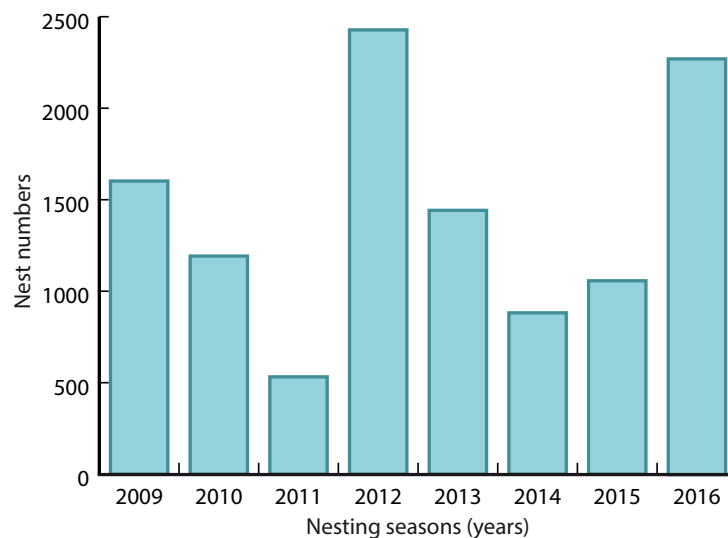


Fig. 21: Combined numbers of nests on the beaches Norte, Canto, Curral Velho, and Lacacão from 2009 to 2016. The trend of graph approximates the overall nesting trend on Boavista in the given period with very low nesting numbers in 2011 and very high nesting numbers in 2012 and 2016. See table 2 for detailed numbers including those beaches that were integrated later into the protection program, and thus, are not included in the graph (Água Doce, Boa Esperança, Gatas, and Ponta Pesqueira).

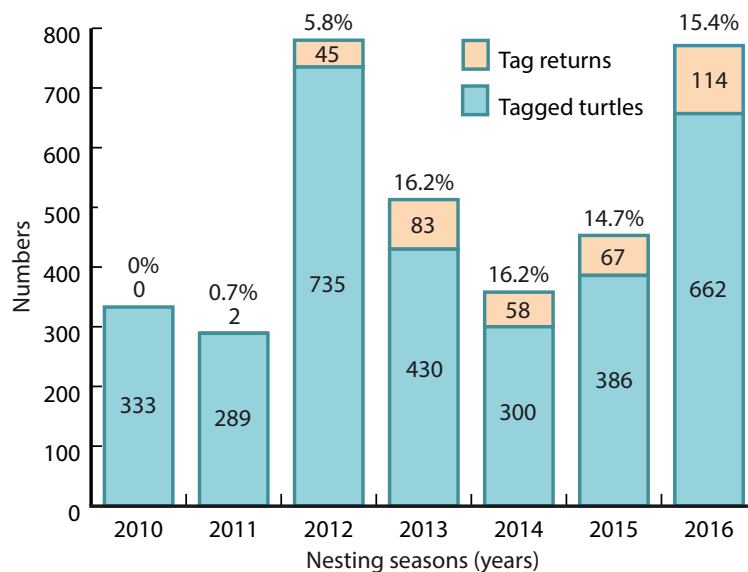


Fig. 22: Numbers of turtles individually identified by new tagging ("Tagged turtles") and returns from previously tagged turtles ("Tag returns") from 2010 to 2016. The percent numbers indicate the return rates of the given year in respect to all turtles identified individually during a particular season (tagged turtles plus tag returns). Individual animals that were encountered two or more times during one season are counted here as single encounter. Returns from tags that were not applied by Turtle Foundation are not included.

tagged (Fig. 22), while 215 individuals, having been marked in previous years by Turtle Foundation (114 animals) or other organizations, were identified again. The information derived from these data is evaluated to explore the specific nesting biology of nesting loggerhead turtles on Boavista, and to estimate the current size, condition, and structure of the local turtle population and its temporal development, and thus considerably helps to improve our conservation measures.

4.2.2. Effect of artificial light on nesting behavior and hatching orientation

It is known that adult turtle females are largely deterred by artificial illumination from coming ashore to nest because they tend to favor darker locations to lay their eggs. If they come on land anyway, light can confuse them as they try to crawl back to the sea due to their tendency of crawling towards flat, brightly lit areas. For hatchlings, they orientate themselves by scanning the horizon and are attracted to areas that reflect more light. On dark, remote beaches, this would be the seaward horizon. However, beach front lighting creates an artificial light horizon on the landward side of the beach, causing hatchlings to crawl away from the sea, resulting in death by exhaustion, predation, or dehydration after sunrise. Thus, artificial beach illumination is causing severe and increasing problems for sea turtle conservation.

On Lacacão beach, the 2,000 bed all-inclusive resort (RIU Touareg) was set operational in 2011 and is further expanded since 2016. More hotels and resorts are expected to be constructed there in future. Adjacent to the resort a water treatment plant is producing fresh water for the hotel facilities. Despite known adverse effects to nesting and hatching sea turtles, the hotel, the construction sites, and the water plant are brightly lit during nighttime. An expertise of Erik Martin, a specialist in turtle-friendly lighting for hotels and other construction on turtle nesting beaches, suggesting measures for mitigating the impact of artificial light to the turtles, was largely neglected. However, disturbed nesting behavior on Lacacão beach was

observed since the construction of the hotel began. Derek Aoki, an MSc student from Albert-Ludwigs University Freiburg, Germany, and the project's data collection supervisor, undertook two studies that examined the effects of the beach front lighting on nesting turtles and turtle hatchlings.

GPS nesting data collected by volunteers and staff members from 2012–2016 were used for the spatial distribution analysis of nesting behavior. It was shown that nesting activity was concentrated towards the eastern portion of the beach. It takes a sharp decrease in front of the hotel, and is scarce across the western part of Lacacão. This was also the point where nests became outnumbered by non-nesting attempts.

Experiments with turtle hatchlings were carried out that employed seven circular arenas, spread across the beach, where up to 30 hatchlings were placed in the center of the arena, allowed to crawl for two minutes, and the point where they exited the circle was marked and recorded. The results show that the lights from the hotel and the water plant significantly attract hatchlings, causing them to deviate from their optimal crawling path to the ocean.

In conclusion it was clearly demonstrated that the artificial light on Lacacão beach significantly and adversely affects nesting turtles and their offspring. The results of this study have been worked out in Derek Aoki's master thesis "The effect of artificial light on the nesting tendencies and hatchling orientation of loggerhead sea turtles (*Caretta caretta*) on Boavista, Cape Verde" (supervisors: Dr. Florian Hartig and Dr. Gernot Segelbacher, University of Freiburg, Germany).

4.2.3. Research projects of the Queen Mary University of London

For the sixth season Dr. Christophe Eizaguirre, Reader at Queen Mary University of London (QMUL), and the Turtle Foundation collaborated. The research on Boavista adds to further field studies done on all other islands of the archipelago since 2010. In 2016, field research on Boavista was carried out by Sahmorie Cameron and Emma Lockley, PhD students at QMUL, in the Lacacão field station and adjacent beaches. Research focused on following projects:

Migration and genetic diversity: The overarching goal of this project was to understand the distribution of genetic diversity in the archipelago and to identify the processes that affect this diversity. To this end, small tissue samples of nesting loggerhead turtles were collected and specific genetic regions were sequenced. Combining with results obtained from other islands, it was possible to demonstrate that all turtles nesting in Cape Verde were born in the archipelago, and that most turtles return to their natal island to nest. The underlying mechanisms are still unknown but it is suggested that for maintaining this capacity across islands, genetic diversity is crucial. This work has major impacts for conservation strategies that should be directed to maintain high genetic diversity in sea turtle populations. This is a goal of the lab's long term genetic survey.

Local diversity of feeding strategies: In the past year, the Eizaguirre lab has identified that turtles use different feeding grounds and that the diversity of so-called feeding strategies is not randomly distributed across islands (Fig. 23). For instance, turtles in Boavista mainly use three different feeding grounds, one of them particularly exposed to oceanic conditions in the form of up-welling. Up-welling are the uplifts of cold waters due to trade winds that bring deep sea nutrients to the ocean surface, which can then be taken up by small organisms (plankton), which then will bloom and serve as food items for turtles and other organisms. Understanding how up-welling affects turtle feeding strategies and how on-going climate change will alter up-welling events and consequently impact turtles is also part of the lab's research project.



Fig. 23: Map of Cape Verde Archipelago plotted together with results of stable isotope analysis obtained by the Eizaguirre lab from small skin tissue samples of turtles that nested on the respective islands. The ratios of naturally occurring variants of certain elements, here carbon (C) and nitrogen (N; isotope contents noted as $\delta^{13}\text{C}$ (‰) and $\delta^{15}\text{N}$ (‰)), were used to determine preferred feeding areas and strategies of sampled turtles. These are represented by colored clusters in the point clouds of isotope contents that could be separated by statistical analysis. The plot for Boavista demonstrates that turtles nesting there represent three turtle populations feeding in up-welling areas (orange), in open ocean areas not exposed to nutrient enrichment (green), and in a shallow area off Sierra Leone (black). Figure provided by Dr. Christophe Eizaguirre

Effects of maternal parasite infection on offspring fitness: Over the years a large fluctuation of parasites was observed on turtles nesting in Cape Verde. How those leech parasites affect turtle physiology, and impair reproduction remains unknown. For a number of turtles blood samples were collected, their feeding strategies were determined, the presence of parasite was investigated, and their clutches were tracked over time. Female haematocrit levels, a measure of health, was impacted by the presence of parasites. Furthermore, parasitized females fed less efficiently than non-parasitized turtles, likely a result of weaker body condition. Additionally, while different food regimes did not translate into a lower clutch size, offspring from infected females were significantly smaller than offspring of non-infected females. Such effects may affect the lifetime fitness of offspring, and may have implications for the population dynamics of this endangered species. Current studies aim to determine those impacts.

Altogether the year 2016 has seen the number of turtles tracked increased and evidence suggests that many elements, whether natural or anthropogenic, affect turtles' health and fitness. The more we understand those elements, the better we would be at protecting this emblematic species.

(Project summaries kindly provided by Dr. Christophe Eizaguirre: <http://www.sbc.sqmul.ac.uk/staff/christopheizaguirre.html>)

4.3. Community engagement

4.3.1. Community coordinator

In addition to direct conservation and protection measures, the Turtle Foundation aims to ensure sustainability of the conservation efforts through environmental education and community engagement. For community work and environmental education, for the season 2016 the coordinator Cintia Lima was recruited. The objective was to get better insights into the public perception of nature conservation activities, and into the opinions, needs, and wishes of the local population. By this approach we want to better coordinate future measures for community engagement and development of alternative income opportunities with the local people. The main tasks of the community coordinator were as follows:

- Improving information exchange between the local communities and the nature conservation organizations
- Conducting a social study to explore awareness and valuation of ongoing conservation and protection programs for sea turtles
- Organizing various events and presentations on Boavista aimed to promote appreciation of the interests of nature conservation and to promote the public reputation of locally active nature conservation organizations

4.3.2. Community meetings

A total of four meetings were held in the villages of Povoação Velha, Cabeça dos Tarafes, Fundo das Figueiras, and João Galego. The discussions were, as expected, partly controversial, but can be considered a first step for deeper insights into the mind-sets and opinions of the local people, and a starting point of getting involved into a dialogue.

4.3.3. Community survey

While direct beach protection is the first measure of choice to reduce poaching in the short run, sustainable conservation needs support by local people. To better involve people into conservation strategies and measures it mandatory to have reliable information on public opinions, attitudes, and behavior towards the protection of turtles and the environment, but also about demographic, social, educational, and economic structures of the population. Therefore, with support of the United States Fish and Wildlife Service (USFWS) a community survey was carried out where questionnaires were provided by interviewers to randomly selected members of all communities on Boavista. The questionnaires were intended to be filled by the respondents, aided by the interviewer if necessary.

The first part of the questionnaire contained personal questions about age, gender, origin, residency, education, profession, and access to communication media. To keep anonymity names were not recorded on the questionnaires. The second part contained questions about the respondent's knowledge and opinion towards sea turtle protection on Boavista. Questions were mostly multiple choice, but some required written answers. The questions asked for general knowledge about sea turtles, turtle encounters, and consumption of turtle meat (Fig. 24), about perceived endangered status of turtles, and about knowledge and opinion about protection legislation and prohibition of turtle meat consumption. Further questions asked for knowledge about local conservation organizations, their activities, and requested to judge about their importance and the quality of their work (Fig. 25). The questionnaires were distributed in nine communities grouped in three evaluation segments that make up the island: Sal Rei, Bairro Boa Esperança, Rabil (urban areas), João Galego, Fundo das Figueiras, Cabeça dos Tarafes (northern areas), Bofareira, Estância de Baixo, and Povoação Velha (other areas).

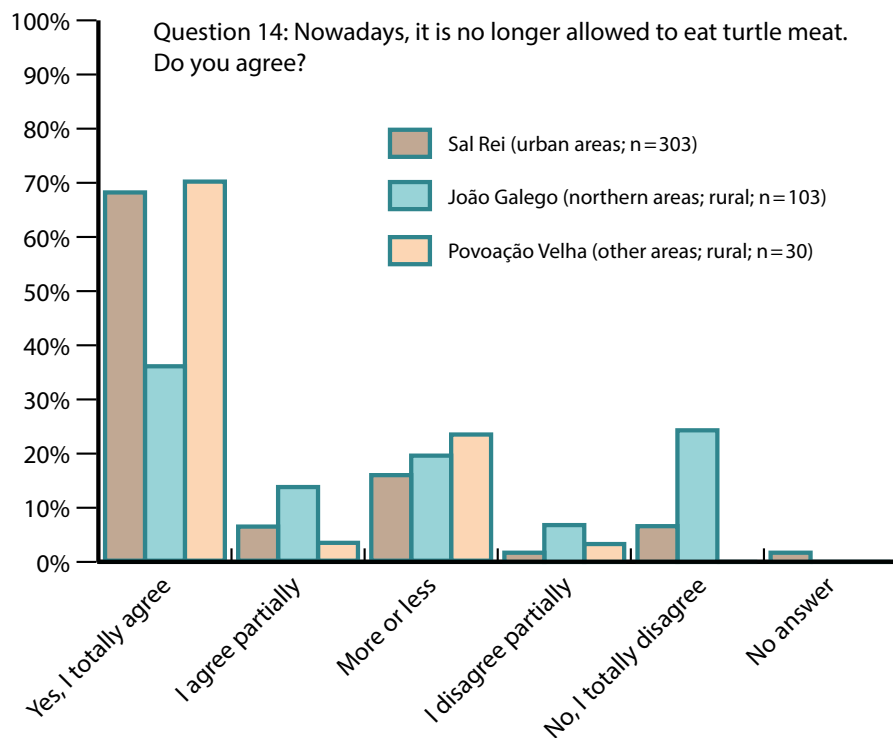


Fig. 24: Percentage of people in three out of the nine communities asked for their opinion about the prohibition of turtle meat consumption. Each community presented in the graph represents one of the evaluation segments “urban areas”, “northern areas”, and “other areas”. As was typical for all northern communities, disagreement about the present legislation banning turtle meat consumption was significantly stronger in João Galego than in Sal Rei and Povoação Velha, representing the evaluation segments “urban areas” and “other areas”, respectively.

In total, 951 people completed the questionnaire (652 = 68.6% urban areas; 197 = 20.7% northern areas; 102 = 10.7% other areas). This corresponded to 6.1% of the population on Boavista according to the official 2016 census counting 15,533 inhabitants. Detailed data of the survey will be published in a separate report; however in the following some general results important for future conservation are summarized.

The urban communities Bairro Boa Esperança and Sal Rei generally showed reasonable acceptance and recognition of the importance of sea turtle protection and of activities of the conservation organizations. On the other hand, many people showed only minor interest in turtles and their protection, which but appears reflecting indifference rather than negative attitudes; further, these people generally did not indicate to consume turtle meat. It is important to note that in these urban communities the percentage of by new-comers to Boavista from other islands of Cape Verde and foreign countries is especially high. Interestingly, a similar situation was found in the rural communities Bofareira and Povoação Velha. Future awareness campaigns in these areas might be mainly targeted to general awareness about environmental protection like avoidance and proper disposal of waste.

In the communities of Rabil and Estância de Baixo, the degree of acceptance was similar as in Bairro Boa Esperança and Sal Rei, but simultaneously the respondents demonstrated rather poor understanding of conservation status and the activities to protect sea turtles. There, awareness campaigns might be specifically targeted to demonstrate the importance of stopping turtle meat consumption.

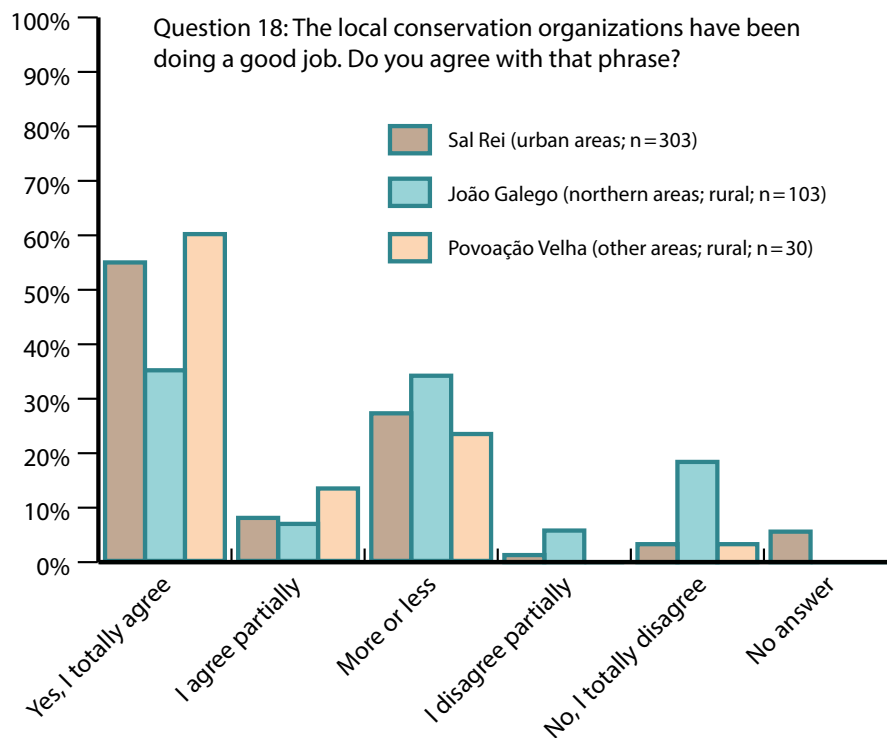


Fig. 25: Percentage of people asked for their opinion about the quality of the work of the local conservation organizations (samples as in Fig. 24). People in João Galego turned out to be most critical about the organization's activities, which was found for the other northern communities, too.

As expected, the main problems for turtle conservation on Boavista reside in the northern area with the communities João Galego, Fundo das Figueiras, and Cabeça dos Tarafes. Surprisingly, there was a high acceptance by a significant number of people of conservational needs as well as of conservation measures and awareness activities carried out by the conservation organizations. On the other hand, a considerable fraction of respondents clearly refused the ban of turtle meat consumption (Fig. 24) and denied that turtles are in danger. Interestingly, these attitudes appeared not to correspond with low educational levels or a general lack of knowledge, but appeared to be closely related with the historical and cultural role of sea turtle consumption. Further, we recognized clearly defiant responses against the influence of the government and NGOs in matters what people think to be personal live habits (Fig. 25). However, we also recognized many misconceptions about the role and work of the conservation organizations, which indicates that we partly failed to explain our mission. Thus, we see a big need and potential to improve our community work mainly in the northern communities. Future measures should emphasize on awareness and information activities, better involvement of communities in the conservation work, supporting the development of alternative income opportunities, increasing the work of the organizations beyond the five months of the nesting season, improving communication for better transparency, and improve relationships between organizations and communities. Another approach could include addressing the widespread problem of alcoholism.

4.3.4. Sustainable tourism and turtle watching

While mass tourism often has adverse effects on culture and environment of affected regions (see also 4.1.6. Sign posting), careful and respectful tourism development can offer opportunities for both local people and nature conservation. Especially on Boavista, sea turtles are

definitive a tourist attraction. Sea turtles do have the potential to provide an important source of income for local people that is much more sustainable and profitable than consumptive use. If turtle-based tourism would significantly contribute to the income of local communities, it could be expected that maintaining a healthy turtle population would be considered as a value among the majority of the local people, while turtle poaching becomes socially discouraged. Simultaneously, awareness about the needs of sea turtle and marine conservation is increased among tourists. Further, frequent visits of beaches scares turtle poachers away. However, great care has to be taken that turtle-based tourism activities are carried out in responsible manner and are regulated to prevent additional harm to endangered sea turtle populations.

On Boavista, several tour operators, but also self-employed taxi drivers offer tours to watch nesting turtles on the beaches at nighttime. While the Turtle Foundation does not provide turtle watching tours, the sustainable development of turtle-based tourism in favor of turtle conservation and benefits for the local communities is one of our big concerns.

Turtle-based tourism on Boavista is regulated by the Cape Verdean Ministry of Agriculture and Environment, which issues licenses for turtle watching activities to companies and to individuals. According to reports from the ministry, in 2016 turtle watching licenses were issued to 8 tour companies and 62 self-employed taxi drivers. A total of 4,280 tourists took part in turtle watching excursions. Of these, 3,371 tourists (79% of total) went with tour operators, while 909 tourists (21%) went with taxi drivers. About 87% of the tourists booking their trip with a company went with the tour operator Naturália, who is collaborating with the local RIU hotels. Of 3,975 tourists visits of which data are available, the majority of tourists visited the beaches João Barrosa (2,161 visitors, 54.3%; 1,755 visitors brought by Naturália), Ponta Cosme (1,166 visitors, 29.3%; all brought by Naturália), and Ervatão (543 visitors, 13.7%). Only sparsely visited were the beaches Porto Ferreira (20 visitors) and Ponta Pesqueira (85 visitors).

The figures indicate a significant concentration of almost 70% of the clients at one particular company on Boavista, which we see problematic in terms of fair distribution of the revenues arising from turtle-based tourism among the local communities. Further, since tourism activities concentrates on few beaches there is a considerable risk of inappropriate disturbance of nesting turtles. Turtle Foundation therefore promotes best practice turtle watching as well as better participation of the local communities in this source of income. There is an urgent need for quality control of turtle watching tours and regulations limiting the number of participants per tour and defining rules of conduct to be followed on the beach. Further, there should be a system where certain quotas for these tours are allocated to all competitors and which distributes the tours evenly to suitable nesting beaches. In 2015, Turtle Foundation has suggested such a system with a custom made distribution software, which we called “The Turtle Hotline”. Even though this idea was rejected in the past, we still hope that an opportunity will occur in the future to implement the project.

4.4. Awareness, education, and outreach

4.4.1. Events

The majority of the events were organized and held in collaboration with local nature conservation organizations and/or government agencies on Boavista.

Children’s craft competition “Toys made from Recycled Material”. This competition was attended by all elementary schools of Boavista. The resulting products were exhibited at the Center for Art and Culture in Sal Rei and evaluated during an award ceremony (Fig. 26). The winning class came from a school in Sal Rei and won an excursion to the village of Fundo



das Figueiras, where the children also visited the local environmental information center. The school itself received a prize money of about 100 EUR/USD donated by the local association promoting tourism.

Outdoor activities with children from Bofareira. 25 children of the village of Bofareira were invited to participate in activities such as painting and crafting outdoors (Fig. 27).

Presentation and discussion in a retirement home in Sal Rei. In a brief presentation, the residents of the retirement home learned about the activities of nature conservation organizations on Boavista (Fig. 28). The following discussion was very revealing as we learned a lot about the history and the background of the turtle hunt on Boavista. 25 people participated in the event.

Soccer competition (Turtle League). A soccer competition was held between the turtle protection organizations Fundação Tartaruga, Natura 2000 and BIOS.CV and the north-eastern villages of João Galego, Fundo das Figueiras, and Cabeça dos Tarafes (Fig 29). Fundação Tartaruga lost early, while the last game between Fundo das Figueiras and Natura 2000 the later was the winner. The competition was concluded by a joint community dinner in which about 120 guests participated.

Exhibitions with accompanying program (Turtle Fairs). In Sal Rei and in the village of João Galego, a one-day event with exhibitions on sea turtles and accompanying program was held (Figs. 30, 31). Exhibits related to sea turtles were shown together with information items; the exhibits were also personally explained. The accompanying program consisted of music, sand



Fig. 26: Award ceremony for the children's craft competition "Toys made from Recycled Material".



Fig. 27: Painting and crafting children in front of the youth center of Bofareira



Fig. 28: Presentation by Cintia Lima in a retirement home in Sal Rei.



Fig. 29: Soccer match between the northeastern villages of Boavista and the locally active nature conservation organizations

sculpture competitions, quests, printing of T-shirts with stencils, and craft activities. Approximately 100 (Sal Rei) and 40 (João Galego) participants took part in the events.

Painting courses. Two members of the local art association «ASGI-Graphy» organized two painting courses for children from Sal Rei and the village of João Galego (Fig. 32). The seminars covered topics like basic painting techniques, knowledge of working material, and artistic expression. A total of 37 children attended the events.

Mural painting. In the town center of Sal Rei, a house wall was painted with turtles and marine motifs by the children who previously attended the painting course in Sal Rei (Fig. 33).

Art seminar with Odo Rumpf. Undoubtedly a highlight of our series of events was an art and sculpture seminar held by the well-known German artist Odo Rumpf (www.odorumpf.de). Together with a group of teenagers in Sal Rei, Mr. Rumpf created a huge sea turtle from metal scrap (Fig. 34) as well as some smaller turtle sculptures. In the seminar he was assisted by a former participant of our “School in Nature” events. The workshop began with an extensive search for suitable materials on scrap-sites and other locations. For the smaller sculptures also plastic material was used, which was gathered at the beaches. The sculptures were exhibited at the Estoril beach near the town center, together with information boards. The smaller turtle sculptures were then transferred to the Center for Art and Culture in Sal Rei (Fig. 35), the big sculpture found its final location in Povoação Velha later.

Beach cleaning action. In a large action with numerous participants, all the beaches of the island’s capital Sal Rei were freed from garbage.

Internal meetings. Several meetings were held with representatives of local conservation organizations and local nature conservation authorities to coordinate joint actions. Further-



Figs. 30, 31: Turtle Fair with accompanying program in Sal Rei



Fig. 32: Theory lesson of the painting course with a teacher from “ASGI Graphy” in Sal Rei. **Fig. 33:** Mural in the center of Sal Rei painted by the children of the painting course



Fig. 34: A turtle sculpture made from metal scrap is created in Boavista's capital Sal Rei under the guidance of the well-known German sculptor Odo Rumpf (left). **Fig. 35:** Smaller turtle sculptures, now parts of the permanent exhibition of the Center for Art and Culture in Sal Rei

more, a one week seminar on communication and conflict resolution was held especially for the turtle conservation NGO's by the Portuguese psychologist Inês Lourenço in order to improve the relationship between them.

4.4.2. School in Nature

The School in Nature (*Escola na Natureza*) is a proven and successful program for the environmental education of children and adolescents, which has already been carried out by the Turtle Foundation for several years. We invite local children to spend a day or a whole week-end in one of our field stations (mostly Boa Esperança, but also Lacacão) and participate in our environmental education course (Figs. 36-39). Outside the classrooms and directly on the beach, the children learn about the diversity and beauty of nature and the life of sea turtles, about the effects of environmental pollution on the sea turtles and the marine environment, and about the importance of sea turtles for the ecological balance of the ocean. However, general family and social issues directly affecting the children are also discussed. The children took part in lectures, working groups, and beach cleaning activities. For most children, the highlight of the event was the participation in our nightly patrols on safe beach areas near the camps, where they can also directly help in measuring and marking the encountered sea turtles – many of these children have never seen a living sea turtle before. In the project year 2016, the School in Nature was held five times separately for children and young people in the age classes between 6-12 years and 13-20 years, with a total of 71 participants.



Fig 36: The hatchery near the Lacacão camp, where young turtles will hatch soon, is explained to children of a School in Nature lesson. **Fig. 37:** Well-deserved lunch in the community tent of the Lacacão camp



Fig. 38: Group work on environmental education in the course of a School in Nature weekend in the Boa Esperança camp. **Fig. 39:** Beach cleaning action during a School in Nature weekend at the beach of Boa Esperança

4.4.3. TAOLA meeting

The Cape Verdean Sea Turtle Network TAOLA held its annual conference between 23 and 26 November 2016 in Rui Vaz on the Island of Santiago. As a founding member of the TAOLA network, Turtle Foundation participated in this 8th annual meeting bringing together the representatives of all sea turtle initiatives and stakeholders in the country. The conference was organized by the NGOs Fundação Biodiversidade Maio (FMB) and Projeto Biodiversidade (PB Sal) and chaired by Leno Passos (FMB) and Berta Renom (PB Sal). The meeting was attended by representatives of all NGOs working on sea turtle conservation on Cape Verde and of the following governmental and non-governmental institutions: General Directorate for the Environment, Maritime Police, several national city councils, University of Cape Verde, National Institute for Development and Fishery (INDP), Cape Verdean Society of Zoology, Spanish Co-operation, General Directorate for Tourism, Protected Areas, eco tourism companies, and US Fish and Wildlife Service. The meeting was opened by the United States Ambassador to Cape Verde Donald Helfin. Thereafter, the participants presented results of the conservation work accomplished in the 2016 nesting season and discussed various topics and issues concerning local sea turtle conservation including general and specific problems that were faced in the field, standardization of data collection and evaluation methods, conditions for creating a national sea turtle data base, ways to increase TAOLA's effectiveness as a platform, and possibilities for better approaching local communities.



4.4.4. “Nha Terra” workshop

In 2016, the Turtle Foundation together with other NGOs involved in sea turtle conservation implemented the “Nha Terra” workshop on Boavista Island. “Nha Terra” is a national campaign aimed at reducing turtle consumption in Cape Verde by raising awareness and training



of the competent authorities. The workshop was presented on 24 June in the Police Station of Sal Rei with participation of the police and several other stakeholders.

4.4.5. MAVA Fondation pour la Nature meeting and project visit

From 16–19 May, one of the main donors of our project, the *MAVA Fondation pour la Nature*, held a workshop on Boavista together with the Turtle Foundation and other local stakeholders. The main objective of the workshop was to develop an action plan for the conservation of two species of sea turtles in West Africa, the loggerhead sea turtle and the green turtle (*Chelonia mydas*), for the next years (2017–2022). The event brought together stakeholders involved in the conservation of sea turtles in Cape Verde and Guinea-Bissau.

Furthermore, we were very pleased about the visit of the MAVA foundation board and staff in September, since 2016 Boavista was selected for the location of their annual board meeting (Fig. 40). The MAVA foundation has been financing a significant part of our project in Cape Verde for several years. Thus, we were very pleased to have the opportunity to present our project to the foundation's board and staff members – and also to plan joint strategies for the near future.



Fig. 40: Visit of the MAVA delegation at the Boa Esperança field station. Right: André Hoffmann, president of the MAVA foundation

5. Challenges

The work on Boavista provides us every year with new as well as continued familiar challenges:

- Conflicts with poachers on the beaches
- Lack of law enforcement and legal prosecution of sea turtle poaching
- Unlicensed turtle watching groups visiting the nesting beaches during the night
- Due to a lack of funding, sometimes the realization of planned additional projects is unfortunately not feasible and preparations and planning of such projects have to be cancelled.
- Poor supply situation of the past was counteracted last year by bulk buying all dry food at the beginning of the season. Particularly in the dry season/high summer there can be a shortage of fresh vegetable and fruit and it is often the case that not enough water is produced by the desalination plants.
- The rustic living conditions in the camps are a challenge for camp residents, particularly for extended periods because of the isolated locations and lack of sanitation facilities.
- While meeting people of various ages and cultures is one of the benefits of the volunteer experience, it also provides the management team with challenges in satisfying everyone's needs and solving conflicts.

6. Project Outcome and Impact

In nesting season 2016 we counted 4,062 nests on the beaches that are protected by Turtle Foundation and the Varadinha project. This corresponds to about 1,000 individual female turtles nesting on beaches protected by Turtle Foundation's engagement on Boavista. With

25 poaching incidents recorded on these beaches there was a poaching rate of about 2.5%. This figure would be higher by a multiple, probably even by a factor of 10 or more, without continuous beach protection, which was apparently the case before Turtle Foundation intervened on these beaches. Thus, our measures directly mitigate the danger of extinction of this important loggerhead turtle nesting population to a certain extent. However, beach protection on the current level is highly demanding in terms of financial and human resources that have to be provided. We generally aim to be able to reduce beach patrolling activities in the future in favor of more sustainable approaches. However, in the face of again increasing poaching pressure during the last years it is unlikely that intensive beach patrolling can be considerably reduced in the next years. Moreover, in the Northeast of the island close to Cruz do Morto another beach camp will be established, in order to improve the protection of the eastern part of the island, which is extremely threatened by poaching. In addition to the so far promoted Project Varandinha in the Southwest, we also will support the establishment of another community-based project at the village Bofareira in the North of Boavista, thus enabling us to effectively protect also the eastern half of the very long beach section of Boa Esperança. By means of those extensions, the two last major gaps within the joint beach monitoring programs on Boavista finally will be closed.

In contrast to direct beach surveillance, the effects and results of public relations, environmental education, community development, and alternative income development are designed for the long term and are not easy to quantify in the short term. In fact, the recent increase in poaching has not yet been stopped, and it will take more time before the intensive and expensive guarding of nesting beaches can be permanently reduced. Through our public relations and outreach work, however, our organization and our goals have now reached a high level of awareness among the people of Boavista. In the near future, we hope that the majority of the people of Boavista will have significantly increased appreciation of sea turtles and local nature as a resource worth of protection, and thus, that in long term the vast majority of the population refrains from the consumption of turtle meat. In this respect we take the denunciation of people illegally selling turtle meat in a small northern village by resident villagers, which happened in 2016 for the first time, as a very positive signal. We moreover are especially hoping that young people will no longer be interested in turtle meat in their future lives, but perhaps even in the present they may influence their parents and families in a way that turtle meat is no longer served at home. Further, we hope that our lobbying activities among the local government as well as our contribution to the work of the local turtle conservation network TAOLA will considerably improve governmental attitudes and efforts towards sea turtle protection. Indeed, a new regulation issued by the parliament of Cape Verde considerably tightened the legal consequences for convicted poachers by defining capturing or killing turtles or any acquirement of turtles or their body parts as a crime rather than only an administrative offense. However, governmental law enforcement efforts have to be increased considerably to achieve noticeable effects.

7. Collaborations and Partnerships

Organization	Description of affiliation/cooperation
General Directorate for the Environment at the Ministry of Environment and Agriculture in Praia	Signed memorandum of understanding; approval for project implementation; using Turtle Foundation's data for their annual report about sea turtle conservation in CV and planning of future conservation strategies; direct exchange via e-mail/phone and personal meetings, TAOLA meeting, etc.
Municipality of Boavista	Provides all permits for the local implementation of the project; partly involved in organizing local awareness events
Protected Areas Boavista	Governmental national park administration. Protected Areas supports sea turtle protection with guards working in the camps, Turtle Foundation contributes to develop strategies for conservation guidelines. Cooperation in measures to regulate turtle-watching activities on Boavista; cooperation in signposting nesting beaches on Boavista
TAOLA (Tartaruga Criola)	Cape Verdian network of governmental and non-governmental organizations concerned with sea turtle protection created in 2009. Turtle Foundation is a founding and leading member of this network. Goals are to standardize research and protection methodology and to increase collaboration between agencies involved in conservation and development. Data and experiences from the members/NGOs are used to inform decision-makers in the government
U.S. Fish and Wildlife Service, MAVA Fondation pour la Nature	Main sponsors for Turtle Foundation's Cape Verde project providing financial, technical, and advisory support.
Natura 2000, BIOS.CV	Sea turtle conservation NGOs operating on Boavista. Mutual collaboration in beach protection, data collection and information exchange regarding the nesting population in Boavista. Cooperation in coordinating night patrol strategies and in implementing education- and awareness events on Boavista
Queen Mary University, London (QMUL)	Provides scientific advice to studies carried out by Turtle Foundation, and performs own research on Boavista and elsewhere on Cape Verde. Turtle Foundation and QMUL collaborate in several studies in the field (so far amongst others: interesting behavior and post-nesting feeding grounds using GPS transmitters; female based mate choice; fitness of hatchlings; swimming behavior of hatchlings; swimming behavior of post nesting females)
Associação Varandinha	Community organization in the village Povoação Velha implementing a beach protection project on the beaches of Varandinha and Santa Monica
Association for the Protection, Research and Sea Turtle Conservation in the Lusophone Countries (ATM)	Partnership for the exchange of knowledge. In 2016, one person from São Tomé e Príncipe stayed with the Turtle Foundation team for a three weeks internship to receive training for the sea turtle conservation project on São Tomé e Príncipe.

Organization	Description of affiliation/cooperation
Tour agencies based in Sal Rei	Turtle Foundation provides guidelines for turtle observation on nesting beaches and educational material to several tour operators on Boavista. In exchange, these companies channel donations from tourists through the local environmental agency.

8. Planned activities 2017

8.1. *Nesting beach surveillance*

Protection and monitoring of all eight beach sections covered in 2016, i.e. Água Doce, Boa Esperança, Norte, Gatas, Canto, Curral Velho, Ponta Pesqueira, and Lacacão, will be continued in 2017 between June and October. Starting 2017, a small satellite camp in Curral Velho will be extended to become a fully operating camp. In the Northeast of the island close to Cruz do Morto a fifth beach camp will be established in order to address an accumulation of poaching events there. In addition to the project Varandinha in the Southwest, we also will support the establishment of another community-based project in the village Bofareira in the North of Boavista, thus enabling us to effectively protect also the eastern half of the Boa Esperança beach. By means of those extensions, the two last major gaps within the joint beach monitoring programs on Boavista finally will be closed.

8.2. *Data collection and research*

Additionally to own collection and evaluation of nesting and tagging data, we will proceed with our cooperation with the Queen Mary University of London also in the nesting season 2017, whereby studies already started will be continued and new studies will be initiated.

8.3. *Community engagement, awareness, education, and outreach*

The Turtle Foundation will continue and, if possible, further expand its successful *School in Nature* program along with other established measures for environmental education such as presentations, public events, and competitions.

Basing on the results of our survey of the local population, we will develop a new participatory concept, in order to invite and actively involve the local population in the conservation of sea turtles. This concept should also include measures for development of alternative income opportunities as well as for poverty reduction.

For recruiting new workers we will as much as possible refer to applicants of Cape Verdean nationality – in particular to local people of Boavista.

8.4. *National and international partnerships*

The Turtle Foundation will continue to expand its networking activities and cooperation with national Institutions, NGOs, and stakeholders to achieve better protection of the sea turtles on the Cape Verde islands, not only directly on the beaches, but also at the political level. The Turtle Foundation is an active member of the Cape Verdean network TAOLA, wherein all organizations engaged in the protection of sea turtles on Cape Verdean islands are united.

The conservation foundation *MAVA Fondation pour la Nature* held out the prospects of giving special support for our and other sea turtle conservation projects on Cape Verde starting in



2017 for the next five years. We hope with this promotion we can achieve significant improvements and innovations in all areas of the project. In particular, the expansion of direct protection measures, the introduction of new techniques for beach protections, first monitoring measures for turtles at sea, increased community engagement, as well as the expansion of scientific flanking projects, are planned. All those measures aim for the sustainability of the protection of sea turtles on Boavista also beyond the proposed five year funding period.

The implementation of all scheduled measures beyond direct protection work will depend on available finances.

9. Outlook for the next years

The principal goal and activity of the Turtle Foundation on Boavista is the immediate and direct protection of nesting females on the beaches. This action was urgently needed because the level of uncontrolled poaching was leading toward the imminent extermination of the population.

The protection strategies of Turtle Foundation since 2008 are proven to be very effective and have dramatically improved the beach monitoring and subsequent protection. The issues with poaching in 2015 and 2016 were more severe than in the previous years. Additionally to noticeable increase of poaching incidences on the beaches monitored by Turtle Foundation, the mortality across the island increased.

The strict protection of turtles, in which each animal's nesting activity is monitored from a proper distance, is an extremely labor and cost-intensive process. In the long run such an approach is hardly affordable. The objective for the future protection program of the Turtle Foundation on Boavista must therefore be to gradually lower the frequency of beach patrols and ultimately pass the protection of the turtles into the hands of the authorities of Cape Verde. Carefully estimated, we need another 5–10 years to reach this goal.

At the same time it is planned to gradually transfer the management of the project activities, including reduced protection with the help of volunteers, public relations and ecotourism, to the Cape Verdean sister organization of the Turtle Foundation, Fundação Tartaruga.

10. Acknowledgements

Turtle Foundation wishes to thank all the individuals and institutions who supported us in the 2016 season and helped in many ways, and without whom it would not have been possible to achieve our current results.

We are very grateful our local and foreign employees, in addition to all rangers, volunteers, and national park rangers who worked in our camps in 2016, and to the team from the Projeto Varandinha in Povoação Velha.

Turtle Foundation would also like to thank the General Directorate for the Environment at the Ministry of Environment and Agriculture (DGA), the Municipality of Boavista, Protected Areas Boavista, the Delegation of the Ministry of Agriculture and Environment of Boavista Island, the local police, INDP, Christophe Eizaguirre and the Queen Mary University of London, Natura 2000, Bios CV, Associação Varandinha, Inês Lourenço and Odo Rumpf and other national and international organizations and institutions that contributed to the success of our project.

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In the name of the Turtle Foundation, our Boavista team 2016 including volunteers is thanking our numerous project partners, donors, and supporters!