

CHANGES ON ÇALIŞ BEACH 2014

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KURZFASSUNG

Im Zuge des Projektpraktikums zum Schutz der Unechten Karettschildkröte (*Caretta caretta*) und ihres Habitats wurden von der Universität Wien in Kooperation mit der türkischen Universität Hacettepe Daten über die Strandveränderungen in Çalış, eine Ortschaft nahe Fethiye, erhoben. Obwohl der Strandbereich durch verschiedene internationale Konventionen des Naturschutzes geschützt ist, bleibt die touristische Erschließung und damit verbundene Veränderung der Niststrände eine Bedrohung für *Caretta caretta*.

So wurde in diesem Jahr ein Anstieg der Sonnenliegen an Çalış Stränden um 8% festgestellt. Zwar gab es einerseits eine Abnahme von Sonnenschirmen um 11% und von Sandsäcken um 20 %, doch andererseits dehnten sich Bars entlang des Strandes durch großflächig ausgelegte Teppiche, durch das Pflanzen von Bäumen oder durch Installationen von Duschen und Volleyball Felder weiter aus. Weitere Bedrohungen für die Niststrände sind der Ausbau von Hotelanlagen, welcher große Teile des Strandes in Anspruch nimmt, sowie die Verschmutzung der Strände selbst.

ABSTRACT

In the course of a nature conservation course and research effort by the University of Vienna in cooperation with the Turkish University Hacettepe, data on changes along the beach of Çalış, a town in Fethiye, were collected. Although Çalış beach is protected by different international conventions of nature conservation, the touristic exploitation and associated changes in the nesting zones continue to be a potential threat to *Caretta caretta*.

On the one hand an increase of sunbeds by 8% was recorded, on the other hand a decrease of parasols by 11% and beanbags by 20%. Bars continued their expansion along the beach area through extensive carpeting, planting new trees or through installation of beach showers and a volleyball court. Additional threats are expansions of hotels, for which large areas of the nesting beach are used, and the pollution of the beach itself.

INTRODUCTION

From 29 June to 12 September, Çalış Beach in Fethiye, a district in the province Muğla, was monitored by Austrian and Turkish biology students in the course of a nature conservation course and research project. Çalış Beach has been monitored since 1994 and is one of the 12 key nesting beaches of *Caretta caretta* (Margaritoulis et al. 2003). It can be divided into two areas, Çalış promenade and Çiftlik, a small village district following Çalış promenade. Both areas are touristic hot spots and also classified as Special Environmental Protected Areas (SEPA) since 1988 (Barcelona Convention 1976). Detailed documentation of such SEPA, such as Çalış Beach, is very important, on the one hand in order to gain a better understanding of the ecosystem and on the other hand to draw conclusions or to make prognoses about the nesting behaviour of *Caretta caretta*.

Tourism can change a natural habitat so strongly that it negatively impacts an ecosystem, including flagship species such as *Caretta caretta* (Miller & Auyong 1991). Particularly physical parameters play an important role such as the beach's sand, temperature and light.

According to Lohmann and Lohmann's natal homing hypothesis (1996), adult female *Caretta caretta* return to the beach, where they hatched, in order to lay their eggs. If the natural habitat is not preserved, adult females are possibly unable to recognize their natal home again. Progressive construction of hotel grounds or bars decreases the beach's area, thus possible places for nesting get lost. Sand becomes compressed, because of using heavy machines for constructions, making nest digging more difficult (Ackerman 1996). Nest can be shaded by big buildings, which affect physical parameters inside the nest for instance temperature or humidity. This in turn, affects the sex determination of hatchlings, which depends on temperature and other factors (Stachowitsch 2006; Lutz 1996). Hotel and bar furniture such as sunbeds and umbrellas also produce obstacles for adults and hatchlings.

Artificial lights such as road lanterns or hotel illuminations have impacts on *Caretta caretta* adults and hatchlings. According to Whiterington & Bjørndal (1990), hatchlings orientate towards the brightest point along the horizon, when emerging from the nest, in order to find quickly the sea. The moon and its reflection represent normally the brightest point on the horizon at night, but artificial lights typically mask this effect; thus, hatchlings get disorientated and crawl towards hotels and bars instead of into the sea.

MATERIAL AND METHODS

Austrian and Turkish students patrolled along the beach area in a search pattern in two shifts, one at 6 a.m. and the other one at 10 p.m. Nests were marked by triangulation, their GPS co-

ordinates taken and protective cages installed with an information sign for local residents and tourists.

The main task in the morning shift was to triangulate all the cages again, to check if they were displaced, but it was also important to check the cages to determine whether hatchlings were captured; we also looked for new tracks and other events. Later in the season, excavations were performed as well in the morning shifts.

In the night shifts the beaches were monitored for tracks, for adults and for hatchlings; all nests, which are expected to hatch, were checked. Temperature was measured every day at 6 a.m., 12 p.m. and 10 p.m.

In general, data on nests, any form of changes along the beach such as adult and hatchling tracks, the emergence of hatchlings and adults, and physical parameters, e.g. temperature and light intensity, were documented and recorded in a field-booklet. Furthermore, any environmental factors possibly influencing *Caretta caretta*'s nesting behaviour, nests, hatchlings and the habitat in general were documented by photography or quantified, for example beach litter and also the facilities on the beach, for example sunbeds and umbrellas at bars and hotels, newly constructed buildings or spotlights and other artificial lighting.

RESULTS

Çalış Promenade

Two new types of information sign were put up in Çalış: a yellow type, which was put up by Austrian students on the main entrances to the beach, and a small white one by Çalış Der, which is principally the price list for the sunbeds but also contains turtle info (Fig. 4).

The local authorities responsible for the beach continued to pay attention to keeping space for nesting between the first and second row of sunbeds along Çalış promenade, while in 2009 this was not yet the case (Fig. 23 & 24). Furthermore, sunbeds were either folded or piled up in the nighttime to increase space at the beach.

Last year, drainpipes were installed into Çalış promenade's showers (Fig. 8). Unfortunately, some of these showers lost their drainpipes and water was disposed of directly onto the beach (Fig. 9). At the taxi station in Çalış at the promenade, a new wooden platform extending onto the beach was installed.

Compared to the data from 2012 (Fig. 1; 528 sunbeds in total), the value increased by 42 (13%). Parasols changed from 274 to 302, an increase by 28 (11%).

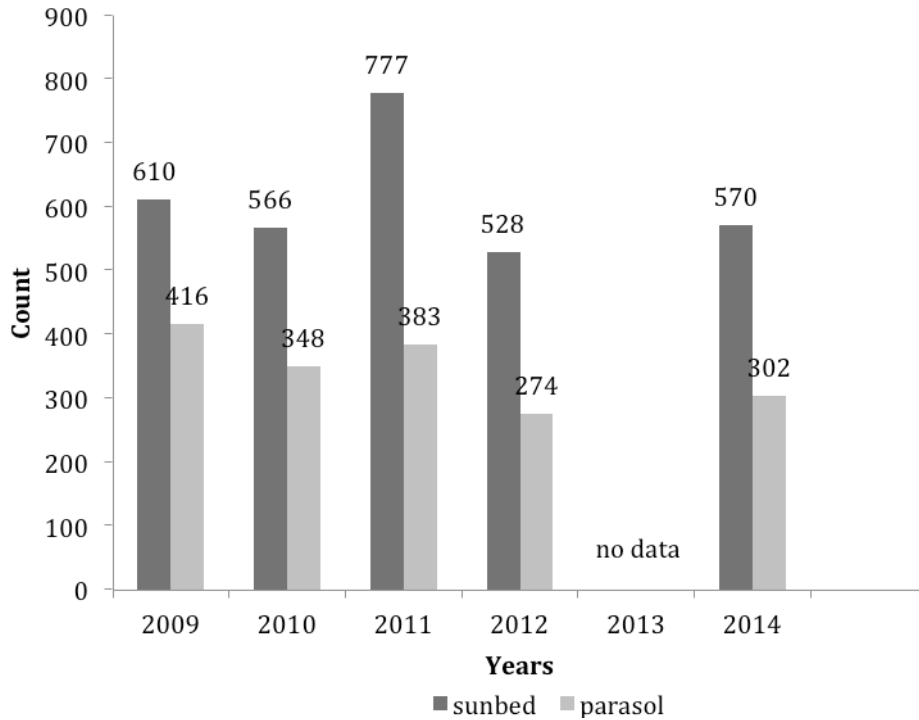


Fig. 1: Number of sunbeds and parasols counted on Çalış promenade per year
 Abb. 1 : Zahl der Sonnenliegen und Sonnenschirme auf Çalış Promenade pro Jahr

Çiftlik Beach

Spor Café (Fig. 10, 11) and the adjoining Surf Café showed significant changes compared with last year: Spor Café spread out on the beach considerably with new beach-huts (Fig. 12), rugs and beanbags. Moreover, a showering platform was installed (Fig. 13) in the middle of the beach, and trees were planted next to Spor Café (Fig. 14). Surf Café covered almost its entire beach section with beanbags and rugs.

The disco called Bakraç, newly opened last year, showed a major expansion on the beach this year. Large white beach-huts (Fig. 16) were erected in front of the extended wooden platform, which is the beach entrance to the disco. Furthermore, a new volleyball court was built in mid-August (Fig. 19). Next to the disco Bakraç, construction on a new facility began in late summer (Fig. 21). During this summer, two new swimming barriers were installed, one at Mekan’s beach (Fig. 20) and one at Jiva-Café.

Some old information signs, which are faded, are still standing on the beach (Fig.7). However, there are also new information signs. Some of them are not really informative, because they lack of information about the Special Environmental Protected Area and are only written in Turkish. Moreover, they are neither solid constructed, nor placed visibly (Fig. 5).

Table 1 lists all touristic facilities at Çiftlik’s beach. The number of sunbeds and parasols of each establishment and the number of rows of sunbeds and parasols horizontal to the water-

line were counted. In total, 1121 sunbeds, 387 parasols and 171 beanbags were counted.

On average, 3.5 rows were lined up. The highest number of rows was five at Onur Beach, Pelina Beach and Güven's Restaurant. Jiva Beach Resort had the highest number of sunbeds, with 137 (last year: 148) and parasols, with 67.

Considerable increases in the number of sunbeds were recorded in Bakrac, from 34 in the year 2013 to 69 this year, an increase by 35 (100%), and Dirlic Café, from 65 to 95 sunbeds, an increase by 30 (46%).

Table 1: Number of sunbeds, parasols, beanbags and rows of beach furniture in Çiftlik 2014
Tabelle 1: Anzahl der Sonnenliegen, Sonnenschirme, Sandsäcke und Reihen dieser Strandmöbel in Çiftlik 2014

Location	Sunbeds	Parasols	Rows	Beanbags	Other observations
Mekan	92	6, 11 "roofs"	3		31 small tables
Kaptan	empty place, only cut-off steel rods remain, some trees planted				
Koca	59	1 long hatched roof	2	25	12 "tire" tables
Escape	73	30, 2 "roofs"	3		11 tables, 2 green pergolas
Bakraç	69	3, 17 "roofs"	3		4 giant hammocks, 1 volleyball
No name	3	2			
Surf Café	102	55	4	87	21 tables, 14 kayaks, 3 fun boats
Spor Café	24	27	2	15	1 paved water place, 82 chairs, 20 tables, 1 volleyball, plants
Sunset Apartments	112	11, 1 giant roof	3	8	4 pergolas, volleyball, plastic children's playground
Jiva Beach Resort	137, 26 stacked	67	3		lifeguard tower
Dirlic (Dolmus)	95	45	5		6 parasols in cable roll tables
Onur Beach	54	15	5	1	
Pelina Beach	35	16	5		
Güven's Restaurant	56	27	5		brown rug bands
Yorük	65	29	3		
Caretta Beach Club	119	54	4	35	102 cordoned-off wall vegetation
Sum	1121	387	3.5 (average)	171	

Compared to the data from 2013 (Fig. 2), with 989 sunbeds in total, sunbeds increased by 132 (13%). Parasols changed from 436 to 387, a decrease by 49 (11%). Beanbags decreased by 44, from 215 to 171 (20%).

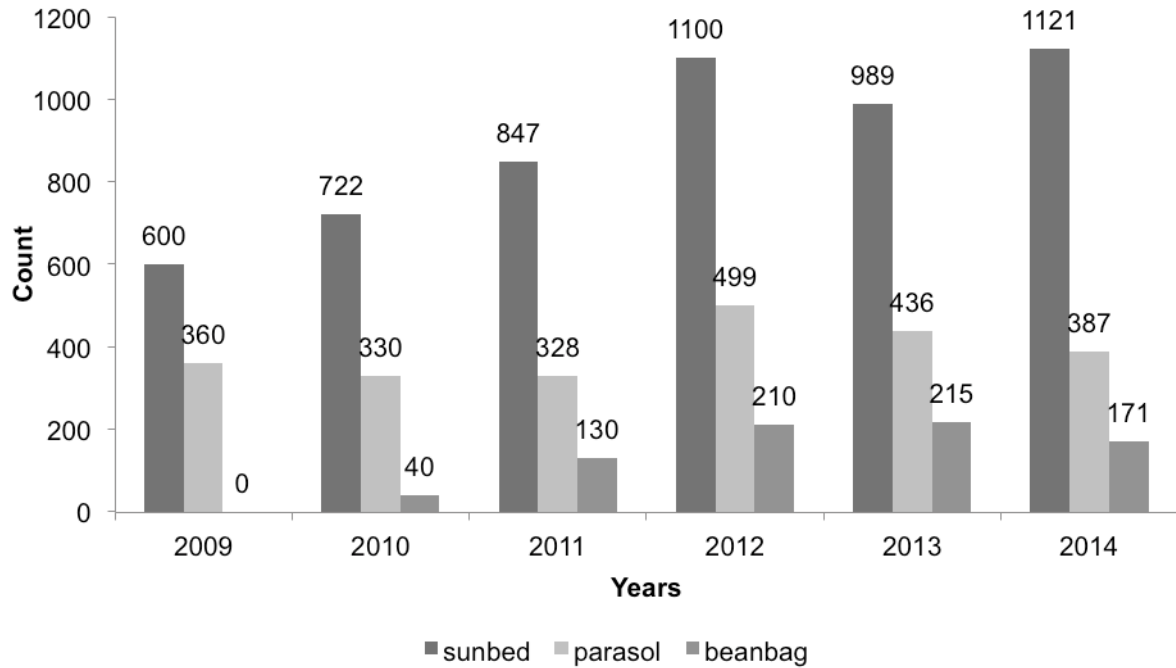


Fig. 2: Number of sunbeds, parasols and beanbags on Çiftlik's beach counted per year
 Abb. 2: Anzahl der Sonnenliegen, Schirme und Sandsäcke auf Çiftliks Strand pro Jahr

Çalis Beach

Unfortunately we have no data on sunbeds and parasols from 2013 for the whole beach, but according to Figure 3 the number of sunbeds increased compared to the year 2012 from 1627 to 1691, by 64 (4%); this is the highest number of sunbeds in the last few years on the whole beach. Parasols decreased by 84 (11%), from 773 to 689 compared to 2012.

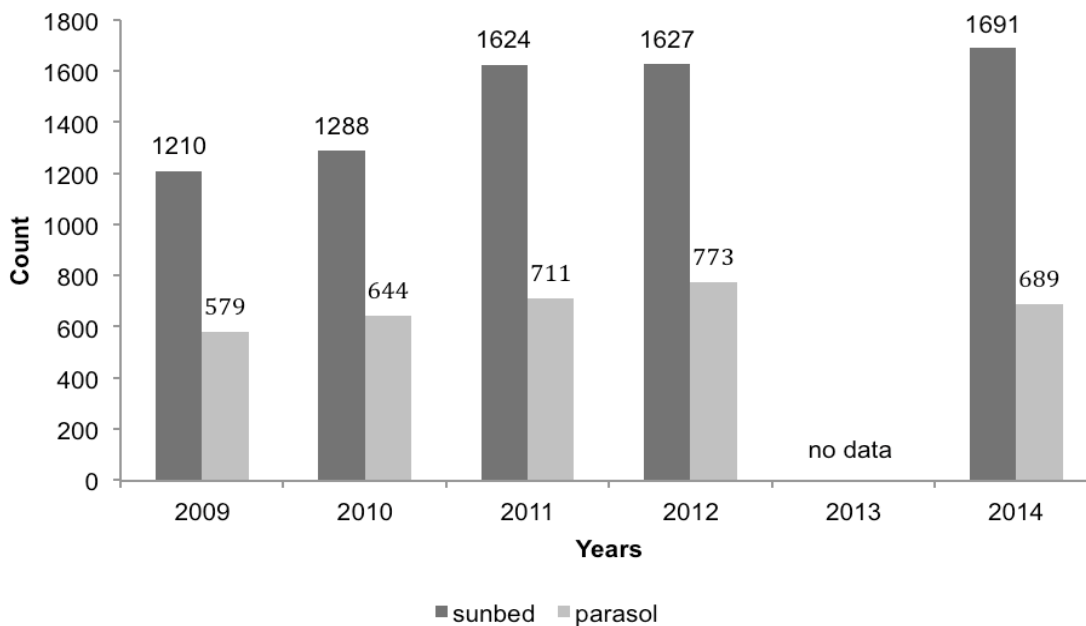


Fig. 3: Number of sunbeds and parasols on Çalis Beach counted per year
 Abb. 3: Anzahl der Sonnenliegen und Schirme am Strand Çalis pro Jahr

In general, pollution along the beach continued to be high (Fig. 17). As in past years, waste was piled up beside waste containers (Fig. 18). Most of the observed waste was not on the beach next to the promenade, because there are buckets for the waste, although often some of them overflowed. The most highly polluted area was around the picnic area in Çiftlik, where many plastic bottles, plastic cups, cigarette butts and organic waste were lying around. Waste was also found inside the nest cages, even though the cages were labelled with signs which pointed out that there is a sea turtle nest.

DISCUSSION

This year, we observed a record high number of nests at Çalış Beach with 37 nests, compared to 2013 with 35 nests. However, this record high number of nests at Çalış Beach may be connected to the decrease of nests in Yanıklar, as both beaches are part of one natal homing zone and the conditions for sea turtles worsened in Yanıklar since the past years.

Nevertheless, this reflects no improvement of the conditions at Çalış Beach. The beach in Çalış is getting worse for sea turtles too, because of the increase of buildings next to the beach, which spread out onto the beach with their furniture.

Çalış Der organized their employees to fold the sunbeds (Fig. 15), which was a really great idea, because the sea turtles are less disturbed by the sunbeds and there is more space to dig their nests. Unfortunately, on many of the days the sunbeds were either partially folded or not one at all and sometimes the employees were folding the sunbeds when the hatchlings were hatching. Interestingly, Çalış Der organized only the folding of the sunbeds on the beach of Çalış promenade, although changes on Ciftlik's beach increased dramatically in the last years compared to Çalış promenade according to Figure 1 and 2. For this reason folding of sunbeds in Ciftlik Beach would be advisable in order to increase space for nesting of *Caretta caretta*.

In general, the number of sunbeds on Çalış Beach increased significantly over the whole summer, since there were much more sunbeds in September than in June, as well as the rows of sunbeds.

The number of beanbags has not completely changed yet (Fig. 22), but there is a decline of 44 beanbags in 2014 compared to 2013. These beanbags represent two threats: first they hinder both adult and hatchling sea turtles, second some of them become damaged and their styro-foam contents become distributed on the sand.

Waste brings another problem, namely of stray dogs on the beach (Fig. 22). They seek food among the garbage and tear open plastic bags containing food items. As potential predators, they are a problem for sea turtles and especially the hatchlings. Furthermore, Turkish students

stationed in Belek reported that they observed a pack of dogs attacking a sea turtle while nesting and injuring her badly. Nest number CY-08 was also predated by dogs. The hatchlings were all dead and covered in blood and many of them were missing.

During summer at the picnic area many bonfires were lit at night, where families were gathered and had a barbeque. Additionally, we saw cars parking on the beach at this area every night. There were always deep vehicle ruts on this beach and at the area of Çaliştepe. Some people also put up tents and spent the night on the beach. These circumstances make it important to inform local residents, tourists and other visitors. Our information desk on Çaliş promenade is a good start, although, only people, who are interested stop by.

A good idea for the hotels would be to put some information about this tourist destination on the doors of the hotel rooms. This would help reach more tourists. Nonetheless, also the hotel owners, bar owners and travel agencies have to be informed better.

Even this is only a first step, because some people who already know about the nesting beach simply ignore the rules. This underlines the importance of combining awareness about the environment with enforcement of existing laws and regulations governing protected areas and protected species.

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APPENDIX



Fig. 4: New information signs on the promenade part of the beach
 Abb. 4: Neue Informationsschilder am Strand neben der Promenade
 (Foto: M. Stachowitsch, 2014)



Fig. 5: New information sign on Çiftlik Beach
 Abb. 5: Neue Informationsschilder am Strand von Çiftlik
 (Foto: M. Stachowitsch, 2014)



Fig. 6: Sign installed at the promenade in 2011
 Abb. 6: 2011 wurden Schilder bei der Promenade aufgestellt
 (Photo: M. Gross, 2011)



Fig. 7: Old, faded sign on Çiftlik Beach
 Abb. 7: Alte, verblasste Schilder am Strand von Çiftlik
 (Foto: M. Stachowitsch, 2014)



Fig. 8: Drainpipe was installed on the promenade shower in 2013
 Abb. 8: 2013 wurde ein Abflussrohr an der Dusche montiert
 (Foto: M. Stachowitsch, 2013)



Fig. 9: Some showers on the beach still lack a drainpipe. Note wet sand.
 Abb. 9: Einige Duschen am Strand ohne Abflussrohr. Anmerkung: nasser Sand.
 (Foto: M. Stachowitsch, 2014)



Fig. 10: Largely untouched stretch of beach next to the Surf Café in 2010
 Abb. 10: Großer unbebauter Strandabschnitt neben dem Surf Café in 2010
 (Foto: M. Stachowitsch, 2010)



Fig. 11: Spor Café with a volleyball field in 2013
 Abb. 11: Spor Café mit einem Volleyballfeld in 2013
 (Foto: M. Stachowitsch, 2013)



Fig. 12: New beach-huts at Spor Café
 Abb. 12: Neue Strandhütten bei Spor Café
 (Foto: M. Stachowitsch, 2014)



Fig. 13: New shower platform at Spor-Café
 Abb.13: Neue Duschvorrichtung bei Spor-Café
 (Foto: M. Stachowitsch, 2014)



Fig. 14: Newly planted trees on beach next to Spor-Café
 Abb. 14: Neu gepflanzte Bäume neben dem Spor-Café
 (Foto: M. Stachowitsch, 2014)



Fig. 15: Upturned sunbeds on the promenade part of the beach
 Abb. 15: Zusammengeklappte Liegestühle am Strand neben der Promenade
 (Foto: M. Stachowitsch, 2014)



Fig. 16: New beach-huts and platforms at Bakraç establishment, Çiftlik
 Abb. 16: Neue Strandhütten und Bühnen bei Bakraç, Çiftlik
 (Foto: M. Stachowitsch, 2014)



Fig. 17: Waste at the "picnic area" of the beach
 Abb. 17: Müll am Strand bei „Picnic-Area“
 (Foto: M. Stachowitsch, 2014)



Fig. 18: Waste on the beach between Sunset Apartments and Spor Café, next to empty container
 Abb. 18: Abfall am Strand neben leeren Müllkontainer, zwischen Sunset Apartments und Spor Café
 (Foto: M. Stachowitsch, 2013)



Fig. 19: New volleyball-field at Bakraç, Çiftlik
 Abb. 19: Neuer Volleyballplatz bei Bakraç, Çiftlik
 (Foto: M. Stachowitsch, 2014)



Fig. 20: New swimming barrier at Mekan, Çiftlik
 Abb. 20: Neue Schwimmbarriere bei Mekan, Çiftlik
 (Foto: M. Stachowitsch, 2014)



Fig. 21: Wooden frames for cementation of new establishment, Çiftlik
 Abb. 21: Holzrahmen für Betonierung von einem neuen Gebäude, Çiftlik
 (Foto: M. Stachowitsch, 2014)



Fig. 22: Beanbags and several stray dogs on beach at Surf Café
 Abb. 22: Sandsäcke und einige Streunerhunde am Strand bei Surf Café
 (Foto: M. Stachowitsch, 2014)



Fig. 23: Free nesting zone between sunbed rows
 Abb. 23: Freie Zone zwischen Sonnenschirme
 (Photo: Google Maps, 2009)

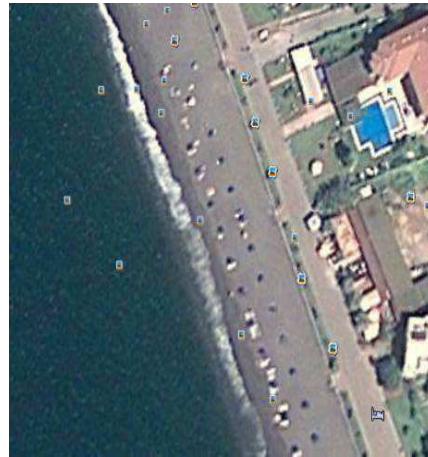


Fig. 24: Nesting zone not kept free
 Abb. 24: Keine freie Zone zwischen Sonnenschirmen
 (Photo: Google Maps, 2011)

Changes at Yaniklar/Akgöl, Turkey 2014

Maria-Isabella Herzog, Edwin Kniha

KURZFASSUNG

Bereits seit einundzwanzig Jahren betreut die Universität Wien, in Partnerschaft mit türkischen Universitäten (diesjährig Hacettepe University, Ankara), Niststrände der Unechten Karettschildkröte (*Caretta caretta*) in Fethiye, Türkei. Der Abschnitt Yaniklar/Akgöl wird touristisch etwas weniger als Çalış genutzt, nichtsdestotrotz treten jedes Jahr elementare Schwierigkeiten auf, die das erfolgreiche Legen von Nestern erschweren.

Im Rahmen des Projekts werden Problematiken wie die touristische Nutzung von Stränden, Lichtverschmutzung, Müll, Fischerei und mehr genau dokumentiert und mit vorjährigen Daten verglichen. Die Hotelkomplexe Majesty Club Tuana und Majesty Club Lykia Botanika nutzen große Teile des Strandes für die Installation von Sonnendächern und Liegestühlen bzw. zahlreiche Sport- und Wassersportaktivitäten. Die Zahl der Sonnendächer und Liegen ist auch heuer wieder gestiegen und hat unmittelbar die Expansion des von Urlaubern genutzten Strandes zur Folge.

Zusätzlich ist seit dem Jahr 2014 ein weiterer riesiger Hotelkomplex (Barut Hotel Fethiye) in Bau, der einen enormen Abschnitt des Strandes für die touristische Nutzung einnehmen wird und riesige Flächen der sich dahinter befindlichen Feuchtgebiete verbaut. Außerdem stellen Müll und am Strand entsorgte Fischernetze weiterhin – vor allem für Hatchlinge – große Gefahren dar.

Auch in Zukunft muss dieses Nistgebiet durch Schutz- und Forschungsprojekte aufrecht erhalten werden.

ABSTRACT

Twenty-one years have gone by since students from the University of Vienna were first invited (by Turkish Universities, this year Hacettepe University) to join the sea turtle conservation efforts in Fethiye, Turkey. More precisely, to monitor the nesting sites of the Loggerhead Turtle (*Caretta caretta*).

The beach section Yaniklar/Akgöl is a little less crowded than Çalış and therefore more “natural”, nonetheless major problems are registered every year, endangering the nesting population of *Caretta caretta* in this area. The set of problems, including touristic use of the beaches, light pollution, litter, and fisheries, were documented this year and compared to earlier years. Two major hotels, Majesty Club Tuana and Majesty Club Lykia Botanika, use

parts of the beach for sunroofs, sunbeds, sport- and watersport activities. This year the numbers of sunroofs and sunbeds have increased again, leading to an expansion of the area used by tourists. Additionally, another hotel complex has been under construction since early 2014. A huge area of wetlands behind the beach has already been bulldozed and in the near future a large stretch of the beach is expected to be used for hotel guest activities. Litter and fisher nets on the beach are an additional source of harm to both adult and hatchling turtles. In the future, the survival of the Loggerhead sea turtle population in this area will continue to depend on the activity of the university sea turtle teams.

INTRODUCTION

Two teams of students observed two different beaches in Fethiye. This report focuses on Yaniklar, which is divided in two sections named Akgöl and Yaniklar. Onur Camp, where the team has been staying for the past few years, forms the border between the two sections. During the period of egg deposition by adults, the teams walked night shifts as well as morning shifts to monitor the nesting season and collect data. By the time of the first hatchling emergence, the night shifts were cancelled for safety reasons. Hatchlings were very hard to see in the dark and the risk of stepping on the juveniles was too high.

Two big hotels and a few smaller accommodations, namely Karaot Restaurant, Yonca Lodge, Onur- and Doga Camp, are distributed alongside the beaches, leading to more crowded parts during the day. Throughout the project's history, different problems for the Loggerhead Turtle have been identified and recorded. Touristic use of the beaches plays a key role at the affected beaches. Sunbeds, parasols and pavilions represent a disturbance factor for the turtles and reduce the potential egg deposition area. Litter left behind endangers both adults and hatchlings, and the situation has not improved in the past few years. Fishery, light pollution and other potential threats have been monitored over the years, as well as this summer. In 2014, the team collected data about nest location, egg deposition, measurement of adults, size of the nests, hatchling emergence, surrounding parameters and compared them to last year's data. The clutches were observed on a daily basis. With a new major hotel complex under construction, another human intervention into the turtle's environment has come up.



Fig. 1: Aerial view of Akgöl and Yaniklar beach
 Abb. 1: Satellitenaufnahme des Strandes von Akgöl und Yaniklar
 (Photo: google maps 16.11.2014)

MATERIAL & METHODS

Students from the University of Vienna monitored the beaches in Yaniklar and Akgöl during the nesting season of *Caretta caretta*. The first group traveled to Fethiye on 28 June, the last group on 9 August, 2014. Every week a group of students arrived and stayed for five weeks. During their stay, a wide range of data was collected. The number of nests and the exact location (GPS-Data), temperature, changes on the beaches, parked cars, litter, light pollution and several beach facilities were documented.

Nests were marked with stones and signs (Fig. 2). At the hotel beaches and locations with high light pollution, the nests were protected by handmade cages to capture the emerging hatchlings for release in darker beach spots (Fig. 3).

Two teams of students walked along the beaches at two different times: At night to report egg deposition by adults, and in the early morning to document tracks and hatchling emergence. During the shifts, data on tracks – either adult or hatchling – and the condition of the nests were observed. Students observing the nests in August and September additionally did nest excavations to obtain a full overview of hatchling emergence and the condition of each nest (Fig. 4).

RESULTS

Condition of the beaches

The two beaches – Akgöl (1.5 km) and Yaniklar (4 km) (Lesch R. & C. Mähr 2013) – with a total length of 5.5 km, provide different conditions for turtles in relation to sand quality, grain size and beach width. Nests were distributed all over the two beaches, with hotspots at the end of Akgöl and the part between Hotel Majesty Club Lykia Botanika and so-called “Lonely Tree”, a landmark used by the team for better orientation.

This year we documented 20 nests on the Akgöl side. As in the last year, the adult turtles preferred the western end – where the Akgöl lake is located – of the beach for egg deposition. As local residents prefer this spot as well for family get-togethers and BBQ, we often found sunbeds or parasols very close to the nests. In some cases all the nest markings were removed and we had to find the nests again by triangulation. Especially at this part of the beach, a lot of trash was found.

One nest (AY-09) was laid in the moist stream bed. No hatchlings emerged from this nest.

In the middle section of the beach, where Karaot-Bar is located (Fig. 1) the substrate is somewhat rockier and fewer nests were laid here.

At Majesty Club Tuana, the beach sand is strongly manipulated mechanically (Fig. 37). Nonetheless, one nest (AY-20) was laid at the hotel beach. Usually the substrate is too compact for egg deposition there.

From Majesty Club Tuana to Yonca Lodge (Fig. 1) the beach is rocky and narrow, not offering good conditions for sea turtles (Fig. 5). In front of Yonca Lodge, two nests were laid (see below “Beach facilities”). Light pollution in this area is high due to the beach restaurant at the Yonca Lodge and vacationers at Onur camp.

The Yaniklar part of the beach is marked by the endpoints Onur Camp and “Small Beach”, and 41 nests were detected here. This 4-km-long beach offers different substrates for sea turtles. On the section from Majesty Club Lykia Botanika to “Small Beach”, the highest number of nests was counted. Rocky substrate as well as fine sand is present here. Although this part of the beach is the most natural one, a lot of marine debris can be found as well as dumped garbage (Fig. 6). After the “Lonely Tree”, the beach, called “Picnic Area”, is used by local residents and tourists, and litter pollution is very high. Additionally, in front of Akmaz Buffet (Fig. 1) we detected big tire tracks and a huge excavation channel, clearly excavated by a bulldozer, directly next to a nest (Figs. 7, 8).

The remaining part of the beach is broad with fine sand, but only one nest was found. At the end next to Karatas Buffet (Fig. 1), three nests were recorded.

Vehicles and vehicle tracks

Vehicles on the beach are a recurring problem and the team often witnessed cars stuck in the sand (Figs. 10, 11, 12).

At the end of Akgöl, the owner of Karaot Buffet sent his workers to clean up seaweed on the beach. The seaweed was raked to small piles and then picked up by car directly from the beach. The car drove by very close to the nests, causing one nest to hatch during daytime due to the vibration induced by the car (Fig. 9). At the Yaniklar part, we faced another problem: on several occasions we discovered tire tracks ending in a big pile of waste. Often the tire tracks were very close to some of the nests.

Information boards

In 2011, a new sign instructing about the Special Protected Area was placed at the end of Yaniklar beach (Wiemers 2011) (Fig. 13). Every year the increasing break-up of this sign has been photo documented. This year not even the wooden stakes were left (Figs. 14-16).

Lights

Light pollution is a problem at diverse parts of the beach. Karaot Buffet has very bright lights turned on the whole night, illuminating the beach in front of the restaurant. Hotel Majesty Club Lykia Botanika painted the part of the lights facing the ocean black (Lesch R. & C. Mähr 2013). This year, new unpainted lamp shades were installed (Figs. 17, 18).

Another problem was a light at Karatas Buffet, illuminating the street. Many hatchlings crawled towards the very bright light, which had been turned on during the night. It was shut off after talking to the owner.

Fishing

On the early morning shifts, fishermen were seen throwing out their nets from the shore. Lost or discarded nets on the beach pose a threat to hatchlings: they can get hopelessly entangled and die on their way to the sea (Figs. 19-22).

Litter

Litter is still an unresolved problem affecting all parts of the beach. Very few rubbish bins are installed, especially in much used areas such as the picnic area and “Small Beach” (Fig. 23). A lot of waste is thrown away on the beach and in the surrounding area.

In several cases, students followed the tire tracks on the beach, leading them to garbage heaps

alongside the beach.

Fireplaces

Fireplaces were mostly seen in crowded areas on the beaches. They are installed by local people for BBQs, but most are extinguished properly. Once, however, a still glowing bonfire was put out by students (Fig. 24).

Water sport activities

As mentioned above, water sport activities are offered by the two big hotels in this area, Majesty Club Tuana and Majesty Club Lykia Botanika. Beyond the diving boat that heads for the nearby “Rabbit Island” every day, fast jet-skis and motorboats are used throughout the day for parasailing, “banana ride” and other activities. Additionally to high-speed driving, they operate within the swimming area marked by buoys, 200 meters offshore. This poses a serious threat for swimmers and sea turtles (Figs. 25, 26).

Beach facilities

Yonca Lodge

Two nests were located on the beach in front of Yonca Lodge. Using cages, we managed to capture and put all the hatchlings into the sea (Figs. 27, 28).

The number of sunbeds has declined, the number of wooden pavilions has not changed, and the number of parasols has doubled since 2013 (Figs. 29, 30).

Table 1: Numbers of beach facilities at Yonca Lodge in the years 2011-2014

Tabelle 1: Anzahl der Strandeinrichtungen der Yonca Lodge in den Jahren 2011-2014

Yonca Lodge				
Facilities	2011	2012	2013	2014
Sunbeds	20	19	19	11
Wooden pavilions	1	2	2	2
Parasols	*	5	5	10

*no records (keine Daten vorhanden)

Majesty Club Tuana

Located at Akgöl beach, Majesty Club Tuana (Fig. 1) is the biggest complex in this area. As a result of numerous activities offered by the club, the beach in front of the hotel is very crowded during daytime. A watersport center and a diving school are located directly on the beach, as is a beach volleyball court (Figs. 31-34).

Although the sand in front of the hotel is treated and compressed mechanically for tourist comfort, we were able to locate a nest directly on the hotel beach (Figs. 35, 37-39). Two additional problems arose in this respect. Firstly, sunbeds were often put very close to the marked nest. Secondly, the hotel held bonfire beach parties every first weekend of the month, causing a very crowded beach at nighttime, close to the nest (Fig. 36). The number of sunbeds and sunroofs has increased.

Table 2: Numbers of beach facilities at Majesty Club Tuana in the years 2007-2014

Tabelle 2: Anzahl der Strandeinrichtungen des Hotel Majesty Club Tuana in den Jahren 2007-2014

Majesty Club Tuana								
Facilities	2007	2008	2009	2010	2011	2012	2013	2014
Sunbeds	310	326	268	233	201	170	*	254
Sunroofs	33	33	33	40	34	*	*	40

*no records (keine Daten vorhanden)

Karaot Buffet and the cabin at the westernmost end of Akgöl

On the Akgöl part of the beach, Karaot Buffet represents the biggest source of light pollution. Diverse bright lights are turned on during the night, requiring us to put cages on the nests close by. The numbers of sunbeds and wooden pavilions are similar to 2013 (Fig. 40). This year the cabin, which has the same owner as Karaot Buffet was not in use (Figs. 41-44).

Table 3: Numbers of beach facilities at Karaot Buffet in the years 2011-2014

Tabelle 3: Anzahl der Strandeinrichtungen des Karaot Buffet in den Jahren 2011-2014

Karaot Buffet				
Facilities	2011	2012	2013	2014
Sunbeds	22	27	20	20
Wooden pavilions	3	3	12	12
Parasols	13	7	12	11
Roofed terrace 3x30m	*	*	1	1

*no records (keine Daten vorhanden)

Onur and Doga Camp

Sunbeds were not counted this year. The wooden pavilion, the sunroofs and the volleyball court at Doga Camp are still situated at the same places (Figs. 45-47).

Table 4: Numbers of beach facilities at Onur und Doga Camp in the years 2011-2014

Tabelle 4: Anzahl der Strandeinrichtungen des Onur und Doga Camps in den Jahren 2011-2014

Onur und Doga Camp				
Facilities	2011	2012	2013	2014
Sunbeds	17	16	29	*
Wooden pavilions	0	0	1	1
Parasols	0	0	0	0
Sunroofs**	4	4	1	1

*no records (keine Daten vorhanden)

**one permanent since 2013 (3x20m)

Majesty Club Lykia Botanika

Majesty Club Lykia Botanika is the second big hotel complex at Yaniklar/Akgöl. One wooden boardwalk has been installed to reach the pier (Fig. 48).

The disco on the beach has been removed and rebuilt off to the side in the vegetation behind the beach. Sand has been removed from the beach directly next to section used by hotel guests, probably for the rebuilt disco platform (Figs. 49-51). The number of sunbeds has increased by 35 sunbeds from 2012 to 2014, with no recorded data in 2013. Sunroofs were newly installed in 2014 (Fig. 48).

Table 5: Numbers of beach facilities at Lykia Botanika in the years 2007-2014
Tabelle 5: Anzahl der Strandeinrichtungen des Lykia Botanika in den Jahren 2007-2014

Lykia Botanika								
Facilities	2007	2008	2009	2010	2011	2012	2013	2014
Sunbeds	134	191	157	157	120	145	*	190
Sunroofs	*	*	*	*	*	*	*	30

*no records (keine Daten vorhanden)

Akmaz Buffet:

The number of sunbeds and parasols declined by 28 sunbeds and 9 parasols from 2013 to 2014. Only 12 sunbeds and 6 parasols were present this year on the beach. Although Akmaz Buffet was closed this year, little activity was observed here and a few people were seen (Figs. 52-55).

Table 6: Numbers of beach facilities at Akmaz Buffet in the years 2011-2014
Tabelle 6: Anzahl der Strandeinrichtungen des Akmaz Buffet in den Jahren 2011-2014

Akmaz Buffet				
Facilities	2011	2012	2013	2014
Sunbeds	0	33	40	12
Parasols	0	4	15	6
Small tables	0	0	16	*

*no records (keine Daten vorhanden)

Karatas Buffet

At the end of Yaniklar beach, Karatas Buffet offers wooden pavilions right next to the restaurant in addition to the sunbeds and parasols close to the water. There are 3 new wooden pavilions next to the Buffet, built in 2014. We recorded very little use of these new pavilions, at least during the morning shifts (Figs. 56, 57).

Table 7: Numbers of beach facilities at Karatas Buffet in the years 2011-2014

Tabelle 7: Anzahl der Strandeinrichtungen des Karatas Buffet in den Jahren 2011-2014

Karatas Buffet				
Facilities	2011	2012	2013	2014
Sunbeds	19	19	47	20
Parasols	10	10	0	9
Small tables	0	0	5	*
Wooden pavilions**	0	0	0	3

*no records (keine Daten vorhanden)

**new since 2014

Barut Hotel Fethiye

Barut Hotel Fethiye is being built right now. By the time of completion it will be the biggest complex in the close area. Right now a huge fenced area behind the beach marks the construction site (Figs. 58, 59). Vast parts of the wetlands around it were bulldozed (Figs. 60, 61). Based on the website given below, this complex is expected to expand and take up a long stretch of the beach as well (Fig. 62).

The fenced construction site made it difficult to directly see the full size of the area. A hill next to “Small Beach” offered a better view of the full size of the construction site (Fig. 63). No signs around the construction area provide information about the development. At night, the light pollution associated with the construction project is visible from far (Fig. 64). The full dimension of this project can be seen on the homepage of Barut Hotels. (www.baruthotels.com/fethiye)

DISCUSSION

The extraordinary ability of sea turtles to locate the spot they were born after a decades-long time of absence is a bane and blessing at the same time. On the one hand, their ability makes sure they find a proper site for egg deposition. On the other hand, they often return to find different conditions and, in a worst-case scenario, their hatchling beach has been destroyed.

The monitored beaches Yanıklar and Akgöl have been facing such problems of a changing environment for a long time. This summer (2014) as well, the sea turtle team was able to detect a multitude of problems and changes on the beaches.

These issues are mainly induced by anthropogenic influences. Firstly local people use the beaches in their leisure time for various activities, often resulting in a lot of garbage left

behind. Although dustbins are present at diverse spots, waste is often thrown away carelessly, unaware of the consequences for the sea turtles. Also, sunbeds and parasols are often placed very close to the nests. Conversations with local people and tourists show that many are aware of the turtles hatching on Fethiye’s beaches. But a lot of them are ignorant upon the harm litter can do to adults and hatchlings. More educational effort must be done in order to keep the beaches clean for the turtles and, of course, for the next generations of local people, who will be using these beautiful beaches as well. Secondly, two major hotels and a few smaller accommodations house a large number of tourists alongside the beach. As a result, the hotel beaches are very crowded during the day.

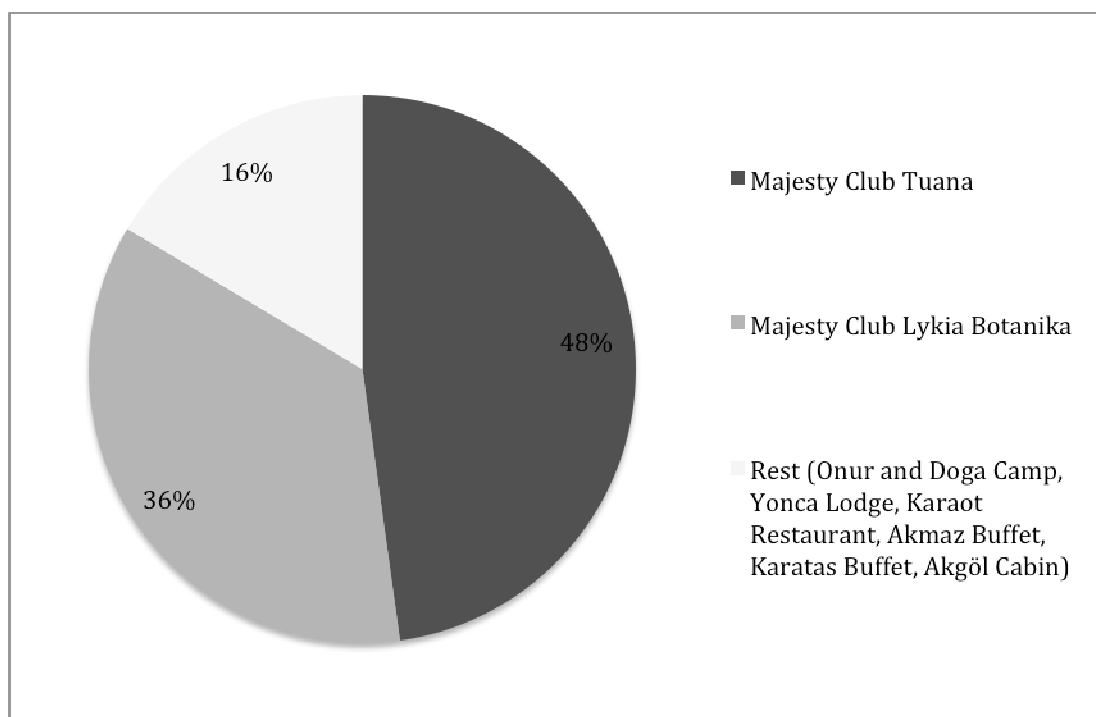


Figure 64 Percentage of beach facilities comparing Majesty Club Tuana, Majesty Club Lykia Botanika and the others (Onur and Doga Camp, Yonca Lodge, Karaot Restaurant Akmaz Buffet, Karatas Buffet, Akgöl Cabin) in 2014.

Abbildung 64: Prozentsatz der Strandeinrichtungen von Majesty Club Tuana, Majesty Club Lykia Botanika und die restlichen Einrichtungen (Onur and Doga Camp, Yonca Lodge, Karaot Restaurant Akmaz Buffet, Karatas Buffet, Akgöl Cabin) im Jahr 2014.

The prohibition of staying off the beaches from 8 pm to 8 am is being strictly supervised by guards at the big hotels. Of course, small groups or couples were sometimes seen at the seaside by night. This year we found a nest on the beach in front of Majesty Club Tuana. Many hotel guests were interested in our work but completely unaware of all the problems *Caretta caretta* is facing in this area. This interest could be used to draw attention to the precarious situation of the Loggerhead Turtle, for example by placing brochures in the hotels

or even preparing short presentations at the hotels for interested tourists.

All the hotels on Akgöl and Yaniklar offer their guests sunbeds, parasols or wooden pavilions, typically all at the same time. All those facilities take nesting space from the Turtles. As observed this Year, the facilities of Karaot Buffet, Karatas Buffet and Akmaz Restaurant declined in numbers and/or were rarely used.

Table 8: Numbers of all the beach facilities (sunbeds, parasols, wooden pavilions, sun roofs etc.) in the years 2012-2014

Tabelle 8: Zahlen aller Strandgegenstände (Sonnenliegen, Sonnenschirme, Pavillions, Sonnendächer etc.) in den Jahren 2012-2014

	2012	2013	2014
Onur and Doga Camp	20	31	3*
Yonca Lodge	35	35	21
Karaot Buffet	37	45	31
Akmaz Buffet	37	71	18
Karatas Buffet	29	52	29
Akgöl Cabin	0	39	0
All together (without Majesty Club Tuana & Majesty Club Lykia Botanika)	158	273	101

*Sunbeds were not counted this year

Another major problem is light pollution. Especially Karaot Buffet illuminates its entry very brightly, which affects parts of the beach as well. A nest close by had to be supplied with a cage to ensure that the hatchlings won't run towards the light. Behind the unused beach volleyball court on Akgöl, a private house owner had lights on in his backyard, causing the hatchlings of a secret nest (AY-16) close by to crawl in the wrong direction. The owner reported that he collected one group of hatchlings and put them to the sea. A similar situation was discovered at the eastern end of Yaniklar beach. A very tall lamp, installed by the owner of Karatas Buffet, illuminated the street alongside the beach. Hatchlings from a secret nest had problems reaching the sea. Tracks were found all over the street, ending at the front of a wall. Both owners turned off the lights immediately after a conversation with us, giving a perfect example of the efforts we make by conversations with local people.

An upcoming issue is the construction of a new hotel complex behind Akmaz Buffet. The first impacts on the environment are already clearly visible. The construction site encompasses a huge wetland area alongside the beach, and during our stay a large transformation of the surrounding wetlands was recorded. Wetlands are highly important for biodiversity because they exhibit a unique composition and high species richness in both fauna and flora. Large numbers of endemic and threatened species inhabit them (Ozdemir et al. 2011) (Figs. 60, 61). Moreover, construction activity was evident on the beach itself: a huge ditch (apparently

related to sand removal/mining) was dug on the beach, very close to a nest (Fig. 7). A full graphical representation of the hotel can be seen online and clearly underlines that this hotel will have a large impact on the beach as well (Fig. 62).

In regard to all the problems *Caretta caretta* faces in the Fethiye area, the work of the students of the University of Vienna will remain necessary for conservation. Raising awareness about the species *Caretta caretta*, classified as “endangered” by the IUCN (International Union for the Conservation of Nature and Natural Resources), has to be the ongoing main goal of our efforts.

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APPENDIX



Fig. 2: Nest markers (Photo: K. Bürger)
Abb. 2: Nestmarkierung



Fig. 3: Cage over nest to capture emerging hatchlings for release in darker beach spots (Photo: M. Herzog)
Abb. 3: Käfig über einem Nest, um Hatchlinge einzufangen und sie anschließend in dunkleren Strandabschnitten freizulassen



Fig. 4: Nest excavation (Photo: M. Herzog)
Abb. 4: Excavation eines Nestes



Fig. 5: Beach condition at Akgöl between Yonca Lodge and Majesty Club Tuana (Photo: M. Herzog)
Abb. 5: Strandzustand in Akgöl zwischen Yonca Lodge und Majesty Club Tuana



Fig. 6: Marine debris and garbage at Yaniklar beach (Photo: M. Herzog)
Abb. 6: Treibgut und Müll am Strand von Yaniklar



Fig. 7: Bulldozed section next to a nest (Photo: M. Herzog)
Abb. 7: Baggergrabungen neben einem Nest



Fig. 8: Tire tracks and sand removal in front of Akmaz Buffet (Photo: M. Herzog)
 Abb. 8: Reifenspuren und Baggeraushub vor Akmaz Buffet



Fig. 9: Seaweed clean-up at Akgöl beach (Photo: M. Lambropoulos)
 Abb. 9: Seegrasbeseitigung am Akgölstrand



Fig. 10: Wheel tracks at Akgöl (Photo: M. Adrion)
 Abb. 10: Reifenspuren in Akgöl



Fig. 11: Wheel tracks at Yaniklar beach (Photo: M. Herzog)
 Abb. 11: Reifenspuren am Strand von Yaniklar



Fig. 12: Motorscooters in front of two nests, Akgöl (Photo: M. Herzog)
 Abb. 12: Motorräder vor zwei Nestern



Fig. 13: Information board at Akgöl at border between Onur Camp and Yonca Lodge (Photo: M. Herzog)
 Abb. 13: Informationsschild von Akgöl an der Grenze zwischen Onur Camp und Yonca Lodge



Fig. 14: Part of the old information board at the eastern end of Yaniklar beach 2014 (Photo: M. Herzog)

Abb. 14: Teil des alten Informationsschildes am östlichsten Ende vom Yaniklarstrand 2014



Fig. 15: Frames of the information board at Yaniklar 2013 (Photo: M. Stachowitsch)
 Abb. 15: Steher des Informationsschildes in Yaniklar 2013



Fig. 16: Information board at Yaniklar 2012 (Photo: M. Stachowitsch)

Abb. 16: Informationsschild in Yaniklar 2012



Fig. 17: New, replaced lamps at Majesty Club Lykia Botanika 2014 (Photo: M. Stachowitsch)

Abb. 17: Neue, ausgetauschte Lampen bei Majesty Club Lykia Botanika 2014



Fig. 18: Blackened Lamp at Majesty Club Lykia Botanika 2013 (Photo: M. Stachowitsch)

Abb. 18: Geschwärzte Lampe bei Majesty Club Lykia Botanika 2013



Fig. 19: Fisherman with net at Akgöl (Photo: M. Herzog). In background, pier of Majesty Club Tuana
 Abb. 19: Fischer mit Netz in Akgöl. Im Hintergrund der Pier von Majesty Club Tuana



Fig. 20: Fishing net, Yaniklar (Herzog)
 Abb. 20: Fischernetz, Yaniklar



Fig. 22: Dead hatchling in fishing line, Yaniklar (Photo: M. Herzog)
 Abb. 22: Toter Hatchling in Angelschnüre verwickelt, Yaniklar



Fig. 23: Garbage dumped at "Picnic Area" (Photo: M. Herzog)
 Abb. 23: Deponierter Abfall bei „Picnic Area“



Fig. 24: Fireplace, Akgöl (Photo: M. Herzog)
 Abb. 24: Feuerstelle, Akgöl



Fig. 25: Motorboat with "banana ride" near the beach at Akgöl (Photo: M. Herzog)
 Abb. 25: Motorboot mit „Banane“ nahe des Strandes in Akgöl



Fig. 26: Motorboats at high speed in the swimming area, Akgöl (Photo: M. Herzog)
 Abb. 26: Schnell fahrende Motorboote im Schwimmbereich, Akgöl



Fig. 27: Two nests on the beach in front of Yonca Lodge (Photo: M. Herzog)
 Abb. 27: Zwei Nester am Strand vor Yonca Lodge



Fig. 28: Tourists directly next to a nest in front of Yonca Lodge (Photo: M. Herzog)
 Abb. 28: Touristen direkt neben einem Nest vor Yonca Lodge



Fig. 29: Beach facilities at Yonca Lodge (Photo: U. Dursun)
 Abb. 29: Strandeinrichtungen bei Yonca Lodge



Fig. 30: Wooden pavilions next to the restaurant of Yonca Lodge (Photo: M. Herzog)
 Abb. 30: Holzpavilions neben dem Restaurant von Yonca Lodge



Fig. 31: Beach facilities at Majestic Club Tuana 2014 (Photo: U. Dursun), arrows mark edge of wooden boardwalk visible in Fig. 32.
 Abb. 31: Strandeinrichtungen bei Majestic Club Tuana 2014, Pfeile markieren die Ecke des Bretterweges von Abb. 32



Fig. 32: Beach facilities and wooden boardwalk at Majestic Club Tuana 2013 (Photo: M. Stachowitsch)
 Abb. 32: Strandeinrichtungen und Bretterweg bei Majestic Club Tuana 2013



Fig. 33: Water sport center at Majestic Club Tuana (Photo: M. Herzog)
 Abb. 33: Wassersport-Center bei Majestic Club Tuana



Fig. 34: Diving center and volleyball court at Majestic Club Tuana (Photo: M. Herzog). Note that court is watered.
 Abb. 34: Tauchcenter und Volleyballplatz at Majestic Club Tuana. Man beachte, dass der Volleyballplatz gewässert wird.



Fig. 35: Nest directly on the hotel beach of Majestic Club Tuana (Photo: M. Herzog)
 Abb. 35: Nest direkt am Hotelstrand von Majestic Club Tuana



Fig. 36: Bonfire beach party at Majestic Club Tuana next to a nest (Photo: M. Herzog)
 Abb. 36: Lagerfeuer-Strandparty von Majestic Club Tuana nahe einem Nest



Fig. 37: Compressed sand because of using heavy machines on the whole beach area of Majestic Club Tuana (Photo: M. Herzog)

Abb. 37: Durch Einsatz von schweren Maschinen wird der Sand am gesamten Strandbereich von Majestic Club Tuana verdichtet



Fig. 38: Excavator restructuring the beach in front of Majestic Club Tuana (Photo: M. Herzog)

Abb. 38: Bagger bearbeitet den Strandbereich vor Majestic Club Tuana



Fig. 39: Holes and tracks from the excavator (Photo: M. Herzog)

Abb. 39: Gräben und Spuren vom Bagger



Fig. 40: Beach facilities Karaot Buffet 2014 (Photo: U. Dursun)

Abb. 40: Strandeinrichtungen Karaot Buffet 2014



Fig. 41: New cabin at the westernmost end of Akgöl beach was not in use in 2014 (Photo: M. Stachowitsch)

Abb. 41: Hütte am westlichsten Ende des Akgölstrandes war heuer nicht in Benutzung



Fig. 42: Cabin towards the westernmost end of the Akgöl beachside 2013 (Photo: M. Stachowitsch)

Abb. 42: Hütte am westlichsten Ende des Akgölstrandes 2013



Fig. 43: Sunbeds at the end of Akgöl beachside 2014 (Photo: M. Lambropoulos)

Abb. 43: Sonnenliegen am Ende von Akgölstrandseite 2014



Fig. 44: Sunbeds at end of Akgöl beach 2013 (Photo: M. Stachowitsch)

Abb. 44: Sonnenliegen am Ende von Akgölstrandseite 2013



Fig. 45: Unchanged situation at Doga Camp from 2013 to 2014 (Photo: M. Herzog)

Abb. 45: Unveränderte Situation am Campingplatz von Doga Camp



Fig. 46: Beach facilities at Onur Camp (Photo: M. Herzog)
 Abb. 46: Strandeinrichtungen bei Onur Camp



Fig. 47: Beach area and volleyball court at Doga camp. In background, pier of Majesty Club Lykia Botanika (Photo: M. Herzog)
 Abb. 47: Strandareal und Volleyballplatz bei Doga camp. Im Hintergrund der Pier von Majesty Club Lykia Botanika



Fig. 48: Wooden boardwalk crossing the beach of Majesty Club Lykia Botanika (Photo: U. Dursun)
 Abb. 48: Bretterweg am Strand von Majesty Club Lykia Botanika



Fig. 49: Former location of the disco of Majesty Club Lykia Botanika (Photo: M. Stachowitsch)
 Abb. 49: Ehemaliger Standort der Disco von Majesty Club Lykia Botanika



Fig. 50: New location of the disco (Photo: M. Stachowitsch)
Abb. 50: Neuer Standort der Disco



Fig. 51: Former location of the disco of Majesty Club Lykia Botanika 2013. Note the large speaker towers on the platform. (Photo: M. Stachowitsch)
Abb. 51: Ehemaliger Standort der Disco von Majesty Club Lykia Botanika 2013. Man beachte die großen Lautsprecher auf der Plattform.



Fig. 52: Beach of Buffet Restaurant Akmaz 2014 (Photo: U. Dursun)
Abb. 52: Strandbereich von Buffet Restaurant Akmaz 2014



Fig. 53: Beach of Buffet Restaurant Akmaz 2013 (Photo: M. Stachowitsch)
Abb. 53: Strandbereich von Buffet Restaurant Akmaz 2013



Fig. 54: Buffet Akmaz 2014. Not fully in operation this year (Photo: M. Stachowitsch)
Abb. 54: Buffet Akmaz 2014. War dieses Jahr nicht vollständig in Betrieb.



Fig. 55: Situation at the Buffet Akmaz 2013 (Photo: M. Stachowitsch) □
Abb. 55: Situation beim Buffet Akmaz 2013



Fig. 56: Karatas Buffet and its wooden boardwalk 2014. Note the track of an adult sea turtle next to the boardwalk. (Photo: M. Lambropoulos)
 Abb. 56: Karatas Buffet und deren Bretterweg 2014. Beachte Spur einer adulten Meeresschildkröte neben diesem.



Fig. 57: Beach facilities on the side of Karatas Buffet 2014 (Photo: M. Herzog, U. Dursun)
 Abb. 57: Strandeinrichtungen neben Karatas Buffet 2014



Fig. 58: Construction site Barut Hotel Fethiye (Photo: M. Stachowitsch)
 Abb. 58: Baustelle Barut Hotel Fethiye



Fig. 59: Construction site Barut Hotel Fethiye (Photo: M. Stachowitsch), arrows mark the huge spotlights along the fence

Abb. 59: Baustelle Barut Hotel Fethiye, Pfeile markieren die riesigen Flutscheinwerfer entlang des Zaunes



Fig. 60: Wetland next to the construction site before and after being bulldozed (Photo: M. Herzog)

Abb. 60: Feuchtgebiet neben der Baustelle vor und nach der Rodung



Fig. 61: Reed belt next to the construction site before and after bulldozing (Photo: M. Herzog, M. Stachowitsch)

Abb. 61: Schilfgürtel neben der Baustelle vor und nach der Rodung



Fig. 62: Planned hotel area (<http://www.baruthotels.com/de/fethiye>, google maps 22.10.2014)
 Abb. 62: Geplantes Hotelareal



Fig. 63: View from the hill revealing the huge construction site and deforestation zone (Photo: M. Herzog)
 Abb. 63: Blick vom Hügel um das Ausmaß der Baustelle und Rodungszone zu sehen



Fig. 64: Light pollution from the construction site at a full moon night as seen from the beach in front of Onur Camp (Photo: Herzog)
 Abb. 64: Lichtemission der Baustelle in einer Vollmondnacht aus Sicht vom Strand vor Onur Camp

The Status of Loggerhead Sea Turtles in the Mediterranean

Timea Németh

KURZFASSUNG

Das Mittelmeer gilt als beinahe geschlossener Lebensraum, da es nur durch die 14 Kilometer breite Straße von Gibraltar mit dem Atlantischen Ozean, und durch den Suezkanal mit dem Roten Meer verbunden ist. 46,000 km Küstengebiet grenzen an das Mittelmeer, das von 21 Ländern und verschiedenen Kulturen umkreist ist. 150 Millionen Menschen leben an der mediterranen Küste, Zweitwohnsitze nicht einbezogen. Hinzu kommen jährlich etwa 170 Millionen Touristen, die zusätzlich die Küstengebiete belasten (Spangenberg 2005).

Drei von sieben Meeresschildkrötenspezies (alle 7 Arten sind auf der Roten Liste gefährdeter Arten eingestuft) kommen im Mittelmeer vor: Die Lederschildkröte (*Dermochelys coriacea*), die Grüne Meeresschildkröte (*Chelonia mydas*) und die Unechte Karettschildkröte (*Caretta caretta*). Von den genannten Arten nisten nur *Caretta caretta* und *Chelonia mydas* an der Mittelmeerküste, die Lederschildkröte ist ein atlantischer Besucher. Die Unechte Karettschildkröte nistet vorwiegend an den Küsten Griechenlands, in der Türkei, Zypern und Libyen. Der Mittelmeerraum ist das nördlichste Gebiet weltweit, in dem Meeresschildkröten nisten.

Da die Meeresschildkröte mehrere Lebensräume besetzt, ist sie mehreren anthropogenen Bedrohungen ausgesetzt. Seit dem verstärkten Aufkommen von Tourismus und der industriellen Fischerei ist die Meeresschildkröte vom Aussterben bedroht. Durch die Verbauung von Stränden verliert sie einen essentiellen Lebensraum, den Niststrand. Im Wasser ist sie der Massenfischerei ausgesetzt, wodurch jährlich 6000-8000 Meeresschildkröten im Mittelmeerraum getötet werden (Spangenberg 2005).

Internationale Schutzbemühungen, wie das Washingtoner Artenschutzübereinkommen, die Berner Konvention und die Bonner Konvention und NGOs, beispielsweise ARCHELON und EKAD kämpfen um den Erhalt der Meeresschildkröten.

ABSTRACT

The Mediterranean Sea is a unique habitat, in part due to its enclosed basin connected to the Atlantic only through the 14-kilometer-wide Strait of Gibraltar and to the Red Sea by the Suez Canal. The 46,000-km-long coastline is inhabited by approximately 150 million people in 21 countries, and this number is rising. During summer, 170 million tourists come to the coast each season (Spangenberg 2005).

The Mediterranean hosts the northernmost record for loggerhead sea turtle nests worldwide. Although three sea turtle species occur in the Mediterranean, only two of them nest here, *Chelonia mydas* and *Caretta caretta*. Both are classified as endangered species on the Red List of IUCN. The species migrate every two to three years from foraging areas to nesting sites to lay their eggs. A total of 2280-2787 loggerhead turtles are estimated to nest in the Mediterranean every year (Broderick et al. 2002). Most clutches are laid in Greece, Turkey, Cyprus and Libya. The overall number of nests per year is estimated to be 7200 for *Caretta caretta*. Moreover about 300-400 Green turtle nests are reported each year, with Turkish and Cyprus beaches as their nesting hotspots (Casale et al. 2010).

Booming tourism and the growing fish trade threaten sea turtles such as *Caretta caretta*. Every year 6000-8000 sea turtles die as by-catch in the Mediterranean (Spangenberg 2005).

Research institutes, Governmental and Nongovernmental organizations as well as individuals are trying to save the sea turtles. The main goals of such organizations are the protection of species, conservation of nature and scientific research. Progress can be made by developing Action Plans, prohibiting the building of hotel complexes near nesting sites, decreasing coastal illumination, setting specially protected areas and monitoring the nests.

The Greek organization ARCHELON makes great efforts by fencing the nests against predation and shielding the nests to reduce hatchling disorientation due to artificial lighting. Furthermore, organizations are called upon to raise public awareness by distributing information and making presentations for tourists to ensure the turtles` survival.

THREATS

The Loggerhead sea turtle, like many reptiles, is a long-existing species that due to human influences is now threatened with extinction. Human activities hinder the sea turtles` life-cycle in many ways.

Once an adult female has laid a nest, the eggs are endangered by predation and tourism. Sea turtle eggs are still sold in some countries. The hatchlings are threatened also by predation, light pollution and fishing activities. Naturally they would follow the brightest point on the horizon after hatching to reach the sea, but unfortunately street lighting, bars and hotels next to the nesting beach attracting hatchlings in the wrong direction, so many die because they do not reach the sea. Only one hatchling of a thousand survives the first twenty years, which sea turtles need to become sexually mature (Razer 1986).

Of course overfishing also has an impact on the sea turtles' lives. The fishery threat is especially high in Spain, because Spain has one of the most important fishing fleets in the world, and the largest in the European Union, capturing over one million tons of prey every year (Casale et al. 2010). The number of incidental captures of loggerheads has been estimated over 150,000 per year. The greatest threats are posed by pelagic longlines, trawls, demersal longlines and set nets. Nowadays, trawls with a turtle excluder device (TED) are available, but those tools reduce the fishing efficiency as well, so fishermen often refuse using them. Also in the North Adriatic, TEDs are not considered to be a realistic solution for reducing sea turtle by-catch, because they are designed for the shrimp trawl fishery and they would exclude the larger commercial specimens too (Casale et al. 2004).

Beyond that, intentional killing and exploitation are still common in some Mediterranean countries, particularly in Greece and Egypt. Also dynamite fishing is causing many deaths, which is a common practice in Greece, Lebanon, Libya and Syria (Casale et al., 2010).

Natural threats to the hatchlings are predation by wild canids such as foxes, dogs or jackals; crabs, coleopteran larvae can attack the eggs and predation by birds and crabs can also decrease hatchling survival.

The loggerhead sea turtle is omnivorous, feeding mainly on bottom-dwelling invertebrates such as gastropods, bivalves, and decapods. Since loggerheads also eat jellyfish, they sometimes swallow plastic bags, which they mistake for food. Plastic bags can cause suffocation. Other marine debris and pollutants that affect sea turtles are crude oil, tar and heavy metals, that may have a negative impact on the animals' respiration, energy metabolism, digestive tract and blood chemistry.

Male turtles never leave the sea, but females go on land to lay their eggs. Both sexes are endangered by fishing and illegal hunting. When the female returns to her nesting beach to lay eggs, she is once again (i.e. after the hatching stage) endangered by predation by foxes, dogs and other carnivores. Sea turtles are fertile every two to three years and nest up to four times per season (Casale et al. 2010).

Another human influence on the ecology of sea turtles may be climate change. With increasing temperatures the sex ratio of sea turtle hatchlings could change in favor of more females.

Above 29°C nesting temperature, only females develop, below this value only males.

All the above anthropogenic threats are leading to a gradual decrease of loggerhead populations (Lutcavage et al. 1997).

Since sea turtles occupy different habitats – the terrestrial zone as well the oceanic and neritic zone – they face miscellaneous risks. Both Loggerhead sea turtles and *Chelonia mydas* are classified as endangered and are listed on the Red List of Threatened Species by the International Union for the Conservation of Nature (IUCN 2010) and are listed under Appendix I of the Convention on International Trade in Endangered Species, making international trade illegal. Further conventions and NGOs are devoted to protecting the sea turtles of the Mediterranean.

Successful conservation requires efforts from multiple countries.

ORGANISATIONS AND INDIVIDUALS

ARCHELON

During the summer of 1977 a Greek couple discovered marine turtle nesting on the island of Zakynthos. Dimitris and Anna Margaritoulis became more involved; they collected data that proved the importance of Zakynthos as a nesting site and urged the Greek government to protect the beaches. Articles were published in newspapers and magazines and speeches were given throughout Greece. This is how ARCHELON started. In 1981 a monitoring program was initiated and in 1983 the sea turtle protection society officially named itself ARCHELON. Its aim is to study and protect the sea turtles and their habitats through fieldwork, management, collaboration with stakeholders, public awareness and rehabilitation.

KAPTAN JUNE

June Haimoff, an English environmentalist, has dedicated her life to sea turtle protection and launched a successful campaign to preserve İztuzu Beach in Dalyan, Turkey as a breeding habitat for the *Caretta caretta*. In April 1987 building started on an 1800-bed hotel complex, the Kaunos Beach Hotel on this beach. This caused a storm of protests world-wide, including from the IUCN, Greenpeace, the World Wildlife Fund and the Zoologische Gesellschaft Frankfurt. Particularly in Germany the construction caused a major uproar, because the German DEG (Deutsche Finanzierungsgesellschaft für Beteiligungen in Entwicklungsländern) wanted to use the equivalent of 5 million euros from public means under the heading of development aid. June Haimoff approached the WWF and consequently their President asked the Turkish Prime Minister Turgut Özal for a moratorium, while awaiting the outcome of an Environmental Impact Assessment. In the meantime the German Federal Government had forbidden DEG to invest development aid money for the building of the hotel complex. The project was stopped in September 1987 and in 1988 the Turkish

government decided to forbid future building at the beach. The Köyceğiz-Dalyan region then obtained the status of Special Environmental Protection Area (SEPA) (Haimoff et al. 1997). In 2009, June Haimoff started a foundation to protect the habitat of the loggerhead turtle. The *Kaptan June Sea Turtle Conservation Foundation* was officially established in February 2011 and has its Information Centre and Museum in Kaptan June's Hut at the minibus side of the beach, overlooking the place where construction of the Kaunos Beach Hotel had started in April 1987.

CONVENTIONS

The following conventions are involved in protecting the sea turtles in the Mediterranean (Casale et al 2010)

- African Convention on the Conservation of Nature and Natural Resources (1968), where all marine turtles are listed on Class A of the Convention
- Convention for the protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) (1976), which contains the SPA protocol and the Mediterranean Action Plan (MPA)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973), where all sea turtles are listed on Appendix I, the highest protection status. CITES permits the trade of sea turtles and their products
- Convention on the Conservation of European Wildlife and Natural Habitats - Bern Convention (1979). In this convention, *Caretta caretta* is listed on Appendix II as a strictly protected fauna species
- Convention on the Conservation of Migratory Species of Wild Animals (CMS) - Bonn Convention (1979)
- Convention on Biological Diversity (CBD) (1992)
- Habitats Directive (1992) established by the European Union

ECOSYSTEM IMPORTANCE

Caretta caretta has a keystone role because of its ecological effect. It feeds on large numbers of invertebrates, affecting their populations and allowing their broken shells to be used as a calcium source for other species. Over 100 species from 13 phyla may live on the carapace of loggerheads, which makes them transport vehicles for epibionts (Spotila, 2004).

Due to its important nesting grounds, the Mediterranean coasts of Turkey are of great interest for protective measures. The University of Vienna has been conducting a long-term sea turtle

field course in Fethiye each season, working with Turkish universities, to protect the nesting turtles. Fethiye belongs to one of the 20 reported major loggerhead nesting grounds in Turkey, and Turkey is a member of several Conventions such as the Barcelona Convention, the Convention on Biological Diversity (CBD), CITES and the Bern Convention. The beaches of Fethiye are designated as *Specially Protected Areas* in the framework of Barcelona Convention. Nonetheless, turtles nesting on these beaches remain exposed to the full range of threats that tourism entails.

FIELDWORK

During the nesting season, volunteers of diverse organisations monitor the sandy beaches for nests in nightshifts and morning shifts. We, the students of the University of Vienna, take part in protecting *Caretta caretta* by attending a field course which is held every year during the nesting season.

In some cases we may relocate the nests for protection from threats such as high spring tides or roots that might destroy eggs. Also we monitor the nests daily for disturbances. After the eggs hatch, we uncover and tally hatched eggs, undeveloped eggs and dead embryos, and dead hatchlings. Any remaining live hatchlings are released.

This year in Calis, in the summer of 2014, we counted the highest number of nests since the beginning of the monitoring efforts in 1993. Unfortunately, however, the number of nests is apparently decreasing on beaches without special care.

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Bachelor Thesis

Sea turtle strandings in Fethiye (Turkey) in Summer 2014
Gestrandete tote Meeresschildkröten in Fethiye (Türkei) im Sommer 2014

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ZUSAMMENFASSUNG

Meeresschildkröten spielen eine wichtige Rolle in den Ökosystemen des Mittelmeeres. Heute werden diese Funktionen beeinträchtigt, da die Meeresschildkröten durch die voranschreitende Zerstörung der Ökosysteme und ihres Lebenszyklus, vom Aussterben bedroht werden. Die hohe Sterberate wird hauptsächlich durch anthropogen bedingte Probleme erzeugt. Um diese Todesursachen von Schildkröten in Fethiye, Türkei genauer zu verstehen, beobachteten Studenten der Universität Wien und der Hacettepe Universität, die Strände Çaliş und Yaniklar. Wenn eine gestrandete Schildkröte gesichtet wurde, wurden – nach einer ausführlichen Fotodokumentation – die flache Carapax Länge und Breite, die gewölbte Karapax Länge und Breite, der Fundort, die Verletzungen und die möglichen Todesursachen dokumentiert. Im Laufe des Projekts, welches vom 30. Juni bis zum 11. September andauerte, wurden sechs tote gestrandete Schildkröten dokumentiert, wobei vier Schildkröten der Spezies *Caretta caretta* (Unechte Karettschildkröte), eine *Chelonia mydas* (Grüne Meeresschildkröte) und eine *Trionyx triunguis* (Nilweichschildkröte) angeschwemmt wurden. Wir beobachteten, dass während der Nistzeit, vermehrt tote Schildkröten gefunden werden. Deshalb nehmen wir an, dass die Nestzahlen mit den Daten der toten Adulten korrelieren. In letzten 14 Jahren steigt die Anzahl der toten Schildkröten. Im Vergleich zu 2013 sind dieses Jahr jedoch weniger Todesfälle dokumentiert worden.

ABSTRACT

Sea turtles once played an important role in the ecosystems of the Mediterranean Sea. Today, however, these functions are heavily impacted because turtle life cycles are disturbed and the animals are often killed by humans. In order to understand the causes of deaths of sea turtles in Fethiye, Turkey, students observed the beaches of Çaliş and Yaniklar during the University of Vienna's sea turtle field course. When a stranded turtle was sighted, its straight carapace length and width, its curved carapace length and width, location of finding, injuries and probable cause of death were documented. This was accompanied by a detailed photo documentation. In the course of the project, lasting from 30 June until 11 September, six stranded turtles were found: four were of the species *Caretta caretta* (Loggerhead Turtle), one was a *Chelonia mydas* (Green Turtle) and one was of the species *Trionyx triunguis* (Nile Soft-shell Turtle). We observed that more turtles than ever nest in Çaliş and at the same time more dead turtles strand in the area. We conclude that the waters around Çaliş beach have become more dangerous for sea turtles. In the

past 14 years, the numbers of dead sea turtles have risen drastically. In comparison to 2013, however, there were less dead turtles documented this year.

INTRODUCTION

Today, the Mediterranean is inhabited by three species of sea turtles, namely *Dermochelys coriacea* (Leatherback Turtle) *Chelonia mydas* (Green Turtle) and *Caretta caretta* (Loggerhead Turtle), whereby the two latter also nest in the Mediterranean (Casale, 2010). On the Turkish coast, *Chelonia mydas* is most abundant on the east side, whereas *Caretta caretta* mostly nests on the central and south-west coast of Turkey (Casale, 2010). This distribution correlates with different diets of turtles, which consequently frequent different habitats (Casale, 2007). Green Turtles and Loggerhead Turtles differ from each other in their appearance and their ecological role. While the latter are primarily carnivorous, although they ingest some vegetation (Bolten 2003), the former mainly live herbivorous and feed on sea grass. Through their distribution and their contrasting diet, they fulfill different ecological roles in the Mediterranean Sea. The Green Turtle, for instance, is one of the few large herbivores to forage on sea grass, and therefore, increases productivity (Wilson 2010). The Loggerhead Turtle, on the other hand, increases the rate of nutrient recycling in benthic ecosystems because they feed on hard-shelled prey on benthic ecosystems and function as transport systems for epibionts and thus structure ecosystems by distributing these (Wilson 2010).

These functions, however, are in danger because sea turtles in the Mediterranean Sea are threatened and their numbers are constantly being reduced. In fact, both *Caretta caretta* and *Chelonia mydas* are listed as Endangered on the Red List of Threatened Species of the International Union for Conservation of Nature and Natural Resources (IUCN; Hilton-Taylor 2000).

Adult turtles are exposed to various threats caused by humans, one of the main ones being marine pollution (Tomás, 2002). Additionally, habitat degradation and introduction of feral predators lead to a decline of sea turtle populations (Lutz 1996).

On the Turkish coast, sea turtles are confronted with these threats constantly. There are, however, rescue centers, like the “Dekamer Sea Turtle Research Rescue and Rehabilitation Center” in Dalyan, Mugla, Turkey. The goal of the rescue center is to treat and reintroduce turtles after injuries in the ocean. Anthropogenic offshore threats for sea turtles, however, are hardly reduced.

In the following study, students from the University of Vienna and the Hacettepe University examined sea turtle strandings at Yanıklar and Çalış beach in Turkey from 30 June until 11 September. The collected data, which contains the site of stranding, sex, age, species, curved carapace length and width, straight carapace length and width, types of injuries, probable cause of death and photographs, were recorded on data sheets.

MATERIAL AND METHODS

Çalış

At the beginning of the season, the daily monitoring routine in Çalış consisted of a morning shift and a night shift, while in between these shifts other tasks, such as closing cages before sundown and informing tourists about sea turtles at the info desk, were fulfilled.

The day started off with the morning shift beginning at 5:50am. At 6am the temperature was measured on the beach. During shifts, the team, consisting of at least two people from the University of Vienna and Hacettepe University, walked from “Cadiri” restaurant to Çalıştepe in a straight line on the sand perpendicular to the ocean, with each member of the group observing the area in front of them. These observations consisted of identifying tracks and fresh nests of adult turtles in the early season. Later in the season, students mostly monitored secret nests, hatched nests and hatchling tracks.

At 10pm, the night shift was started at “Cadiri” restaurant. First of all, temperature was measured. The team, consisting of three to four team members, walked to “Surf Café” in the same manner as during the morning shift. After an approximately 20 minute break, the team returned to “Cadiri” restaurant. The procedure was repeated a second time. During the first 2.2 km walk to Surf Café, cages were checked for signs of hatchlings in particular. At the end of the season, night shifts were shortened and replaced by hatchling patrols.

Besides night shifts, the team organized an info desk to distribute information about sea turtles on Çalış beach every day from 9 pm to 11pm. This part was especially important for locating stranded sea turtles, since tourists could inform the team about sighted carcasses on the beach and offshore.

Yanıklar

The other part of the team monitored the beaches of Yanıklar and Akgöl. Therefore, the team had to be separated into two parts in the morning shift. One group, consisting of at least two people,

observed Yaniklar beach. There, they walked until Karataş beach, also called “Small beach” and back. The other group, consisting of at least two people as well, walked until the end of Akgöl beach.

Night shifts started at 10pm. The team usually started walking towards Yaniklar until they reached the so-called “Lonely Tree”. There, the students waited 15-20 minutes until they walked back. Then, they either walked to Akgöl or they took another 15-20 minute break and walked to the “Lonely Tree” again. In Yaniklar and Akgöl, students walked night shifts only until turtles started hatching, since the beach would be too dark and hatchlings would hardly be visible.

At all times of the season, both teams were responsible for monitoring stranded sea turtles. Contact with tourists, hotel and restaurant owners, as well as daily presence on the beach was essential to spot these turtles. When the team was informed about stranded sea turtles, at least two members went to the site.

A backpack was carried during shifts and examinations of dead turtles by one team member. This backpack contained a data booklet, pencils, a torch, nest signs, yarn for attaching nest signs, a long measuring tape, a short measuring tape, a walkie-talkie, a permanent marker, gloves, temperature measuring device and a knife. A bucket with a dark rag and a wooden sliding caliper were also carried on night shifts. When examining dead turtles, a shovel was needed in order to bury the turtle. As the team arrived at the stranding site, they held on to the following routine:

- They identified the species of the dead turtle.
- They determined the condition of the turtle (alive, fresh dead, decomposed, dried carcass, skeleton bones only).
- They checked the turtle for tags.
- They measured the straight carapace length and width with a wooden sliding caliper.
- They measured the curved carapace length and width with a measuring tape.
- They determined the sex of the turtle by observing the tail length.
- They checked the turtle for injuries.
- They took photos from the dorsal, ventral, front and back side of the turtle.
- They made assumption about the cause of death.
- They buried the turtle at a tourist-free part of the beach or waited for garbage collectors to take the turtle away

After the team returned to the camp, they completed the data form with the collected information (Fig. 5).

RESULTS

In summer 2014, six dead sea turtles were found on Çaliş and Yanıklar beach, whereby one was found in Yanıklar and five in Çaliş.

1. On 5 July 2014 during the morning shift, a buried *Trionyx triunguis* (Nile Soft-shell Turtle) was found close to the sea at Karataş beach by accident (Fig. 6.1). Since the female turtle was partly decomposed and buried, no wounds could be identified. Therefore, it was impossible to draw conclusions about causes of death. The curved carapace length measured 0.79 m, while the curved carapace width was 0.59 m.
2. On 18 July 2014 during the morning shift, *Caretta caretta* (Loggerhead Turtle) was found at Çaliştepe (Fig. 7.1). The turtle was female and decomposed. It had a curved carapace length of 0.74m and a curved carapace width of 0.64m. Nose and mouth were filled with blood.
3. On 26 July 2014 at 12:00, *Chelonia mydas* (Green Turtle) was at Surf Café in Calis. The female turtle was freshly dead, had a straight carapace length of 0.73m, a straight carapace width of 0.53m, a curved carapace length of 0.77m and a curved carapace width of 0.68m. Even though the turtle hardly showed abnormalities on first sight, closer examination revealed bruises, bloody eyes and mouth (Fig. 8.1). Since the mouth was filled with blood and the turtle had bruises on the plastron, it can be assumed that the turtle was bleeding internally (Fig. 8.2).
4. On 28 July 2014 at about 22:00, a male *Caretta caretta* was found at Çaliştepe. The straight carapace length of the turtle, which was freshly dead, measured 0.63m, while the straight carapace width was 0.55m, the curved carapace length measured 0.68m and the curved carapace width 0.68m. The measured carapace length, however, is incorrect because the carapace was cut off in the back (Fig. 9.1.). The turtle had various injuries, namely, an opened carapace on the left lower side and an open spot on the plastron (Fig. 9.2.). The upper layer of the carapace came partly off in the back. This combination of injuries leads to the conclusion that this turtle was killed by a ship propeller.
5. On 26 August at 16:00, a female *Caretta caretta* was found in between Taxi office and Café Green along the Çaliş promenade (Fig. 10.1.). The curved carapace length of the partly decomposed turtle was 0.68m, the curved carapace width 0.59m, the straight carapace length 0.62m and the straight carapace width 0.46m. The right eye of the turtle was damaged and the turtle had a net around its neck, which was apparently taken off and

discarded by tourists just before the observers of the sea turtle team arrived. Therefore, no information about net size and type is available.

6. On the same day, another dead female *Caretta caretta* was found at 17:30 in Fethiye. It was reported to the Turkish team members by the Turkish coastguard, who brought the animal to the harbor with a boat. The straight carapace length was 0.58m, the straight carapace width was 0.47m, the curved carapace length was 0.62m and the curved carapace width was 0.60m. The carapace contained three holes, which could have been caused by gun shots (Fig. 11.1). Besides a fishing line was wrapped around the right front flipper of the decomposed turtle (Fig.11.2).

Tab. 1: Dead and severely injured adult turtles found in Calis (C) and Yaniklar (Y) during the last 12 years (CC=*Caretta caretta*, CM=*Chelonia mydas*, TT= *Trionyx tringuis*, f= female, m=male, n.d.= not determined, a=adult, j=juvenile)

Tab. 1: Tote Schildkröten gefunden in Calis (C) und Yaniklar (Y) in den letzten 12 Jahren (CC= *Caretta caretta*, CM=*Chelonia mydas*, TT=*Trionyx tringuis*, f=weiblich, m=männlich, n.d.= nicht aufgenommen, a=adult, j= juvenile)

Year	Species	Location	Date of find	Sex	Age	Injuries	Probable cause of death
2000	CC	F	31.07-31.08	f	a	Still alive with injuries of the head	Injured by a blunt object
2001	CC	C	n.d.	f	a	Swallowed fish hook	Fish hook
2002	CC	F	n.d.	n.d.	n.d.	Very decomposed, age and sex unknown	n.d.
	CM	F	n.d.	f	n.d.	Bursted carapace; broken flipper	Ship propeller
2003	CC	Y	04.09	m	n.d.	Decomposed and gnawed, especially in the skull area	n.d.
2004	CM	C	24.08	m	j	Small right hind limb; raw parts of bottom slide of throat	Caught in a fisherman's net, drowned
	CC	F	Late June	n.d.	n.d.	Carapace torn open	Ship propeller
2005	No dead turtles		recorded				
2006	CC	C	June	f	a	Right hind limb missing, perhaps hereditary	n.d.
	CC	C	19.08	f	a	Front extremity and eye missing	n.d.
	CC	C	25.08	n.d.	n.d.	Back part of body missing	n.d.
	CC	Y	July	m	n.d.	Head and body skeletonized, hole in skull	Ship propeller
	CM	C	Sept.	f	j	One eye missing	n.d.
	TT	C	August	n.d.	n.d.	No external injuries	n.d.

Tab. 1: Dead and severely injured adult turtles found in Calis (C) and Yaniklar (Y) during the last 12 years (CC=*Caretta caretta*, CM=*Chelonia mydas*, TT=*Trionyx tringuis*, f= female, m=male, n.d.= not determined, a=adult, j=juvenile)

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Year	Species	Location	Date	Sex	Age	Injuries	Probable cause of death
2007	CC	C	07.08.	m	a	Head injuries, decomposed	collision with boat
	CM	C	05.08.	f	j	Head injuries; parts of the flipper missing	killed by a human
	CM	C	02.09.	f	j	Carapace torn open, injury extending down to the plastron	Ship propeller
	CM	F	04.09.	m	a	Still alive! No external injuries ; unable to dive	alive
2008	CC	Y	02.07.	m	n.d.	Scars on top of head, cut on the side of the body, carapace damaged	boat accident
	CC	C	04.07.	f	n.d.	n.d.	n.d.
	CC	C	15.07.	m	n.d.	Fishing line around neck, 80% of carapace missing	Caught in fishing line
	CC	F	30.07.	n.d.	n.d.	n.d.	n.d.
2009	CC	C	04.08.	f	a	Left flipper entangled with a fishing net, fishing hook	Caught in fishing net
	CM	C	05.08.	f	n.d.	n.d.	n.d.
2010	CC	Y	21.07.	f	a	decomposed	strike on the head
	TT	C	16.08	n.d.	n.d.	Hole in the carapace	Ship propeller
2011	CC	C	24.07.	n.d.	a	Decomposed, cuttings on carapace, head, three flippers and tail missing	Boat collision
	CC	Y	27.07.	n.d.	a	Hole in the carapace, head missing	strike on the head
	TT	C	June	n.d.	n.d.	Decomposed, carapace injuries	n.d.
2012	CC	Y	03.07.	n.d.	j	Decomposed, smashed head, holes in bones	Maybe killed by a human
	CC	F	03.07.	f	a	Swallowed fish hook	Fish hook, drowned
	CC	F	09.07.	f	a	Swallowed plastic bag	Plastic bag, starvation

Tab. 1: Dead and severely injured adult turtles found in Calis (C) and Yaniklar (Y) during the last 12 years (CC=*Caretta caretta*, CM=*Chelonia mydas*, TT=*Trionyx tringuis*, f= female, m=male, n.d.= not determined, a=adult, j=juvenile)

Tab. 1: Tote Schildkröten gefunden in Calis (C) und Yaniklar (Y) in den letzten 12 Jahren (CC= *Caretta caretta*, CM=*Chelonia mydas*, TT=*Trionyx tringuis*, f=weiblich, m=männlich, n.d.=nicht aufgenommen, a=adult, j= juvenile)

Year	Species	Location	Date	Sex	Age	Injuries	Probable cause of death
2012	CC	C	12.07.	f	a	Swallowed plastic bag	Plastic bag, starvation
2013	CC	F	23.06.	f	a	n.d.	Drowned in fisher net
	CC	Y	27.06.	n.d.	n.d.	Head and right flipper left	n.d.
	CC	F	28.06.	f	a	Propeller damage	Ship propeller
	CM	C	17.07.	f	a	Left flipper was missing	Drowned in fisher net
	CC	Ö	27.07.	n.d.	a	Fisherline was around its left flipper	n.d.
	CC	C	01.08.	m	a	Cut on carapace	Drowned in fisher net
	CC	C	27.08.	f	j	Decomposed, tail, eyes and half left front flipper were missing; piece of plastic in pharynx	n.d.
	CC	C	02.09.	m	n.d.	Propeller damage, carapace was almost cut in half	Ship propeller
2014	CM	Y	13.09.	m	a	Cut on right side	Ship propeller
	TT	Y	05.07.	f	a	n.d.	n.d.
	CC	C	18.07.	f	a	Blood in nose and mouth	fish hook?
	CM	C	26.07.	f	a	Bruises, inner bleeding and bloody eyes	Dynamite fishing?
	CC	C	28.07.	m	a	Upper layer of carapace came off, back of carapace cut off, open wounds on carapace and thorax	Ship propeller
	CC	C	26.08.	f	a	Right eye damaged, net around neck	Caught in fishing net
CC	F	26.08.	f	a	Lower jaw missing, three holes in carapace, right front flipper entangled in a fishing line	Possibly shot after being caught in fishing line	

DISCUSSION

Since the start of documentation of stranded sea turtles at Fethiye beach in 2000, the number of recorded strandings has risen dramatically (Fig. 2). This more or less constantly rising number correlates with the rising nest number in Çaliş (Fig. 3).

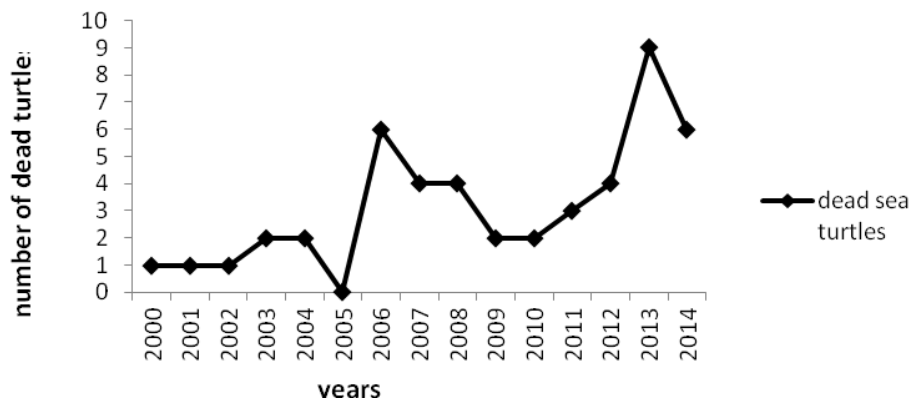


Fig. 1: Dead sea turtles in Fethiye, Çaliş and Yaniklar from 2000-2014

Abb. 1: Tote Meeresschildkröten in Fethiye, Çaliş und Yaniklar von 2000-2014

In the past, Yaniklar was a rather safe nesting beach for turtles because in the past 14 years only one dead female turtle was recorded. All in all, only ten dead turtles have been found in Yaniklar in that period. Today, however, Yaniklar beach is becoming less attractive as a nesting beach for female turtles since most of it consists of cobbles, stones and pebbles (Lesch and Mähr, 2013). Besides, there is an immense increase in tourism, light pollution and vehicles on the beach (Lesch and Mähr, 2013). These factors impede nesting for turtles in Yaniklar. Therefore, a decrease of nesting turtles can be documented, even though the inshore threats are kept to a minimum in comparison to Çaliş. Since at the same time the nest number in Çaliş has increased, one interpretation is that turtles are forced to take the risk to nest there. The inshore area in Çaliş, however, shows higher human activities such as fishing and boating. There, a lot more sea turtles, especially females, die every year (Fig. 2), and in the past two years even more turtles have died than in the past (Fig. 1).

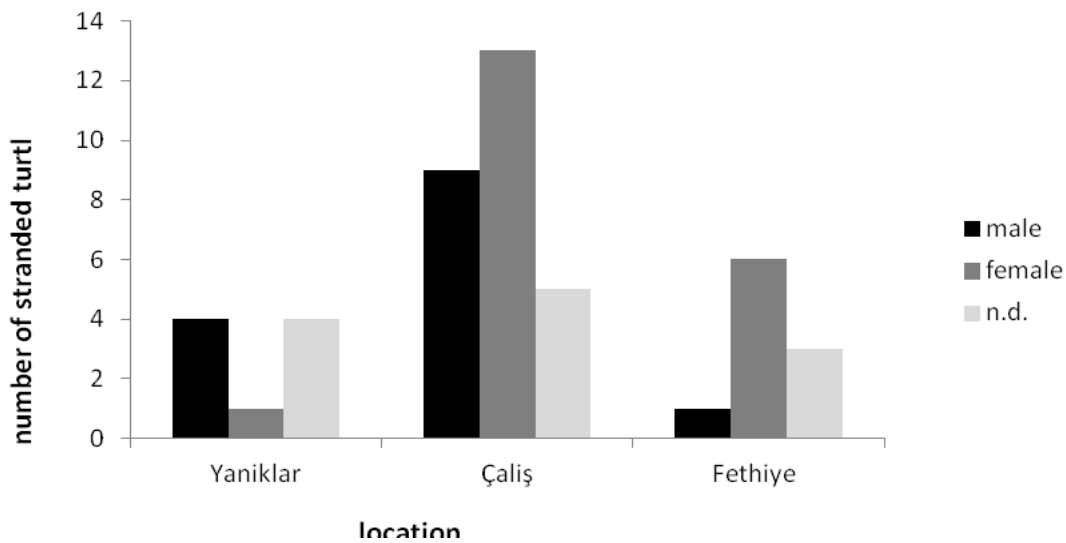


Fig. 2: Mortalities in Yaniklar, Çaliş and Fethiye; sexes of dead turtles indicated
 Abb. 2: Tote Schildkröten, aufgeteilt in Yaniklar, Calis und Fethiye; Geschlechter der toten Schildkröten angegeben

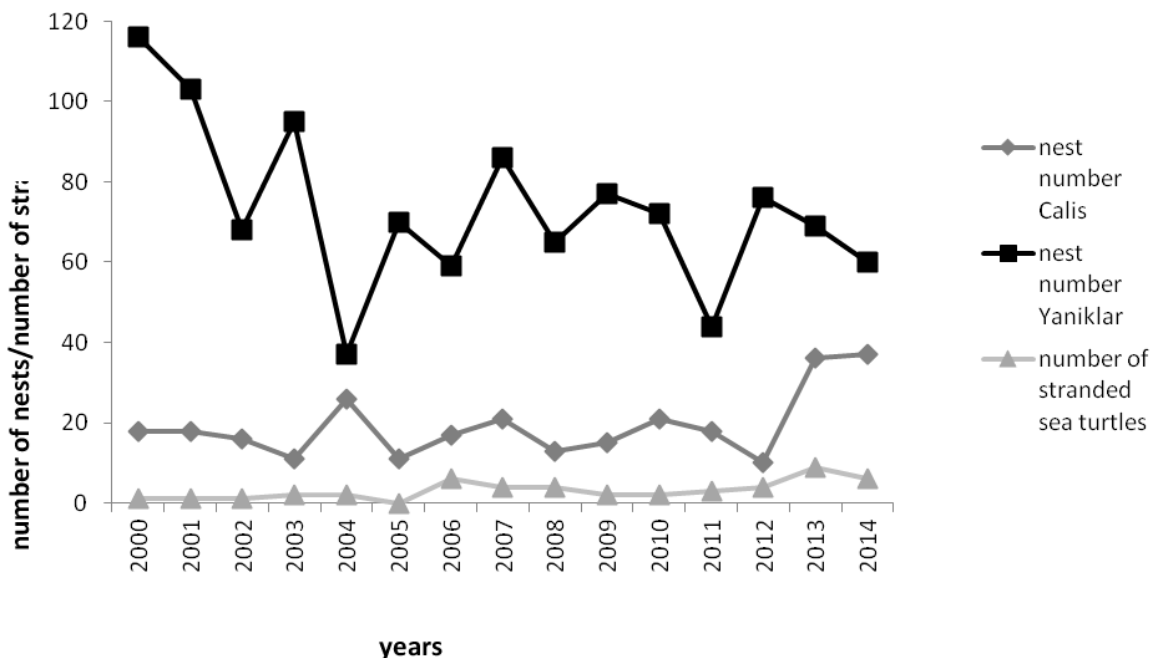


Fig. 3: Number of nests in Yaniklar and Çaliş in relation to the number of dead turtles

Abb. 3: Anzahl der Nester in Yaniklar und Çaliş im Vergleich zu der Anzahl der gestrandeten toten Schildkröten.

Especially, killings through fishing have increased in the past two years (Fig. 4). In the Mediterranean, more than 60 000 turtles are caught every year; most of them were caught by surface longline and driftnets, followed by bottom trawls and gillnets, whereas mortality rates range from 10% to 50% (Tudela, 2004). This year, three turtles died through fishing in Çaliş.

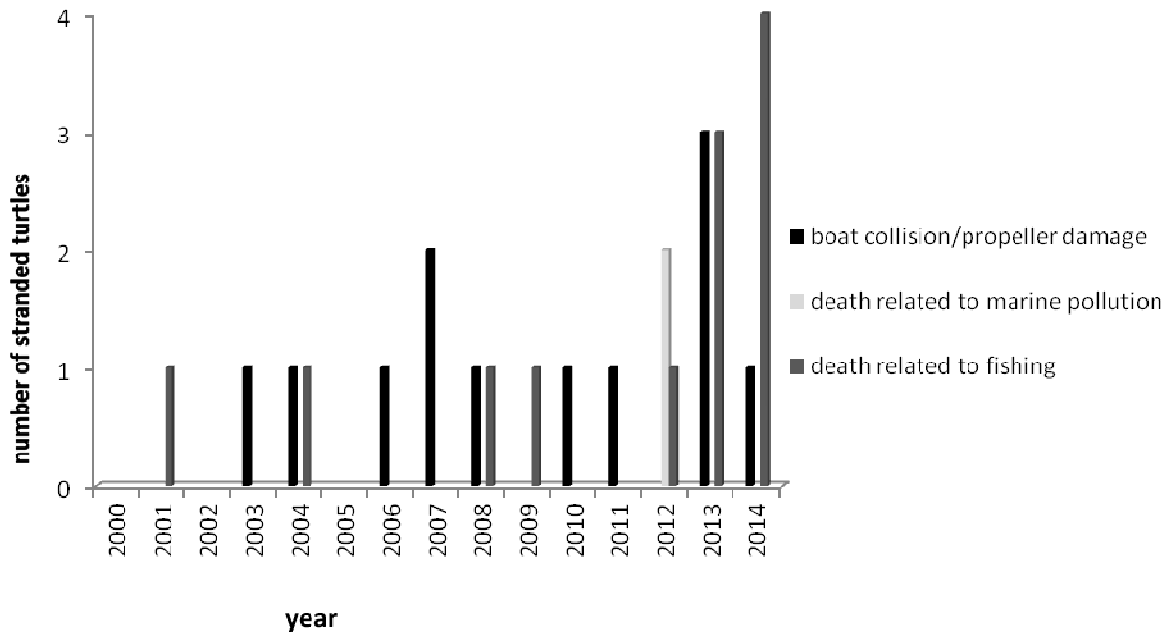


Fig. 4: Stranded dead sea turtles in Calis, Fethiye and Yaniklar related to cause of death. Only clearly determined cases of death are included.

Abb. 4: Tote angespülte Meeresschildkröten in Calis, Fethiye und Yaniklar in Verbindung mit der Todesursache. Hier werden nur Schildkröten angezeigt, deren Todesursache bestimmt werden konnte.

The first turtle killed through fishing in 2014, number two in the results, was an adult female *Caretta caretta* and was probably killed by a fish hook. This was determined through blood in nose and mouth. Mortalities due to fish hooks could be reduced by using so-called circle or “C” fish hooks, which differ in their shape and size to the usual “J” fish hooks (Read, 2006) and are therefore less dangerous to turtles.

The second turtle killed through fishing in 2014, number three in the results, is a very unusual case. This turtle was an adult female *Chelonia mydas*. While there were hardly any signs of injuries on the surface of the body, the turtle had suffered from internal bleeding as there were bruises on the plastron and on the sides of its bloated body. Besides, the eyes of the turtle were filled with blood and swollen. Blood entered the mouth and other body tissues. Since there were hardly any injuries visible on the outside, besides bruises, the team concluded that the turtle must have died from high pressure, which was either achieved through dynamite fishing or a net that kept the turtle at the bottom of the ocean for a long period of time. Dynamite fishing is an illegal but widespread practice in Turkey and leads to overall negative effects on the ecosystem (Tudela, 2004).

The third turtle killed through fishing is recorded as case number five in the results section. According to the tourists, who had first sighted the turtle, this female *Caretta caretta* had a net around its neck (Fig.10.1). They, however, took it off and threw it back in the ocean. For this reason, there is no information about the size and the type of the net.

On the same day, another turtle was found. This turtle, however, showed a higher degree of decomposition, which indicates that the turtle must have been dead for a longer period of time. The right front flipper of this *Caretta caretta* was entangled in a fishing line (Fig. 11.2.). Moreover, there were three holes in the front of the carapace (Fig. 11.1.). These holes may have been caused by gunshots. One possible interpretation is that the turtle was shot and then its front flipper was disentangled from the fishing line by cutting the line off.

In summer 2014, there were only two stranded turtles whose death was not related to fishing. The first turtle found this season was a *Trionyx triunguis* (the Nile Soft-shell Turtle) (Fig. 6.1.). When found, this turtle was already buried. The death of this turtle is alarming because only three major subpopulations remain, namely two in Turkey and one in Israel (Shanas 2012). This situation has been caused by degeneration of land, which hinders sea turtles to nest on the beach, fragmentation processes, and climate change, which has led to habitat loss (Shanas 2012).

Another *Caretta caretta* was found at Çaliştepe on 28 July 2014 at 22pm. This turtle, however, was assumedly killed by a boat propeller because the carapace was cut off in the back and it contained wounds at the carapace and plastron (Fig.9.1, Fig. 9.2.).

In the past years, most determined causes of death were related either to fishing or boat collisions (Fig. 4). However, the causes of death in most cases could not be determined. Importantly, most determinations of causes that lead to death are merely assumptions.

As seen in Figure 4, in 2012, two turtles were identified to have died by ingesting plastic bags. This was not the case in any other year. In 2012, however, dead turtles were dissected and examined more closely. Therefore, clearer statements about the causes of death could be provided. Such precise findings can rarely be obtained by merely examining the turtle externally. The number of dead turtles recorded is a minimum estimate. This is because the sea turtle team is on site for only a small part of the year. Moreover, some carcasses remain at sea and never strand on the beach and therefore are never to be documented. Even when turtles strand, they may be removed before the team can examine them or they strand in unpopulated stretches of the coast and go unnoticed.

Therefore, data about stranded sea turtles is sometimes ambiguous and imprecise. This calls for stranded sea turtles to be more closely monitored.

Theoretically, a survival ratio of 1:1000 turtles is expected. In 1994, for instance, 1638 hatchlings reached the sea in Çaliş. In about 20 years, these hatchlings reached adulthood. This means, 1.6 turtles of hatchlings from the year 1994 should have grown up by now. In 2014, however, 4 dead turtles were recorded on Çaliş beach. Therefore, more dead turtles were documented than were produced.

Overall, the data of 2014 shows an increasing number of stranded turtles (even though some turtles might have been missed) and thus a poor perspective for the population in the future.

Dead or injured sea turtles 2014

Observer: Stranding date and time:

Species: *Caretta caretta*- loggerhead turtle
Chelonia mydas- Green turtle
Trionyx triunguis – Nile softshell turtle
 Other:.....

Stranding location: Offshore (beach) Inshore (sea, lake, river)
Descriptive Location:.....

Sex: undetermined Male Female

How was sex determined: necropsy tail length (adult only)

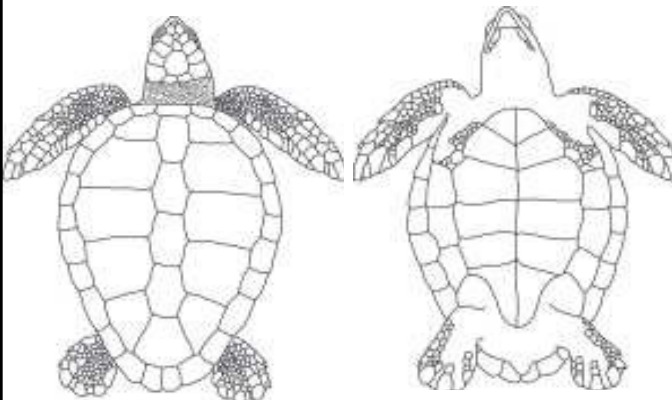
Condition: 1 alive
 2 fresh dead
 3 decomposed
 4 dried carcass
 5 skeleton bones only

Tags: Checked for tags? Yes no Tagnumber:.....
 Tag location:.....
 Return adress:.....

Carapace measurements: SCL SCW.....
 CCL CCW.....

Photos taken? Yes no
Nr. of photos:

Mark wounds/abnormalities on diagrams and describe. Please also note if no wounds or abnormalities are found.



- holes/ wounds made by gun
- deformations
- cuttings
- missing parts
- gear or debris entanglement
- propeller damage
- others:

Notes:

Fig 5: Data sheet used to document dead sea turtles
 Abb 5: Datenblatt, welches verwendet wurde um tote Schildkröten zu dokumentieren.



Fig. 6.1: Dead *Trionyx triunguis* (Nile soft-shell turtle) was found buried on Karatas beach (Yaniklar). (Photo: E. Rameder)

Abb. 6.1: Diese tote *Trionyx triunguis* (Nilweichschildkröte) wurde eingegraben am Karatas Strand (Yaniklar) gefunden.



Fig. 7.1: Stranded dead *Caretta caretta* found at next to Çalıştepe. (Photo: E. Rameder)

Abb. 7.1: Tote *Caretta caretta*, welche bei Çalıştepe angespült worden ist.



Fig. 8.1: Frontal view of the stranded *Chelonia mydas* (Green turtle) found on Çaliş beach. Note the blood coming out of eyes and nose. (Photo: N. Falk)

Abb. 8.1: Frontal Ansicht der toten *Chlonia mydas* (Suppenschildkröte), welche am Çaliş Beach gefunden wurde. Man betrachte das Blut, welches aus Augen und Nase kommt.



Fig. 8.2: Ventral view of the stranded *Chelonia mydas* (Green turtle) on Çaliş beach. Note the bruises on the Plastron. (Photo: N. Falk)

Abb. 8.2: Ventral Ansicht der gestrandeten *Chelonia mydas* (Grüne Meeresschildkröte) auf Çaliş beach. Zu betrachten sind die blauen Flecken am Plastron.



Fig. 9.1: Stranded male *Caretta caretta* (Loggerhead turtle) at Çaliştepe, which contains a hole on the left side of the carapace (Photo: J. Martini)

Abb. 9.1: Gestrandete männlichen *Caretta caretta* (Unechte Karettschildkröte) bei Çaliştepe, die ein Loch auf der linken Seite des Carapax aufweist.



Fig. 9.2: Plastron of stranded male *Caretta caretta* (Loggerhead Turtle) at Çaliştepe. Note the hole and the bruises on the plastron (Photo: J. Martini)

Abb. 9.2: Plastron der gestrandeten männlichen *Caretta caretta* (Unechte Karettschildkröte), welche bei Çaliştepe gefunden wurde Man beachte das Loch und die blauen Flecken am Plastron.



Fig. 10.1: Stranded dead female *Caretta caretta* (Loggerhead Turtle) found on 26 August 2014 at 17:30. The net that had entangled the turtles was removed and discarded by tourists (Photo: M. Stachowitsch)
Abb. 10.1: Gestrandete tote weibliche *Caretta caretta* (Unechte Karettschildkröte), welche am 26. August 2014 um 17:30 gefunden wurde. Dieses Tier war verfangen in einem Netz, wobei dieses schon vor den Fotoaufnahmen von Touristen abgenommen wurde.



Fig. 11.1: Decomposed stranded female *Caretta caretta* (Loggerhead Turtle) in Fethiye harbor. Note the three holes in the carapace (Photo: M. Stachowitsch)
Abb. 11.1: Zersetzte gestrandete weibliche *Caretta caretta* (Unechte Karettschildkröte). Zu sehen sind drei Löcher im Carapax der Schildkröte.



Fig. 11.2: Left front flipper of the stranded female *Caretta caretta* (Loggerhead turtle) illustrated in Fig 11.1. Flipper entangled in fishing line (Photo: M. Stachowitsch)
 Abb. 11.2: Tote angespülte weibliche *Caretta caretta* (Unechte Karettschildkröte), welche auch in Abb. 11.1 zu sehen ist. Der linke Vorderflipper ist in einer Angelschnur verfangen.

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Bachelor Thesis

Light pollution along the beach promenade in Çaliş, Fethiye, Turkey

Lichtverschmutzung an der Strandpromenade in Çaliş, Fethiye, Türkei

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Aspired academic title
Bachelor of Science (BSc)

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KURZFASSUNG

Am Strand von Çaliş stellt die Lichtverschmutzung weiterhin ein großes Problem dar, indem sie das Verhalten der vom Aussterben bedrohten Meeresschildkröten-Art *Caretta caretta* negativ beeinflusst. Das Licht, das von den vielen Lampen und Laternen von der Promenade auf den Strand fällt, kann zu einem Rückgang der Nest-Zahlen, aber auch zur Desorientierung der frisch geschlüpften Jungtiere auf ihrem Weg zum Wasser führen. Um die derzeitige Situation möglichst genau darzustellen, wurde die Promenade in 99 Abschnitte eingeteilt. Jeder dieser Abschnitte repräsentiert ein Gebäude. Die Lichter jeder dieser Abschnitte wurden gezählt und ihre Lichtintensität wurde gemessen. Diese Messungen wurden sowohl vor als auch nach Mitternacht durchgeführt.

Die Ergebnisse zeigten einen deutlichen Anstieg der Lichtanzahl im Vergleich zu den Vorjahren. Während es 2013 nur 946 Lichter waren, wurden in diesem Jahr 1206 gezählt. Die durchschnittlichen Lux-Werte hingegen sanken von 15,44 auf 11,75 zwischen 22:00 und 00:00 Uhr sowie von 5,34 auf 3,70 nach Mitternacht.

Im Anschluss wurden die Lichtintensitätswerte der Verteilung der Nester in diesem Strandabschnitt gegenübergestellt, um zu überprüfen, ob sich die Unterschiede in der Lichtintensität an der Promenade auch auf die Platzierung der Nester durch die weiblichen Schildkröten auswirken. In diesem Zusammenhang konnte allerdings keine eindeutige Korrelation festgestellt werden.

Um Möglichkeiten zur Verbesserung der Situation aufzuzeigen, wurden diverse Management-Strategien ausgearbeitet. Neben verschiedenen technischen Veränderungen direkt an den Lichtern, sollte ein Lichtschutz mittels Pflanzen oder andere Barrieren errichtet werden und die Anzahl der Lichter vor allem nach Mitternacht in bereits geschlossenen Lokalen stark reduziert werden. Zusätzlich sollten die lokalen Behörden strengere Auflagen und Reglementierungen vorsehen. Natürlich sollte aber auch die einheimische Bevölkerung für das Problem sensibilisiert werden, sodass sie ein stärkeres Bewusstsein dafür entwickelt, ihre Natur zu schützen und in der Lage ist den Touristen in der Region dieses Verständnis weiterzugeben.

ABSTRACT

The light pollution in the Special Protected Area of Çaliş Beach remains a serious problem threatening the endangered sea turtle species *Caretta caretta*. The illumination of the beach by the different lights used on the promenade to attract tourists to the restaurants, bars and shops can have a negative impact on the number of nests laid on this part of the beach as well

as on the seaward orientation of hatchlings after they have emerged from the nest. To show the actual lighting situation in Çaliş, the lights of 99 sections of the promenade were counted and the light intensity was measured. Measurements were taken both before and after midnight. The comparison of the data with the values from the last years showed an increase in the number of lights from 946 in 2013 to 1206 in 2014. The lux-values between 22:00 and 00:00 decreased slightly from 15.44 in 2013 to 11.75 in 2014 and those after 00:30 from 5.34 (2013) to 3.70 (2014). Moreover, the placement and distribution of the nests was analysed in relation to the light intensity values from the corresponding section on the promenade and the intensity directly over the nest and at the waterline in order to determine if there was a correlation. No significant correlation was found.

As the situation has not shown any improvement in the last year, I present some management strategies. Aside from technical modifications to the lights themselves, taller light barriers should be erected to shield the beach from direct lighting.

Additionally, the number of lights should be reduced especially after midnight in already closed bars or restaurants and stricter regulations and laws by local authorities should be implemented. It is also important to raise awareness on the part of local residents and tourists for the conservation of nature. The aim should be to reduce the problem so that the biologists can concentrate on the endangered sea turtles themselves.

INTRODUCTION

Light has always been a symbol for progress and cultural development. However, the excessive presence of artificial light during nighttime has become an increasing global problem in the last decades. This phenomenon, termed ‘light pollution’, has had and continues to have an impact on the ecology of many different species including our own. In general, light pollution is defined as the unnatural brightening of the night sky through artificial light sources as well as the direct influence of lights on organisms (Posch, 2013). It is considered to be a kind of environmental pollution caused by humans as a side effect of industrialisation. The lack of darkness is also harmful for humans, interfering with our natural day-night rhythm and disrupting our biological clock (Cajochen, 2013). Moreover artificial light has large-scale negative consequences for several ecosystems and is the cause of a high rate of mortality in animals, in particular of nocturnal species such as insects, birds or bats (Eisenbeis, 2013). Sea turtles, 110-million-year-old vertebrate species, have also been increasingly threatened by the environmental changes due to light pollution.

In the Mediterranean Sea both species nesting in this region *Chelonia mydas* (Green turtle) and *Caretta caretta* (loggerhead sea turtle) are listed as endangered (IUCN, 2014). Female sea turtles come to the beach to lay their nests by night; the hatchlings then emerge from the nest by night (Witherington et al., 1990 cited in Salmon, 1995) and use visual cues to crawl to the sea (Mrosovsky, 1972, cited in Salmon, 1995). Considering these facts, any changes in lighting therefore affect their behaviour.

The disruptive effect of light pollution on hatchling orientation is well documented. Under normal circumstances, hatchlings show a positive phototaxis, which means that they move towards the brighter horizon over the sea and crawl away from higher silhouettes from the vegetation, dunes or other tall objects using form vision. Verheijen (1985) showed that hatchlings often get disrupted by artificial light, which leads them to either crawl in non-directed paths (“disorientation”) or move towards the bright light source and not seawards (“misorientation”).

The nest-site choosing behaviour of adult female sea turtles is influenced by several additional conditions. The females consider a variety of factors when deciding where to lay their nest: an easily accessible beach with a high sand quality, stable conditions to minimise the risk of erosion, few terrestrial predators (Mortimer, 1982, cited in Salmon, 1995), and the existence of offshore currents to help the hatchlings swim into the open ocean (Collard and Ogren, 1990, cited in Salmon, 1995).

As Witherington showed in 1992, the lighting situation on the beach is an important factor as well. On beaches directly impacted by (primarily mercury vapour) lights the number of nesting attempts by loggerhead or green turtles decreased significantly.

The present study examined the current situation in Çaliş, a beach in the Special Protected Area (SPA) near Fethiye in southwest Turkey. From an ecological point of view the conditions on the beach in Çaliş are getting worse especially for the sea turtle *Caretta caretta*, which is the main nesting species in this area. Beyond the decreasing sand quality, the increasing number of sunbeds, parasols and other beach equipment, and the continuous presence of humans on the beach both day and by night, the light pollution poses a serious threat for the sea turtles and a constant challenge for biologists and volunteers working for different nature conservation projects.

The development of tourism is clearly important for the economy of this region, but with the growth of tourism and the industrial sector, nature issues find themselves getting neglected. Therefore, studies like these are important to document the problem over a certain period of time. This helps ensure that the damage caused to nature isn't ignored, and that human beings will actively take part in conserving and protecting the environment.

The purpose of this study is to document the current situation of light pollution on Çaliş Beach in order to compare it to the data of the last years and to detect potential trends that could become a serious problem. Data were collected not only before midnight but after midnight as well, when most of the localities are closed, in order to demonstrate how many lights are turned on late at night when the restaurants etc. themselves are already closed. The more lights that burn after midnight, the fewer chances female turtles have to find a darker area on the beach to lay their nest. In addition, I examined the effect of the lights along the promenade on the position of the nests in order to determine if there is any correlation between the light intensity and the nest-site choice.

Furthermore, I present a management plan to sensitize the owners and the employees of the hotels. Some strategies to reduce the photopollution in this specific area are also discussed, as well as some possible compromises that combine the developing tourism with the conservation of endangered species.

MATERIAL AND METHODS

In order to document the light pollution on Çalış Beach, a 1.5-km-long stretch was examined. This area was divided into 99 sections. Each section corresponds to one building along the beach promenade. The measurements began at the southern part of the beach at Çadiri Restaurant and continued towards the northern part. The last section is Caretta Beach Club, which marks the end of the promenade. On 12 August and 14 August 2014, the lights of the different bars, restaurants and hotels were counted and the light intensity was measured between 22:00 and approximately midnight. This period should give an accurate view of the situation when most lights are on. The same measurements were repeated on 23 August and 25 August 2014 between 00:30 and 02:00 to examine the light pollution when most of the localities are already closed. The survey was carried out by two students who counted the lights of each bar, restaurant or hotel and measured the light intensity with a lux-meter (Gossen Mavolux digital, Figure 10 in the Appendix). Additionally, photos of each building were taken with a digital camera (Panasonic Lumix DMC-S1, Night Scenery Mode). Each photo and each measurement of the light intensity was taken at a distance of at least 6 m from the building from approximately 130 cm above the ground. The number of lights taken into account for the study includes only the lights visible from the promenade and turned on at the time of the examination. Furthermore, the lights were divided up into different types: light bulbs/tubes, neon lights, signs/screens, light chains, coloured lights, illuminated refrigerators and others (containing illuminated desks and tables, moving lights, game consoles, background lights, illuminated aquariums).

The hypothesis that the intensity of light deriving from the promenade has a negative effect on the nesting behaviour of the adult sea turtles of the species *Caretta caretta* was also examined. For this purpose, the nest plan developed by the students of the sea turtle course during June, July and August 2014 was used. The exact locations of the 18 nests on the beach near the promenade were compared to the light intensity measured on the corresponding position on the promenade. Additionally, the light intensity was quantified on top of 9 of the 18 nests (about 10cm and 130cm above the ground) and on the waterline (at a height of approximately 10cm). These measurements were taken on 27 and 28 August 2014. For this evaluation only those nests were chosen whose exact nesting time was known, so that the measurement took place at nearly the same time as the adult turtle was on the beach. As a reference value, the intensity of the moonlight on 10 August 2014 (full moon) was measured in the darkest area of the beach, in Çalış Teppe.

The number of lights has already been quantified in the years from 2005 to 2013; however, the light intensity has been measured only since 2012. In order to compare the collected data

with the results from the last years the values were entered in Excel. Tables and graphs to describe the development of light pollution over the last years were created in order to determine a potential correlation between nest positions and light intensity on the beach and promenade.

The photos from the first measurement period (from 22:00 to 00:00) were added to a photo catalogue already containing the images from 2011 to 2013 in order to present a visual account of the situation in Çaliş.

RESULTS

In 2014, the number and intensity of lights was evaluated in 99 sections, each corresponding to one locality along the promenade. Compared to the last years, the number of sections studied increased: in 2011 84 sections were examined, in 2012 only 74 and in 2013 the promenade was divided up into 83 parts (some new buildings were constructed in the meantime and the number of mobile sales booth changed).

Table 1 shows the exact values counted or measured in each section. Since 2012, the number of lights has been counted and their intensity measured (whereas before 2012, only the former was done).

In 2012, the light intensity measurements were taken only before midnight, while in the years 2013 and 2014 they were carried out both before and after midnight.

Table 1: The 99 sections along the promenade in Çaliş with the corresponding numbers of lights and light intensity values from the years 2011, 2012, 2013 and 2014. The data were collected within two periods (22:00-00:00 and 00:30-02:00). (n.d.: no data)

Tabelle 1: Die 99 Abschnitte entlang der Promenade in Çaliş mit der jeweiligen Anzahl der gezählten Lichter und der Lichtintensitätswerte aus den Jahren 2011, 2012, 2013 und 2014.

section	location	2011	2012		2013				2014			
		lights 21:00	lux ¹ 22:00	lights ² 22:00	lux ¹ 22:00	lights ¹ 22:00	lux ² 00:30	lights ² 00:30	lux ¹ 22:00	lights ¹ 22:00	lux ² 00:30	lights ² 00:30
1	TürküçCadiri	n.d.	n.d.	n.d.	12.4	14	8.6	14	9.5	17	9.5	20
2	IceCreamShop ¹	n.d.	20	4	9.0	4	5.2	4	13.6	4	13.6	4
3	HaslamaMisir ¹	n.d.	11	3	11.4	3	9.2	3	6.9	7	2.1	0
4	HaslamaMisir ²	n.d.	7	3	10.3	3	1.8	0	10.9	5	10.8	5
5	LocmaciPilavEvi	n.d.	0	0	9.5	2	2.4	0	n.d.	n.d.	n.d.	n.d.
6	MutluPark	n.d.	11	n.d.	15.5	8	8.8	0	n.d.	n.d.	n.d.	n.d.
7	RestaurantMutlu ¹	n.d.	14	29	12.4	4	8.8	8	11.1	29	1.1	0
8	RestaurantMutlu ²	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	6.1	9	6.0	9

Table 1 (cont.): The 99 sections along the promenade in Çaliş with the corresponding numbers of lights and light intensity values from the years 2011, 2012, 2013 and 2014. The data was collected within two periods (22:00 and 00:30). (n.d.: no data)

Tabelle 1: Die 99 Abschnitte entlang der Promenade in Çaliş mit der jeweiligen Anzahl der gezählten Lichter und der Lichtintensitätswerte aus den Jahren 2011, 2012, 2013 und 2014.

section	location	2011	2012		2013				2014			
		lights	lux	lights	lux	lights	lux	lights	lux	lights	lux	lights
		21:00	22:00	22:00	22:00	22:00	00:30	00:30	22:00	22:00	00:30	00:30
11	JewelleryShop	3	5	5	6.0	4	1.6	0	n.d.	n.d.	n.d.	n.d.
12	HamsiBar	n.d.	18	18	3.5	16	1.9	7	0.6	33	0.4	41
13	ManasParkOtel	n.d.	8	8	7.9	8	2.8	4	0.9	22	0.8	6
14	ManasParkLounge	n.d.	14	14	3.6	11	1.9	4	11.2	37	1.5	39
15	IndianCuisine	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
16	AnnaRestaurant	n.d.	9	40	8.1	35	4.1	6	4.9	15	2.4	26
17	IceCreamShop2	n.d.	52	8	30.0	8	6.1	3	29.9	7	25.8	7
18	DenizBeachOtel	n.d.	16	6	21.0	10	2.4	4	14.2	9	13.8	8
19	HotelSimsek	n.d.	20	16	12.5	13	7.5	0	11.6	14	9.0	14
20	IceCreamShop3	n.d.	57	4	45.7	4	35.0	4	43.6	5	45.2	5
21	HotelBerlin	n.d.	13	6	26.4	4	5.3	0	9.6	5	9.5	6
22	FruitSmoothie	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	18.5	12	6.8	10
23	HaslamaMisir	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	17.9	4	1.1	0
24	Er-ÖzHotel	n.d.	9	16	10.5	15	1.5	0	7.7	17	1.2	4
25	GülMarket	n.d.	n.d.	n.d.	10.2	5	3.9	4	6.6	8	1.3	3
26	Motto	n.d.	6	20	12.8	11	2.0	0	4.4	12	0.7	8
27	BellaMammas/DeltaHotel	n.d.	10	25	10.4	22	1.4	1	9.8	18	0.1	1
28	Painter	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	6.8	5	n.d.	0
29	LocalBar/MilanoClothingShop	n.d.	12	27	22.0	22	2.9	0	21.4	20	0.5	1
30	Vojo	n.d.	14	11	18.9	9	15.0	10	7.3	11	2.7	4
31	EyülOptik	n.d.	12	17	17.2	17	7.9	1	14.1	6	6.9	4
32	BeachHouse	n.d.	18	17	13.5	13	8.9	5	10.5	9	7.1	9
33	NilBar&Restaurant	n.d.	10	15	12.3	9	5.4	8	9.8	15	2.5	4
34	AzureProperties	n.d.	n.d.	n.d.	9.7	10	3.0	2	7.2	12	1.4	2
35	BambuBar1	n.d.	13	15	8.8	11	6.2	1	9.8	16	1.4	7
36	BambuBar2	n.d.	6	25	14.0	26	6.4	1	4.8	14	1.3	1
37	MacDonaldsIceCream	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	7.2	10	2.3	0
38	CaféSoul	n.d.	33	18	21.4	17	3.4	20	14.4	25	8.5	15
39	InterskyTourism/TravelAgency	8	41	11	11.2	4	2.0	1	18.9	10	2.8	7
40	LaCasadiMammaRistorante	8	15	26	16.7	28	5.6	0	13.3	10	0.8	1
41	TattooSelim	22	32	24	24.5	10	1.4	0	3.4	8	1.5	2
42	SouvenirShop	22	26	22	33.3	22	1.6	0	37.0	8	1.4	0
43	SeasideTravelAgency	18	26	18	35.1	22	2.9	1	32.8	20	18.2	5
44	Serkul2Restaurant	17	27	34	32.0	38	2.7	0	20.9	30	2.0	1
45	Serkul1Restaurant	21	18	33	34.0	38	18.1	2	22.7	32	0.2	0
46	George's	16	14	18	23.6	22	9.0	2	18.1	16	0.5	2
47	EynaRestaurant	18	11	10	15.0	4	4.2	2	8.8	6	0.7	3
48	ThePalmsRestaurant/HotelIdee	23	15	23	18.2	19	2.5	4	16.7	37	0.9	7
49	SouvenirShop	13	29	13	41.5	9	4.8	n.d.	27.3	15	1.0	0
50	FocusTravelAgency	17	21	13	40.3	16	33.5	7	32.6	27	3.5	0
51	CalisTaxi	2	28	4	33.0	10	26.8	3	31.3	3	19.3	5
52	SugarDaddyIceCream	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	17.5	2	11.9	0
53	CaféGreen	n.d.	20	10	21.5	7	5.0	0	17.0	10	3.0	0
54	CalisBazar	n.d.	19	15	20.9	5	2.1	0	15.2	2	2.0	0
55	FunparkEntrance/SnackBar	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	5.9	4	0.7	0
56	CalisFastFoodRestaurant	17	n.d.	n.d.	23.3	4	1.3	0	15.1	10	1.2	0
57	Mado	17	19	15	27.5	7	1.3	0	18.6	17	0.9	0
58	MadoFruitBar	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	20.5	5	1.2	0
59	Calligraph/Painter	2	6	2	6.0	2	0.0	0	10.0	1	n.d.	0
60	Entrance/DoganMarket	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	21.9	4	1.7	8

Table 1 (cont.): The 99 sections along the promenade in Çaliş with the corresponding numbers of lights and light intensity values from the years 2011, 2012, 2013 and 2014. The data was collected within two periods (22:00 and 00:30). (n.d.: no data)

Tabelle 1: Die 99 Abschnitte entlang der Promenade in Çaliş mit der jeweiligen Anzahl der gezählten Lichter und der Lichtintensitätswerte aus den Jahren 2011, 2012, 2013 und 2014.

section	location	2011	2012		2013				2014			
		lights 21:00	lux ¹ 22:00	lights ² 22:00	lux ¹ 22:00	lights ¹ 22:00	lux ² 00:30	lights ² 00:30	lux ¹ 22:00	lights ¹ 22:00	lux ² 00:30	lights ² 00:30
61	Souvenir/ClothingShop	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	19.1	11	2.4	0
62	Glassformer	n.d.	5	2	10.0	3	0.0	0	10.3	2	n.d.	0
63	Sevda	n.d.	n.d.	n.d.	23.3	4	0.0	0	n.d.	n.d.	n.d.	n.d.
64	WaffleShop(Lighthouse)	n.d.	n.d.	n.d.	9.6	4	4.9	3	12.6	6	9.5	4
65	LighthouseLounge&Bar	15	3	15	6.8	17	6.1	5	15.5	32	4.4	29
66	OkyanusRestaurant	15	5	15	6.7	5	4.6	4	8.7	13	0.4	0
67	TravelAgency1	7	12	7	18.5	8	16.8	4	11.3	11	0.5	0
68	1905Pub/HotelArea	17	4	22	5.1	17	3.0	11	2.9	27	0.9	25
69	HaslamaMisir/WaffleShop	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	2.5	1	0.7	1
70	RoseBar	19	6	19	8.2	23	2.0	0	5.3	14	0.5	0
71	Bar&RestaurantDüğretmenvi	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	3.6	1	n.d.	0
72	Maison	n.d.	25	4	49.9	7	44.5	7	n.d.	n.d.	n.d.	n.d.
73	AromaBar	7	22	7	26.3	7	9.8	0	13.3	12	0.2	4
74	MerhabaRestaurant	14	20	10	20.3	7	1.2	0	14.8	12	0.4	0
75	ClothingShop	20	16	20	16.9	20	1.2	0	12.0	16	0.5	0
76	Lily'sSteak&GrillHouse	15	15	15	8.9	4	1.1	0	15.5	13	5.1	6
77	CalisBeachRestaurant	n.d.	6	12	21.4	7	1.5	0	15.4	13	0.4	0
78	GünesRestaurant(Hotel)	17	11	17	18.2	9	1.4	1	15.5	19	0.2	4
79	SecilClothingShop	10	25	10	19.0	7	1.3	0	16.8	11	0.0	0
80	SecilMarket	12	19	10	11.9	6	1.3	0	13.5	11	0.0	0
81	TravelAgency2	n.d.	n.d.	n.d.	13.5	6	1.3	0	n.d.	n.d.	n.d.	n.d.
82	SekreturOpenHouse	7	9	7	6.9	10	1.3	0	3.3	5	0.2	0
83	LaSpezia/HotelSeketur	23	4	23	5.9	10	2.4	0	11.9	37	0.1	3
84	CarettaInfoDesk	3	1	2	2.5	2	1.2	0	1.1	2	0.0	0
85	KeyifCafé	11	2	11	4.8	8	1.0	0	4.7	25	0.2	0
86	TakeAwayEJ's	11	0	8	4.6	8	1.0	0	6.8	4	1.1	2
87	Callisto	8	0	11	3.3	8	1.2	0	4.0	12	2.6	21
88	Lee'sBar	n.d.	1	8	4.1	6	1.2	4	2.9	10	2.9	10
89	X-Factor(HotelCeren)	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	2.5	6	0.1	0
90	HotelCeren	25	2	16	7.5	15	1.5	0	4.8	20	0.2	1
91	House2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.4	4	0.1	1
92	TurkuazMarket	7	3	6	4.5	6	1.3	0	4.5	3	0.3	3
93	BahameBar	8	8	13	8.2	4	3.6	7	4.0	7	2.5	10
94	HotelYasmin	11	8	10	5.0	4	1.9	2	8.8	14	2.7	2
95	MalhunRestaurant/Hotel	17	5	8	6.6	5	1.0	0	4.9	22	2.7	17
96	HotelLetoon1	32	6	44	6.1	25	1.7	1	1.5	13	0.2	8
97	HotelLetoon2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	4.1	34	1.0	1
98	House3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.7	3	0.4	8
99	CarettaBeachClub	n.d.	8	61	5.2	50	1.2	0	8.2	44	6.0	4

The total number of lights in the restaurants, bars, hotels and sales booths on the promenade in 2014 is higher than in any other year. Figure 1 shows the clear increase from 273 lights in 2005 to 1206 in 2014. The lights were not only counted but also divided into different categories. Table 2 shows how many lights corresponding to each of the 7 categories were counted before and after midnight. The number of illuminated refrigerators and coloured lights increased after midnight, whereas the number of light bulbs and light tubes was more than halved in the same time. Many of the neon lights turned off after midnight, as were more than half of the light chains and signs.

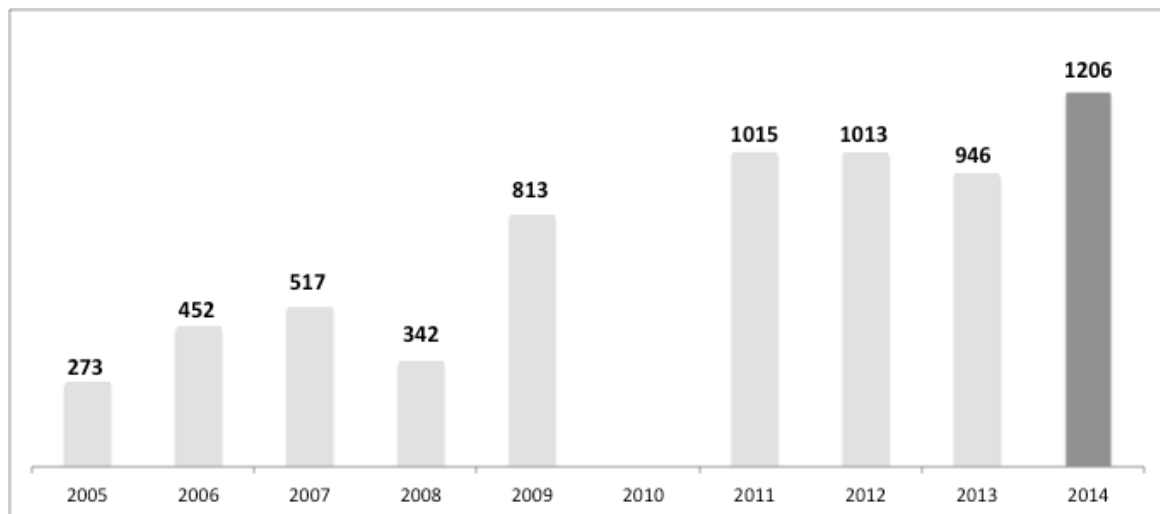


Figure 1: The total number of lights counted in the years 2005 to 2014. (2010: no data)
Abbildung 1: Die Gesamt-Anzahl der Lichter, die in den Jahren zwischen 2005 und 2014 gezählt wurde. (2010: keine Daten)

Table 2: The different types of lights counted in 2014 before and after midnight.
Tabelle 2: Die verschiedenen Licht-Typen aus dem Jahr 2014 mit den jeweiligen Gesamt-Zahlen vor und nach Mitternacht.

	22:00	00:30
lightbulbs/tubes	788	309
neonlights	133	29
signs/screens	179	65
lightchains	66	24
coloredlights	19	26
illuminatedrefrigerators	8	15
other	13	7
	1206	475

Table 1 lists the light intensity values for each section. The overall average of the lux-values from 22:00 slightly decreased since last year. While in 2012 the value was 13.85 and in 2013 15.44, the average of the measurements this year was only 11.75. The measurements after midnight showed the same trend. This average decreased from 5.34 (2013) to 3.70 (2014). Figure 2 shows the averages from the last years with their standard deviations. The highest light intensity at 22:00 in 2014 was 43.6 lux, whereas in 2013 it was 49.9 and in 2012 57.

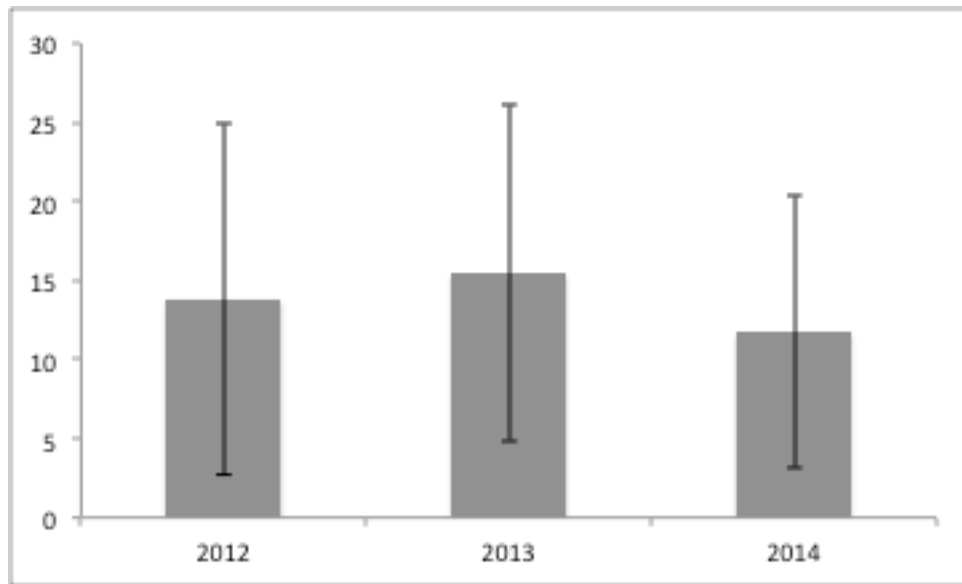


Figure 2: Comparison of the overall average values of the lux-measurements before and after midnight from the years 2012, 2013, 2014 with their standard deviations. (2012: no data after 00:30)
 Abbildung 2: Die Grafik zeigt eine Gegenüberstellung der Durchschnittswerte der Lichtintensitätsmessung vor und nach Mitternacht aus den Jahren 2012, 2013, 2014 mit den Standard-Abweichungen. (2012: keine Daten nach 00:30)

In 2014, 18 nests were laid in front of the beach promenade in Çaliş. The exact nesting time is known for only 9 of these nests. These 9 nests were divided into “laid before midnight” and “laid after midnight”, and measurements were taken at the corresponding time over the nest and at the waterline (in order to simulate the light situation when the female sea turtle came to the beach). The results are presented in table 3. Figure 3 shows the lux-values from the promenade before and after midnight. The nests are marked with two different symbols: the cross shows that the nesting time is known exactly and the ellipses mark those nests where it is not known.

Table 3: Overview of the lux-values measured approximately 130cm and 10cm over the nest and 10cm over the waterline. (P: promenade; N: nest; W: waterline) Time 1 refers to when the nest was laid, Time 2 shows the time of the measurements. The values on the promenade corresponding to the nesting time of the 9 nests for which the nesting time is known stand out in bold.

Tabelle 3: Die Ergebnisse der Lichtmessungen, die über den Nestern in einer Höhe von 130cm und 10cm, sowie 10cm über der Wasserlinie gemessen wurden.

NestNr.	Date	Time1	Location	lux1P	lux2P	luxN	luxN10cm	luxW10cm	Time2
CY_01	bef.04.06.14	bef.05:30	HamsiCafé	0.6	0.4	0.1	0.0	0.1	01:05
CY_25	secret	n.d.	BellaMammas/DeltaHotel	9.8	0.1	n.d.	n.d.	n.d.	n.d.
CY_27	secret	n.d.	Bambu	9.8	1.4	n.d.	n.d.	n.d.	n.d.
CY_02	bef.04.06.14	bef.05:30	CaféGreen	17.0	3.0	4.2	1.0	0.6	01:17
CY_35	secret	n.d.	LighthouseLounge&Bar	15.5	4.4	n.d.	n.d.	n.d.	n.d.
CY_20	04.07.14	n.d.	Okyanus	8.7	0.4	n.d.	n.d.	n.d.	n.d.
CY_11	30.06.14	22:23	1905Pub	2.9	0.9	0.7	n.d.	n.d.	22:36
CY_17	24.05.14	bef.05:30	MerhabaRestaurant	14.8	0.4	0.0	0.0	0.0	01:25
CY_12	01.07.14	23:15	SecilMarket	13.5	0.0	3.9	0.0	0.1	22:45
CY_33	secret	n.d.	LaSpezia	11.9	0.1	n.d.	n.d.	n.d.	n.d.
CY_06	bef.20.06.14	n.d.	HotelCeren	4.8	0.3	n.d.	n.d.	n.d.	n.d.
CY_03	bef.04.06.14	bef.05:30	Trafo	1.4	0.1	1.4	0.8	0.3	01:57
CY_21	09.07.14	1:10	TurkuazMarket	4.5	0.3	0.4	0.3	0.3	01:59
CY_18	01.07.14	23:20	MalhunRestaurant	4.9	2.7	2.0	0.6	0.5	23:01
CY_19	01.07.14	after00:00	HotelLetoon	4.1	1.0	0.3	0.3	0.3	02:03
CY_34	secret	n.d.	HotelLetoon	4.1	1.0	n.d.	n.d.	n.d.	n.d.
CY_26	secret	n.d.	CarettaBeachClub	8.2	6.0	n.d.	n.d.	n.d.	n.d.
CY_13	01.07.14	n.d.	CarettaBeachClub	8.2	6.0	n.d.	n.d.	n.d.	n.d.

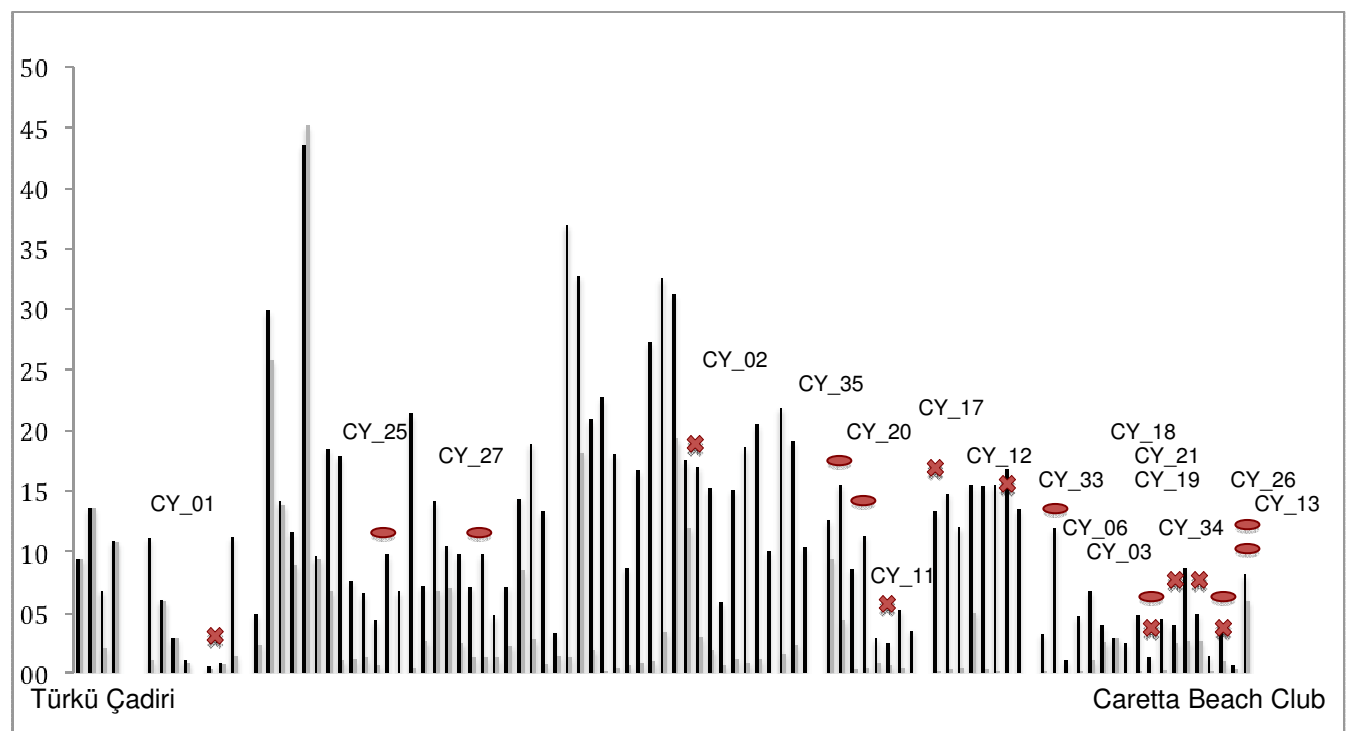


Figure 3: The distribution of the 18 nests near the beach promenade with the lux-values of the 99 sections before (black) and after midnight (grey).

Abbildung 3: Die Verteilung der 18 Nester an der Strandpromenade mit der Lichtintensität der einzelnen Abschnitte vor und nach Mitternacht.

When collecting the data, I took into account whether or not the restaurants were still open at 00:30.

The lights that were still turned on at the already closed locations were counted and the light intensity was measured. On 25 August 2014, after 01:00, 51 locations were already closed. In only 29 of these had the lights been completely switched off. In the remaining 22 several lights were still on. The total number of lights in the already closed restaurants and bars was 60; the highest lux-value measured in front of an officially closed location was 18.2. Table 4 lists the names of the closed restaurants and bars, the number of lights and the light intensity.

Table 4: Number of lights and light intensity in locations that were already closed at the time of measurement. Data collected on 25 August 2014 after 01:00.

Tabelle 4: Anzahl der Lichter und Lichtintensität von bereits geschlossenen Lokalen vom 25. August 2014 nach 01:00.

2014 section	location	lux 00:30	lights 00:30
3	Haslama Misir	2.1	0
13	Manas Park Otel	0.8	6
23	Haslama Misir	1.1	0
25	Gül Market	1.3	3
27	Bella Mammias/Delta Hotel	0.1	1
29	Loco Bar/Milano Clothing Shop	0.5	1
31	Eyül Optik	6.9	4
36	Bambu Bar	1.3	1
37	MacDonalds Ice Cream	2.3	0
39	Intersky Tourism Travel Agency	2.8	7
40	La Casa Di Mamma Ristorante	0.8	1
41	Tattoo Selim	1.5	2
42	Souvenir Shop	1.4	0
43	Seaside Travel Agency	18.2	5
44	Serkul Restaurant	2.0	1
45	Serkul Restaurant	0.2	0
46	George's	0.5	2
47	Eyna Restaurant	0.7	3
49	Souvenir Shop	1.0	0
50	Focus Travel Agency	3.5	0
53	Café Green	3.0	0
54	Calis Bazar	2.0	0
55	Funpark Entrance/Snack Bar	0.7	0
56	Calis Fast Food Restaurant	1.2	0
57	Mado	0.9	0
58	Mado Fruit Bar	1.2	0
59	Calligraph/Painter	n.d.	0
61	Souvenir/Clothing Shop	2.4	0
62	Glassformer	n.d.	0
66	Okyanus Restaurant	0.4	0

Table 4 (cont.): Number of lights and light intensity in locations that were already closed by the time of measurement. Data collected on 25 August 2014 after 01:00.

Tabelle 4: Anzahl der Lichter und Lichtintensität von bereits geschlossenen Lokalen vom 25. August 2014 nach 01:00.

2014 section	location	lux ² 00:30	lights ² 00:30
67	Travel Agency ¹	0.5	0
70	Rose Bar	0.5	0
71	Bar & Restaurant Ögretmenvi	n.d.	0
72	Maison	n.d.	n.d.
73	Aroma Bar	0.2	4
74	Merhaba Restaurant	0.4	0
75	Clothing Shop	0.5	0
76	Lily's Steak & Grill House	5.1	6
77	Calis Beach Restaurant	0.4	0
79	Secil Clothing Shop	0.0	0
80	Secil Market	0.0	0
82	Sekretur Open House	0.2	0
84	Caretta Info Desk	0.0	0
85	Keyifi Café ²	0.2	0
86	Take Away T.J's	1.1	2
89	X-Factor (Hotel Ceren)	0.1	0
90	Hotel Ceren	0.2	1
92	Turkuaz Market	0.3	3
94	Hotel Yasmin	2.7	2
97	Hotel Letoon ²	1.0	1
99	Caretta Beach Club	6.0	4

In addition the photo catalogue from 2013 was completed with the images taken in 2014. A photograph of each restaurant, bar, hotel, or sales booth on the beach promenade was taken. The photo catalogue is included in the Appendix along with several other pictures depicting the situation in Çaliş (Fig. 5 to 8) and the work carried out by the students during the sea turtle course 2014.

DISCUSSION

In 2014, 39 nests were laid on the beach of Çaliş. This is a new record when compared to the values of the last 20 years in which this combined university course and project has existed. 18 of the 39 nests were located along the promenade, whereas in 2013 there were 22 nests documented on this part of the beach, and in 2012 only 7. The overall numbers reflect a positive nesting trend. The number of lights, in turn, shows a clear increase from 946 (2013) to 1206 (2014), continuing the trend of the last 9 years (Fig. 1), whereas the light intensity values have slightly decreased. The measurements before midnight as well as those after midnight showed higher lux values in 2013 (Table 1); the highest value for a particular section was recorded in 2012. Note, however, that these variations in the results may not solely represent actual changes in the light situation on the promenade: some variation may reflect the method used to collect data. The counting of lights has a subjective component because it depends on decisions by the data collector, for example whether small lights in the background of the locations potentially influence the sea turtles and therefore whether they are counted or not. This problem could only be solved or at least moderated by creating some strict guidelines for the students who will be carrying out the counting in the following years. Moreover, the variation in the measurements of light intensity may also be caused by the differing use of the highly sensitive lux-meter. The value changes are considerably depending on the direction or the height in which the device is held.

Nonetheless, tourism in Çaliş is apparently on the increase and the number of lights will no doubt continue to grow. The consequences of the high number of lights along the promenade are evident in the already well-documented reaction of hatchlings. Nature and species conservation projects such as the one in Çaliş have tried to find ways to help the hatchlings find their way to the sea unhindered. In Çaliş, metal cages are necessary to prevent hatchlings from crawling in the wrong direction; members of the project must collect and release them at a darker area of the beach. In other parts of the world, so-called “hatcheries” are sometimes carried out in such cases—the translocation of the whole nest to a safer, darker place. Although cages, hatcheries and other strategies can be potentially risky and are costly, they are currently the only possibility – beyond turning the lights off! – to actively increase the chances of the hatchlings’ survival.

The number

What we do not see and what we cannot influence directly is the number of nesting attempts that are disrupted and inhibited by artificial lights. An unknown number of sea turtles attempt to come to the beach but do not leave the water, possibly because of the bright lights that

potentially signify daylight for the females (Witherington, 1992). Witherington showed in 1992 that the number of nesting attempts decreased significantly when beaches are directly impacted by artificial lights.

The distribution

The distribution of the 18 nests laid this year along the beach promenade in Çaliş does not show any correlation with the light intensity of the corresponding sections or the values measured directly over the nest (Fig. 3 and Table 3). On the one hand there was too little data to test for a significant relation, on the other hand several studies elsewhere have shown the absence of a correlation in this context. Salmon (1995) showed for example that “the levels of light intensity vary from the beach with location (...) and that nest density is unrelated to this variation (...)”. After examining the effect of mercury vapour and low-pressure sodium vapour lamps, Witherington (1992) also concluded that neither type of light had an influence on the position and distribution of the nests once the adult females left the sea.

Interestingly, Figure 3 shows that more nests were laid in the northern part of the beach (between Café Green and Caretta Beach Club), as was the case in the previous year. Nonetheless, it is difficult to draw any conclusions because the exact nesting time of 7 of these nests is not known. This distribution could also be explained by some other factors like the presence of humans on the beach or the sand quality.

An interesting question connected to this topic is: why do female sea turtles continue to lay their nests on this part of the beach if they try to avoid highly illuminated beaches (Witherington 1992)? The answer might already have been given by Salmon (1995) in his study on the “Behavior of Loggerhead Sea Turtles on an Urban Beach.” In the first subsection “Correlates of Nest Placement” he describes the phenomenon that female sea turtles prefer to place their nests in front of tall objects like buildings, while there are no studies showing similar behaviour on natural beaches. This could therefore be a new factor affecting nest-site choice as turtles adapt to light pollution. Accordingly, the female places her nest in the shadow of a light barrier. Nonetheless, the freshly emerged hatchlings crawling towards the sea become disorientated by the lights as soon as they leave the barrier’s shadow (Berry et al., 2013). The female merely avoids the direct illumination, whereas the seaward orientation of hatchlings also gets disrupted by indirect background lights shining through gaps in the light barrier. Those gaps are more likely to be present in artificial light barriers such big buildings, unlike the silhouette formed by natural vegetation or dunes (Salmon, 1995). Another possible explanation for why the females still lay the nests in front of the promenade is that they may

emerge from the sea only late at night when most of the lights are off (Salmon et al. 1995), while the hatchlings emerge mostly before midnight (Witherington et al., 1990 cit. in Salmon et al., 1995). The results from this year's light measurements support this hypothesis: the lux-values near the 9 nests for which the exact nesting time is known are relatively low (Table 3). In general the nest-site choice is probably a compromise between several physical and biological characteristics of which we know too little. We cannot do anything specific to attract the females to a particular beach or beach section besides making the beach itself as attractive as possible and safe enough for the nesting process (by promoting the known favourable factors).

Keeping this in mind, nature conservationists and local residents should try to provide the sea turtles with as many beaches, locations and as much darkness as possible in order to minimize the risk that the nest distribution becomes limited to a few areas and therefore could be easily be endangered by natural catastrophes, nest-parasites or predators.

In order to make a step into the right direction a management plan should be developed including some of the following suggested solutions.

The number of lights

The most logical measure would be to reduce the number of lights by keeping them turned off or by removing them. Of course, this would not always be possible due to human safety issues or economic aspects in areas strongly affected by tourism. Lights in this context are used to attract customers and visitors.

The light spectrum

An alternative would be to change the type of light. According to Witherington (1992) not only the number of lights but also the light spectrum of the lamps has an impact on sea turtle nesting behaviour. He demonstrated that the use of mercury vapour lights was followed by a significant decrease in nesting attempts and actual nests, while the effect was not noticed with yellow, low-pressure sodium vapour lights. This might be because the emitted light by low-pressure sodium vapour lights is not mistaken to be daylight by loggerheads and green turtles. Generally, yellow, long-wave light does not disrupt nesting by *Caretta caretta*, whereas white light with a broad-spectrum of short and long waves has been proven to have a negative effect on the nesting activity and on the hatchling seaward orientation (Salmon, 2003).

The focus

Additionally, lights that shine directly on the promenade should be reduced. Some modifications have already been done in past years: some of the 24 street lanterns along the promenade using modern light technology to cover one half of the lamp shade to concentrate

the light on the promenade itself rather than on the beach (Fig. 4, Appendix). This strategy is only partially effective and it has not been applied to all lamps.

Filters

Other, simpler solutions would to reduce the light intensity with lower wattage or insert filters to eliminate short-wave light from the spectrum. Some hotels for example covered their lamps with yellow or red cloths to create a more romantic atmosphere for their guests (Fig. 11, 12).

Light barriers

A more extensive management plan could eliminate the tall street lanterns and replace them with lights that are lower or even set into the surface of the promenade. This could be accompanied by the construction of a higher light barrier, maybe by raising the promenade wall between the lights and the beach. Additionally, more trees or bushes could be planted to cover the light hot spots on the promenade and provide a barrier with fewer gaps.

The situation after midnight

In addition to a general reduction of the lights, the situation after midnight should be changed. Many already closed restaurants and bars still have abundant active lights (Table 4; Fig. 13-18). If the light intensity before midnight cannot be drastically reduced due to its importance for tourism, at least the time after midnight should be made more sea turtle friendly. Such regulations should be stipulated by the local authorities as well as by the Compliance Committee of the Barcelona Convention. In 1995 Turkey signed this Convention for the Protection of the Mediterranean Sea against Pollution and agreed to combat pollution and to assist with monitoring and scientific research. The laws and regulations would need to be applicable only for the period from May to August, when the nests are laid and most of them hatch.

General regulations

Generally, there should be stricter regulations for the hotels and restaurants along the beach. For example some types of light (e.g. neon lamps) should be forbidden, white light should be reduced, and there should be some restrictions for lights after midnight. Restaurants should turn off all their lights after closing. In hotels, for example, motion sensors could be installed to make sure that light is used only when really necessary. Regulations should also be implemented for buildings constructed in the future; these could regulate the lights on the outside of the building and interior lighting, for example with prescribed curtains or awnings.

Environmental awareness

Moreover, the sensitization of tourists and local residents is another important step when developing a management plan. It is necessary to raise awareness for the importance of

species conservation; however, sea turtle monitoring teams from abroad, like the present sea turtle course in Çaliş, are not empowered to take specific action or recommend codes of behaviour or regulations to local residents and businesspeople. What such groups can do is to informally inform interested parties about the importance of the endangered species within their ecosystem (as is being done, for example, in the evenings in our information booth on the promenade). Only if people understand that every species has its role in the ecosystem (which provides them with many different products and services) will they assume the responsibility.

Thus, more information events with the locals and hotel owners should be organized. They can then pass the information on to the tourists (for example providing information material at the hotels). Additionally, a label to designate hotels that have implemented especially “turtle-friendly” regulations could be created.

Tourists should respect nature and ecology when on vacation; in Çaliş, for example, they should be aware that they are staying in a Special Protected Area and know the associated rules. Such rules stipulate that people are not allowed to stay on the beach during the night. This is important not only because where there are humans there are lights, but also because people can easily interfere with a nesting attempt, causing the female to return to the sea without having laid her nest.

The light pollution problem is gaining importance not only along the promenade in Çaliş, but also on the other parts of the beach and on the neighbouring beach of Yaniklar. Measures should be taken now rather than later to prevent the same happening there as well. Currently, most beach stretches in Yaniklar are still dark enough for hatchlings to find their way into the sea without help, but this seems to be changing for the worse (Fig. 9).

In the future, the light pollution should continue to be monitored in Çaliş and adjoining beaches so that impacts can be documented early enough to intervene with further management strategies. The long and complex life cycle of sea turtles requires a wide range of measures by conservation biologists. Reducing light pollution should be one of the first to implement.

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APPENDIX



Figure 4: One of the 24 street lamps along the promenade with a technical modification to (partially) block the light from the beach. (Photo: M. Stachowitsch)

Abbildung 4: Eine der 24 Straßenlaternen entlang der Promenade mit einer technischen Veränderung, um das Licht auf die Promenade zu fokussieren.



Figure 5: View from atop the wall separating the promenade from the beach. In background: the sky glow of Fethiye. (Photo: J. Martini)

Abbildung 5: Aussicht von der Promenadenmauer in Richtung Fethiye. Im Hintergrund ist der durch die Lichter der Stadt hell erleuchtete Nachthimmel zu sehen.



Figure 6: The lighting situation on the picnic area of Çaliş beach. People are sitting on the beach and using bright lights to illuminate the part of the beach without street lanterns. (Photo: J. Martini)

Abbildung 6: Lichtverschmutzung in der Picknick-Zone abseits der Promenade. Viele Menschen sitzen dort und beleuchten den Strandabschnitt, an dem es keine künstliche Beleuchtung gibt, mittels eigens mitgebrachten Lampen und Laternen.



Figure 7: An example for the light situation after midnight. There are still a lot of lights on. Especially the artificial light of the street lanterns illuminates the area. (Photo: J. Martini)

Abbildung 7: Ein Beispiel für die Situation nach Mitternacht. Vor allem das grelle Licht der Straßenlaternen erleuchtet diesen Strandabschnitt.

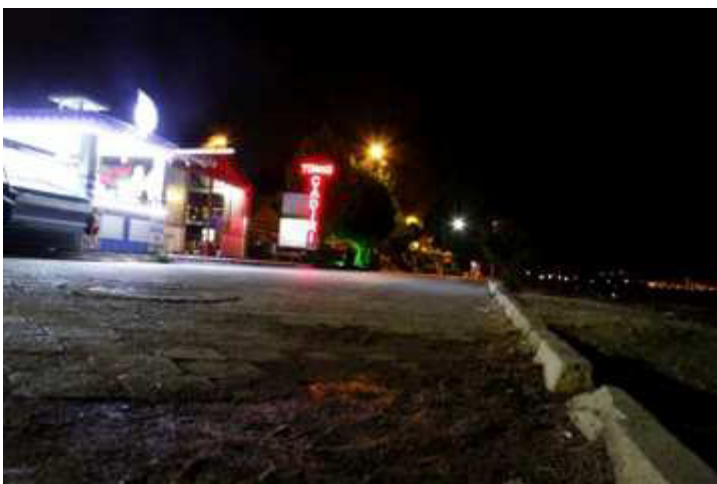


Figure 8: A highly illuminated Ice Cream Shop (section 2) near Türkü Çadiri. (Photo: J. Martini)

Abbildung 8: Ein hell-erleuchteter Eis-Verkaufsstand (Abschnitt 2).



Figure 9: The highly illuminated construction area of the new hotel being built in Yaniklar. The floodlights are clearly visible from Yaniklar Beach, several kilometers away. (Photo: M. Herzog)
 Abbildung 9: Die stark beleuchtete Baustelle der neuen Hotel-Anlage in Yaniklar. Die Flutlichter sind über weite Kilometer hin sichtbar.

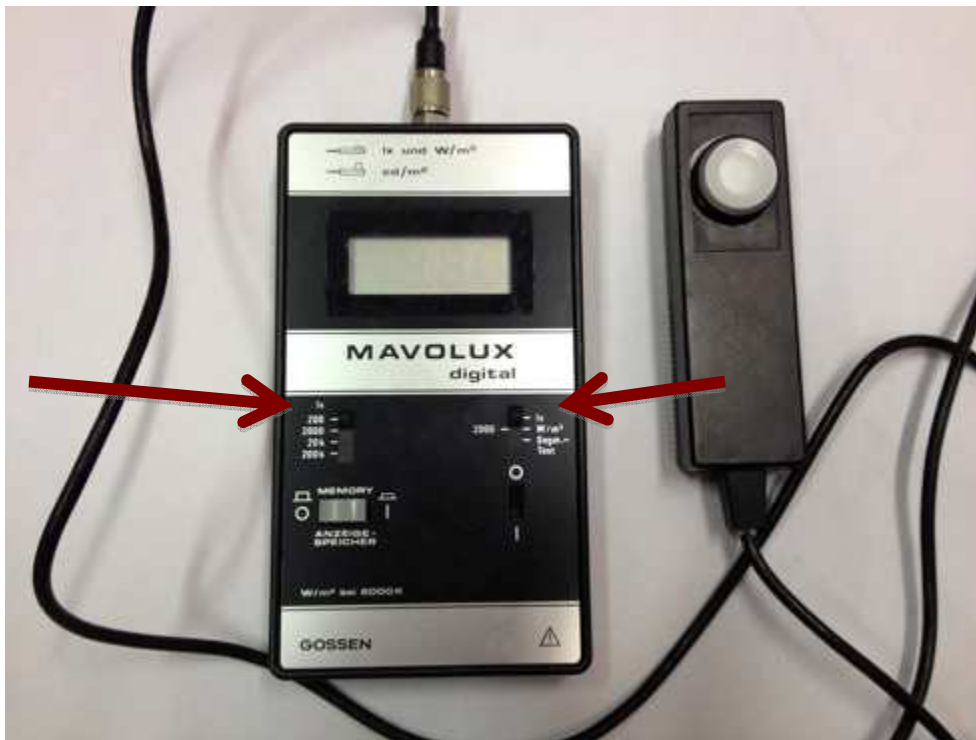


Figure 10: Lux-meter “Gossen Mavolux digital”. The red arrows show the used settings (200; lx). On the top right the sensor that is held towards the light source during the measurements. (Photo: J. Morandell)
 Abbildung 10: Lux-Meter “Mavolux digital”. Die roten Pfeile zeigen die verwendeten Einstellungen. Oben rechts befindet sich der Sensor, der beim Messen in Richtung Lichtquelle gehalten wird.



Figure 11 + 12: Lights in Hotel Berlin along the promenade covered with cloths or curtains. A bartender explains that the covering is supposed to create a more romantic atmosphere for the customers. (Photo: J. Morandell)

Abbildung 11 + 12: Einige Lichter eines Restaurants wurden mit Tüchern verhängt.

Photographs of selected shops, bars and restaurants already closed after midnight, along with their lux-values and a short description of the light situation. The photos show the lights still turned on in those restaurants. (Photos: J. Morandell):

Im Folgenden einige Fotos als Beispiel für Geschäfte, Bars und Restaurants, die nach Mitternacht bereits geschlossen waren aber noch sehr viele Lichter angeschaltet hatten. Dazu die nach Mitternacht ermittelten Lux-Werte und eine kurze Beschreibung der Lichtsituation.



Figure (Abb.) 13: Gül Market lux2 (1.3)
Highly illuminated refrigerators.
Hell erleuchtete Kühlschränke.



Figure (Abb.) 14: Vojo lux2 (2.7)
Light bulb illuminating the menu.
Grelle Glühbirne, welche die Speisekarte beleuchtet.



Figure (Abb.) 15: Eyül Optik lux2 (6.9)

Two highly illuminated signs in front of the store as well as some background lights behind the shop window.

Zwei Schilder vor dem Geschäft, sowie Hintergrundbeleuchtung im Schaufenster.



Figure (Abb.) 16: Azure Properties lux2 (1.4)

Neon lights in front of the already closed shop.

Neon-Röhren, welche den Eingang des bereits geschlossenen Geschäfts erleuchten.



Figure (Abb.) 17: Seaside Travel Agency lux2 (18.2)
Bright advertising lights, giving information about the offers of the travel agency the whole nightlong.
Helle Leuchtschrift, welche die ganze Nacht lang die neuesten Angebote des Reisebüros ankündigt.



Figure (Abb.) 18: La Spezia lux2 (0.1)
Lights and signs still on at 01:30.
Lichter und Schilder, die um 01:30 Uhr immer noch eingeschaltet sind.

Bachelor Thesis

Condition of The Special Protection Area in Fethiye-Göcek, Turkey

Ufuk Dursun

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“We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes — something known only to her and to the mountain. I was young then, and full of trigger-itch; I thought that because fewer wolves meant more deer, that no wolves would mean hunters’ paradise. But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view. Since then I have lived to see state after state extirpate its wolves.”

Aldo Leopold, “Arizona and New Mexico: Thinking Like a Mountain”, p. 130-132.

For a sustainable life for all earthlings...

ABSTRACT

During the course of the University of Vienna “Protection of Sea Turtles in Turkey” I aimed to understand the conditions and problems of the special protection areas (SPAs) ^[1], focusing on Fethiye-Göcek SPA. This has also been the site of research for more than 20 years in the field of sea turtles, specifically the loggerhead turtle, *Caretta caretta*, and the green turtle, *Chelonia mydas*. Both species are endangered as are all the other species of sea turtles.

SPAs are defined as places with wild flora and fauna and their natural habitats, especially of those species and habitats for species that are vulnerable and endangered, including migratory species, whose conservation requires the co-operation of several States ^[7].

In Turkey, SPAs are under governance of the Ministry of Environment and Urban Planning and the ministry uses the definition of SPAs according to the Barcelona Convention ^[9]. Fethiye-Göcek district was declared an SPA according to this convention in 1988. This region is also declared an archeological heritage site.

Examining research reports from the last 20 years and reports written by MEDASSET (Mediterranean Association to Save the Sea Turtles) and local NGOs, and keeping the nature of the region in mind, shows that it is crucial to investigate the situation and problems of the Fethiye-Göcek area ^[10].

Researchers have noted a considerable decline in sea turtle nesting in Fethiye since 1993. Some improvements were recorded in 2011, but these improvements did not persevere and the nesting beaches were further built up (MEDASSET 2011, 2012).

The 2014 monitoring season recorded that the same ongoing problems.

Firstly, my research concentrated on understanding how people in that region defined and perceived SPAs and how settlements and infrastructure were affected according to their definition of SPAs. Further, this effort involved understanding the current condition of the SPA, keeping in mind the duration of the sea turtle project and examining the findings of recent studies in this area.

Areas that are specified as protection areas and all definitions made with regard to these areas are, according to Turkish laws, under many different subordinations, and legislations differ within these subordinations. Even though the protection areas are under governance of two different ministries, all activities pertaining to the management of these areas are solely the responsibility of environment and urban planning ministry ^[16].

As conclusion it is clear what needs to be done in the Fethiye-Göcek SPA case. The first step would be to enforce the conditions and clauses of the international agreements that are already signed by the government. The relevant legislation should be structured so that it

leaves no vagueness and no open room for misconception regarding the SPAs and all the other protection areas that the international agreements cover. Furthermore, local residents should be informed and educated about the area they live in and what kind of responsibilities they should assume. Ultimately, supervision, inspection and reinforcement of the legal clauses is crucial.

INTRODUCTION

In Turkey there are 16 different special protection areas (SPAs or SEPA as in Special Environmental Protection Area)^[1]. One of these SPAs is Fethiye-Göcek, which has also been the site of research for more than 20 years in the field of sea turtles, specifically the loggerhead turtle, *Caretta caretta*, and the green turtle, *Chelonia mydas*.

Today, there are seven species of sea turtles. *C. caretta* and *C. mydas* are the two main species inhabiting the Mediterranean Sea. They also nest on the beaches of Fethiye, which are 8 km long. Both species are endangered, as are all the other species of sea turtles.

Accordingly, sea turtles are under protection stated by international conventions such as the Bern Convention ^[1,2], Barcelona Convention ^[3] and CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) ^[4]. All three conventions were signed by Turkey: Bern in 1984, Barcelona in 1988 and again in 2002, and CITES in 1996. In addition to these, several other agreements such as Ramsar (Convention on Wetlands of International Importance, especially as Waterfowl Habitat) in 1994, CBD (Convention of Biological Diversity) in 1996, and Florence Convention (European Landscape Convention) in 2004 are signed by Turkey ^[5,6].

The Bern Convention defines the SPAs as places with wild flora and fauna and their natural habitats, especially of those species and habitats for species that are vulnerable and endangered, including migratory species, whose conservation requires the co-operation of several States ^[7]. The Barcelona Convention, which is a part of UNEP (United Nations Environmental Program World Conservation Monitoring Center), has also defined SPAs separately. According to this definition, PAs (Protected Areas) are terrestrial, freshwater or marine areas that are recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values ^[8].

In Turkey, SPAs are under governance of the Ministry of Environment and Urban Planning and the ministry uses the definition of SPAs according to the Barcelona Convention ^[9]. Fethiye-Göcek district was declared an SPA according to this convention in 1988. This region

is also declared an archeological heritage site. The area, which totals 817 km², comprises Göcek, Çiftlik, Fethiye, Ölüdeniz municipalities and some of Karaçulha and Çamköy municipalities. Some species endemic to this area are the oriental sweetgum tree, *Liquidambar orientalis*, and Fazil Lycian salamander, *Lyciasalamandra fazilae*. Another aspect is that according to the map set out by the cabinet on 18 April 1996 (number 96/8109), the region is in serious danger of being struck by an earthquake. The major faults included in the map are Babadağ, Fethiye and Ölüdeniz. In addition to the main ones, there are several other minor faults ^[1].

MEDASSET (Mediterranean Association to Save the Sea Turtles) is one organization responsible for organizing and maintaining the records with the Bern Convention, the European Commission and Turkish authorities since 2008. This area has been a research site since 1993. In this framework, scientists have already recorded a serious decline in sea turtle nesting in Fethiye since 1993. There were some improvements recorded in 2011, but these improvements were mainly temporary and in the following years the nesting beaches were further built up (MEDASSET, 2011, 2012).

Examining research reports from the last 20 years and reports written by MEDASSET and local NGOs, and keeping the nature of the region in mind, shows that it is crucial to investigate the situation and problems of the Fethiye-Göcek area ^[10].

Firstly, my research concentrated on understanding how people in that region defined and perceived SPAs and how settlements and infrastructure were affected according to their definition of SPAs.

Further, this effort involved understanding the current condition of the SPA, keeping in mind the duration of the sea turtle project and consulting recent studies. I also aimed to examine other similar SPAs and compare their condition data and other findings with the situation in Fethiye.

MATERIAL AND METHODS

I examined relevant websites of the municipalities and ministries and local businesses. I relied on documents produced by MEDASSET and Karaot Solidarity. I also prepared a questionnaire for interviews.

Interviews were coinducted with locals and local enterprises, scientists and NGOs in order to receive up-to-date information about the area and to help focus the research. Also obtained were reports (both dating back and recent) from several NGOs working in the area and relevant website of the Turkish authorities. Statements were made by the bar associations

regarding any new resolutions that may be made by the Turkish legislation were also included in the research.

The interview questions that were used were as follows:

To local businessmen:

- 1) How long have you been running this place for? How is the place you are operating lined off from the beach?
- 2) What do you know about SPA sites? What is your opinion on SPAs?
- 3) Did you know that this area is an SPA?
- 4) Does the government have any legislation regarding this area? Or has the government informed you about this?
- 5) Are coastline construction sites and the distance between the coastline and construction sites in line with the relevant legislation and is this enforced by the law as stated?
- 6) Have you ever been involved in a study regarding SPAs?
- 7) Is there anything that you would like to add?

To scientists and NGOs:

- 1) What do SPAs really mean according to the law in Turkey? Do they differ in any way from the way in which they were described in the conventions?
- 2) Do the protection studies in SPA of Fethiye include sea turtles only?
- 3) Do you think there is a significant improvement or deterioration in SPA in Fethiye since 2008 (or since 1993)?
- 4) Are there any legal restrictions or actions regarding the violations in SPA? If so how are these coming along?
- 5) Are there any other SPAs other than in Fethiye that are biologically similar? If so do you know what condition they are in?
- 6) Do coastline construction sites and the distance between the coastal line and construction adhere to the relevant legislation and is this enforced by the law as stated?
- 7) Is there anything that you would like to add?

RESULTS

1. Definition and Management of SPAs

1.1. Protection Areas

Protection Areas in Turkey are further classified as follows:

Protection Area: Term used for preserving biological diversity, protecting natural and cultural areas associated with these, involving national parks, nature parks, nature monuments, nature protection areas, natural sites, wetlands, special environmental protection areas and similar protected terrestrial, water or sea areas described by the relevant legislations.

Wetlands: Natural or artificial, temporary or permanent, with calm waters or with high currents, fresh, salt or brackish water, waters that will not go over 6 meters during low tides, water areas that are natural habitats for all animals especially for water birds, swamps, peat beds and their shore lines that include moist areas.

Ramsar Area: According to Ramsar agreement dated 28/12/1993 and legislation number 3958 item number 2 classified as internationally acknowledged and important wetlands.

Nature Protection Area: Important for science and education, rare, endangered or threatened ecosystems, species and natural events occur, and areas should be protected and accessible for science and educational purposes only.

Nature Park: Plant and natural wildlife habitats: the law states that it includes nature parks for leisure and recreation time of the people.

National Park: Includes scientifically and aesthetically, national and internationally rare natural and cultural values and the protection of these, for recreation and tourism purposes.

Natural sites: Related to geological formations, these sites are rare and therefore extraordinary and can be under or above ground and should be protected ^[11].

The above definitions are merely excerpts from the relevant directories but contain the information relevant for this paper.

All the protected areas are under the supervision of two ministries and their responsible units. Natural sites, nature monuments (monument trees and caves) are under the legislature of the Ministry of Environment and Urban Planning and its Unit of Protection of Natural Assets. National parks, nature protection areas, natural monuments, wildlife protection and improvement areas and nature parks are under the legislature of the Forestry and Water Unit^[12,13].

Both ministries take into account the definition of IUCN (International Union for Conservation of Nature) protection areas. According to IUCN's definition set in 1994 protection areas are: Water and or terrestrial areas, under regulation by legislations and/or

other measures, where especially biological diversity should be natural and, due to this diversity, culturally maintained and protected. According to IUCN's definition in 2008: Areas that have a geographical border that are under regulation by legislation and or other effective measures for the protection of nature and all related ecological systems/services and cultural values in the long run.

For SPAs that fall under protected areas, a definition is available from the Barcelona Convention (2002), of which IUCN is a party. According to this definition, SPAs are areas that have an importance both nationally and universally, aquatic and terrestrial areas that are under threat by environmental pollution and degradation where biological diversity, natural sources and all related cultural sources should be protected for the future generations by the legislation of related ministries in order to unify the sources of any planning and protection activities.

Protected areas have the goal of protecting biological and cultural diversity, protecting waterfronts and terrestrial areas and wetlands, maintenance of natural products and improving the area socioeconomically as well as supporting tourism, recreation and educational activities. The importance of protected areas is also emphasized by the CBD (Convention of Biological Diversity) which was signed by Turkey in 2002. The 8th item in the agreement states that parties signing the agreement should foresee the improvement of all protected areas [14].

Duties of protection of natural assets unit as given in Turkish legislation dating 29/6/2011 number 644:

- a) National parks, nature parks, nature monuments, natural protection areas, wetlands, and similar protection areas are to be approved, registered, declared such areas and to register its boundaries.
- b) Natural assets and natural sites and special environmental areas are to be approved, declared, registered and if any changes shall be made to these, these changes should be carried out with the written approval of the unit.
- c) National parks, nature parks, nature monuments, nature protection areas, natural sites, wetlands, special protection areas and similar protection areas are to be under protection against any planning activities and if there is an environmental project to be considered, carrying out this project and its specifics is the duty of the unit.
- d) Nature assets, natural, historical, archeological, and urban sites and all other areas where there is a declaration for protection should be monitored and if these areas cross each other their planning and management shall be done with the approval of related

ministries and to decide which other units should be responsible for these areas both partially and as a whole, to carry out and approve all projects relating to every scale.

e) Allocation and regulation of immovable assets not belonging to forest areas, protection areas and natural sites according to the plan of the related ministry.

f) Obtaining necessary maps, running, approving and planning necessary projects and relating to the nature assets, natural sites and special environmental protection areas. Also running any projects aiming to raise awareness and educate the local residents. Propriation of areas where there is prohibition of use or confiscation of areas in a similar way. Inspection and governance of these areas. Investment in projects and supporting any projects in order to prevent and reduce pollution of the areas. Giving necessary permits, finding funding for any projects and managing any savings that can be made in the area regarding these protection areas.

g) To carry out similar duties that are to be assigned by the minister himself ^[15].

Areas that are specified as protection areas and all definitions made with regards to these areas are according to Turkish laws under many different subordinations and legislations differ within these subordinations. Even though the protection areas are under governance of two different ministries, all activities pertaining to the management of these areas are solely the responsibility of environment and urban planning ministry ^[16].

1.2. Turkish Law Proposal for the Protection of Nature and Biological Diversity

Execution of protection and regulation of protection areas in Turkey is based on document dated 7/21/1983 Cultural and Natural Assets' Protection Law numbered 2863. Besides, there are also laws within the scopes of protection area-related legislations, such as Environment Law numbered 2872, Forest Law numbered 6831, National Parks Law numbered 2873, Land Hunting Law numbered 4915 and Water Products Law numbered 1380.

A law proposal prepared by the Ministry of Forest and Water Affairs to arrange the lacks, faults and loopholes about protection of the nature and biological diversities, was presented to the Grand National Assembly of Turkey (TBMM, Türkiye Büyük Millet Meclisi) by Council of Ministers in 2002 (Alıca, 2012).

New arrangements are made with a bylaw about verdicts of laws numbered 644, 645 and 648 which effectuated during this process, and these arrangements caused some changes in aforesaid law proposal. Before 2011, with the law-amending ordinances (numbered 636), the Ministry of Environment Forestry and Urbanization is organised; but with the future

arrangements, this ministry is divided into two; with law-amending ordinances (numbered 644) the Ministry of Environment and Urban Planning was founded, and with law-amending ordinances (numbered 645) the Ministry of Forest and Water Affairs was founded. Environmental Protection Agency for Special areas (ÖÇKK) was shut down and its mission is assigned to the General Directorate of Cultural and Natural Heritage, which was founded within the Ministry of Environment and Urban Planning. In spite of shutting down of ÖÇKK, law-amending ordinances (numbered 383), which founds the agency and determines its jurisdiction and missions, was not abolished. Besides jurisdiction of protection of natural sites' protection, which was under the responsibility of Ministry of Culture and Tourism, was assigned to this general minister^[17].

These arrangements and the final state of the law proposal drew reactions of many bar associations as well as public opinion and NGOs. In the statements of NGOs and bar associations about this subject, it is specified that this law proposal is contradictory to the Constitution of the Republic of Turkey and international agreements to which Turkey is a contracting government (Alıca, 2012)^[18, 19, 20, 21].

The Protection of the Nature and Biological Diversity law proposal is still on the agenda of the council^[22].

2. Condition of studies in Fethiye-Göcek

2.1. Studies that were conducted

Twenty-five different projects were made with collaboration of the Ministry of Environment and Urban Planning and other institutions within the years 1991-2012 in Fethiye-Göcek area. Of these activities some are environmental education (1991), Fethiye (Çalış, Yanıklar, Akgöl) ÖÇK Sea Turtle Research and Protection Project in 1992, Recycling of Solid Waste in 1995, Water Quality Screening Project in 2005, Project of screening and determination of capacity of sea transportation tools in 2007, Protection of endangered Nile softshell turtles and their habitats in 2008, which is still running^[23].

According to the activity report in 2013 for the area; the projects that are still ongoing are: Screening of water quality and efficiency of waste water facilities in special protection areas, Protection and screening of species and habitats and populations of sea turtles (*Caretta caretta*, *Chelonia mydas*) and Nile softshell turtle (*Trionyx triunguis*) in SPAs^[23].

Moreover, another project was conducted to determine the terrestrial biological diversity, aiming at natural, historical, cultural values and socio-economic structure determination with regards to the sustainability of the area of Fethiye-Göcek SPA. This covered a terrestrial area

of 465 km² to determine and propose measurements for the protection of species that contribute to biological diversity and are endemic, rare, endangered and under threat. This project identified 408 taxa of plants, of which 52 are endemic, 17 mammals, 126 birds, 6 amphibians, 18 reptiles of which 1 is endemic, and 117 insects. Also within the project, all human influences that can be considered negative were identified and attempts were made to solve them. Some areas within SPAs were defined as being sensitive based on the biological diversity they have and their interaction with human use. Land use proposals (tourism, settlement, agriculture) were developed keeping in mind the diversity of plants and animals that inhabit that area, which was then identified as a sensitive area^[24].

In addition, in 2010 a project was conducted in order to determine the biological diversity of shore and water areas. In this study, beyond considering the biodiversity of the area some of the environmental problems the area faced were taken into account, and data were collected in order to tackle these environmental problems. Furthermore, this study included the populations and distributions of species that are under protection, exotic species and facies species (algae and phanerogams especially), 15 marine sites representing the area were sampled for bacteriological, biological and physical properties. This project identified 347 polychaete species, 288 mollusc species and 264 crustacean species. Within these identified species, according to the Bern and Barcelona agreements and IUCN list, the project found 40 species that were under protection in the Mediterranean region; 2 reptile species were within this list (*Caretta caretta* and *Trionyx triunguis*) and 2 mammals (*Monachus monachus* and *Tursiops truncatus*)^[25].

2.2. Sea Turtle Project

Since 1988 there has been a project in Fethiye-Göcek which is declared an SPA, studying sea turtles. The Fethiye coast is divided into three parts for this purpose, namely Çalış, Yanıklar and Akgöl. Çalış, 2.5 km long, is separated from the other two parts by a small rocky peninsula. Over about half its length is lined by a concrete wall, topped by a broad promenade with hotels, restaurants, bars etc. to accommodate to tourism. Yanıklar 4.5 km long, ranges from 50-80 m in width and is the core nesting site of Fethiye. Akgöl, is 1 km long and mostly 50 m wide: except for some short yet important stretches of sand at both ends, this beach is less suitable for nesting (about 300-400 m are mostly covered with pebbles). Studies on these beaches are supported by grants awarded to Adnan Menderes University, Dokuz Eylül University, Hacettepe University and Pamukkale University by the ministry. The University of Vienna is invited to join the studies each year as a collaborator. In addition,

locally from 1994-2009 FETÇEV / FETAV (Fethiye Tourism, Promotion, Education, Culture and Environment Foundation), and since 2009 ÇALIŞ-DER (Çalış Tourism Association) has also supported the study.

MEDASSET (Mediterranean Association to Save the Sea Turtles), which has started working in Turkey in 1988, has been involved with this project since 2008 and has been reporting the outcome of the study annually to the Bern Convention, the European Commission and Turkish authorities ^[10].

It has been established that protecting this nesting area as a SPA is still important after ongoing research for over 20 years. In addition to this, the decline in sea turtle nesting at Fethiye Beach is thought to be the result of anthropogenic impacts. Along the coastline, the many buffets, restaurants, cafes, volleyball courts, docks and similar structures along with parasols, sunbeds, walkways made of wood, plastic carpets and such items are listed and reported (MEDASSET, 2012). The University of Vienna also provides documentation in its annual field course reports ^[26]. Addition disturbance factors include boats, cruise lines and bulldozer-assisted sand movement and removal operations, picnic places, bonfires, use of fireworks, entry onto the beach with motor vehicles or at hours when visitors are not allowed, use of fishing nets, nighttime activities of the adjoining hotels, inappropriate lighting and, finally, pollution, including marine debris of beach litter. All these activities continue without abatement.

As a result, researchers have already reported a considerable decline in sea turtle nesting in Fethiye since 1993. Some improvements recorded in 2011, but these improvements did not persevere and the nesting beaches were further built up (MEDASSET 2011, 2012).

The 2014 monitoring season recorded the same ongoing problems.

3. Local Settlements

The beach monitoring efforts have shown that settlements near and in the Fethiye-Göcek SPA have been increasing since the start of the sea turtle project (see annual reports by MEDASSET and the University of Vienna).

An example of this type of settlement in Çalış is after the promenade: a first major construction site directly in the wetland was started in 2004, when the hotel Sunset Beach Club was built until 2006 and in 2009 a boat jetty was built in front of that hotel (since removed). Again, along the same coastline section Jiva Beach Resort was built in 2012, Surf Cafe considerably expanded its premises onto the beach in 2008 and 2009, and in 2013 and 2014 a similar expansion was undertaken next to Surf Cafe by Spor Cafe and other

establishments (e.g. Bakrac). Each establishment now has its own beach huts, full sets of umbrellas and sunbeds etc., beach walkways, and assorted beach rugs, beanbags and other items that prevent virtually any sea turtle nesting efforts.

In Yanıklar there has been a 5 star hotel construction since 2009. The hotel will be located on a land of 200,000 m² with 60,000 m² of building. Immediately next to this touristic establishment there will be twin villas of 150-180 m². Furthermore, recreation areas, commercial centres, parks and sports facilities are also included in the plans which will be more than adequate to meet the requirements of the project. It has been noted that this 5-star hotel to be constructed by the Kayalar Group will be located between the Yanıklar Village on the main road and the shore. With a coastline of 1200 m along the sea, this touristic establishment will be built on a total land of 872,000 m² ^[27].

Furthermore, in 2008 a plan was announced by ÖÇKK Environmental Organization Revision, which involves Akgöl (Karaot) region. This plan involves the construction of a yacht harbor and slipway facility. According to this project, 203,750 m² land, sea and coastline will be used, and a 14,643 m² indoor area will be built. A lawsuit against this project has been filed and continues to be pursued by several NGOs and local residents ^[28, 29, 30].

4. Comparing the situation of Fethiye-Göcek SPA with other similar SPAs

When climate, biodiversity, habitat, environmental factors, the life style of local residents and the current condition of the area is taken into account, Patara SPA shows similarities to Fethiye-Göcek SPA.

Patara is an archeological site that was historically home to four different civilizations. It is also a major sea turtle nesting site and is therefore of international importance. In Patara beach, along Eşen creek, stretches 7 km from the east side and has an over 25 m broad wet line consisting of very fine-grained sand. This is the primary nesting area for *Caretta caretta* and *Chelonia mydas*. Here, research has been conducted by Dokuz Eylül University along with the collaboration of the Special Environmental Protection Agency since 1992 under the title Sea Turtle research project. According to the collected data the density of nests has been established as being 2-19 nests/km ^[31].

Threats regarding Patara SPA were first disclosed by MEDASSET in 1988. In 1996, a lawsuit was filed. This lawsuit was finalized in 2001; but MEDASSET has given their annual reports to the Bern Convention until 2009. MEDASSET has also made a claim to the congress regarding a summer residence project, comprising 400-750 villas, in 2012. There has been no

data regarding a ÇED (Environmental Impact Evaluation) report or the determination of a carrying capacity. When this project is complete it is expected that sea turtles and their nesting areas will be under great pressure and that the disturbance of the sea turtles will be much higher. 27 villas and a swimming pool were constructed in 2013. More construction planned for 2014 (MEDASSET 2013, 2014). MEDASSET has delivered its opinions regarding the subject to the Turkish Ministry of Environment and Urban Planning in 2014. MEDASSET's call for a lawsuit has been accepted in a final meeting with the ministry ^[32].

5. Coastal layout

Coastal layout implementation has been under regulation by the Ministry of Environment and Urban Planning. Last amendments to the law were made in 2013 by the ministry:

According to the definition of the law, the coast is the area between the waterline and a line near the coast.

Coastline: Where the sea and natural lakes edge at least 100 m from their coast in direction of land. The aim of coastal land use has two aspects, both of which are defined according to the topography and natural limits in accordance with construction plans. Constructions that are to be built on the coastline can only approach the coastline with a maximum of 50 m. This remaining 50 m can be used in regard to the construction plan for recreation, leisure, resting and pedestrian walkways ^[33].

It has been noted that within the 50 m located between the coastline and near the coastline according to the definitions, there has been a constant violation of the law with parasols, wooden walkways and similar items that are useful solely for humans, and it has also been observed that there is no enforcement of the laws.

DISCUSSION

It was very difficult to look into an SPA in Turkey, to research its conditions and problems and to locate the source of the problems. The Fethiye-Göcek SPA is a case in point.

Such an exercise must take into account a range of levels from biological processes to tourism, ethical values to bureaucracy. In order to do so, data from several different backgrounds such as biology, law and political science were collected.

Declaring an area as SPA is itself problematic; the scientific research in order to do this was limited and lacking for the most part. This had a tremendous limitation on finding the sources for determining the condition of an SPA.

The webpages of the relevant ministries show how deficient the necessary inventory and how lacking the observations are regarding the SPAs. According to the report of the Ministry of Forest and Water Affairs in 2013 there were 0 inventory and observation efforts in 2012 and 30 in 2013 ^[34]. According to the sources of the Ministry of Environment and Urbanization, in Fethiye-Göcek SPA there are only two biological diversity projects, of which one is being conducted on land and one marine. The ministry does not specify or give any information regarding how these projects are run or what kind of techniques and materials are used. In addition it is not specified when these projects take place and who is responsible for these studies ^[24, 25]. The Ministry of Environment and Urbanization has 25 ongoing projects for this SPA of interest. The content of these projects is stated but there is no further information regarding each project, nor is any up-to-date information or results available ^[35, 36].

There is much more printed information available only in Turkish. Compared to online sources, these sources still only reveal information on a project-to-project basis and include mostly end reports. Nonetheless, even my 5-week-long participation in the university field course in Fethiye-Göcek beach was enough to understand how insufficient or lacking the regulations and their enforcement are.

It was not possible for me to get satisfactory answers to the questions that I prepared for the interviews with the scientists and sources from Turkish universities. Instead, I had to use information from NGOs as a source. Since the interviews with local businesses include only subjective information and for the reasons stated above, I excluded them from the results part of this thesis and instead gave place to the interviews here.

I made interviews with 6 local businesses; Yonca Lodge and Onur Camp located in Yanıklar/Akgöl, Sunset Beach Club, Jiva Beach Resort, Golden Moon Hotel and Keyif Cafe located in Çalış and also with ÇALIŞ-DER (Çalış Tourism Association), which has 52 local business members. Without exception all these respondents stated that the area should be protected further and were happy to see that there was research looking into the condition of the SPA and into understanding the regulations. They were supportive of the sea turtle project. Additionally, business owners and local residents themselves remarked that there was little to no regulation and enforcement regarding the legislation related to the SPA. People were generally informed about why and how nature should be protected but they mainly had a superficial background regarding the subject and the current legislation regarding the SPA. Also, the constant changes made to the legislation are found to be confusing by most local people. As an example, no one had matching or concrete information on how the law regarding the 50 m of coastline should be interpreted. One of the responsibilities of the

ministry is to educate and inform the people, but my interviews demonstrate that this is not the case.

Another crucial example explaining the status of the beach is the proposed yacht harbor/dry dock area in the Akgöl (Karaot) region. According to the press release given out by Karaot Solidarity dating 8 February 2014: “There is no management plan since the declaration of the SPA site in 1988 until today for Fethiye Bay and its coasts. In contrast, according to the Fethiye-Göcek Environment Revision Plan, there are items where approval has been granted to destroy sensitive species and their habitats. Accordingly, in 2008 the SPA Facility approved the Fethiye-Göcek SPA Region Environmental Order Revision Plan: a yacht harbor construction site and tourism facilities are set in places where there is forest, sensitive zones and turtle habitats.” (February 2014, Karaot Solidarity Press Release).

When considering already existing buildings and construction, along with ongoing work, it is clear that absolute priority is not being given to nature and animals.

The improper use of the beaches by tourists and locals, and violations of the legislation, should be punished. From an interview I conducted with the Fethiye Municipality Environment Protection and Control Unit, I determined that municipalities hold no such authority. During the field work done this year in Fethiye-Gocek, no such enforcement was observed, and no authority except the relevant ministeries could be identified. Additionally, my questions were mostly redirected to FETAV. Clearly, however, it is unlikely that an NGO could serve as an authority where even when the municipality holds no authority. It cannot be expected that under these circumstances any improvements or efforts will go beyond a personal level, and it is therefore highly unlikely that such efforts will result in significant improvements.

It is clear what needs to be done in the Fethiye-Göcek SPA case. The first step would be to enforce the conditions and clauses of the international agreements that are already signed by the government. The relevant legislation should be structured so that it leaves no vagueness and no open room for misconception regarding the SPAs and all the other protection areas that the international agreements cover. Futhermore, local residents should be informed and educated about the area they live in and what kind of responsibilities they should assume. Ultimately, supervision, inspection and reinforcement of the legal clauses is crucial.

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Bachelor Thesis

Survey about sea turtles at the *Caretta caretta* information desk
in Çaliş, Turkey

Umfrage über Meereschildkröten am *Caretta caretta* Informationsstand in
Çaliş, Türkei

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KURZFASSUNG

Es gibt viele Gründe, warum immer mehr Arten von Flora und Fauna in ihren Populationszahlen verringert werden, vom Aussterben bedroht sind oder sogar schon ausgestorben sind. Viele Menschen würden möglicherweise ihr Verhalten diesen Arten gegenüber ändern, wenn sie besser über sie informiert wären.

Diese Bachelor Arbeit setzt an diesem Punkt an. Die Idee war, eine Umfrage über Meeresschildkröten im Allgemeinen und speziell über *Caretta caretta* am Informationsstand in Çaliş durchzuführen. Dafür habe ich einen Fragebogen entworfen und fünf verschiedene Typen von Informationsmaterialien Meeresschildkröten betreffend verwendet. Der Fragebogen wurde dabei in drei Abschnitte mit verschiedenen Fragen unterteilt: 1) Basisdaten über die Teilnehmer, 2) Informationsmaterial über Meeresschildkröten und 3) spezifische Fragen über *Caretta caretta*.

An der Umfrage nahmen insgesamt 76 Personen teil. Die Auswertung der Ergebnisse erfolgte in zwei Teilen unter Verwendung von Excel. Im ersten Teil wurde jede Frage separat ausgewertet. Diese Resultate zeigen zum Beispiel, dass die meisten Teilnehmer ihr favorisiertes Informationsmaterial aufgrund dessen optischer Erscheinung ausgewählt haben und dass die meisten Teilnehmer der Meinung waren, dass Umweltverschmutzung die größte Gefahr für Meeresschildkröten generell und *Caretta caretta* im Speziellen darstellt. Im zweiten Teil wurden die Ergebnisse von jeweils zwei Fragen miteinander verknüpft, um genauere Schlüsse ziehen zu können. Diese Resultate zeigten zum Beispiel, dass die Informationsmaterialien in den meisten Fällen (54 von 76) anhand ihrer optischen Erscheinung ausgewählt wurden oder dass Einheimische bei Weitem öfter wussten (91%), dass *Caretta caretta* am Strand von Çaliş nistet, als dies türkische (46%) und ausländische Touristen (52%) taten, hingegen wussten 100% der türkische Touristen, dass es sich bei *Caretta caretta* um eine gefährdete Art handelt.

ABSTRACT

There are many reasons why ever more species of flora and fauna are shifting their distributions, facing extinction or have already become extinct. Many people would probably change their behavior toward these species if they were better informed about them.

This bachelor thesis focuses on this point. The idea was to conduct a survey about sea turtles in general and on *Caretta caretta* in particular at the information desk in Çaliş. I created a questionnaire and presented five different types of sea turtle information materials. The questionnaire included three sections with different questions concerning: 1) basic data about the participants, 2) the information material on sea turtles and 3) specific questions about *Caretta caretta*.

Seventy-six persons participated in the survey. The results were evaluated (using Excel) in two parts. In the first part, each question was evaluated separately. This showed, for example, that most participants chose their favorite information material based on visual appearance and that most participants thought that environmental pollution is the greatest threat for sea turtles in general and *Caretta caretta* in particular. In the second part, the answers of always two questions were linked to draw more exact conclusions. These results, for example, showed that the information materials were mostly chosen due to their visual appearance (54 of 76) or that residents far more often knew (91%) that *Caretta caretta* is nesting on Çaliş beach than did Turkish (46%) and foreign tourists (52%). Conversely, Turkish guests better knew that this turtle is an endangered species (100%).

INTRODUCTION

Climate change and habitat destruction are just two reasons why an increasing number of species of flora and fauna are shifting their distributions, facing extinction or have already become extinct. Most people might know about this in general, but they often don't know that they themselves possibly encounter and influence threatened species. In Fethiye this holds true for the endangered sea turtle species *Caretta caretta*. Some people probably know that Fethiye has the status of a so-called SPA (= Specially Protected Area) but nevertheless do not behave accordingly. Many others, however, would probably change their behavior if they were better informed.

This bachelor thesis focuses on this point. The idea of it was to conduct a survey about sea turtles in general and *Caretta caretta* in particular. I therefore created a questionnaire (Fig. 6) and presented five different types of information material concerning sea turtles (Figs 1-5) which differed in visual appearance, information quality and information amount. During my five-week stay in Çaliş I asked residents and tourists who came to the *Caretta caretta* information desk (Fig. 7) to participate in the survey. In this context I sought answers to following questions: 1) Which presented information materials are the most attractive and by which criterion did the participants in most cases use to make their decision? Are the criteria related to age? These two aspects are interesting because I think that nowadays the visual

appearance of an advertisement may be as important as or even more important than its information content (information quality and information amount). 2) How good are people in general informed about *Caretta caretta* and what do people think are the greatest threats facing *Caretta caretta* in Çaliş? Do residents generally know more about *Caretta caretta* than tourists (Turkish or foreign) do?

MATERIAL AND METHODS

Information materials concerning sea turtles

For my survey I first collected five different types of sea turtle information materials (Figs. 1-5), which were made available by Michael Stachowitsch. These five information materials differed in three main criteria: visual appearance, information quality and information amount.

Information material Nr. 1 (Fig. 1) was produced by WWF Switzerland. It has the form of a sea turtle and furthermore illustrates one on its front. The back cover describes some general facts about the biology of sea turtles with little text and some additional pictures.

Information material Nr. 2 (Fig. 2) was produced by the Sea Turtle Conservancy Organization Florida. It is a hotel door hanger. The front side depicts a sleeping sea turtle with the superscript “Please Do Not Disturb”. The back side contains important information concerning the nesting season of sea turtles and the most important rules of conduct for not disturbing sea turtles as a tourist.

Information material Nr. 3 (Fig. 3) was also produced by the Sea Turtle Conservancy Organization Florida. It is a sticker that can be attached to the bumper of a vehicle or elsewhere and has the form of a stripe. The front illustrates two adult sea turtles heading back to sea after egg deposition. It also bears the superscript “Sea Turtles Dig the Dark”. The back, lists the most important rules of conduct for not disturbing sea turtles as a tourist.

Information material Nr. 4 (Fig. 4) was produced by the Sea Turtle Conservancy Organization Florida as well. It is a fold-together stand-up display, but was presented flat because all information materials were shrink-wrapped to prevent damage from daily handling. On the front it shows the same information as information material Nr. 2 (Fig. 2) - important information concerning the nesting seasons of sea turtles and the most important rules of conduct for not disturbing sea turtles as a tourist (Fig. 4).

Information material Nr. 5 (Fig. 5) was produced by TUI in cooperation with organizations such as MEDASSET. It is in an A4-format and provides the same photographs and information on both sides: one side is written in English, the other in Turkish. This

information material contains an extensive description of the different life stages of sea turtles combined with photos illustrating these as well as detailed rules of conduct to help save sea turtles as a tourist. Furthermore the invocation “Help us save our turtles!” is superscripted.



Fig. 1: Front and backside of information material Nr. 1 produced by WWF Switzerland.

Abb. 1: Vorder- und Rückseite von Informationsmaterial Nr. 1 produziert von WWF Schweiz.



Fig. 2: Front and backside of information material Nr. 2 – a hotel door hanger produced by the Sea Turtle Conservancy Organization Florida.

Abb. 2: Vorder- und Rückseite von Informationsmaterial Nr. 2 – ein Aufhänger für Hoteltüren produziert von der Sea Turtle Conservancy Organization Florida.

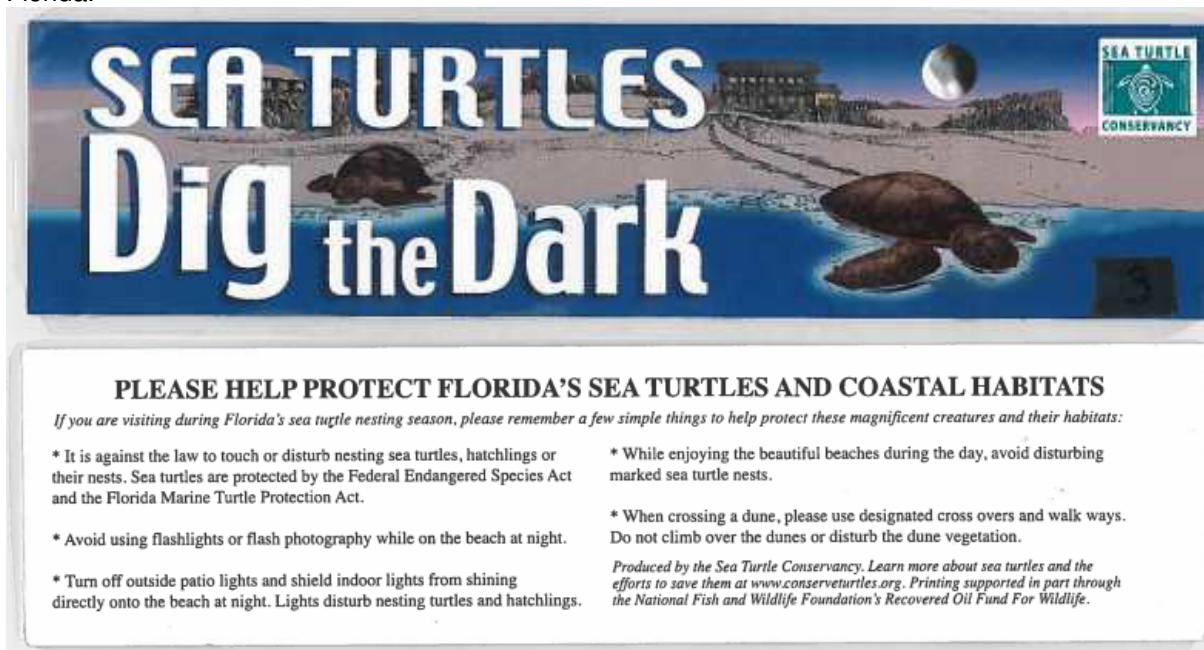


Fig. 3: Front and backside of information material Nr. 3 – a sticker produced by the Sea Turtle Conservancy Organization Florida.

Abb. 3: Vorder- und Rückseite von Informationsmaterial Nr. 3 – ein Sticker produziert von der Sea Turtle Conservancy Organization Florida.



Fig. 4: Front and backside of information material Nr. 4 – a fold-together stand-up display produced by the Sea Turtle Conservancy Organization Florida.
 Abb. 4: Vorder- und Rückseite von Informationsmaterial Nr. 4 – ein zusammenklappbarer Aufsteller produziert von der Sea Turtle Conservancy Organization Florida.



Fig. 5: Front and backside of information material Nr. 5 – an A4-format produced by TUI in cooperation with other organizations including MEDASSET.
 Abb. 5: Vorder- und Rückseite von Informationsmaterial Nr. 5 – ein A4-Format produziert von TUI in Kooperation mit Organisationen wie zum Beispiel MEDASSET.

Questionnaire

After collecting the five types of information materials, I created a questionnaire (Fig. 6). This questionnaire was divided in three main sections.

1) Basic information: Here I entered the sex (male / female) and age group (children (<15) / young adults (16-25) / adults (26-60) / seniors (>60)) of the participants as well as their status in Fethiye/Çalış (resident / tourist (Turkish guest / foreign guest).

2) Information material about sea turtles: In this section the following data were recorded: Firstly the favorite sea turtle information material (Nr. 1-5 (Figs 1-5)) chosen by the participants at the survey and secondly, the participants' main reason for their choice (visual appearance / information quality / information amount).

3) Specific questions about *Caretta caretta* were asked here: 3.1) "Did you know that Fethiye is a Specially Protected Area?" ; 3.2) "Did you know that *Caretta caretta* nests on the beaches in Fethiye/Çalış?" ; 3.3) "Did you know that *Caretta caretta* is an endangered species?" ; 3.4) "What do you think are the greatest threats for *Caretta caretta*?". While the participants had to answer questions 3.1)-3.3) with yes or no, the last question was an opinion question.

Questionnaire: Sea turtle information survey

Questionnaire Nr.:

1. Basic information

1.1. Sex

male female

1.2. Age group

children young adults adults seniors
(8-15) (16-25) (26-60) (60 +)

1.3. Reason for the stay in Fethiye

resident tourist
 turkish guest foreign guest

2. Information material concerning sea turtles

2.1. Most favorite information material

Nr. 1 Nr. 2 Nr. 3 Nr. 4 Nr. 5

2.2. Reason for the choice

visual appearance information quality information amount

3. Specific questions about *Caretta caretta*

3.1. Did you know that Fethiye is a specially protected area?

yes no

3.2. Did you know that *Caretta caretta* nests on the beaches in Fethiye/Çalış?

yes no

3.3. Did you know that *Caretta caretta* is an endangered species?

yes no

3.4. What do you think are the greatest threats for *Caretta caretta*?

Fig. 6: Self-designed questionnaire used in the sea turtle information survey

Abb. 6: Selbsterstellter Fragebogen, welcher in der Meeresschildkröten-Informationsumfrage verwendet wurde.

Survey

The survey took place at the *Caretta caretta* information desk (Fig. 7) on the promenade in Çaliş during my five-week stay (9 August – 13 September 2014) in Çaliş. The information desk was opened every evening, approximately between 21:00 and 24:00 (the opening time varied depending on how many students and supervisors were available, the workload on the nightshifts and how many residents and tourists were on the promenade).

The following survey protocol was applied. First, the sex and approximate age group of the participants were filled in. After this, respondents were asked if they are residents or tourists (section 1: Basic data). Then they were shown the five different information materials (Figs 1-5) and were asked to choose their favorite one and to state the criterion used to make their decision. This enabled section 2 (Information material concerning sea turtles) to be filled in. Finally, respondents were requested to answer the four questions belonging to section 3 (Specific questions concerning *Caretta caretta*). This completed the questionnaire.



Fig. 7: *Caretta caretta* information desk on the promenade in Çaliş (closed during the day)
Abb. 7: *Caretta caretta* Informationsstand an der Promenade in Çaliş (unter Tags geschlossen)
(Photo: M.Lambropoulos)

Evaluation of the questionnaires

The questionnaires were evaluated after my return to Vienna. All results were entered in Excel (Tab. 1) and the answers of every section were counted by using the function for “filtering” results in Excel. To evaluate the results of the information survey, I divided the evaluation into two parts. In the first part, I collected the data of every question in each section of the questionnaire separately. The results are illustrated in tables (Tab. 1-4). In the second part of the evaluation, results of always two questions have been linked to draw more exact conclusions. The results of this second evaluation part are illustrated with tables and diagrams (Tab. 5-8 and Figs 8-11).

RESULTS

The evaluation of the questionnaires was done in two parts.

In the first part, “Separated results”, all questions of each questionnaire section were analyzed separately. Section 1) Basic data, involved recording how many men and women participated in the survey, which age groups participated and how many participants were residents and how many tourists (Turkish or foreign guests). For section 2) Information material concerning sea turtles, I wanted to determine which information material was chosen in the majority cases and which selection criterion was dominant. Section 3) Specific questions about *Caretta caretta*, was designed to determine how many participants answered the three yes/no-questions with yes and which threats were thought to be the most dangerous for *Caretta caretta*. The results of this first part of the evaluation are illustrated with tables (at the end of the first part).

In the second part, “Linked results”, the results of always two questions were linked to draw more detailed conclusions. The aim of this was to determine: 1) what factor explained the choice of one of the five types of sea turtle information materials (Fig. 1-5); 2) whether the selection criterion was age-related; 3) whether residents answered the three yes/no-questions about *Caretta caretta* (Fig. 6) more often with yes than Turkish or foreign guests; and 4) whether residents knew more about possible threats to *Caretta caretta* than Turkish or foreign guests did. The results of this second part of the evaluation are illustrated as tables and diagrams (at the end of the second part).

Separated results

Basic information

A total of 76 people participated in the information survey (Table 1) and filled out the questionnaires. Of these 76 participants, 31 were male and 45 female. Concerning the age groups, 6 persons were children (<15), 17 young adults (16-25), 38 adults (26-60) and 15 seniors (>60). Most participants were foreign guests (52), while 13 were Turkish guests and 11 residents.¹

Information material on sea turtles

The most popular sea turtle information material was Nr. 2 (Fig. 2), which was chosen by 24 participants (Tab. 2). In descending order the other information material was chosen as

¹ Concerning the number of residents and Turkish guests, note that maybe more persons belonging to these two groups would have participated (Tab. 1) had there been Turkish students at the information desk every evening (easier communication with most of the residents and Turkish guests).

follows: 23 selected Nr. 1 (Fig. 1), 15 Nr. 5 (Fig. 5), 9 Nr. 3 (Fig. 3) and 5 Nr. 4 (Fig. 4) (Tab. 2). Concerning the reason for the choice, by far the most participants (54 of 76) decided mainly due to the factor visual appearance. Nine made their decision based on information quality and 13 on information amount.

Specific questions about *Caretta caretta* – yes/no-questions

Of 76 participants, 39 knew that Fethiye is a so-called Specially Protected Area; 37 persons did not (Tab. 2). Concerning the second question – “Did you know that *Caretta caretta* nests on the beaches in Fethiye/Çalış?” (Fig. 6) – 43 persons answered with yes, and 33 people said they didn’t know this before being informed at the information desk (Tab. 2). Moreover, 57 persons knew that *Caretta caretta* is an endangered species, while 19 did not know this until being informed.

Specific questions concerning *Caretta caretta* – opinion question

The fourth and last question, which was an opinion question (Fig. 6) asking about the greatest threats to *Caretta caretta*, yielded several answers which are illustrated in Tab. 3 and 4.

All 76 participants thought that human influence is the greatest threat for *Caretta caretta* (Tab. 4). Of these 76, 60 persons gave more specific answers describing what human influence they think is bad for sea turtles in general and *Caretta caretta* in particular: 39 mentioned pollution, 15 habitat destruction (this factor includes the beach use as well as the buildings on the beach and its surrounding), 9 the influences of tourism and 16 fishing activity (this factor includes the fishing activity itself as well as boat driving, which can injure sea turtles because of the propellers).

Of the 39 participants who mentioned pollution as a big danger, 20 gave a more specific answer concerning this threat : 10 meant that light pollution is an important factor (instead of heading towards the moonlight, sea turtles often orientate to the much brighter lights as for example on the promenade in Çalış and therefore don’t find their way to the sea), 5 said that plastic bags on the beach and plastic waste unloaded into the sea are a big problem (sea turtle species that feed on jellyfish can mistake plastic bags for jellyfish and consume them, leading to either choking or blocked digestive tracts) and 3 participants mentioned chemicals or oil in the water as very harmful (of course not only to sea turtles, but also to the overall marine ecosystem).

Of the 15 participants who mentioned habitat destruction as a key threat, one believed that the government’s policy doesn’t do enough to save the sea turtles, and one thought that sun umbrellas – also relating to Çalış – are responsible for habitat destruction (such umbrellas

make it more difficult for female adult individuals to find a adequate nesting place and more difficult for hatchlings to find their way to the sea; besides, umbrellas also may damage nests or hatchlings that are just hatching).

Next to human influences, 8 of 76 participants mentioned also predators as a danger for *Caretta caretta* in Çaliş. Of these 8 persons, 3 thought that dogs are the main predators of *Caretta caretta* hatchlings in Çaliş (here, many stray dogs live on or near the beach), while 2 persons mentioned birds as hatchling predators.

Tab. 1: Total questionnaire data (quantitatively evaluated)

Tab. 1: Gesamtdaten aus der Umfrage (quantitativ ausgewertet)

questionnaire number	sex	age group	reason for stay	information material	reason for choice	SPA	nesting beach	endangered species	greatest threats
1	m	a	fg	1	va	n	y	y	h
2	f	ya	fg	2	va	y	y	y	hp
3	m	ya	fg	2	va	n	y	n	hp
4	f	a	fg	5	ia	n	n	y	hp (hppb, hpo)
5	f	a	fg	3	ia	n	n	y	hp, ht
6	f	a	fg	5	va	y	n	y	h, prd
7	f	a	fg	5	va	n	n	y	hp
8	f	ya	fg	3	va	n	n	n	hp
9	f	a	fg	3	va	n	n	n	hf
10	m	ch	fg	5	va	n	n	n	hp (hpo, hpch)
11	f	a	fg	5	ia	n	n	n	hp, hhde
12	f	a	fg	2	va	n	n	n	h
13	m	ch	tg	2	va	y	y	y	hhde, prbi
14	f	s	r	5	ia	y	y	y	h
15	f	s	r	5	ia	y	y	y	h
16	m	a	fg	2	iq	y	y	y	hp
17	m	ch	r	1	va	n	y	y	hhde
18	f	s	fg	4	ia	y	n	n	hhde, prbi
19	m	a	fg	3	va	n	n	y	hp, ht
20	f	a	fg	2	va	n	n	y	hp (hpl), ht,
21	f	a	fg	1	va	y	n	y	h
22	f	s	fg	4	iq	y	y	y	h
23	f	a	fg	5	ia	y	y	y	h
24	f	a	fg	2	va	y	y	y	hp (hpl), hf
25	f	a	fg	5	va	y	y	y	hp (hpl)
26	f	ya	fg	2	va	n	n	y	h
27	m	a	fg	1	va	y	y	y	ht
28	f	a	fg	5	ia	n	y	n	hhde, pr
29	m	a	fg	2	va	n	n	y	hhde
30	f	s	fg	2	va	n	n	y	hhde
31	m	s	fg	3	va	n	y	n	hhde
32	m	s	r	1	va	y	y	y	hp (hpl), hf
33	m	s	fg	3	va	y	y	y	hp (hppb, hpch)
34	f	s	fg	2	va	y	y	y	hp, hhde
35	f	a	fg	2	va	n	n	y	hhde
36	m	a	fg	2	va	y	y	y	hp, hf
37	m	a	fg	1	va	y	y	n	hp
38	m	ya	r	3	va	y	y	y	hp (hpl) hf
39	f	a	tg	1	va	n	n	y	hp

Tab. 1: Total questionnaire data (quantitatively evaluated)

Tab. 1: Gesamtdaten aus der Umfrage (quantitativ ausgewertet)

questionnaire number	sex	age group	reason for stay	information material	reason for choice	SPA	nesting beach	endangered species	greatest threats
40	f	ya	fg	1	va	n	y	n	hp
41	f	ya	fg	1	va	n	y	n	h, prd
42	f	ch	fg	1	va	y	n	n	hf
43	f	a	fg	1	va	y	y	y	hp, hhde
44	m	a	r	5	ia	y	y	y	h
45	m	ch	r	5	va	y	y	y	hp
46	f	ya	tg	2	iq	n	n	y	h
47	f	a	r	1	va	y	y	y	hp
48	f	a	fg	2	va	n	n	y	hp, hhde
49	m	a	tg	2	iq	y	y	y	hf, pr
50	f	a	tg	2	va	n	n	y	hp, prd
51	m	ya	fg	1	ia	y	y	y	ht
52	f	ya	fg	1	va	y	y	y	ht
53	f	a	fg	1	va	n	n	n	hp, hf
54	m	a	fg	2	va	n	n	y	hhde, hf
55	f	a	fg	1	ia	n	n	n	hp, hf
56	m	ya	fg	1	iq	n	n	n	ht, hf
57	m	ya	fg	1	ia	n	n	n	ht
58	f	ya	tg	1	va	y	y	y	h
59	m	a	fg	1	va	n	n	n	ht
60	f	ya	tg	2	iq	n	n	y	hp
61	m	a	r	5	ia	y	y	y	hp (hpl), hhde (hhdeg), hf
62	f	s	fg	2	va	y	y	y	hp (hpl), hhdeg (hhdesu)
63	f	a	fg	2	va	y	y	y	hp (hpl)
64	f	s	fg	4	va	y	y	y	hf
65	f	a	tg	1	va	y	y	y	hp (hpl)
66	m	ya	r	2	va	n	n	y	hp
67	m	ya	r	1	va	y	y	n	hp
68	f	a	tg	2	va	y	y	y	h
69	m	s	fg	5	iq	y	y	y	hp (hppb)
70	m	s	tg	3	va	y	y	y	h
71	f	ya	fg	1	va	n	y	y	hf
72	m	s	fg	4	va	y	y	y	hp (hpl)
73	f	s	fg	2	va	y	y	y	hp (hpl, hppb)
74	m	ch	tg	5	iq	n	n	y	hp
75	f	a	tg	4	iq	n	n	y	h
76	m	a	tg	3	va	n	n	y	hf, pr

Abbreviations: qu/question. = questionnaires; SPA = Specially Protected Area; m = male; f = female; ch = child; ya = young adult; a = adult; s = senior; r = resident, tg = Turkish guest; fg = foreign guest; va = visual appearance; iq = information quality; ia = information amount; y = yes; n = no; h = human; hp = pollution; hppb = pollution by plastic bags on the beach and plastic waste in the sea; hpo = oil pollution; hpl = light pollution; hpch = chemical pollution; ht = tourism; hf = fishing; hhde = habitat destruction; hhdeg = habitat destruction by government; hhdesu = habitat destruction by sun umbrellas; pr = predation; prbi = predation by birds; prd = predation by dogs

Tab. 2: Evaluation of the sections 1) Basic information, 2) Information material on sea turtles and 3) Specific questions about *Caretta caretta* (question 3.4) excluded) (Fig. 6).

Tab. 2: Auswertung der Abschnitte 1) Basisinformationen, 2) Informationsmaterial über Meeresschildkröten und 3) Spezifische Fragen *Caretta caretta* betreffend (Frage 3.4) ausgeschlossen) (Abb. 6).

question.	sex	age group	reason for stay	information material	reason for choosing	SPA	nesting beach	endangered species
76 qu	31 m	6 ch	11 r	23 Nr.1	54 va	39 y	43 y	57 y
	45 f	17 ya	13 tg	24 Nr.2	9 iq	37 n	33 n	19 n
		38 a	52 fg	9 Nr.3	13 ia			
		15 s		5 Nr.4				
				15 Nr.5				

Abbreviations: qu/question. = questionnaires; SPA = Specially Protected Area; m = male; f = female; ch = child; ya = young adult; a = adult; s = senior; r = resident, tg = Turkish guest; Nr. = number; fg = foreign guest; va = visual appearance; iq = information quality; ia = information amount; y = yes; n = no

Tab. 3: Answers given to question 3.4) ("What do you think are the greatest threats for *Caretta caretta*?") (Fig. 6).

Tab. 3: Antworten auf die Frage 3.4) („Was glauben Sie sind die größten Gefahren für *Caretta caretta*?“) (Abb. 6).

questionnaire number	all answers	pollution	habitat destruction	tourism	fishing	predation	specific answers
1	h	x	x	x	x	x	x
2	hp	hp	x	x	hf	x	x
3	hp	hp	x	x	x	x	x
4	hp (hppb, hpo)	hp	x	x	x	x	hppb, hpo
5	hp, ht	hp	x	ht	x	x	x
6	h, prd	x	x	x	x	prd	x
7	hp	hp	x	x	x	x	x
8	hp	hp	x	x	x	x	x
9	hf	x	x	x	hf	x	x
10	hp (hpo, hpch)	hp	x	x	x	x	hpo, hpch
11	hp, hhde	hp	hhde	x	x	x	x
12	h	x	x	x	x	x	x
13	hhde, prbi	x	hhde	x	x	prbi	x
14	h	x	x	x	x	x	x
15	h	x	x	x	x	x	x
16	hp	hp	x	x	x	x	x
17	hhde	x	hhde	x	x	x	x
18	hhde, prbi	x	hhde	x	x	prbi	x
19	hp, ht	hp	x	ht	x	x	x
20	hp (hpl), ht,	hp	x	ht	x	x	hpl
21	h	x	x	x	x	x	x
22	h	x	x	x	x	x	x
23	h	x	x	x	x	x	x
24	hp (hpl), hf	hp	x	x	hf	x	x
25	hp (hpl)	hp	x	x	x	x	hpl
26	h	x	x	x	x	x	x

Tab. 3: Answers given to question 3.4) ("What do you think are the greatest threats for *Caretta caretta*?") (Fig. 6).

Tab. 3: Antworten auf die Frage 3.4) („Was glauben Sie sind die größten Gefahren für *Caretta caretta*?“) (Abb. 6).

questionnaire number	all answers	pollution	habitat destruction	tourism	fishing	predation	specific answers
27	ht	x	x	ht	x	x	x
28	hhde, pr	x	hhde	x	x	pr	x
29	hhde	x	hhde	x	x	x	x
30	hhde	x	hhde	x	x	x	x
31	hhde	x	hhde	x	x	x	x
32	hp (hpl), hf	hp	x	x	hf	x	hpl
33	hp (hppb, hpch)	hp	x	x	x	x	hppb, hpch
34	hp, hhde	hp	hhde	x	x	x	x
35	hhde	x	hhde	x	x	x	x
36	hp, hf	hp	x	x	hf	x	x
37	hp	hp	x	x	x	x	hpch
38	hp (hpl) hf	hp	x	x	hf	x	hpl
39	hp	hp	x	x	x	x	x
40	hp	hp	x	x	x	x	x
41	h, prd	x	x	x	x	prd	x
42	hf	x	x	x	hf	x	x
43	hp, hhde	hp	hhde	x	x	x	x
44	h	x	x	x	x	x	x
45	hp	hp	x	x	x	x	hppb
46	h	x	x	x	x	x	x
47	hp	hp	x	x	x	x	x
48	hp, hhde	hp	hhde	x	x	x	x
49	hf, pr	x	x	x	hf	pr	x
50	hp, prd	hp	x	x	x	prd	x
51	ht	x	x	ht	x	x	x
52	ht	x	x	ht	x	x	x
53	hp, hf	hp	x	x	hf	x	x
54	hhde, hf	x	hhde	x	hf	x	x
55	hp, hf	hp	x	x	hf	x	x
56	ht, hf	x	x	ht	hf	x	x
57	ht	x	x	ht	x	x	x
58	h	x	x	x	x	x	x
59	ht	x	x	ht	x	x	x
60	hp	hp	x	x	x	x	x
61	hp (hpl), hhde (hhdeg), hf	hp	hhde	x	hf	x	hpl, hhdeg
62	hp (hpl), hhdeg (hhdeg-su)	hp	hhde	x	x	x	hpl, hhdeg-su
63	hp (hpl)	hp	x	x	x	x	hpl
64	hf	x	x	x	hf	x	x
65	hp (hpl)	hp	x	x	x	x	hpl
66	hp	hp	x	x	x	x	x
67	hp	hp	x	x	x	x	x

Tab. 3: Answers given to question 3.4) (“What do you think are the greatest threats for *Caretta caretta*?”) (Fig. 6).

Tab. 3: Antworten auf die Frage 3.4) („Was glauben Sie sind die größten Gefahren für *Caretta caretta*?”) (Abb. 6).

questionnaire number	all answers	pollution	habitat destruction	tourism	fishing	predation	specific answers
68	h	x	x	x	x	x	x
69	hp (hppb)	hp	x	x	x	x	hppb
70	h	x	x	x	x	x	x
71	hf	x	x	x	hf	x	x
72	hp (hpl)	hp	x	x	x	x	hpl
73	hp (hpl, hppb)	hp	x	x	x	x	hpl, hppb
74	hp	hp	x	x	x	x	x
75	h	x	x	x	x	x	x
76	hf, pr	x	x	x	hf	pr	x

In the columns “pollution”, “habitat destruction”, “tourism”, “fishing”, “predation” and “specific answers” the data from the column “all answers” are headed separately to evaluate them more easily by Excel using the filtering application.

Abbreviations: h = human; hp = pollution; hppb = pollution by plastic bags on the beach and plastic waste in the sea; hpo = oil pollution; hpl = light pollution; hpch = chemical pollution; ht = tourism; hf = fishing; hhde = habitat destruction; hhdeg = habitat destruction by government; hhdesu = habitat destruction by sun umbrellas; pr = predation; prbi = predation by birds; prd = predation by dogs

Tab. 4: Summary of all answers given to question 3.4) (“What do you think are the greatest threats for *Caretta caretta*?”) (Fig. 6).

Tab. 4: Zusammenfassung aller erhaltenen Antworten auf die Frage 3.4) („Was glauben Sie sind die größten Gefahren für *Caretta caretta*?”) (Abb. 6).

threats	times answered
human activity	76
human activity in general	16
specific human activity	60
pollution	39
light pollution	10
plastic bags	5
chemicals	3
oil	2
habitat destruction	15
gouvernement	1
sun umbrellas	1
tourism	9
fishing	16
predation	8
dogs	3
birds	2

Linked results

Information material and choice factor

The results concerning the information material linked with those concerning the choice factor showed that material Nr.1 (Fig. 1) (19 times), Nr. 2 (Fig. 2) (20 times) and Nr. 3 (Fig. 3) (8 times) were by far more often chosen because of their visual appearance than because of

their information quality or their information amount (Tab. 5 and Fig. 8). Material Nr. 4 (Fig. 4) was chosen due to visual appearance as many times (twice) as due to information quality, while information amount was chosen only once (Tab. 5 and Fig. 8). In contrast, participants who decided in favor of material Nr. 5 (Fig. 5) did this mostly because of its information amount (8 times) (Tab. 5 and Fig. 8).

Age group and choice factor

The linkage of age group and choice factor revealed that most participants of each age group chose their favorite sea turtle information material based on visual appearance (Tab. 6 and Fig. 9): 5 of 12 children (<15), 12 of 17 young adults (16-25), 27 of 38 adults (26-60) and 10 of 15 seniors (>60). Furthermore, there was no major quantitative difference between choosing between information quality and amount. Only in adults was a clear difference evident: 8 decided in favor of information amount, only 3 in favor of information quality.

Participants' residency status and yes/no-questions 3.1)-3.3)

The linkage of the participants' residency status and the yes/no-questions 3.1)-3.3) (Fig. 6) concerning *Caretta caretta* showed different results for each question (Tab. 7 and Fig. 10).

On question number 3.1) "Did you know that Fethiye is a Specially Protected Area?" (Fig. 6), residents mostly answered with yes (82%), whereas less than half of the Turkish and foreign guests did (46% in both groups) (Tab. 7 and Fig. 10).

Also on question number 3.2) "Did you know that *Caretta caretta* nests on the beaches in Fethiye/Çalış?" (Fig. 6), the group answering the most with yes was the residents (91%), the second was the foreign guests (52%) and the last was the Turkish guests (46%) (Tab. 7 and Fig. 10).

In contrast, on the third question, 3.3) "Did you know that *Caretta caretta* is an endangered species?" (Fig. 6), all Turkish guests answered with yes, while only 91% of the residents and 65% of the foreign guests did (Tab. 7 and Fig. 10).

Participants' residency status and opinion question 3.4) ("What do you think are the greatest threats for *Caretta caretta*?)

The results of the last question about *Caretta caretta*, 3.4) "What do you think are the greatest threats for *Caretta caretta*?" (Fig. 6), linked with the participants' residency status are presented in Tab. 8 and Fig. 11. When asked what specific human activity they thought to be most harmful, most persons of every group answered pollution: among the residents 7 of 11, among the Turkish guests 5 of 13, and among the foreign guests 27 of 52. Concerning pollution, the broadest spectrum of answers was given by foreign guests: of 27 persons, 6

mentioned light pollution, 4 plastic waste/bags, 3 chemicals and 2 oil as very harmful to sea turtles. In contrast, no resident and no Turkish guest mentioned chemicals or oil in the sea as threats; Turkish guests also did not mention plastic waste as a problem.

The second biggest threat identified by residents was fishing and habitat destruction (in both cases 3 of 13). One resident also thought that wrong government policy is an additional reason why *Caretta caretta* is endangered. No resident, however, mentioned predation and tourism to be dangerous for *Caretta caretta* in Çaliş.

Turkish guests, in contrast, thought predation to be the second biggest threat for *Caretta caretta* here (3 of 13), whereas 1 of them mentioned (stray) dogs as enemies. Two of 13 Turkish guests listed fishing, just 1 habitat destruction. No Turkish guest said that tourism is a critical criterion.

Among the foreign guests, the greatest threats after pollution, in descending order, were thought to be: habitat destruction (13 of 52), fishing (11 of 52), tourism (9 of 52) and lastly predation (4 of 52). Concerning habitat destruction, 1 foreign guest mentioned sun umbrellas as harmful for *Caretta caretta* and, concerning predation, 1 of 4 believed that birds, and 2 that (stray) dogs threaten the sea turtles here.

Tab. 5: Linkage: information material and choice factor.

Tab. 5: Verknüpfung: Informationsmaterial und Auswahlkriterium.

	Nr. 1	Nr. 2	Nr. 3	Nr. 4	Nr. 5	Totals
visual appearance	19	20	8	2	5	54
information quality	1	4	0	2	2	9
information amount	3	0	1	1	8	13
totals	23	24	9	5	15	76

Fig. 8: Linkage: information material and choice factor.

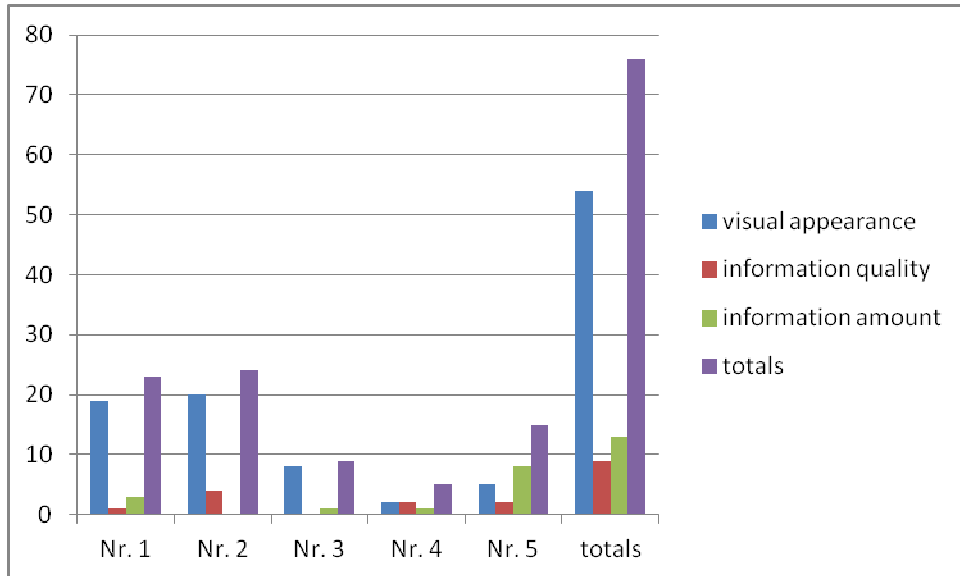


Abb. 8: Verknüpfung: Informationsmaterial und Auswahlkriterium.

Tab. 6: Linkage: age group and choice factor.

Tab. 6: Verknüpfung: Altersgruppe und Auswahlkriterium.

	children (<15)	young adults (16-25)	adults (26-60)	seniors (>60)	totals
visual appearance	5	12	27	10	54
information quality	1	3	3	2	9
information amount	0	2	8	3	13
totals	6	17	38	15	76

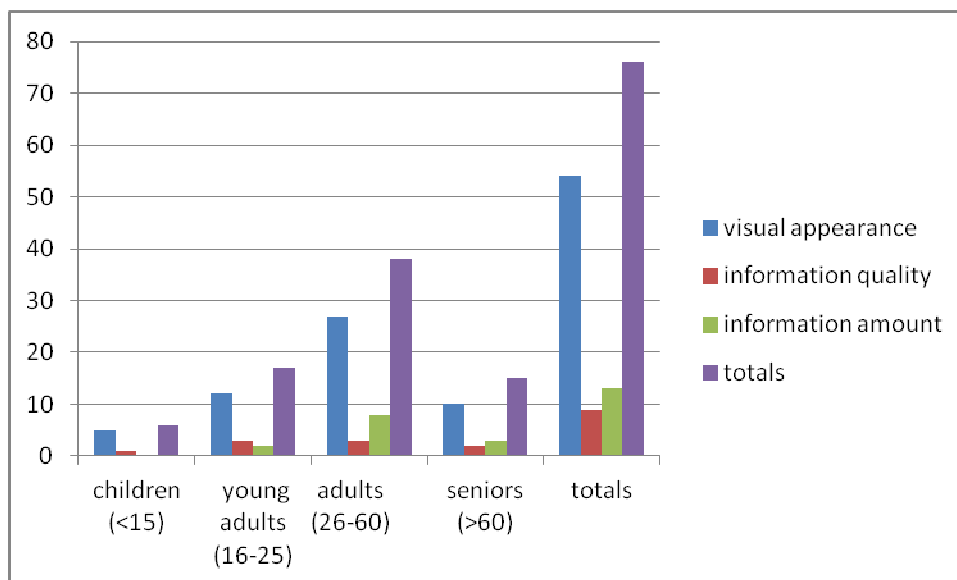


Fig. 9: Linkage: age group and choice factor.

Fig. 9: Verknüpfung: Altersgruppe und Auswahlkriterium.

Tab. 7: Linkage: answers to questions 3.1)-3.3) (Fig. 6) and participants' residency status.
 Tab. 7: Verknüpfung: Antworten auf die Fragen 3.1)-3.3) (Abb. 6) und Aufenthaltsgründe der Teilnehmer

	residents	Turkish guests	foreign guests	totals
participants	11	13	52	76
SPA (yes)	9	6	24	39
SPA (no)	2	7	28	37
SPA (yes in %)	82	46	46	
SPA (no in %)	18	54	54	
nesting beach (yes)	10	6	27	43
nesting beach (no)	1	7	25	33
nesting beach (yes in %)	91	46	52	
nesting beach (no in %)	9	54	48	
endangered species (yes)	10	13	34	57
endangered species (no)	1	0	18	19
endangered species (yes in %)	91	100	65	
endangered species (no in %)	9	0	35	

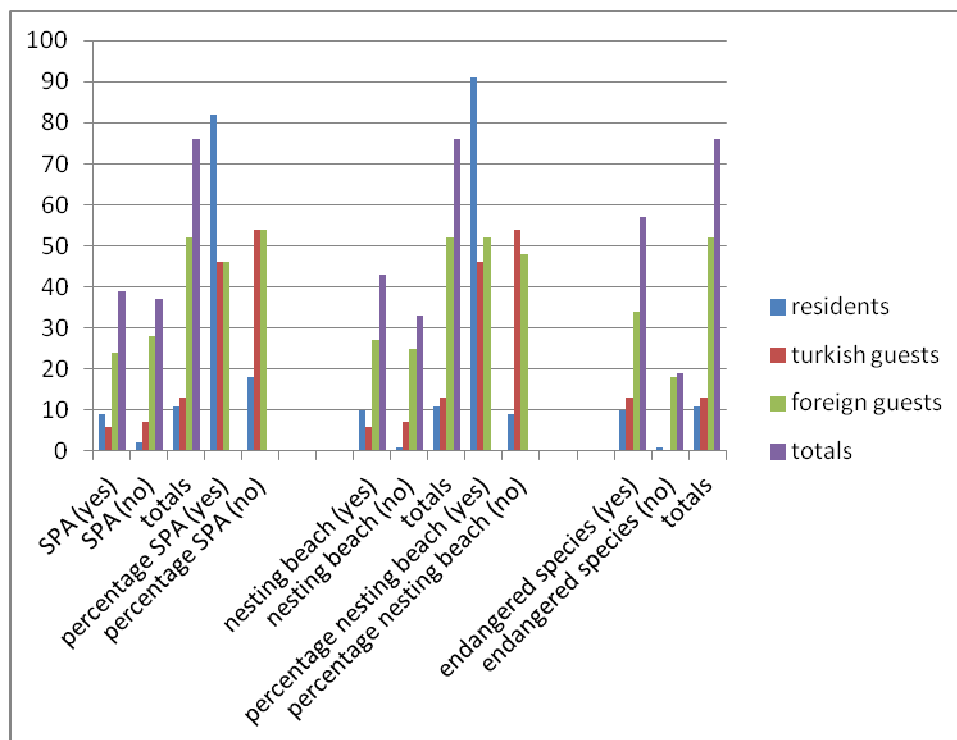


Fig. 10: Linkage: answers to questions 3.1)-3.3) (Fig. 6) and participants' residency status.
 Abb. 10: Verknüpfung: Antworten auf die Fragen 3.1)-3.3) (Abb. 6) und Aufenthaltsgründe der Teilnehmer.

Tab. 8: Linkage: answers to question 3.4.) ("What do you think are the greatest threats for *Caretta caretta*?") and participants' residency status.

Tab. 8: Verknüpfung: Antworten auf die Frage 3.4) („Was glauben Sie sind die größten Gefahren für *Caretta caretta*?“) und Aufenthaltsgründe der Teilnehmer.

	residents	Turkish guests	foreign guests
participants	11	13	52
human activity (in general)	3	5	8
pollution (in general)	7	5	27
light pollution	3	1	6
plastic bags	1	0	4
chemicals	0	0	3
oil	0	0	2
habitat destruction (in general)	2	1	12
government	1	0	0
sun umbrellas	0	0	1
tourism	0	0	9
fishing	3	2	11
predation (in general)	0	2	1
birds	0	0	1
dogs	0	1	2

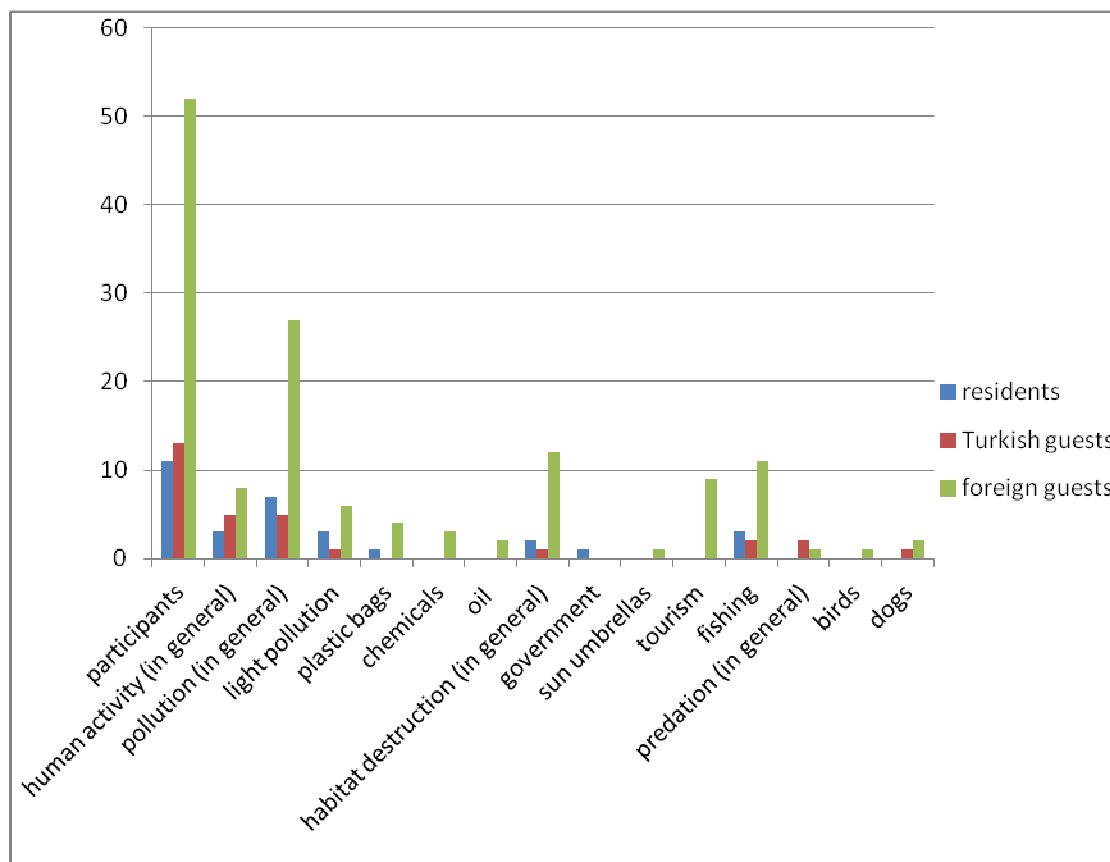


Fig. 11: Linkage: answers to question 3.4.) ("What do you think are the greatest threats for *Caretta caretta*?") and participants' residency status.

Abb. 11: Verknüpfung: Antworten auf die Frage 3.4) („Was glauben Sie sind die größten Gefahren für *Caretta caretta*?“) und Aufenthaltsgründe der Teilnehmer.

DISCUSSION

Separated results

Information material on sea turtles

Today, the visual appearance of an advertisement can be equally or even more relevant than its information amount. This is also clearly reflected in the results: most participants chose their favorite sea turtle information material based on visual appearance (Tab. 2). Eye-catching items are simply more interesting. This is probably closely connected to the technical development of the last years, whereby the range of advertisement tools has become much bigger. Clearly, one explanation for the results is that many participants did not take the time to read through every single information material.

Specific questions concerning *Caretta caretta* – yes/no-questions

Interestingly, more participants knew that *Caretta caretta* is nesting on the beaches in Fethiye/Çalış than participants knew that Fethiye is a Specially Protected Area (Tab. 2). One potential reason is the following: Many tourists (Turkish and foreign) who participated in the survey told us that they have seen our cages on the beach, information signs on the beach saying that Fethiye/Çalış has nesting beaches for sea turtles, or that they saw us working on the beach. Furthermore, many more participants knew that *Caretta caretta* is an endangered species than knew about Fethiye being a SPA and Fethiye/Çalış being a nesting beach. I explain this by the fact that tourists may have seen *Caretta caretta* in other places, for example Dalyan, and therefore know about the status of this species.

Specific questions concerning *Caretta caretta* – opinion question

Concerning the greatest threats for *Caretta caretta*, most participants believed that environmental pollution in all its facets is most harmful to sea turtles in general and in our case to *Caretta caretta* in particular (Tab. 3 and 4). A reason for this can be that people often know about the problem of environmental pollution globally; they may transfer this awareness to this region because they may have seen waste on the beach. Many tourists told us that they have seen how our cages were used either mistakenly or purposefully as rubbish bins.

Linked results

Information material and choice factor

As expected, the information materials Nr. 1 (Fig. 1) and Nr. 2 (Fig. 2) were far more often chosen due to their visual appearance than the materials Nr. 3-5 (Fig. 3-5) (Tab 5. and Fig. 8).

Why? The idea of producing information in this form is good and the execution was also good: they are eye-catching and unusual. Information material Nr. 5 (Fig. 5), in contrast, was mostly chosen because of its information amount (Tab. 5 and Fig. 8). This is also easy to explain because, although an A4-format isn't really eye-catching, it does contain a lot of interesting information as well as numerous good and interesting images (Fig. 5).

Age group and choice factor

Most participants of every age group chose their favorite sea turtle information material based on visual appearance (Tab. 6 and Fig. 9). Thus, the reasons outlined above for doing so were apparently valid for both young and old.

Participants' residency status and yes/no-questions 3.1)-3.3) (Fig. 6)

Most residents knew that Fethiye is a so-called Specially Protected Area and that *Caretta caretta* nests in the beaches in Fethiye/Çalış (Tab. 7 and Fig. 10). Even all Turkish guests, however, knew that *Caretta caretta* is an endangered species. They may have known this from reports on other nesting sites (Dalyan).

Participants' residency status and opinion question 3.4) ("What do you think are the greatest threats for *Caretta caretta*?)

Most participants of every age group believed that environmental pollution is the most harmful human activity to sea turtles in general and to *Caretta caretta* (Tab. 8 and Fig. 11). Interestingly, no resident mentioned predation and tourism as being dangerous for *Caretta caretta*. This result may partially reflect poor communication (when no Turkish student was present at the information booth) because residents who have good knowledge about *Caretta caretta* should also know about these aspects as well. Interestingly, one resident mentioned the government's policy as not really helpful for *Caretta caretta* and other sea turtles. I believe this to be an important and good closing statement: If nature conservation would become a more important issue – this is no doubt valid globally – factors such as environmental pollution and habitat destruction could be brought under better control.

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