CHANGES ON ÇALIŞ BEACH 2016

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KURZFASSUNG

Die Unechte Karettschildkröte (*Caretta caretta*) wird durch mehrere nationale Gesetze und international Konventionen wie die Barcelona Konvention, die Biodiversitätskonvention (CBD), CITES (Übereinkommen über den internationalen Handel mit gefährdeten Arten freilebender Tiere und Pflanzen) und die Berner Konvention geschützt. Trotzdem gibt es insgesamt einen bemerkbaren negativen Trend der mediterranen Populationen während der letzten Jahrzehnte.

Dieses Jahr war das 23. Mal, dass die Universität Wien in Zusammenarbeit mit einer türkischen Universität im Zuge ihres gemeinsamen Schutzprogrammes für *Caretta caretta* in der Fethiye Region im Südwesten der Türkei gearbeitet hat. Solche Projekte schaffen mehr Möglichkeiten zum Schutz und Langzeit-Monitoring von Meeresschildkröten und können helfen deren Populationsrückgang zu bremsen und der Degradation von Niststränden entgegen zu wirken.

Strandmöblierung sowie Lichtverschmutzung an Niststränden stellen ernsthafte Probleme und Hürden für adulte als auch sich entwickelnde und schlüpfende Meeresschildkröten dar. Während der Saison 2016 konnten wir eine Abnahme von 0.8 % bezüglich der Sonnenliegen und 1.8 % der Sonnenschirme am Strand von Çaliş, ein Teil des Strandes der Fethiye Region, feststellen. Anhand der Daten, die wir in den Jahren 2009 bis 2016 gesammelt haben, ist nichtsdestotrotz eine Zunahme an Strandmöbeln erkennbar.

Auch in der Anzahl der Lichter, welche zu einer Lichtverschmutzung des Strandes führen und somit Meeresschildkröten nachweislich stören, zeigt sich eine Abnahme von 11.9 % zum Vorjahr. Heuer waren es mehr als dreimal so viele Lichter als elf Jahre zuvor.

ABSTRACT

The Loggerhead sea turtle (*Caretta caretta*) is protected by several national laws and internationals conventions such as the Barcelona Convention, the Convention on Biodiversity (CBD), CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and the Bern Convention. Nonetheless, there has been a perceptible decrease in most Mediterranean populations over the last decades.

This year was the 23rd time that the University of Vienna in cooperation with a Turkish university (Pamukkale University) worked on a conservation program for *Caretta caretta* in

the Fethiye region in southwest Turkey. Projects like this offer possibilities to protect and monitor sea turtles over the long term, to reduce their population decline and prevent deterioration of nesting beaches.

Beach furniture and litter pollution on nesting beaches can cause severe problems for adult sea turtles and the development and hatching process of young sea turtles. During the 2016 season we recorded a small overall decrease of 0.8 % in sunbeds and 1.8 % in parasols in comparison to the last year on Çaliş beach, a part of the Fethiye beach region. Nonetheless, based on the data collected from 2009 to 2016, we can detect an increasing number of sunbeds and parasols during the last eight years.

The number of lights, which cause light pollution on this beach and therefore disturb sea turtles, decreased by 11.9 % in comparison to the previous year but were more than three times as much as eleven years ago.

INTRODUCTION

As every year since 1994, also this May to September (2016) a group of Turkish and Austrian volunteers, from Pamukkale University (TR) and the University of Vienna (AT), worked together as a team on the sea turtle conservation program in Çaliş and Yaniklar, two towns in Fethiye, a district of the Muğla Province in southwest Turkey.

The beaches of Fethiye are among the most important nesting sites for *Caretta caretta* (Loggerhead sea turtle) along the Mediterranean cost of Turkey and are also nesting areas for *Chelonia mydas* (Green sea turtle) (Fellhofer-Mıhcıoğlu et al. 2015). Also *Dermochelys coriacea* (Leatherback turtle) has been found on this coast (Canbolat 2004, Casale & Margaritoulis 2010).

Furthermore, both beaches are part of the SEPA (Special Environmental Protection Area) “Fethiye-Göcek” and therefore protected by Turkish law (“SEPA-Turkey” 2016).

Sea turtles in Turkey are protected by different national laws and international conventions such as the Barcelona Convention, the Convention on Biodiversity (CBD), CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and the Bern Convention (Casale & Margaritoulis 2010).

According to the IUCN Red List of Threatened Species, the Mediterranean subpopulation of *Caretta caretta* has recently been classified as “Least Concern” (Casale 2015). Although the number of nests increased during a survey from 2011 to 2013 the overall number of nests decreased over the last two decades (Baskale et al. 2016).

As many other sea turtle species, *Caretta caretta* females return to their origin beaches to lay their eggs. This process is called “natal homing” (Watanabe et al. 2011). The Mediterranean is the leading tourist destination in Europe. Therefore there is an increasing need to protect nesting beaches. Many different causes can make beaches unsuitable for female turtles to lay their clutches. Light pollution, sunbeds, umbrellas, trash, other physical obstacles, noise, movement and compacted or gritty sand are serious problems for nesting sea turtles. Also boats and other water sport activities can scare, injure or even kill turtles (Bolten & Witherington 2003, Margaritoulis & Demetropoulus 2003).

Sea turtle hatchlings typically emerge from their nest during night. They orientate themselves on the brightest spot, which is naturally the moon-lit horizon above the sea. Owing to strong light pollution on beaches, the hatchlings are guided into the wrong direction and are either disorientated or misorientated. Therefore many hatchlings cannot find their way into the ocean. This can increase the mortality of hatchlings through photopollution by artificial lights of bars, restaurants, hotels, streetlights and visitors turning lamps on at the beach during the night (Peters & Verhoeven 1994).

To avoid and reduce the disturbance of nesting sea turtles and hatchlings through human impact, it is necessary to monitor nesting areas and collect data about changes on these beaches.

MATERIAL AND METHODS

During the nesting season of 2016, groups of two to four volunteers patrolled Çaliş beach during night and morning shifts. Moreover, also during daytime the students collected data about *Caretta caretta* and changes on this beach.

Çaliş beach can be divided into two sections. The first section is the public beach from the Türkü Cadiri restaurant to the Letoon hotel, which we designate as Çaliş promenade. This part of the beach is maintained by the organization Çaliş DER, which is responsible for the beach furniture and waste on the beach. The second section is referred to as Çiftlik and reaches from the Aroma Beach Club to the western end of the beach at the cape. This zone includes many beach areas that adjoin hotels, restaurants and bars, but also includes a public picnic area. In the Çiftlik section, the establishments have their own beach furniture and management.

The most important factors that constitute problems for sea turtles on Çaliş beach are the same. Nonetheless, the individual factors keep on changing over time and therefore need to be monitored over the years. These include:

- the number of sunbeds, parasols/umbrellas, tables and beanbags on the beach,
- other hurdles as green carpets, wooden platforms and sun protections,
- lights of bars, restaurants, hotels, shops and standings,
- streetlights and promenade lighting.

The sunbeds were counted during daytime. Also the number of rows in which they are arranged were noted. If there were, for example, 10 sunbeds in 2 rows and 10 sunbeds in 3 rows belonging to the same establishment, we counted them as two times 10 sunbeds (therefore 20 sunbeds) in 2.5 rows. On the Çaliş promenade the beach was divided into sectors extending from one hotel/restaurant/bar to another one. For Çiftlik section of the beach, the different types of furniture and gaps between businesses made it clear which sunbeds belong to which establishments.

We followed the same counting system for parasols, tables and beanbags.

Other obstacles such as green carpets, wooden platforms or other sun protection infrastructures were noted for each hotel, restaurant or bar.

During the nights of 16 to 19 August 2016, between 9 pm and 11 pm, the lights of all hotels, restaurants or bars along the beach got counted. Only those lights that are visible from the beachside and therefore more strongly affect the brightness of the beach area. We also included those lights that were within groups of shining lights but whose bulbs were broken: such lamps would be expected to be replaced within the summer season. Light chains were counted as one light. The lights of fridges and other machines were also included. In the last

two years (2014+2015), only the lights of the promenade inclusive the lights of the first establishment in the Çiftlik section (Aroma Beach Club) were counted. This year the lights of both sections were counted.

Finally, the taller streetlights and the promenade lights that are close to the beach or can have a effect on the nesting and hatchlings on the beach were counted and divided into different groups: promenade lights with a partial shield on the beach side, promenade lights painted with dark ink on the beach side, promenade lights without any darkening, and streetlights with a clear influence on the illumination of the beach.

Besides these major factors, also the change in the approximate amount of waste on the beach, the presence of trashcans, barriers preventing car access to the beach, turtle information signs and human activities such as camping at the beach or the construction of new playgrounds were documented.

RESULTS

Sunbeds, parasols, tables, beanbags and other beach furniture

Whole Çaliş beach extends over a length of approximately 3.5 km (see Fig. 4, chapter 1 this report). During our fieldwork we counted a total of 558 sunbeds, arranged in one to maximum three rows, and 279 parasols in the Çaliş promenade area. In the Çiftlik section we counted a total of 1314 sunbeds arranged in many different numbers of rows, 468 parasols, 264 tables and 55 beanbags (Table 1). There were no tables or beanbags on the publicly managed beaches (i.e. Çaliş promenade and picnic area). Importantly, the sunbeds along Çaliş promenade were flipped together during the night. Only on some short stretches, they were moved to the back of the beach, i.e. sunbeds that belonged to certain hotels, restaurants or bars.

Tab. 1: Number of sunbeds (and number of rows), parasols, tables and beanbags per beach area or hotel/restaurant/bar.

Tab. 1: Anzahl der Sonnenliegen (in wie vielen Reihen), Sonnenschirme, Tischchen und Sitzsäcke pro Strandabschnitt beziehungsweise Hotel/Restaurant/Bar.

		Location from	to	Sunbeds	Rows	Parasols/ umbrellas	Tables	Beanbags
Çaliş beach	Çaliş promenade	Türkü Cadiri	Hamsi Bar	42	1	21	0	0
		Hamsi Bar	Gür Market	86	2	43	0	0
		Delta Hotel	Nil Restaurant Bar	78	3	39	0	0
		Azure Properties	Green Caffee	124	2	62	0	0
		Lighthouse	Okyanus Restaurant	26	2	13	0	0
		Fish Pedicure	Rosary Beach	18	1	9	0	0
		Beetles Travel	former Spezia Ital. Rest.	92	2	46	0	0
		Caretta Info Desk	Caren Beach Hotel	32	1	16	0	0
		Turkuaz Market	Hotel Letoon	60	1	30	0	0
	Çiftlik section	Aroma Beach Club		110	3	53	55	0
		Yücel Hotel		22	2	11	10	0
		Yörük Hotel		70	4	35	25	0
		Güvens Beach Bar		66	5	33	22	0
		Korsan Beach		26	6	16	13	0
		Onur Beach Bar		30	5	15	15	0
		Last Stop		54	4	27	0	0
		Ceviz Beach		60	5	30	0	0
		Beach Camp		0	1	6	0	0
		Daphne Residence		6	1	0	0	0
		Jivas Beach Resort 1		128	5	59	0	0
		Jivas Beach Resort 2		189	3	49	0	0
		Sunset Beach Club		86	1	15	10	0
		Çaliş Sports Beach Club / Spor		35	3	18	5	0
		Fethiye Surf Center		35	3	18	12	9
		Surf Cafe 1		23	3	15	0	10
		Surf Cafe 2		32	4	15	16	27
		Bakrac incl. Beach Park 1		7	1	0	0	0
		Bakrac incl. Beach Park 2		31	2	0	0	0
		Bakrac incl. Beach Park 3		42	3	21	0	0
		Zentara Beach		64	2	21	21	0
		Koca Çaliş Beach Club		78	3	0	25	0
		Ada Beach Park		30	2	0	15	4
		Hasaj / Mekan		65	2.5	0	11	0
		Surf Blue		25	3	11	9	5
Çaliş promenade				558		279	0	0
Çiftlik section				1314		468	264	55
Total Çaliş beach				1872		747	264	55

Tab. 2: Other facilities that present problems for sea turtles such as sun shades, carpeting or wooden platforms and their adjoining hotels/restaurants/bars.
Tab. 2: Problemquellen für Meeresschildkröten, wie Überdachungen als Sonnenschutz, grüne Teppiche oder Holzplateaus und ihre dazugehörigen Hotels/Restaurants/Bars.

Location	beach facility
Aroma Beach Club	Sun shade (5x3m)
Daphne Residence	2 sun shades (12x4m each)
Jivas Beach Resort 1	Beach volleyball field
Sunset Beach Club	Sun shade (60x6m), playground
Çaliş Sports Beach Club / Spor	Playground (10x20m), 3 sun shade (2.5x4m), wooden platforms (4x3m), green plastic carpet
Fethiye Surf Center	Green plastic carpets
Surf Cafe 1	Green plastic carpet
Surf Cafe 2	Green plastic carpet
Bakrac incl. Beach Park 1	2 wooden platforms (4x4m), 2 wooden platforms (5x4m)
Bakrac incl. Beach Park 2	7 sun shades (2.5x2m), 2 hammocks, 7 wooden platforms (total: 20x8m)
Bakrac incl. Beach Park 3	2 wooden platforms (4x4m)
Zentara Beach	3 wooden platforms (3x3m)
Koca Çaliş Beach Club	Sun shade (40x12m)
Ada Beach Park	3 sun shades (5x30m)
Hasaj / Mekan	14 sun shades (5x3m)
Surf Blue	Green plastic carpet (15x20m)

Some hotels, restaurants or bars also had some additional beach furniture such as canopies/shades as sun protection, green carpets on the sand and wooden platforms to lie or sit on (usually with roof). Moreover, the Jivas Beach Resort had its own volleyball field and establishments like the Sunset Beach Club and the Çaliş Sports Beach Club / Spor had their own playground for kids (Table 2, Fig. 5).

Based on the data from 2009 to 2016, there is an evident overall increase of sunbeds and also an increasing number of parasols on Çaliş beach during the last eight years. Nonetheless, this year, in comparison to 2015, there was a decrease of 0.8 % in sunbeds and 1.8 % in parasols: this is 15 sunbeds and 14 parasols less (Fig. 1).

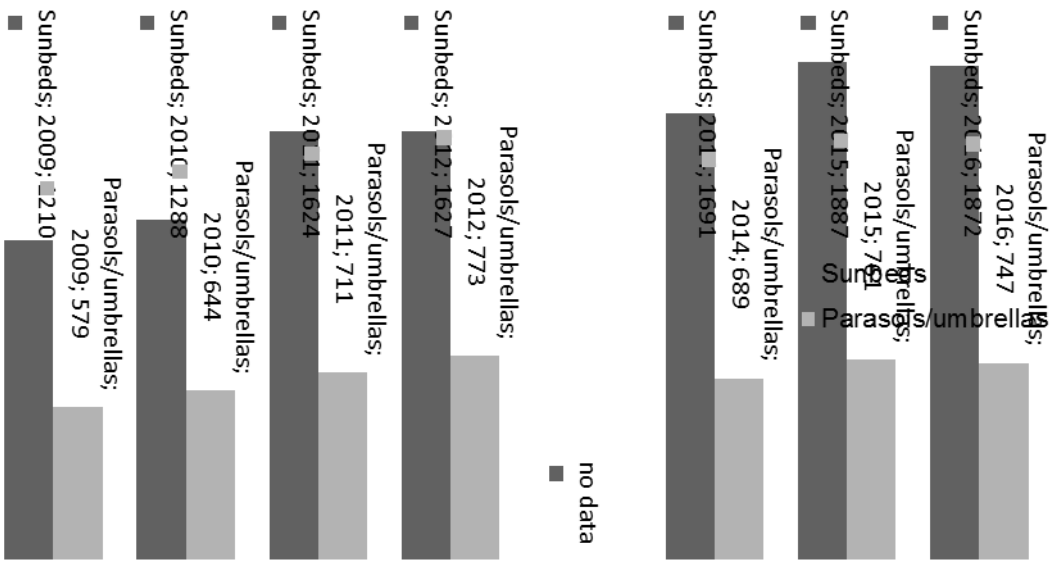

Fig. 1: Numbers of sunbeds and parasols on Çaliş beach from 2009 to 2016.
Abb. 1: Anzahl der Sonnenliegen und Sonnenschirme am Strand von Çaliş in den Jahren von 2009 bis 2016.

In Çiftlik an increase of sunbeds (1.9 %), parasols (1.3 %) and tables (29.4 %) could be shown. Since the number of sunbeds and parasols was reduced along Çaliş promenade, however, the overall total decreased in the whole Çaliş area (Fig. 1, Fig. 2). Noteworthy is the 45.0 % decrease in beanbags compared to the previous year (Fig. 2).

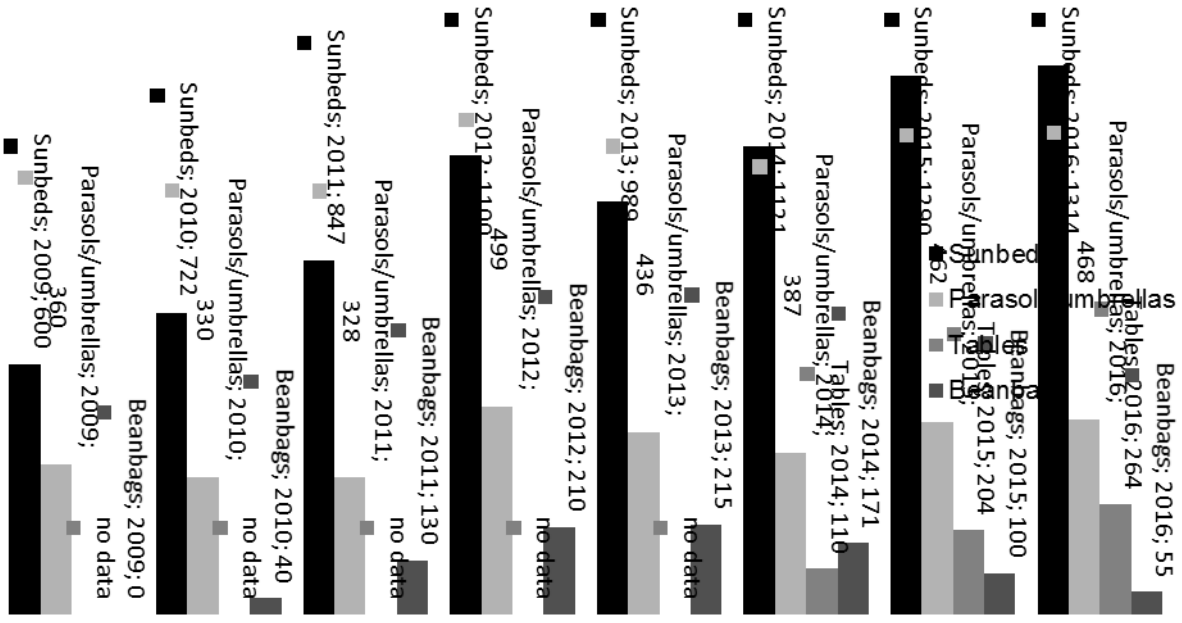

Fig. 2: Number of sunbeds, parasols, tables and beanbags on the Çiftlik stretch of beach from 2009 to 2016.
Abb. 2: Anzahl der Sonnenliegen, Sonnenschirme, Tischchen und Sitzsäcke im Çiftlik Gebiet in den Jahren 2009 bis 2016.

Tab. 3: Numbers of sunbeds, rows of sunbeds, parasols, tables and beanbags of the major hotels/restaurants/bars from 2015 and 2016 in comparison – ordered based on the highest number of sunbeds.
Tab. 3: Anzahl der Sonnenliegen, Reihen der Sonnenliegen, Sonnenschirme, Tischchen und Sitzsäcke der größten Hotels/Restaurants/Bars von den Jahren 2015 und 2016 im Vergleich – geordnet anhand der höchsten Anzahl von Sonnenliegen.

Location	Sunbeds		Change [%]	Rows		Parasols / umbrellas		Change [%]	Tables		Beanbags	
	2015	2016		2015	2016	2015	2016		2015	2016	2015	2016
Jiva Beach Resort 2	121	189	56.2%	4.0	3.0	54	49	-9.3%	5	0	0	0
Jiva Beach Resort 1	126	128	1.6%	4.0	5.0	58	59	1.7%	9	0	0	0
Aroma Beach Club	112	110	-1.8%	3.0	3.0	54	53	-1.9%	37	55	0	0
Sunset Beach Club	122	86	-29.5%	3.0	1.0	19	15	-21.1%	28	10	0	0
Bakrac incl. Beach Park	91	80	-12.1%	4.0	2.0	31	21	-32.3%	0	0	21	0
Koca Çaliş Beach Club	101	78	-22.8%	4.0	3.0	0	0	0.0%	0	25	0	0
Yörük Hotel	79	70	-11.4%	2.5	4.0	40	35	-12.5%	0	25	0	0
Güvens Beach Bar	62	66	6.5%	6.0	5.0	31	33	6.5%	29	22	0	0
Hasaj / Mekan	94	65	-30.9%	3.0	3.0	0	0	0.0%	35	11	0	0
Zentara Beach	84	64	-23.8%	4.0	2.0	24	21	-12.5%	0	21	0	0

Continuation of Tab. 4: Numbers of sunbeds, rows of sunbeds, parasols, tables and beanbags of the major hotels/restaurants/bars from 2015 and 2016 in comparison – ordered based on the highest number of sunbeds.
Fortsetzung der Tab. 3: Anzahl der Sonnenliegen, Reihen der Sonnenliegen, Sonnenschirme, Tischchen und Sitzsäcke der größten Hotels/Restaurants/Bars von den Jahren 2015 und 2016 im Vergleich – geordnet anhand der höchsten Anzahl von Sonnenliegen.

Location	Sunbeds		Change [%]	Rows		Parasols / umbrellas		Change [%]	Tables		Beanbags	
	2015	2016		2015	2016	2015	2016		2015	2016	2015	2016
Ceviz Beach / Beskaza	31	60	93.5%	3.0	5.0	20	30	50.0%	9	0	0	0
Surf Cafe	79	55	-30.4%	3.0	3.5	40	30	-25.0%	0	16	76	37
Last Stop	53	54	1.9%	3.0	4.0	19	27	42.1%	21	0	0	0
Çaliş Sports Beach Club / Spor	38	35	-7.9%	3.0	3.0	18	18	0.0%	0	5	0	0
Onur Beach Bar	27	30	11.1%	5.0	5.0	16	15	-6.3%	22	15	0	0
Korsan Beach	30	26	-13.3%	5.0	6.0	16	16	0.0%	9	13	1	0
Yücel Hotel	22	22	0.0%	2.0	2.0	11	11	0.0%	0	10	0	0

Table 3 lists the biggest hotels, restaurants and bars according to their number of sunbeds. The biggest increase occurred at Ceviz Beach (Beskaza) with a plus of 93.6 % of sunbeds and 50.0 % of parasols. There was also an increase of sunbeds at the Jiva Beach Resort, which already had the highest number of sunbeds in the previous year (Table 3).

The big hotels, restaurants or bars showed a minus in sunbeds (0.8 %) and a minus in parasols (1.2 %). Since the overall values increased, however, this means that there was a plus in the beach furniture of smaller establishments (Fig. 2, Table 3).

Light pollution

This year we counted 971 lights along the Çaliş promenade and 476 lights along the other part of Çaliş beach which belongs to hotels, restaurants, bars and shops and that are visible from or illuminate the beach. This is an decrease of 11.9 % (138 lights) in comparison to 2015 and more than 3.8 times as much as eleven years ago in 2005 in the Çaliş promenade section (incl. Aroma Beach Club) (Fig. 3).

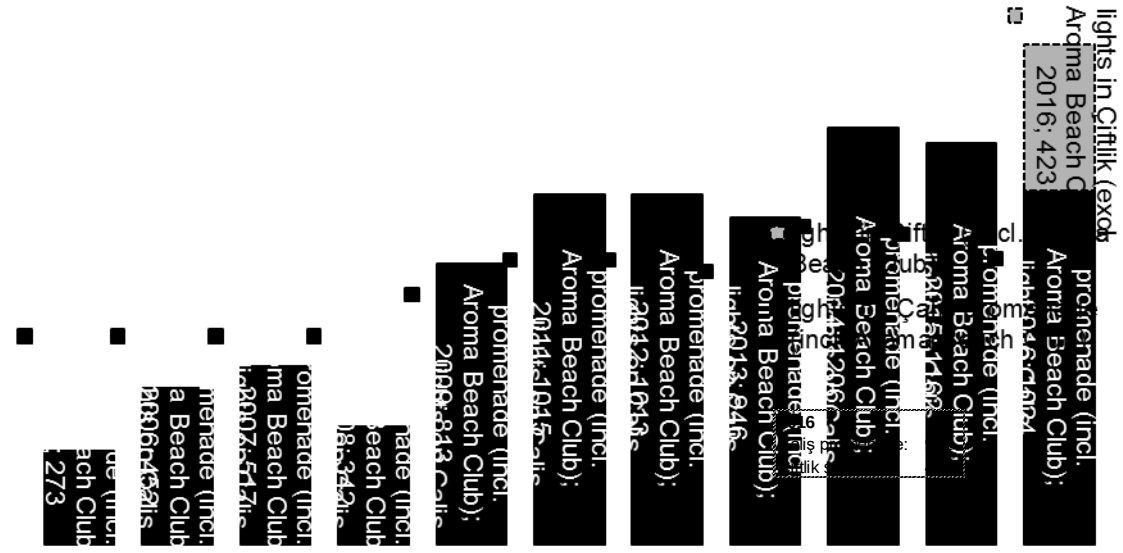

Fig. 3: Lights of hotels/restaurants/bars counted during night on Çaliş promenade (incl. Aroma Beach Club) from 2005 to 2015 and the number of lights in 2016 from 2005 to 2016.
Abb. 3: In der Nacht gezählte Lichter von Hotels/Restaurants/Bars entlang der Promenade von Çaliş (incl. Aroma Beach Club) in den Jahren 2005 bis 2015 und die Anzahl der Lichter 2016.

Tab. 5: Streetlights and promenade lights in Çaliş that can have (additional to the other lights) a direct impact on sea turtles.
Tab. 4: Straßenlichter und Promenadenbeleuchtung in Çaliş, welche (zusätzlich zu den anderen Lichtern) einen direkten Einfluss auf Meeresschildkröten haben können.

Location	Promenade lights with partial shield on beach side	Promenade lights painted on beach side	Promenade lights without darkening	Streetlights with influence
Çaliş promenade	16	3	6	0
Çiftlik section	0	0	0	9
Total Çaliş beach	16	3	6	9

Beyond the above-mentioned establishment lights, we also counted the promenade lights and streetlights. There were six promenade lights without any darkening and 9 streetlights in the Çiftlik section that shined directly on the beach (Tab. 4).

Other changes and important observations

At the Çaliş Sports Beach Club / Spor Cafe, many new green plastic carpets cover an area of soft sand that would offer potential spots for Caretta caretta to dig their nests and lay their eggs. In 2015, no such carpets were installed there (Fig. 4). Also, a new playground (10x20 m) has been built next to the area with the green carpets (Fig. 5).

Also at the Surf Blue, extensive new green plastic carpets (10x20 m) and a new sun protection for their catamarans were installed (Fig. 6). The carpet-covered area of sand this establishment covered in 2016 was four times that in 2015.

Close to the end of Çiftlik, a new establishment (Ada Park) with 3 sun shades à 5x30 m, 30 sunbeds in two rows, 15 tables and 4 beanbags has been constructed (Fig. 7 (A)). In 2015 there were only a few parasols at this location (Fig. 7 (B)); in 2014 this stretch was open (Fig. 7 (C)) and in 2013 there had been two rows of sunbeds and parasols (Fig. 7 (D+E)). Comparing 2013 to 2015 reveals that the area behind the beach furniture has since been landscaped and planted. All the sandy area is now covered by grass, bushes and sunbeds, leaving no place for sea turtles to nest.

Positive changes have also taken place. New trashcans for plastic bottles were installed along the promenade to provide visitors with an alternative instead of leaving their beverage containers on the beach (Fig. 8).

An important aspect of nesting beach conservation is to protecting beaches from vehicle traffic. In 2011, the authorities dug deep trenches to keep cars away from the beach. After a short period these trenches were filled with water and trash and represented potential traps for adult sea turtles and hatchlings (Fig. 9 (C+D)). In spring 2016, new small stonewalls were erected as barriers for cars in front of Sunset Village and adjoining road stretches. These barriers, designed to hold plants, also prevent hatchlings from getting even further away from the sea if they become disorientated by artificial lights. The plants in the middle of these barriers could ultimately help shield the beach from light when they grow bigger in the future (Fig. 9 (A)). Furthermore, some poles were inserted into the sand next to the street to discourage people from driving onto the beach (Fig. 9 (B)), whereby, importantly, vehicle traffic was diverted from the back-beach road by traffic signs.

Nevertheless, there are still spots where cars can get on the beach, compressing the sand and therefore potentially endangering hatchlings and their development (Fig. 10).

Figure 11 shows that some people continue to confuse nest protection cages with trashcans and leave their empty packaging and bottles in or next to them.

As previously mentioned in last year's report (Gabriel & Schmidt, 2015), people continue to put up tents at night to sleep there, mainly on the beach along the Çaliş promenade and in the picnic area of Çiftlik. This could potentially keep hatchlings from so-called secret nests (nests that have not been identified before hatching) from hatching, cover potential nesting spots for *Caretta caretta* adults, and disorient hatchling if camping lights are used (Fig. 12).
Finally, signs are erected at various entrances to the beach; they provide basic information about *Caretta caretta* or list guidelines on how to behave on a nesting beach (Fig. 13).

DISCUSSION

The beach area in which sea turtles nest is usually within a distance of 5 to 20 m to the sea in the Fethiye region (Başkale & Kaska 2005). Most nests are laid between 10 and 20 m from the waterline, following in frequency by areas 20 to 30 m and 0 to 10 m from the water (Başkale et al. 2016). Çaliş beach is at some parts wider than 20 m and therefore offers many potential nesting areas all over the beach width (if these parts are not artificially altered and not contain any physical obstacles for sea turtles). This is why it is important to count the rows and number of sunbeds, parasols, tables and beanbags: they typically occupy and shade precisely this area of the beach. Due to the increasing number of sunbeds, parasols and tables – usually in many rows and therefore covering a broad area of beach – in the Çiftlik area it has become increasingly harder for *Caretta caretta* females to find an appropriate place to nest. The arrangement of beach furniture along the Çaliş promenade area leaves more space in the most suitable area for nests. Furthermore the sunbeds are uprighted after sunset. There, the number of sunbeds and parasols has also decreased since last year (Fig. 1, Fig. 2). The degree to which this reflects the respective tourism levels (i.e. most likely less this year considering the political turmoil), can only be determined based on long-term monitoring in the future as well.
Furthermore, the shade produced by the parasols and other sun protection infrastructure cause negative effects on the incubation temperature of nests. This calls for considering their reduction in nesting areas (Margaritoulis & Demetropoulus 2003).
Although there was a decrease of 11.9 % in lights on Çaliş promenade (Fig. 3), these can have a remarkable negative effect on nesting sea turtles and hatchlings (Peters & Verhoeven 1994, Bolten & Witherington 2003). There are many strategies of light management to reduce the photo pollution of beaches such as (Salmon 2003):

- to turn off unneeded lights,
- reduce the wattage of lights,

— focus the light on the spots where it is needed,
— attach shields which redirect lightning,
— keep lights close to the ground and do without upward-directed lights and
— use alternative light resources

The six promenade lights without any darkening and 9 streetlights that have an effect on the brightness of the beach (Table 4) could be turned off after a specific time when they are no longer necessary.

Cars that drive on the beaches (Fig. 10) can compact sand and thus make areas unusable for nesting, destroy existing nests and make it difficult for hatchlings to emerge. Such traffic can be reduced with barriers as documented in Figure 9 (A)+(B). Besides that, human activities on the beach during the night (Fig. 12) should be forbidden to reduce the disturbance of nesting female sea turtles (Margaritoulis & Demetropoulos 2003). According to the signs, nighttime activity on the beach is, in fact, forbidden, but this would need to be more strictly enforced.

Garbage on the beach (Fig. 11) can represent hurdles and traps for hatchlings on their way to the sea. They can get stuck in cups, nets, canisters and have to evade other obstacles such as bottles or styrofoam items. This effort takes time and energy and can lead to disorientation (Triessnig et al. 2012). Especially plastic items that end up in the sea can cause problems for adult *Caretta caretta* turtles because this species ingests more debris than other sea turtle species due to its feeding behaviour (Thomás et al. 2002).

It is also important to maintain the existing signs and erect new ones about sea turtles and nesting beaches to make people aware of the situation and provide them guidelines on how to behave on such beaches.

As the tourism development in the Mediterranean within the last two decades has posed an ever more severe threat for sea turtles (Margaritoulis & Demetropoulus 2003), it is important to monitor the development of Çaliş beach and implement effective conservation programs to stem the overall negative population trend of *Caretta caretta* (Ilgaz et al. 2007) and to prevent the population's protection status from being downgraded on the IUCN Red List of Threatened Species.

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APPENDIX

Figure 4: Green plastic carpeting around the patio area of the Çaliş Sports Beach Club / Spor in 2016 (left); no green carpets in 2015 (right).
Abbildung 4: Grüner Kunstgrasteppich aus Plastik um die Sitzfläche beim Çaliş Sports Beach Club / Spor 2016 (links) und keine grünen Teppiche 2015 (rechts).
(Photos: M. Stachowitsch)

Figure 5: New playground at the Çaliş Sports Beach Club / Spor in 2016. Note also volleyball court in the nesting zone.
Abbildung 5: Neuer Spielplatz beim Çaliş Sports Beach Club / Spor 2016. Siehe auch Volleyballplatz in der Nistzone.
(Photo: M. Stachowitsch)

Figure 6: Extensive green plastic carpeting at the Surf Blue in 2016 (left) in comparison to initial carpets in 2015. Also note the new water sport equipment and sunshades.
Abbildung 6: Grüner Plastikteppich vor dem Surf Blue 2016 im Vergleich zum Vorjahr. Auch neue Wassersport-Ausrüstung und ein neues Sonnendach.
(Photos: M. Stachowitsch)

Figure 7: Ada Beach Park, new in 2016 (A). Derelict parasols at the same spot in 2015 (B), nothing in 2014 (C) and two rows of sunbeds and parasols in 2013 (D+E).
Abbildung 7: Der neu errichtete Ada Beach Park 2016 (A) im Vergleich zu einigen verlassenen Sonnenschirmen am selben Ort 2015 (B), einem leeren Strand 2014 (C) und zwei Reihen von Sonnenliegen und – schirmen 2013 (D+E).
(Photos: M. Stachowitsch)

Figure 8: New and clever trashcans for plastic bottles along the promenade in Çaliş.
Abbildung 8: Neue Mülleimer für Plastikflaschen entlang der Promenade in Çaliş.
(Photo: M. Stachowitsch)

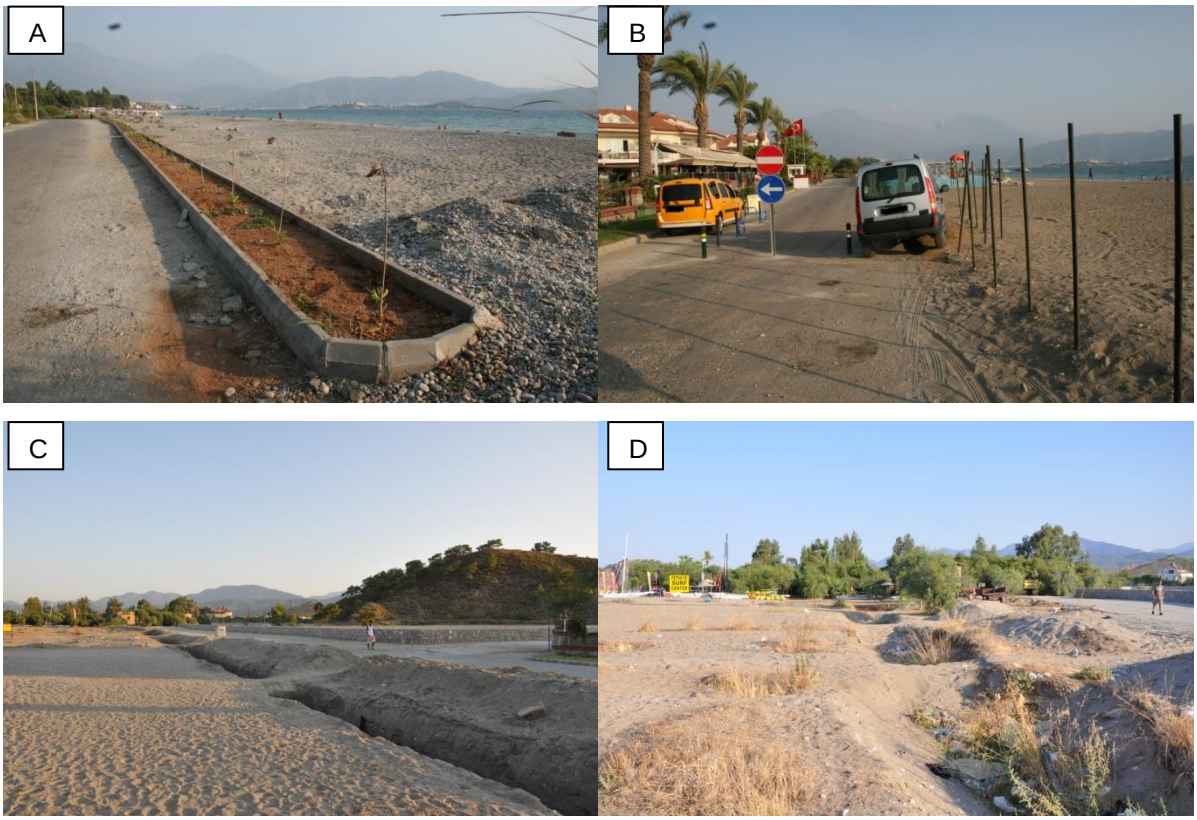

Figure 9: New barriers against cars along a section of Çiftlik in front of the Sunset Villages in 2016 (A+B) in comparison to ditches in 2011 and 2012 (C+D).
Abbildung 9: Neue Barrieren gegen Autos entlang eines Abschnittes von Çiftlik vor den Sunset Villages im Jahr 2016 (A+B) im Vergleich zum zu den Gräben im Jahr 2011 und 2012 (C+D).
(Photos: M. Stachowitsch)

Figure 11: Some vehicles can still overcome suboptimal barriers on the beach.
Abbildung 10: Manche Fahrzeuge können trotz Barrieren immer noch auf den Strand zufahren kann.
(Photo: Project volunteer 2016)

Figure 10: Waste next to a cage in 2016. Despite clear multilingual signs, visitors continue to leave their garbage in and next to nest protection cages.
Abbildung 11: Müll direkt neben einem Schutzkäfig im Jahr 2016 trotz klarer Beschilderung, welche auffordert keinen Müll in oder neben dem Käfig zu hinterlassen.
(Photo: Volunteer of the project 2016)

Figure 12: People camping in tents on the beach along the promenade of Çaliş in 2016.
Abbildung 12: Camper mit Zelten übernachten am Strand der Çaliş Promenade im Jahr 2016.
(Photos: Project volunteer 2016)

Figure 13: Signs on Çaliş beach informing about sea turtles and nesting beaches.
Abbildung 13: Schilder am Strand von Çaliş um über Meeresschildkröten und Niststrände zu informieren.
(Photos: M. Lambropoulos)