CHANGES ON ÇALIŞ BEACH 2015

Andreas Gabriel & Lisa-Maria Schmidt

KURZFASSUNG

Obwohl *Caretta caretta* (Unechte Karettschildkröte) in der Türkei durch eine Vielzahl von Gesetzen und Abkommen, wie CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), sowie der Berner Konvention und der Barcelona Konvention geschützt werden sollte, ist diese Art einigen ernsthafte Bedrohung ausgesetzt. Das diesjährig, zum 22. Mal stattfindende Projektpraktikum der Universität Wien, in Kooperation mit der türkischen Hacettepe Universität, zum Schutz von Meeresschildkröten in der Türkei, ermöglicht eine langjährige Beurteilung und Überwachung dieses Strandabschnittes.

In diesem Jahr musste entlang Çaliş Stränden ein Anstieg der Sonnenliegen um 11.6% und der Sonnenschirme um 10.4% festgestellt werden. Besonders anzuführen ist hier Jiva Resort, bei welchem der größte Anstieg von Sonnenliegen und Schirmen verzeichnet wurde. Sowohl Spor Cafe, das durch die Vergrößerung seiner Plattform und der Fertigstellung diverser Konstruktionen direkt am Strand, als auch Surf Cafe, mit seiner hohen Anzahl an Plastikmatten und Sitzsäcken, tragen zur denkbar schlechtesten Situation für die Erhaltung der Niststrände von Meeresschildkröten bei.

ABSTRACT

Although *Caretta caretta* (Loggerhead Turtle) is be protected by a variety of laws and conventions in Turkey, like CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), the Bern Convention and the Barcelona Convention, this species is exposed to some severe threats. This year's 22nd nature conservation course of the University of Vienna in cooperation with the Turkish Hacettepe University for the conservation of marine turtles in Turkey, offers the opportunity for long-term evaluation and monitoring of this beach section.

This year an increase of sunbeds by 11.6% and of parasols by 10.4% was recorded. Especially for Jiva Resort the biggest increase for both sunbeds and parasols was recorded. Due to the expansion of Surf Cafe's platform, the completion of various constructions and the high

number of plastic mats as well as beanbags in the center of the beach sector, both Spor Cafe and Surf Cafe represent clear worst-case scenarios for sea turtle nesting site conservation.

INTRODUCTION

The Mediterranean Sea is frequented by three species of sea turtles, namely *Caretta caretta* (Loggerhead Turtle), *Chelonia mydas* (Green Turtle) and *Dermochelys coriacea* (Leatherback Turtle) (Casale, 2010). The first two mentioned species are globally listed as Endangered, the latter as Critically Endangered on the IUCN Red List of Threatened Species 2004 (WWF Species Action Plan, 2005).

Although *Caretta caretta* inhabits the whole Mediterranean Sea, it nests mainly in Turkey, Greece, Cyprus and Libya (Margaritoulis et al., 2003). Along the Turkish coastline a total of 22 major nesting sites were listed (Canbolat, 2004), whereby 3 of them are declared as Special Protected Areas (SPAs). Fethiye beach, including Çaliş Beach and Yaniklar, was designated an SPA in 1988 and is one of the key nesting beaches in Turkey (Ilgaz et al., 2012).

Adult female individuals of *Caretta caretta* – as most other sea turtles – return to the beach where they are born in order to lay their eggs. This phenomenon is called natal homing (Bowen et al. 2004). This exemplifies the necessity to protect every nesting beach, each of which represents a certain turtle sub-population.

Especially the decline of nesting beaches due to excessive tourism is a major threat for marine turtles. Beach areas covered by densely arranged sunbeds and parasols complicate nesting and can shade nests. Sex determination of hatchlings depends among other factors on temperature and can be therefore influenced by such furniture (Kaska et al., 2006). Another source of danger can be light pollution such as brightly lit bars and restaurants but also street lights. This artificial light can mislead hatchlings, which are normally orientating towards the brightest surface to find the sea after hatching (Whiterington & Bjorndal, 1990).

The monitoring program in Fethiye took place for the 22nd time in 2015. The program lasted from 27 June until 12 September and was carried out in Çaliş as well as in Yaniklar. Students of the University of Vienna collected data together with research associates of the Hacettepe University in Ankara with the aim to provide effective protection for loggerhead turtles. Data about *Caretta caretta* nests, hatchlings, number of dead and alive individuals, and changes

concerning both sites were recorded. This report focuses on changes concerning the beach in Çaliş compared to previous years.

MATERIAL AND METHODS

Between 27 June and 12 September, 12 students from the University of Vienna and 3 research associates of the Hacettepe University in Ankara monitored the nesting of *Caretta caretta* in Çaliş Beach. Every day, two to four people walked along the beach in two shifts (morning and night shift). Nests were marked by triangulation, GPS data were taken and protective cages where put on top of all nests.

Before every shift and additionally at noon, temperature was recorded.

Morning shift

Morning shift started at about 5:30 am (later in season at 6 am) at Mutlu Hotel and was extended to ÇalişTepe (end of the beach). The survey was conducted by two people walking in two parallel lines along the waterline.

The main task was to check all triangulations to make sure that the protective cages were correctly positioned on top of the nests, search for tracks (adult and juvenile) and check cages for captured hatchlings.

Night shift

Night shift started at 10 pm at Mutlu Hotel and was finished earliest at 2 am. The monitored beach section extended until the last recorded nest, which was located right after Surf Cafe. At the beginning of the season, students walked along this beach section four times during night shift, looking for adult individuals, tracks or nests. During hatching season the beach was additionally checked for hatchlings and their tracks. These surveys were conducted by three students walking in three parallel lines to the sea. At the end of the season, only cages for captured hatchlings were checked.

Nest excavations (several days after the last hatch) were conducted in both shifts depending on available time.

All data concerning nests, adult or juvenile *Caretta caretta*, their tracks and changes on the beach were documented in a field booklet and later transcribed to data sheets and also documented by photography. On 26 August 2015 all sunbeds and parasols where counted for Çaliş promenade and additionally sunbeds, parasols, tables and rows of sunbeds were counted for every restaurant/bar at the Çiftlik stretch of the beach.

RESULTS

Along the entire observed nesting beach area of Çaliş promenade and the Çiftlik stretch, which contained several restaurants and bars ranging from Aroma Beach Club to Mekan (Tab. 1.), 1887 sunbeds and 761 parasols were documented on 26 August 2015. Both Çaliş promenade and Çiftlik extend over a length of 3.5 km. Of these, 597 sunbeds and 299 parasols were counted on Çaliş promenade, while 1290 sunbeds, 462 parasols, 204 tables and 100 beanbags were noted in Çiftlik. This data allowed us to compare the total counts of sunbeds and parasols from 2009 to 2015, even though no data were available in 2013 (Fig. 1). Across 7 years of documentation, the number of sunbeds increased by 677 (+56 %), and 182 (+31 %) additional parasols were counted. The highest number of parasols, with 773 units, was recorded in 2012.

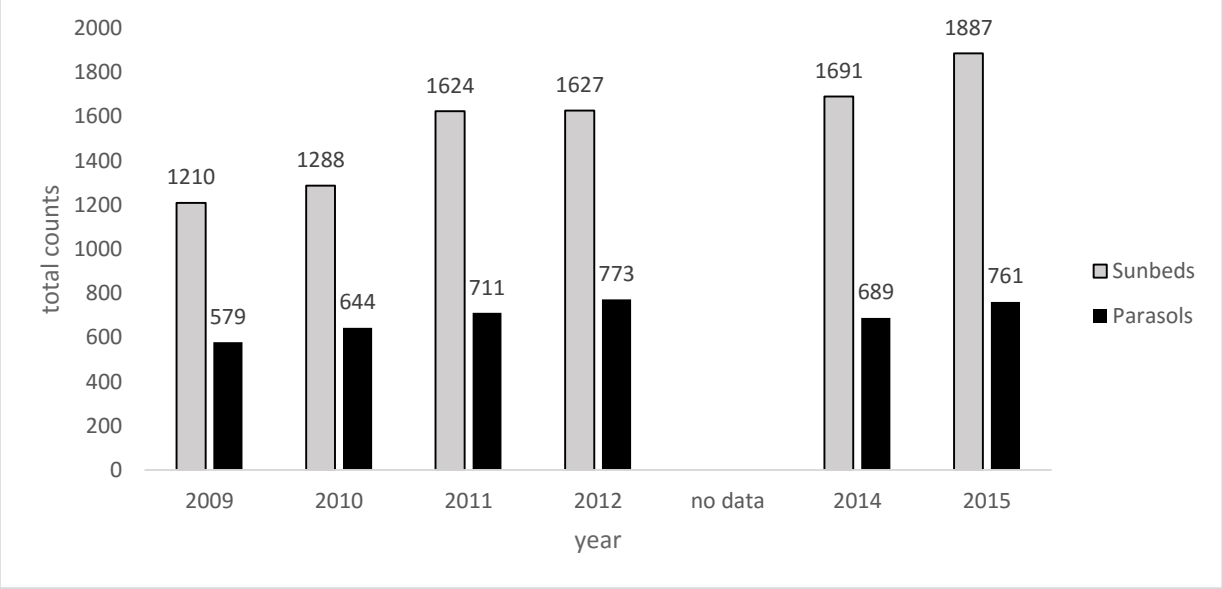

Fig.1: Total number of sunbeds and parasols on Çaliş Beach (promenade and Çiftlik section) per year.
Fig.1: Anzahl an Sonnenliegen und Schirme am gesamten Beobachtungsgebiet der Promenade von Çaliş und am Strand von Çiftlik, pro Jahr.

During the field work in Çiftlik, a total of 19 locations were observed in 2015, while 16 different locations were mentioned in 2014 report (Tab. 1, Tab. 2). Note, however, that the

precise identification of bars and restaurants was difficult because new facilities appeared and others were renamed. To simplify the counting process, Jiva1 and Jiva2 was considered separately, but actually belonged to the same resort, Jiva (Fig. 6).

In 2014, the total number of sunbeds in Çiftlik was 1121 and the total number of parasols reached 387. Compared to the observations in 2015, the number of sunbeds increased by 169 (+15 %) and an additional 75 (+19 %) parasols. Furthermore, 94 (+85 %) tables were added, whereas the number of beanbags decreased by 71 (-42 %). The average number of rows of sunbeds added up to 3.2 in 2015, while in 2014, the average number was 3.5.

Tab. 1: Number of recorded sunbeds, parasols, tables, beanbags and rows of sunbeds at different locations along Çiftlik beach section (Çaliş) in the year 2015. Total number of beach furniture and the average amount of rows are mentioned below.
Tab. 1: Anzahl an registrierten Sonnenliegen, Schirmen, Tischen, Sitzsäcken und Reihen an Sonnenliegen an unterschiedlichen Standorten am Strand von Çiftlik (Çaliş) im Jahr 2015. Die Gesamtzahl der Strandmöbelstücke und die durchschnittliche Anzahl an Sonnenliegenreihen werden unten erwähnt.

Location	Sunbeds	Parasols/umbrellas	Rows of sunbeds	Tables	Beanbags
Aroma	112	54	3	37	-
Yücel Hotel	22	11	2	-	-
Yörük Cadiri2	79	40	2.5	-	-
Güvens	62	31	6	29	-
Korsan	30	16	5	9	1
Onur	27	16	5	22	-
Last Stop Beach	53	19	3	21	-
Beskaza	31	20	3	9	-
Daphne Residence	6	-	1	-	-
Jiva1	126	58	4	9	-
Jiva2	121	54	4	5	-
Sunset	122	19	3	28	-
Spor	38	18	3	-	-
Surf Café	79	40	3	-	76
No Name	2	3	1	-	2
Bakrac	91	31	4	-	21
Koca	101	-	4	-	-
Zentara	84	24	4	-	-
Kaptan	-	8	1	-	-
Mekan	94	-	3	35	-
TOTAL	1280 +10	462	3.2 (average)	204	100

Tab. 2: Number of beach furniture in Çiftlik (Çaliş), 2014. Note that location names do not correspond fully to Table 1 (2015) due to renaming and new facilities.
Tab. 2: Anzahl an Strandmöbel in Çiftlik (Çaliş) im Jahr 2014. Zu beachten ist jedoch, dass, aufgrund zahlreicher Neugründungen und Umbenennungen, einige der erwähnten Bars bzw. Hotels, nicht zur Gänze mit der Tabelle 1 (2015), übereinstimmen.

Location	Sunbeds	Parasols/umbrellas	Rows of sunbeds	Tables	Beanbags
Aroma (former Caretta Beach Club)	119	54	4	-	35
Yörük Cadiri2	65	29	3	-	-
Güvens	56	27	5	-	-
Korsan (former Pelina Beach)	35	16	5	-	-
Onur	54	15	5	-	1
Dirlic (Dolmus)	95	45	5	6	-
Jiva1	137	67	3	-	-
Jiva2	26	-	1	-	-
Sunset	112	11	3	-	8
Spor	24	27	2	20	15
Surf Café	102	55	4	21	87
No Name	3	2	1	-	-
Bakrac	69	3	3	-	-
Escape	73	30	3	11	-
Koca	59	-	2	21	25
Kaptan	-	-	-	-	-
Mekan	92	6	3	31	-
TOTAL	1121	387	3.5 (average)	110	171

Comparing the documented quantities of beach furniture in Çiftlik across 7 years of observation, from 2009 to 2015, a distinct trend is evident (Fig. 2). Although, the total number of sunbeds decreased in 2013, it was nonetheless more than doubled since 2009. Overall, the number of parasols increased by 102 (+28 %) compared to the year 2009, while the number of beanbags has dropped again since 2014.

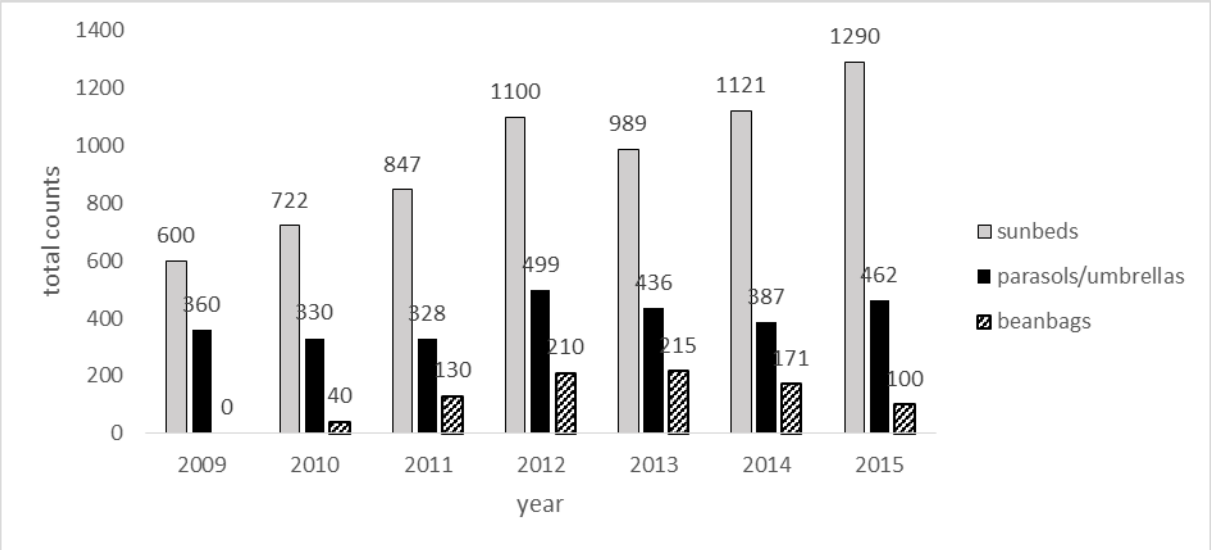

Fig. 2: Recorded number of sunbeds, parasols and beanbags in Çiftlik (Çaliş) across 7 years of observation (2009-2015).
Fig. 2: Dokumentierte Anzahl an Sonnenliegen, Schirmen und Sitzsäcken in Çiftlik (Çaliş), über 7 beobachtete Jahre (2009-2015).

In detail, Aroma Beach Club (-7), Onur (-27), Jiva1 (-11) and Surf Café (-23) clearly reduced the number of sunbeds. The amount of sunbeds was higher at Yörük Cadiri (+14), Güvens (+6), Korsan (+5), Jiva2 (+95), Sunset (+10), Spor (+14), Bakrac (+22), Koca (+42) and Mekan (+2). On the one hand, a reduction of parasols was noted at Jiva1 (-9), Spor (-9), Surf Café (-15) and Mekan (-6). On the other hand, Yörük Cadiri (+11), Güvens (+4), Onur (+1), Jiva2 (+54), Sunset (+8), No Name (+1), Bakrac (+28), Koca (+1) and Kaptan (+8) increased the number of parasols. The most significant changes were documented at the beach sector of Jiva2, which was separated from Jiva1 by a lifeguard tower. Here, Jiva2 showed an enormous increase in the number of sunbeds and parasols compared to the previous year 2014 (Fig. 3, Fig. 4). The greatest increase in the number of tables was recorded at Aroma Beach Club (Fig. 5), where 37 new tables were placed, while all previously recorded beanbags (35) disappeared near this facility.

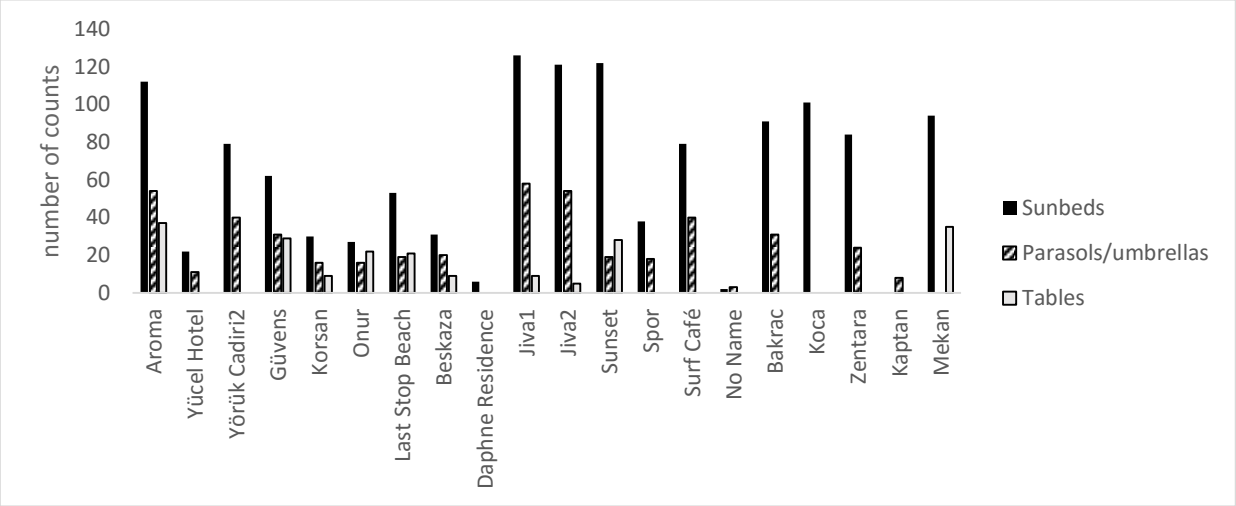

Fig. 3: Number of beach furniture per location in Çiftlik (Çaliş) 2015. Note the strong increase of sunbeds at Jiva, Bakrac and Koca compared to 2014. A considerably increased number of parasols is evident at Jiva and Bakrac. Numerous tables were added at Aroma Beach, Güvens, and Onur, while they were removed at Koca.
Fig. 3: Anzahl an Strandmöbel in Çiftlik (Çaliş) 2015. Ein starker Anstieg an Sonnenliegen kann bei Jiva, Bakrac und Koca, beobachtet werden. Zudem, ist ein erheblicher Anstieg an Schirmen bei Jiva und Bakrac zu verzeichnen. Bei Aroma Beach, Güvens und Onur wurden zahlreiche Tische hinzugefügt, während, bei Koca, alle Tische entfernt wurden.

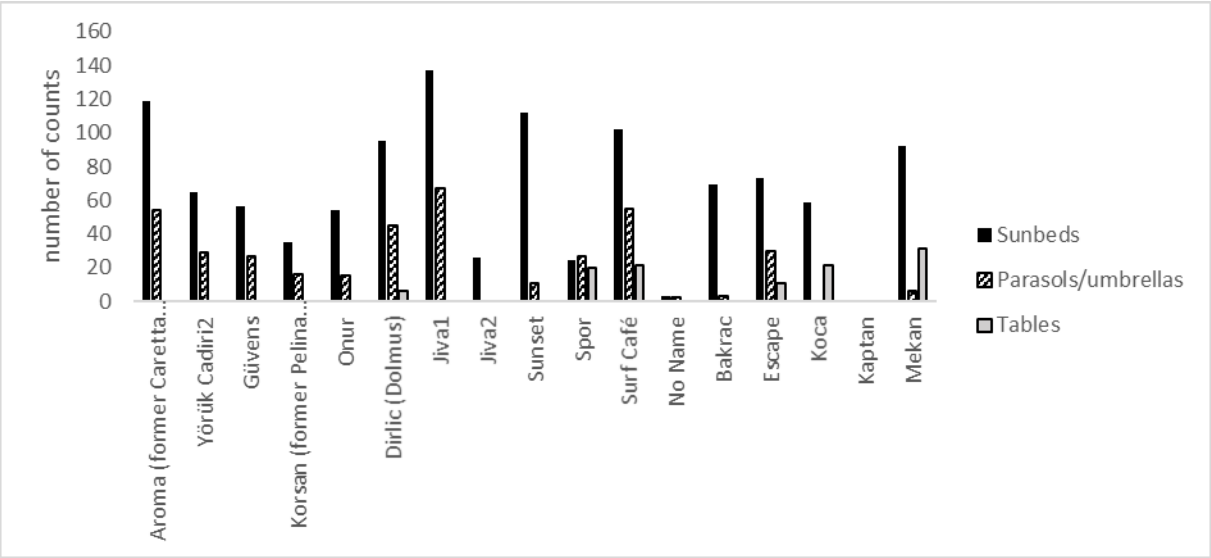

Fig. 4: Number of recorded sunbeds, parasols and tables, present in Çiftlik (Çaliş) 2014. The X axis contains different investigated locations. The Y axis indicates the number of beach furniture.
Fig. 4: Anzahl an beobachteten Sonnenliegen, Schirmen und Tischen in Çiftlik (Çaliş) 2014. Die X Achse beinhaltet verschiedenste Standorte. Die Y Achse beschreibt die Anzahl an Strandmöbel.

The plastic chain barriers present at the backside of the Aroma beach in 2014 were removed (Fig. 9). Observing the Onur location, several new mats were laid this year, which covered a considerable area of soft ground, potentially useful as a nesting site by *Caretta caretta.* At Daphne Residence, two sunshade roofs were installed this year. They shaded the underlying sand surface and thus influenced the temperature here. Moreover, a wooden fence, which newly enclosed the area of the children´s playground, built in 2009 (Fig. 11, Fig. 12), was set up in front of Sunset (Fig. 13).

At the Spor Café, smaller cemented areas were enormously expanded to a large platform (Fig. 19, Fig. 20). Here, a major portion of the nesting area was covered and unavailable for *C. caretta.* Additionally, a wooden construction was completed and a new freshwater-shower was installed in the center of this beach sector (Fig. 15, Fig. 16, Fig. 17). The plastic mats and beanbags, already mentioned in the 2014 report, were still present on the beach of Surf Café and no distinct reduction or removal of these nesting barriers could be observed (Fig. 7, Fig. 22). This situation and the new developments make Spor Café and Surf Café clear worst-case scenarios for sea turtle nesting site conservation. Furthermore, a new cemented platform, adjoining Bakrac, was completed in 2015 (Fig. 25). The photo-documentation of the previous year shows the construction process, which already started in 2014 (Fig. 24). A new (wedding?) pavilion was built and numerous beach parties as well as weddings were organized on the beach section of Bakrac (Fig. 26). During those events, pyrotechnics were often used. These structures and activities pose a threat not only to the hatchlings, but also to the adult individuals. The location Zentara, which was not present in 2014 and therefore not

mentioned in previous reports, installed new wooden chairs and a volleyball court. On a relatively small area near Kaptan, a wooden hut and a camping van were placed. Directly after Mekan, at the end of the beach, a new wooden building as well as several large plastic mats were noted near the sea (Fig. 29).

As in past years, some of the installed showers at Çaliş Beach had an insufficient drainage system and were still spilling large amounts of water onto the beach (Fig. 17, Fig. 18). Besides, the watering of certain beach sections was a common practice, for example in front of Surf Cafe or at beach volleyball courts (Fig. 21). The planted Acacia trees in Çiftlik continue to grow and their roots extend for many meters in all directions. The dense root systems of these plants can prevent adult turtles from digging egg chambers and block hatchlings on their way up through the sand. Importantly, new wooden buildings or camping places (Fig. 27) are now being built between and in the shade of these trees. The front row of the Acacia trees, which directly restricts the narrow sandy nesting area, remains as in the previous years, pollution, especially at the public "picnic area" of Çiftlik, has reached an alarming state. Not only on the beach, but also inside the nest protection cages, litter, mainly consisting of food remains and packaging materials, was found (Fig. 30). This litter also attracted numerous birds and stray dogs, which represent a serious threat to recently hatched individuals. In one special case, a protection cage was removed and used as barbecue equipment at the "picnic area".

Moreover, the trenches along the roadside of "picnic area", dug as a barrier to prevent car access, were partially re-dug this year (Fig. 14). Even though this might be interpreted as progress, the trenches could trap and harm *Caretta caretta* adults and hatchlings. Not to mention serving as repositories of garbage and accumulating fetid water. In spite of the protective trenches, several heavy vehicles – used for building huts, transporting sand or retrieving boats – were spotted on Çiftlik Beach (Fig. 27, Fig. 28). Other key problems facing the Special Environment Protected Area in Çaliş this year were numerous tents on the beach (Fig. 8) and the strong light pollution caused by spotlights of bars and restaurants near the beach. In early September 2015 (off- season), the street lights on Çaliş promenade were switched off at about 23:30 pm. During high season those lights were activated until about 01:30 am. At least one new information board was set up, while older information boards were in an acceptable condition.

DISCUSSION

According to the 2015 sea turtle data, 30 nests were detected at Çaliş Beach, whereas in 2014 the values was 38, which was the long-term record and significantly more than in the current nesting season. More precisely, 11 nests were located at the beach of Çaliş promenade and 19 nests were found on the Çiftlik beach section. The nest data revealed that the number of hatchlings reaching the sea was very low at CS02, CY02, CY12, CY17 and CY19 in relation to the total number of deposited eggs (Loggerhead turtle hatchlings in Çaliş, 2015). The nests CS02 and CY19 were located in front of Sunset, CY02 at Calisto Pizzeria, CY17 at Ibrahim Bay Hotel and CY12 at Hotel Letoon. Thus, three of these nests were located along Calis promenade, while two nests were close to Sunset (Çiftlik stretch). Possible reasons for this can be the highly frequented beach of Çaliş promenade, the run-off of the showers, influencing the moisture regime of the nest in front of Hotel Letoon (Fig. 18) as well as the dense rows of sunbeds and the coarse gravel at Sunset beach.

The increasing amount of nesting barriers (Fig. 10), the presence of different types of vehicles on the beach (Fig. 27, Fig. 28), the watering of several beach sections, either through installed showers or manual watering (Fig. 17, Fig. 18, Fig. 21), as well as light and environmental pollution are key problems in terms of conservation of the nesting habitats. Growing tourism is the factor underlying all these threats. This calls for providing accurate information and basic knowledge about *Caretta caretta* to the tourists and local residents.

The nesting conditions for *Caretta caretta*, especially close to bars and restaurants, have clearly worsened since the conservation efforts were launched in 1994. Interestingly, the number of nests in Çaliş has nonetheless increased in recent years. One potential explanation for this trend is the success of this conservation and research project. Nonetheless, other factors such as the environmental degradation of nearby nesting beaches and shifts in nest site selection by the affected turtles are also potential explanations. The latter could not be analysed in the framework of the present study.

Certain improvements of the nesting conditions, in order to increase the nesting success, can be mentioned in 2015. Workers of the organisation DER did a great job, moving most of the sunbeds away from the nesting zones and stacking them beside the concrete wall of the promenade at night. Accordingly, adult sea turtles had a wider range of movement when seeking places to dig egg chambers. Those hatchlings which were not captured in a protective cage would no doubt also benefit from this obstacle reduction. This positive change should be

expanded to cover the whole beach. Another step towards an effective conservation of nesting habitats in Çaliş, was the reduction of beanbags on Çiftlik Beach. Two main problems caused by beanbags appeared in the last few years. First, they represented obstacles for both adults and hatchlings of *Caretta caretta*, and second, after a short period of time some of them showed considerable material deficiencies and started losing Styrofoam (polystyrene), which was then distributed on the immediate surroundings (Fig. 23).

This year, a committee representing the Bern Convention visited Fethiye to examine the status quo and to determine whether protective guidelines were being adhered to. This led to certain differences on Çaliş Beach directly before and after the visit of the committee. For example, the rows of sunbeds along Çaliş promenade were reduced from 3 to 2 before the inspection. At this point, it must be mentioned that the number of rows did not correlate with the total number of sunbeds at each location. In this way, an increasing average of rows cannot be defined as an indicator for additional sunbeds. Interestingly, the results of 2015 reveal an increasing number of sunbeds, although the average amount of rows decreased (-0.3). Furthermore, some of the parasols were removed but put up again right after the inspection.

The shifting baseline syndrome, can be called upon to explain some of the problems facing Çaliş Beach. It influences the individual perception of environmental changes and probably affects the relevance of participatory monitoring and long-term analysis over generations. Generational amnesia and personal amnesia, where knowledge extinction occurs because people forget their own experiences, are two forms of the shifting baseline syndrome (Papworth et al., 2009). In this way, the conservation of natural habitats of *Caretta caretta* in Çaliş Beach, based on human perception, is more complicated than it looks at first sight. Compared to the documented landscape of Çaliş in previous years (1994, 2004), it has dramatically changed until now. Most of the bars and restaurants were not yet existent and the landscape was not that strongly influenced by anthropogenic impacts. Nevertheless, the younger generation is largely unaware of this tremendous changes and believes that the current conditions also occurred in the past. As a consequence, radical changes can happen without being recognized. It is a major challenge to recognize these radical changes and to recognize that they represent a long chain of often minor individual changes. The difficult task in Fethiye is to step in before this cumulative set of small and large deteriorations has established an irreversible situation in which sea turtle nesting is no longer possible. This calls for closely monitoring each and every infrastructure and every beach stretch in Çaliş and its neighboring beaches in Fethiye over the long term.

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WWF Species Action Plan (2005)

http://maps.google.at/ (23.10.2011)

http://iucn-mtsg.org/about-turtles/ (23.10.2011)

APPENDIX

Fig.5: Screenshot of area following Çaliş promenade, including Aroma Beach, Yücel Hotel, Yörük Cadiri and Güvens.
Fig.5: Bildschirmaufnahme vom Strandgebiet nach der Promenade von Çaliş. Aroma Beach, Yücel Hotel, Yörük Cadiri and Güvens.
(Google Maps, 2015)

Fig.8: Tents on Çaliş Beach promenade.
Fig.8: Zelte am Strand – Çaliş Promenade.
(Foto: M. Stachowitsch, 2015)

Fig.6: Screenshot: Sunset and Jiva resorts.
Fig.6: Bildschrimaufnahme vom Strandgebiet rundum den Standpunkt Sunset und Jiva.
(Google Maps, 2015)

Fig.9: Chain barrier in front of Aroma Beach in 2014, removed in 2015
Fig.9: Sperrkette vor Aroma Beach im Jahr 2014.
(Foto: M. Stachowitsch, 2014)

Fig.7: Screenshot of area around Spor and Surf Café. Large area covered by plastic mats (see circle).
Fig.7: Bildschirmaufnahme vom Strandgebiet rundum Spor und Surf Café. Große Strandfläche bedeckt durch Plastikmatten.
(Google Maps, 2015)

Fig.10: Aborted nesting attempt of an adult *Caretta caretta* due to obstacles.
Fig.10: Abgebrochener Nistversuch eines adulten *Caretta caretta*, bedingt durch verschiedenste Hindernisse.
(Foto: M. Stachowitsch, 2015)

Fig.11: Playground at Sunset Beach, photo taken after construction in 2009.
Fig.11: Spielplatz am Strand von Sunset, Foto des Standortes nach der Errichtung im Jahr 2009.
(Foto: C. Fellhofer-Mıhcıoğlu, 2009)

Fig.14: Re-dug trench to prevent vehicle access to beach.
Fig.14: Künstlich angelegter Graben, um Kraftfahrzeuge vom Strand fernzuhalten.
(Foto: M. Stachowitsch, 2015)

Fig.12: Playground and new sunshade roofs at Sunset beach in 2014.
Fig.12: Spielplatz und neue Sonnendächer am Strand von Sunset.
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Changes on the beaches Yanıklar/Akgöl 2015

Andrés Kluge, Iasmina Laza, Lena Kaufmann

KURZFASSUNG

1993 wurde das Meeresschildkröten-Projektpraktikum, in Zusammenarbeit mit verschiedenen türkischen Universitäten gegründet, um den langfristigen Erhalt der unechten Karettschildkröte (*Caretta caretta*) zu sichern. Dabei wurden diesjährig vom 27. Juni bis 12. September, gemeinsam mit der Hacettepe Universität, Daten der Strände in Çalış, Yanıklar und Akgöl erfasst, um die Veränderungen, die hauptsächlich vom wachsendem Tourismus resultieren, genau dokumentieren zu können. Obwohl diese Niststrände von mehreren internationalen Konventionen des Naturschutzes zur "Special Protected Area" (SPA) ernannt wurden, zeigen sich jährlich viele Probleme unterschiedlichster Art. Zur Dokumentation von Veränderungen werden zum Beispiel jährlich Daten von Sonnenliegen, Sonnenschirmen, Scheinwerfern und Pavillons am Strand gesammelt. Ein Vergleich mit den bisher bekannten Anlagen zeigt, dass sich die Zahl der Einrichtungen im Vergleich zum letzten Jahr, größtenteils nicht geändert hat. So wurde ein deutlicher Anstieg "nur" beim "Majesty Club Lykia Botanika" festgestellt, der statt 190 nun 268 Sonnenliegen aufstellte. In Summe wurden für den gesamten Strandabschnitt 787 Sonnenliegen und 126 Sonnenschirme gezählt.

Diese grundsätzlichen Schwierigkeiten werden hauptsächlich von den zwei großen Hotels "Majesty Club Tuana" und "Majesty Club Lykia Botanika" im Westen von Yanıklar zusammen mit dem "Karaot Buffet" in Akgöl hervorgerufen. Seit diesem Jahr ist jedoch noch ein weiterer Hotelkomplex im Osten von Yanıklar fertiggestellt worden, das "Barut Sensatori Fethiye", welcher nun das Landschaftsbild in diesem Abschnitt wieder komplett neu gestaltet und unsere Projektorganisation vor neuen Herausforderungen bezüglich des Nestschutzes stellt.

ABSTRACT

In 1993 the University of Vienna established together with several Turkish universities a sea turtle conservation effort to preserve the population of the Loggerhead Sea turtle (*Caretta caretta*). To analyse the changes on the beaches at Çalış, Yanıklar and Akgöl, which are

mostly caused by increasing tourism, we collected data in cooperation with the Hacettepe University from 27 June to 12 September. Although these beaches with high usage by sea turtles were declared a "Special Protected Area" (SPA) by international conventions of nature conservation, they still face many different problems over the years. A comparison with the established infrastructures shows that the number of facilities has not changed a lot. The "Majesty Club Lykia Botanika", for example, increased the number of sunbeds from 190 (in 2014) to 268 this year. All in all we counted 787 sunbeds and 126 parasols in our beach sector.

The fundamental problems are mainly caused by the two main hotels "Majesty Club Tuana" and "Majesty Club Lykia Botanika" in the western part of Yanıklar, and in Akgöl by the "Karaot Restaurant". Importantly, this year a major new hotel at the eastern part of Yanıklar, the "Barut Sensatori Fethiye", was completed: it now occupies a major section of this beach, including considerable parts of the sea turtle nesting zone, and represents a major new challenge to the sea turtle monitoring teams.

INTRODUCTION

From 24 June to 12 September, students of the University of Vienna and Hacettepe University (commissioned to Akdeniz Koruma Dernegi) monitored the important nesting beaches of the Loggerhead Sea turtle (*Caretta caretta*) at Çalış, Yanıklar and Akgöl. The aim is to compare the collected data with our past results. These three beaches together belong to one of the 12 nesting areas with key importance for *Caretta caretta* in Turkey (Medasset 2012). This species is the most abundant sea turtle in the Mediterranean Sea, with an estimated 5000 individuals (Demetropoulus & Hadjichristophorou 1995).

In this report we focus on Yanıklar and Akgöl, where one of the two groups of students were located at "Onur Kamp" (Fig. 1). From there, one team started to the eastern part of Yanıklar through the "Desert" (named by our team - way from "Barut Sensatori Fethiye" to "Karataş Beach Restaurant"), ending with the "Small beach" (Fig. 1). The other team went across the shorter western part of Yanıklar to Akgöl.

Overall, the beach has numerous facilities including the major hotels "Majesty Club Tuana" (in the following "Tuana"), "Majesty Club Lykia Botanika" (in the following "Botanika"), the

new “Barut Sensatori Fethiye” (in the following “Barut”) along with numerous smaller facilities such as “Karaot Restaurant”, “Yonca Lodge”, “Doğa Camp” and “Karataş Beach Restaurant” (Fig. 1). Every day, we monitored the beaches in two separate shifts. The night shift existed only until the first hatchling was detected and began at 10 pm. The aim was to encounter adult sea turtles on the beach, to wait until they finished their egg deposition and then to measure them and to examine those for injuries while they returned to the sea. The morning shift started at sunrise and these shifts were continued during the whole summer monitoring period. The goal was to collect data on tracks in the sand, nesting locations, egg depositions, size of the nests and to take care of every single clutch up until an excavation several days after the last hatch, where we possibly could save trapped hatchlings in time, followed by determining the success rate. We also watched for problems that already existed, changed or appeared for the first time. These problems typically involve human impact, specifically increasing tourism, which can change a natural habitat so strongly that it negatively impacts an ecosystem, including the habitat of species such as *Caretta caretta* (Miller & Auyong 1991). This makes it important to know about the status quo and its changes and to compare the data with that of past years. Accordingly, we also take notes on information boards, light pollution, water and beach facilities of the hotels, vehicles on the beach, litter pollution, fire places, fishery and other important occurrences. Especially the data on the new Barut hotel, which were recorded for the first time, will be important for the upcoming years regarding this area.

Fig. 1: Aerial view of Akgöl and Yanıklar beach (the new "Barut Sensatori Fethiye" hotel is not yet visible in this image)
Abb. 1: Satellitenaufnahme des Strandes von Akgöl und Yanıklar ("Barut Sensatori Fethiye" Gebiet sieht bereits anders aus aufgrund des fertiggestellten Hotelkomplexes)
(Photo: google maps 22.10.2015)

MATERIAL AND METHODS

From 27 June to 12 September, students from the Austrian University of Vienna and the Turkish Hacettepe University worked in teams on Fethiye's beaches. The Akgök/Yanıklar beach area was split due to practical reasons: the part from Onur Kamp, where the students were staying, to the western end of Akgöl was about 1.5 km long, and the other part from Onur Kamp to Çalış Tepe directly after Small Beach was about 4 km long (Fig. 1). The teams did two work shifts every day, documenting the condition of the beach and the nests, measuring adults and tracks, taking care of the hatchlings when needed and excavating the nests. At about 6 a.m. the morning shifts started. Two groups of two or more people each were responsible for either the Akgöl or Yanıklar area. During the night shift, which started at about 10 p.m., one group of at least two people searched for adults and checked the nests.

Additional data collection involved measuring temperature and air moisture three times a day, documenting and excavating nests, observing and taking photos and notes of any circumstances that were or seemed to be unusual or unnatural. These included beach

modifications, light and litter pollution, tourism impacts, vehicles on the beach or fishery. Beach facilities, including sunbeds, gazebos/pavilions and parasols as well as water sport facilities were documented and the numbers were compared with those of the last years.

RESULTS

1. General condition of the beach

Along the entire stretch, i.e. from the western end of Akgöl to the eastern end of Yaniklar, the conditions regarding beach structure and composition, width, steepness but also frequency of human or natural disturbances are very different. Consequentially there were "hotspots" where many nests were located at areas that were better suited for the turtles than others.

The westernmost end of Akgöl can definitely be described as one of these "hotspots", as it has had dense nesting over the last years (Herzog & Kniha 2014; Lesch & Mähr 2013), probably thanks to the fine-grained sand and relatively little disturbances (no hotel or artificial light at night). However, there were problems here as well. Like last year, tourists put their sunbeds and parasols close to the nests, even though we put cages on the nests. People sometimes slept at the pavilions on the beach, which was new compared to last year, and even camped there. Interestingly before an official inspection of the special protected area, the wooden pavilions were removed but put back about one week later (Fig. 2).

The on-the-spot visit was conducted by the Bern Convention on 29. July in the context of monitoring and to check enforcement of conservation measures for the loggerhead turtle in Patara and Fethiye Specially Protected Areas (Turkey). The visit consisted of an independent expert, a member of the Convention's Secretariat, MEDASSET, and representatives of the IUCN and WWF-Turkey. Besides the visit of the site, the programme included meetings with the national and local authorities, as well as with other stakeholders. (http://www.coe.int/t/dg4/cultureheritage/nature/Pressrelease/Media_Advisory_Turkey.pdf, 16.11.2016, 17:58)

Furthermore, it is worth mentioning that, like in 2014, one nest was laid in the moist sand very close to Akgöl lake (Herzog & Kniha 2014); the excavated eggs were all moldy and no living hatchlings emerged. This moist area connecting the lake and the sea was dug over once with an excavator. Some of the nests on the beach in front of the parking lot there, where the

beach is mostly composed of small gravel, were lost, i.e. they could no longer be found during the shifts. This is probably because the beach structure makes it very difficult to find a nest. On other cases the tourists sometimes removed the markings, and in some other cases the nests were very close to the sea and repeatedly flooded.

There were only three nests around Karaot Restaurant Human disturbances were more frequent here and the beach was composed of gravel and, further in the direction of Tuana, of bigger stones which are poorly suited for nesting. Only one nest was located in this area. A few times, hatchlings got stuck between such bigger stones here and could not free themselves anymore.

The river next to Tuana was constantly under construction: excavators were changing the direction of the river bed frequently (Fig. 3). Parts of the beach in front of Tuana were dug over several times (Fig. 4) and, at least twice, pipes were laid across the beach to the sea very close to the nests. Interestingly, there were more nests in this area than in previous years. The security guards here also sometimes created problems: they showed the hatchlings to tourists and once even took them out of the bucket where our team had put them. Shortly before the inspection in the framework of Bern Convention, the parking lot in front of Tuana was bordered with big potted plants so that cars could no longer drive directly on the beach. These plants remained in place even after the inspection was over.

Fitting into the general trend of more nests this year, there was a secret nest between Tuana and Yonca. Moreover, also in front of Yonca, Onur/Doğa Kamp and Botanika, 5 nests were laid. Light pollution and tourists were the biggest problems here.

Another “hotspot” was the part of the beach in Yaniklar between Botanika and “Lonely Tree”. Especially midway between those two spots near three big holes in the beach (Fig. 5) and close to “Lonely Tree” there were many nests. The three holes point to illegal sand removal. The overall conditions along this part of the beach were the same as the last years. Very problematic here was the litter pollution. Also very interesting this year was the high predation rate. A predator, probably a jackal, dug up many nests and sometimes even managed to breach predation cages that were put on every nest at this part of the beach. In the whole Yaniklar area, tourists on horses riding alongside the beach were observed, especially early in the morning (Fig. 6).

At the end of the nesting season the litter pollution around Lonely Tree got increasingly worse, probably due to the vicinity of the so-called picnic area, litter pollution appeared to spread from there. The problems remained the same as last year and the year before. However, even here there were more nests than in the past years. This year, someone also used a nest as a fireplace.

The biggest change since last year was the completion of the huge hotel complex Barut Sensatori Fethiye (Fig. 7). This summer it was in service for the first time. The construction of Barut has changed this part of the beach completely. Like at Tuana and Botanika there was animation and loud music until the middle of the night and light pollution was severe. Interestingly and surprisingly, the number of nests increased here compared to past years, and it could be referred to as a "hotspot". We had to put cages with nets on the nests to keep the hatchlings from running towards the artificial lights. One of the nests in front of Barut was very close to the waterline. Tourists were at the beach at night and put their sunbeds close to the nests during daytime. Since the Bern Convention inspection, the staff put the sunbeds behind the wooden walkways, i.e. towards the upper part of the beach at night. Stones on the beach were removed manually before the tourism season and at least once, at the end of August, during the season to provide a full sand beach for the hotel guests; this may have had a positive effect by somewhat improving beach quality for turtle nests. Some of the security personnel helped our team by calling at night when the turtles were hatching, but others also brought tourists and failed to heed any instructions.

More nests than last year were found between Barut and Karataş Beach Restaurant. Here we even found a so-called secret nest based on a predation attempt by a jackal. The predator was seen once in this area during the observation of an adult turtle. East of Karataş, the beach condition stayed more or less the same as in the past years. In the whole area, vehicles frequently drove on the beach. Also at Karataş Restaurant light pollution was a threat to the hatchlings.

At the eastern end of Yaniklar, Small Beach (Fig. 8), the 1 nest that had been found was lost because of the huge number of tourists, many of whom also dug at the beach and removed nest markings. Cars drove on the beach here and litter pollution was also a problem.

2. Information signs

Although the overall number is not sufficient, and the locations are suboptimal, there are some information boards in the Akgöl/Yanıklar beach area. Especially in conversations with interested people, the Austrian and Turkish team also tried to contribute as much as possible to informing residents and tourists about the turtles and the special protected area.

Directly at Akgöl beach close to the lake, there was an information board in Turkish and English (Fig. 9). In this area we also installed stakes with paper sheets with information, for example nearby the parking lot (Fig. 10). The information board close to Karaot Restaurant in the direction of Akgöl beach was still there, as last year (Fig. 11), its position on the upper part of the stony beach, far away from the waterline where people usually walk, means that its effect was probably not optimal.

At Tuana the hotel put up signs, even on the cages, stating that the faeces that could be found in the sea in front of the hotel for more than a week were “sea turtle excrements”. Closer examination revealed that this could not have come from sea turtles but clearly involved illegal dumping of sewage into the sea.

The information board between Yonca Lodge and Onur Kamp is also still there (Fig. 12). This sign was the one containing the most useful and exact information about the rules that should be followed. This year, Yonca Lodge put their own cardboard signs on the cage on the nest in front of their restaurant; we had to remove one of them because it was casting a shadow on the nest. Barut also gave us their own cages with information signs on them (Fig. 13). Further down the beach the two posts with a single remaining information board are still there (Fig. 14, 15, 16 and 17), approximately at the height of Karataş Beach Restaurant.

3. Light pollution

Light pollution is a major problem across the whole beach for adults, but mostly for the hatchlings at night, because of the lights coming from the different infrastructures such as hotels, restaurants or bars. Light disturbs the normal behaviour of sea turtles because it plays a major role in orientation, especially for hatchlings. That is why the focus of the night shifts switched from adults to hatchlings. In normal conditions, when the first hatchlings emerge, night shifts must be stopped because of the danger of stepping on them in the dark. Hatchling

controls were needed because of the light pollution. Special cages with round nets were installed (Fig.18): they prevented hatchling from crawling towards the light and dying on the opposite path from the sea.

This year in Akgöl, one main problem was at Karaot Restaurant, where a large floodlight influenced the sea turtle behaviour at night. The light was visible for humans from Tuana hotel too, but was a problem for the turtles from the Karaot Restaurant until the bridge of Tuana. That light was apparently present in past years as well. At Tuana, there were lights on the beach along the footbridge. They were low and less bright and were turned off later in the evening around 12 p.m. Sometimes green or yellow light emanated from the bar and from the disco of Tuana, but not every night. This is because a new way of alternate entertainment nights between Tuana and Botanika was noticed this year by the working groups during night control in front of the hotels. Between Tuana and Yonca Lodge, at the so called "Dog House", a light was installed over a small improvised green net pavilion, which also disturbed emerging hatchlings. Sometimes they also used to build fire there at night. Onur Kamp had two power poles with small light bulbs on top, near the beach, and a light bulb at the top of one pavilion. It was permitted to turn them off at night, after talking to the owner of the camp.

In Yaniklar, at Botanika the lights were covered with dark paint on the side facing the sea (Fig. 19). In past years, such painted lights were sometimes, but not always, present. For example last year, 2014 (Fig. 20), the lights were unpainted, but in 2013 (Fig. 19) they were painted on one side in black (Lesch & Mähr 2013).

This year's new situation was Barut, which was newly opened this year. The lights created a big problem for the adult sea turtles, but also for the hatchlings. At the beginning of the season, we observed colorful lights inside the pavilions along the beach (Fig. 21). The hotel staff was informed by our Turkish colleague that these lights harm the sea turtles, and they were turned off thereafter. Another problem at Barut was the two very large flood lights in the forest next to the security hut (Fig. 22). They were orientated partly towards the beach and partly towards the picnic area and remained lit until late in the morning. Sometimes the security personnel were open to suggestions to turn these spotlights off, but later in the season they refused to turn them off. In general at Barut light came from the whole hotel complex, including from a restaurant near the beach. On some nights, colourful, bright lights and loud music came from the hotel's entertainment theatre. At the other end of the Barut resort is a sports area with a very high spotlight: It is so bright that it illuminated large areas of the

adjoining beach. At Karataş beach restaurant, because of a light, hatchlings crawled in the wrong direction, up into the vegetation and along a wooden boardwalk. In the parking lot here, we recorded lost hatchlings and hatchlings run over by cars. The hatchlings found dead in the parking lot were attracted by the lights here. This year, Small Beach was intensively used by tourists. Some camped overnight, inevitably using lights at night.

4. Beach and water sport facilities

Akgöl Cabin and Karaot Restaurant Region

Unlike last year, the cabin at the end of Akgöl was in use this summer. The facilities included 4 wooden pavilions (Fig. 2) and beanbags. The latter explained why Styrofoam was found everywhere on this part of the beach for a few days, even in the nests. Sunbeds and parasols which had to be stuck in the sand were also present (Fig. 23). Close to the parking lot at Akgöl Cabin, there was a long canopy at the upper part of the beach (Fig. 24).

At Karaot Restaurant the situation has not changed much since last year. Overall, the numbers of beach facilities for the area were very similar to the last years (Tab. 1).

Tab 1: Numbers of beach facilities at Akgöl Cabin and Karaot Restaurant 2011-2015; *no data
Tab 1: Anzahl der Strandeinrichtungen von Akgöl Cabin und Karaot Restaurant 2011-2015; *keine Daten erhoben

Beach facilities - Karaot Restaurant + Akgöl Cabin	2011	2012	2013	2014	2015
Sunbeds	22	27	20	20	20
Wooden pavilions	3	3	12	12	11
Parasols	13	7	1	1	11
Roofed terrace/canopy**	*	*	1	1	2
Tables	*	*	*	*	7
Beanbags	*	*	*	*	8

Majesty Club Tuana

The number of sunbeds at the beach in front of Tuana has not changed substantially since last year (Tab. 2) and the water sport centre as well as the diving school and the beach volleyball court is still there. At night the sunbeds were usually put back behind the wooden walkway in the upper part of the beach; during daytime they were often put very close to nests by tourists (Fig. 25). A tourist boat was often docked at the pier in front of the beach.

Tab. 2: Numbers of beach facilities at Majesty Club Tuana 2011-2015; *no data
Tab. 2: Anzahl der Strandeinrichtungen von Majesty Club Tuana 2011-2015; *keine Daten erhoben

Beach facilities - Majesty Club Tuana	2007	2008	2009	2010	2011	2012	2013	2014	2015
Sunbeds	310	326	268	233	201	170	*	254	246
Sunroofs	33	33	33	40	34	*	*	40	*

Yonca Lodge

The sunbeds and parasols in front of Yonca were not counted this year, the number of pavilions was increased by 1 (Tab. 3).

Tab. 3: Numbers of beach facilities at Yonca Lodge 2011-2015; *no data
Tab. 3: Anzahl der Strandeinrichtungen von Yonca Lodge 2011-2015; *keine Daten erhoben

Beach facilities - Yonca Lodge	2011	2012	2013	2014	2015
Sunbeds	20	19	19	11	*
Wooden pavilions	1	2	2	2	3
Parasols	*	5	5	10	*

Onur and Doğa Camp

Like the year before, the wooden pavilion and the sunroof/canopy (Fig. 26) is still there, the sunbeds were not counted (Tab. 4).

Tab. 4: Numbers of beach facilities at Onur and Doğa Kamp 2011-2015; *no data
Tab. 4: Anzahl der Strandeinrichtungen von Onur und Doğa Kamp 2011-2015; *keine Daten erhoben

Beach facilities - Onur and Doğa Kamp	2011	2012	2013	2014	2015
Sunbeds	17	16	29	*	*
Wooden pavilions	0	0	1	1	1
Parasols	0	0	0	0	0
Sunroofs**	4	4	1	1	1

Majesty Club Lykia Botanika

This year the number of sunbeds at the beach in front of Botanika was increased considerably (Tab. 5). They were removed from the lower part of the beach around the time of the beach inspection, but afterwards they were usually left in their previous distribution close to the water (Fig. 27). At the upper part of the beach there were sunroofs, they are the same as last year. Like at Tuana, there is also a tourist boat for trips.

Tab. 5: Numbers of beach facilities at Majesty Club Lykia Botanika 2011-2015; *no data
Tab. 5: Anzahl der Strandeinrichtungen von Majesty Club Lykia Botanika 2011-2015; *keine Daten erhoben

Beach facilities - Majesty Club Lykia Botanika	2007	2008	2009	2010	2011	2012	2013	2014	2015
Sunbeds	134	191	157	157	120	145	*	190	268

Barut Sensatori

The most severe change since last year was the opening of Barut, now the biggest hotel in the Akgöl/Yaniklar area. The former Akmaz Buffet at this site (with its 12 sunbeds and 6 parasols) is now gone. Instead the major hotel complex has a water sports and diving centre (Fig. 28), a pier and a buoy-bordered swimming area (Fig. 29). Wooden pathways criss-cross the beach and connect the hotel buildings, the water sports centre, the pier and the 10 wooden pavilions installed on the beach (Fig. 30 and 31). There were **210 sunbeds** and **104 parasols** in front of the hotel. At the beginning of the summer these were left on the beach all the time, close to the many nests, but starting with the Bern inspection date they always put them behind the wooden walkway at night.

Problematic was also that those walkways were built during the nesting season in the middle of the nesting area.

Karataş Buffet

The number of sunbeds at Karataş was substantially higher this year, as was the number of tables (Tab. 6). Although the condition or numbers of the pavilions were not documented in detail, at least one of them was damaged and no longer in use this year.

Tab. 6: Numbers of beach facilities at Karataş Buffet 2011-2015
Tab. 6: Anzahl der Strandeinrichtungen von Karataş Buffet 2011-2015

Beach facilities - Karataş Buffet	2011	2012	2013	2014	2015
Sunbeds	19	19	47	20	43
Parasols	10	10	0	9	11
Small tables	0	0	5	*	14
Wooden pavilions	0	0	0	3	*

5. Tourism in general

Thanks to the growing numbers of tourist facilities over the years, tourists are coming to this nesting area in increasing numbers. The main problems were in the hotel areas, but the

smaller bars and camp sites also represent a problem for the sea turtles. This year, as in other years, in both areas, Akgöl and in Yaniklar, touristic activity influenced the nesting area of the sea turtles. Nonetheless, this region is a "special protected area" (SPA), and this is incompatible with tourists walking along the shore, being on the beach, or swimming at night. So this year's issue, was the growing facilities for tourists and the increased numbers of tourists in a area where last years there was almost no touristic activity (Barut).

This year, many tourists were at the westernmost end of Akgöl, where they sunbathed very close to nests (Fig. 32), used sunbeds, pavilions, beanbags, umbrellas, rugs and towels on the nesting area. In general, in the mornings the beaches were almost empty, but later during the day became more crowded, and were overcrowded especially on the weekends. Many tourists were seen at the Karaot Restaurant, where they sometimes used the pavilions to sleep over night or used tents near the parking lot of the restaurant. During the day, sunbeds were moved across the beach in front of the restaurant, closer to the sea. Between Karaot Restaurant and Tuana, people occasionally slept on the beach over night or drunk people from parties at Tuana disco fell asleep on the beach. At the nest in front of the hotels, camps or restaurants it was sometimes difficult to work, because tourist always gathered around when we stopped at a nest for lengthier periods (Fig. 34). Interestingly, hotels guests seemed to be more careful in their behaviour than campers. There was less touching and disturbing than with tourists from camps, and we received more interested questions about the project and also received surprising praise for the project. This could be also because of the communication possibilities with foreign versus Turkish tourists. One potential improvement within this project would be to find better ways to communicate with local residents. The main problems at Tuana, Botanika and Barut hotels were the sunbeds and the umbrellas that were between and too close to the nests. At Barut and Karaot Restaurant, adult sea turtles sometimes hit the plastic sunbeds and displaced them a few centimetres. Also on the beaches of the three hotels and on the path between Tuana and Onur Kamp and between Onur Kamp and Botanika, tourists often walked along the sea with flashlights at night. In the picnic area next to Barut, the number of tourists was very high and at the end of the season even led to an increase of litter in the area towards the sea. At the main hotels, Tuana, Botanika and Barut, security men were responsible for patrolling the hotel beaches and for keeping people away from the beach between 8 a.m. and 8 p.m. The cooperation and interaction with the security personnel varied over this season, depending partially on the level of interest of each security men and partly on the strong efforts made by our Turkish colleague. Some helped the team by waking them

up when needed if some new situation with adult sea turtles or hatchlings occurred, or by keeping the tourists at distance while working on a nest in front of the hotels and sometimes turning the lights off. In some cases, they may have thought that they were helping, but actually they created difficulties by taking hatchlings and showing them to tourists, or counting and releasing hatchlings when the team wasn`t there. Importantly, this also involved communication problems so that the values we entered into the datasheets were sometimes uncertain. The Karataş Beach Restaurant was less intensely populated by tourists, but the sunbeds were (Fig. 35) moved around a lot and also placed near the sea. The parking lot here was also often full of cars, extending as far away to Small Beach. The Small Beach was always full with tourist (Fig. 36), and some of them drove on the beach with cars very near to the sea (Fig. 37, 40). The Small Beach is a touristic problem: a lot of disturbance is going on that beach. The marking on the only nest there was repeatedly removed by the tourists so many times that, at the end of the season when we tried to excavate it, we were unable to find any nest or nest contents. Also sometimes tourist camped there over night, usually in their vehicles or tents.

6. Vehicles on the beach

Vehicle tracks, cars and even heavy tractors and construction machines (Fig. 38, 39 and 40) were a common sight on the beach, all of them combined especially in the area around Karaot Restaurant up to the bridge over the river next to Majesty Club Tuana. In the past years, cars frequently entered the beach at Akgöl beach, and the sea turtle monitoring team took elaborate measures to hinder this (e.g., ditches). In 2015, the parking lot has grown it doesn't seem to be the rule anymore to drive on the beach but rather an exception. Maybe this improvement is partly due to the cordon we put up around the parking lot, although in the past the more stable barriers mentioned above also did not entirely prevent cars from entering the beach. In front of Tuana, construction machines were repeatedly parked on the beach and used for alterations of the beach and the river bed (Fig. 3).

Between Botanika and Lonely Tree, vehicle tracks were found in the upper part of the beach, sometimes very close to nests, an observation that has also been made last year and in earlier years. In the upper part of the area between Barut and Karataş Beach Restaurant, vehicle tracks were abundant as well. As was the case two years ago, Small Beach remains another

“hotspot” for cars, though usually they parked off the beach behind or under the trees. Nonetheless, some people camped here with their cars for several days (Fig. 41).

7. Litter pollution

Across the years, litter pollution has been a serious human disturbance in the nesting area, as unfortunately was also the case this year. All kinds of plastic items, from fishing lines to plastic cups and bags and different household or parts of different household items, were spread over almost the entire beach. As known from other years, there were certain focus points with lots of trash accumulations.

In Akgöl the biggest problems were some overly filled trash cans; their contents were sometimes spread around by dogs. Another problem in Akgöl was the beanbags with Styrofoam bean filling (Fig. 42); some of these were damaged and many Styrofoam beans spread over the nests. Between Akgöl Cabin and Tuana, especially near the Tuana bridge, many fishing lines were found and sometimes other fishing items (Fig. 43). These pose a possible threat for adult turtles as well as for the hatchlings. Also on this area, trash was left behind by people who spent the night on the beach. Between Tuana and Botanika, the litter pollution was less severe because many waste bins were available in front of the hotels and the hotel staff maintained a certain level of cleanliness.

Between Botanika and Barut the litter pollution varied, and in the wilder part of Yaniklar beach, many old marine debris items were washed ashore (Fig. 44). The picnic area was very dirty this year. Large amounts of litter were left behind every day (Fig. 45). No trash can was big enough for all the litter of that area (Fig. 46). In Barut, the staff gathered all the litter found in the morning on the beach (Fig. 47) and trash bins were available here (Fig. 48). The subsequent stretch was dirtier near the sea, where fishing lines were left behind by fishers and other debris items were washed ashore. At the end of the Yaniklar beach, at the cliff, litter accumulated in denser amounts than the rest of the shore. Because of the many tourists in Small beach, much trash was left behind too.

8. Fireplaces

The fact that many people make fire on the beach, especially in the more crowded areas, has not changed for the past years. This year it might even have gotten worse because we found many fireplaces not only between the river close to Tuana and Karaot Restaurant, all over the picnic area and at Small Beach, but also directly in front of Lonely Tree close to a nest and, at the picnic area, the remains of one directly on one of the nests; it had been extinguished with water.

One time we observed a fire on a metal plate at the beach directly in front of Onur Kamp, another time a fire at the beach in front of Yonca Lodge and more than once fire in big metal drums between Yonca Lodge and Tuana.

9. Fishery

Fishing was and continues to be an issue in this area. Even though the area is a SPA, fishers continue their activity similar to earlier years by fishing with nets and rods from the beach and using small fishing boats. Spear-fishing was again observed this year. There was even a dead turtle (Fig. 49) found this year on the Yaniklar beach, between Botanika and the Lonely Tree, that was hit by a spear-fisher. Fishery activity this year was observed especially at night and early in the morning. In the water off Akgöl Cabin, very often a small boat was present (Fig.50) with a long net, very close to the shore (less than 100 m). This poses a problem because we always had many hatching nests in that part of the beach. Between Karaot Restaurant and Tuana, especially at the Tuana bridge, rod fishing was common and many fishing lines (Fig.51) were found on the beach, which pose a threat for both adults and hatchlings. Fishing remains, like food leftovers, unusable fisheries rests, used bait, were spread all over the beach from Akgöl to the picnic area and a discarded fishing rod was found at the shore of the stretch after Barut. Sometimes, at night lightfishing was spotted in Akgöl, Onur Kamp and in the picnic area, after the Yaniklar bridge to Barut.

10. Other

In Akgöl, grilled bread (Fig.52) was found directly on a nest. This was surrounded by bird tracks, pointing to a tremendous impact on freshly emerging the hatchlings there. In front of Tuana was a nest that was always splashed with water by humans, until a dense sand layer formed over the nest, so that hatchlings could no longer emerge on their own and some survived with the help of the team. The same nest was possibly affected by a short-term working site one night, when a ditch was dug a few meters away. A pipe was put inside the ditch at the time when the team arrived for hatchling control there. Strange yellowish foam was visible inside the ditch.

In Yaniklar, at the beginning of the season, someone dug a big sand clump sand directly on the nest (Fig.53). After the team marked the nest again, this clump was rebuilt every morning for a few days in the row. The same happened to a nest on Small Beach, where every morning shift the team had to relocate, by triangulation, a removed nest marking. Human disturbances were and remain an issue in this area.

This year another new situation was the strong nest predation; The main problem was the predation by a suspected Jackal, but hatchlings and eggs were disturbed by mold, fungus, nematode, insects and their larvae, crabs and birds. Although this can be seen as a natural disturbance, our team had to devote much more effort to this subject than in past years (Fig.54). The predations could be recognised either by the predator tracks, the suddenly stopping tracks of the hatchlings, or by the damage to the nest, including unearthed and eaten eggs around the nest (Fig.55). Sometimes, at excavation, eggs affected by insect larvae were found (Fig.56).

Another new situation this year in front of Barut, in the picnic area and occasionally in camps and the other main hotels, were the pest control workers. In front of Barut pesticide clouds were often seen in the morning or in the evening (Fig. 57) and this was possible with big turbo fogger pest control machines installed on terrain cars (Fig. 57).

During morning shift, on an adult track bloodstains were found on the stones, which could be a proof of injured turtle, who tried to lay eggs, despite its injury (Fig. 58).

At the Akgöl Cabin, one cage was found completely distorted, probably by a heavy machine, while they modified something at the beach in Akgöl (Fig. 59).

DISCUSSION

Generally, the basic problems in the Akgöl/Yaniklar area have not changed much – human impact still pose the biggest threat to the adult turtles, the nests and the hatchlings. Litter and light pollution have not been reduced, vehicles on the beach and beach alterations are still common, and tourism is exerting increasing pressure. Probably the biggest challenge this year for the conservation project was the completion of the hotel complex Barut Sensatori Fethiye and its major impact on the habitat. The part of the beach where Barut is situated has changed completely in the last few years and many measures were and will be necessary to counteract this development.

This situation raises the need to re-think our working routine and adapt to those new conditions. The distance of the hotel to Onur Kamp where our teams were staying was too far to walk there at night. But, as the light pollution coming from Barut made it necessary to put nets on the nests, parts of the team frequently had to stay at the pavilions in front of the hotel at night or drive there, which was only possible because one of the Turkish colleagues helped out with his private car.

Another very important factor that has apparently not improved much is the knowledge about the turtles and the special protected area. This pertains to the hotels staffs, to tourists and to local residents. Education efforts are sorely needed, but these go beyond the capacity of the fieldwork teams. This would, however, be important to gain the support of hotel staff and others, e.g. for security personnel to reliably call the team when they found hatchlings. Changing staff at the hotels from year to year or even within one summer complicate this matter.

Interestingly, despite these long-term problems in the Akgöl/Yaniklar region, we have recorded a recent positive trend regarding numbers of nests and therefore apparently of females that hatched in this area about 2 decades ago. Therefore, one interpretation is that the conservation project is succeeding and the good work should be kept up.

One of the nests in front of Barut was very close to the waterline; maybe the adult was irritated because of the light pollution.

Stones on the beach here were removed manually before the tourism season and at least once, at the end of August, during the season to provide a full sand beach. This influenced the

increase of the nest number positively and created better and much attractive locations for the sea turtles for laying their eggs.

The fact that conservation steps took place along the beaches (Akgöl/ Yaniklar) before the visit organised by the Bern Convention between 28 and 30 July indicates that people know what is allowed and what not in the special protected area. This visit was the reason for the removal of the wooden pavilions from the westernmost end of Akgöl, why sunbeds and other beach facilities were set up farther from the water in front of the hotels and restaurants and the reason why rules seemed to be taken into account in that period of time.

This behaviour shows that professional beach management is possible and that there is room for improvement.

The financial aspect of beach management is surely a priority issue, but can also create conflicts between interested parties. A strategy should be adopted that all interested parties can benefit from: the conservation of the sea turtles, but also the local community. One consideration might be a special tourist “conservation” tax for this nesting area.

Stricter measures from the side of the national authorities should be taken into consideration for the future, and a much stricter controlling system on site must be developed. The controlling system could be done not only by governmental party, but also involve NGOs, scientists and other experts. Such controls must be done at regular intervals, and fines should be levied on those who don`t respect the rules.

Info boards must be repaired at least once a year, and tourism must be used as much as possible to the benefit of the community and the conservation of sea turtles. One approach could be to conduct information events organised by a specialised team: correct information would help raise awareness for the threats to nature that we produce.

Our conservation work would also benefit from better supplies, including better and more cages and nets, bicycles or even a car for emergency cases.

Research and further projects should remain a priority in this area, as our efforts have led to some improvements over the years in the conservation of the sea turtles. Nonetheless, further improvements and the prevention of additional deterioration will require better cooperation between all interested parties.

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APPENDIX

Fig. 2: Top: Wooden pavilions at westernmost end of Akgöl; Bottom: they were removed during the visit of the Bern Convention experts and put back a week after
Abb. 2: Oben: Holzpavilions bei Akgöl; Unten: wurden vor dem Besuch der Experten der Berner Konvention entfernt und eine Woche später zurück montiert.
(Photos: M. Lambropoulos, I. Svalina)

Fig. 3: The river next to Tuana: frequent and major earth-moving activities
Abb. 3: Flussmündung bei Tuana: Spuren von wiederkehrenden Aus- und Umbaggerungsaktionen.
(Photo: L. Kaufmann)

Fig. 4: Beach in front of Tuana with earth-moving vehicle at work
Abb. 4: Bagger-Arbeiten am Strand vor Tuana.
(Photo: A. Kluge)

Fig. 5: Three big holes made for sand extraction in Yaniklar between Botanika and Lonely Tree
Abb. 5: Drei große Gruben durch Sandentnahme in Yaniklar zwischen Botanika und Lonely Tree
(Photo: M. Stachowitsch)

Fig. 6: Hoof mark on sand: proof for horseriding activy across the beach
Abb. 6: Hufabdruck auf Sand: Beweis für Reitaktivitäten am Strand
(Photo: M. Stachowitsch)

Fig. 7: Barut Sensatori Fethiye: left – 2015 in operation, right – 2014 still under construction
Abb. 7: Barut Sensatori Fethiye: links – 2015 Anlage bereits in Betrieb, rechts – 2014 noch im Aufbau (Photo: 2014 M. Stachowitsch, 2015 A. Kluge)

Fig. 8: Small beach at the eastern part of Yaniklar: tourists, cars and beach umbrellas
Abb. 8: Small beach im Osten von Yaniklar mit Touristen, Autos und Sonnenschirmen (Photo: I. Laza)

Fig. 9: Information board in Turkish and English at the westernmost end of Akgöl
Abb. 9: Informationsschild in türkischer und englischer Sprache, am westlichen Strandende in Akgöl. (Photo: M. Stachowitsch)

Fig. 10: Stake with paper sheet with information about sea turtles in Akgöl
Abb. 10: Pfahl mit einem Informationsblatt über Meeresschildkröten in Akgöl
(Photo: M. Stachowitsch)

Fig. 11: Information board close to Karaot Restaurant in the direction of Akgöl beach
Abb. 11: Informationsschild nahe des Karaot Restaurant in Richtug des Akgöl Strandes
(Photo: M. Lambropoulos)

Fig. 12: Information board between Yonca Lodge and Onur Kamp
Abb. 12: Informationsschild zwischen Yonca Lodge und Onur Kamp
(Photo: M. Stachowitsch)

Fig. 13: Barut cages with information signs. Left: note plastic net on inside to prevent emerging hatchlings from crawling towards the lights and away from the sea
Abb. 13: Barut Käfige mit Informationsschild. Links zu sehen: Schutznetz innerhalb des Käfigs nötig.
(Photo: M. Stachowitsch)

Fig. 14: Remnant of an information board near Karataş Beach Restaurant in 2015
Abb. 14: Informationsschild in unmittelbarer Höhe vom Karataş Beach Restaurant im Jahr 2015
(Photo: M. Stachowitsch)

Fig. 15: Destroyed information board approximately near Karataş Beach Restaurant in 2014
Abb. 15: Zerstörtes Informationsschild in unmittelbarer Höhe vom Karataş Beach Restaurant im Jahr 2014
(Photo: M. Herzog)

Fig. 16: Stakes of former information board near Karataş Beach Restaurant in 2013
Abb. 16: Pfähle eines früheren Informationsschildes in unmittelbarer Höhe vom Karataş Beach Restaurant im Jahr 2013 (Photo: M. Stachowitsch)

Fig. 17: Information board near Karataş Beach Restaurant in 2012
Abb. 17: Informationsschild in unmittelbarer Höhe vom Karataş Beach Restaurant im Jahr 2012
(Photo: M. Stachowitsch)

Fig. 18: Special cages with round nets at problematic spots with light pollution
Abb. 18: Besondere Käfige mit rundem Netzt in Problemzonen mit Lichtverschmutzung
(M. Stachowitsch)

Fig. 19: Lamp blackened on seaward side at Majesty Club Lykia Botanika 2015
Abb. 19: Zum Meer hin geschwärzte Lampe bei Majesty Club Lykia Botanika 2015
(Photo: M. Stachowitsch)

Fig. 20: New, unshaded lamps at Majesty Club Lykia Botanika 2014
Abb. 20: Neue, nicht abgeschirmte Lampen bei Majesty Club Lykia Botanika 2014
(Photo: M. Stachowitsch)

Fig. 21: Colored lights inside the pavilions along the beach at Barut
Abb. 21: Färbige Lichter entlang des Strandes, innerhalb der Pavillions bei Barut
(Photo: S. Wagner)

Fig. 22: Two very large floodlights in the forest next to the security hut of Barut
Abb. 22: Zwei sehr starke Flutlichter im Wald neben dem Security Posten bei Barut
(Photo: M. Stachowitsch)

Fig. 23: Sunbeds and parasols, which are stuck into the sand at Akgöl beach
Abb. 23: Sonnenliegen und Sonnenschirme, welche täglich von Neuem in den Sand gesteckt werden (Akgöl)
(Photo: M. Lambropoulos)

Fig. 24: Long canopy at the upper part of the beach close to the parking lot at end of Akgöl
Abb. 24: Lange Abdeckungsvorrichtung am oberen Teil des Strandes in der nähe des Parkplatzes von Akgöl (Photo: M. Lambropoulos)

Fig. 25: Sunbeds in nesting area in front of Majesty Club Tuana
Abb. 25: Sonnenliegen in der Nistzone bei Majesty Club Tuana
(Photo: M. Stachowitsch)

Fig. 26: The wooden pavilion and the sunroof/canopy in nesting zone at Onur and Doğa Kamp
Abb. 26: Der Holzpavilion und die Sonnendach im Nistbereich beim Onur and Doğa Kamp
(Photo: M. Stachowitsch)

Fig. 27: Sunbeds close to water and in nesting zone at Majesty Club Lykia Botanika
Abb. 27: Sonnenliegen nahe zum Wasser bei Majesty Club Lykia Botanika
(Photo: M. Stachowitsch)

Fig. 28: Water sports and diving centre in nesting zone at Barut
Abb. 28: Wasser- und Tauchzentrum von Barut
(Photo: M. Stachowitsch)

Fig. 29: New buoy-bordered swimming area and boat dock at Barut
Abb. 29: Mit Bojen begrenzter Badebereich und neuer Wassersteg bei Barut
(Photo: M. Stachowitsch)

Fig. 30: Boardwalks connects boat dock with the sports and diving center at Barut
Abb. 30: Holzstege verbinden den Wassersteg mit dem Sport- und Tauchzentrum bei Barut
(Photo: M. Stachowitsch)

Fig. 31: The ten wooden pavilions and wooden boardwalk in the nesting zone in front of Barut
Abb. 31: Die zehn Holzpavilions im Nistbereich bei Barut
(Photo: M. Lambropoulos)

Fig. 32: Tourists at Akgöl sunbathing close to the nests
Abb. 32: Touristen bei Akgöl, die nahe zu den Nester sonnenbaden.
(Photo: M. Lambropoulos)

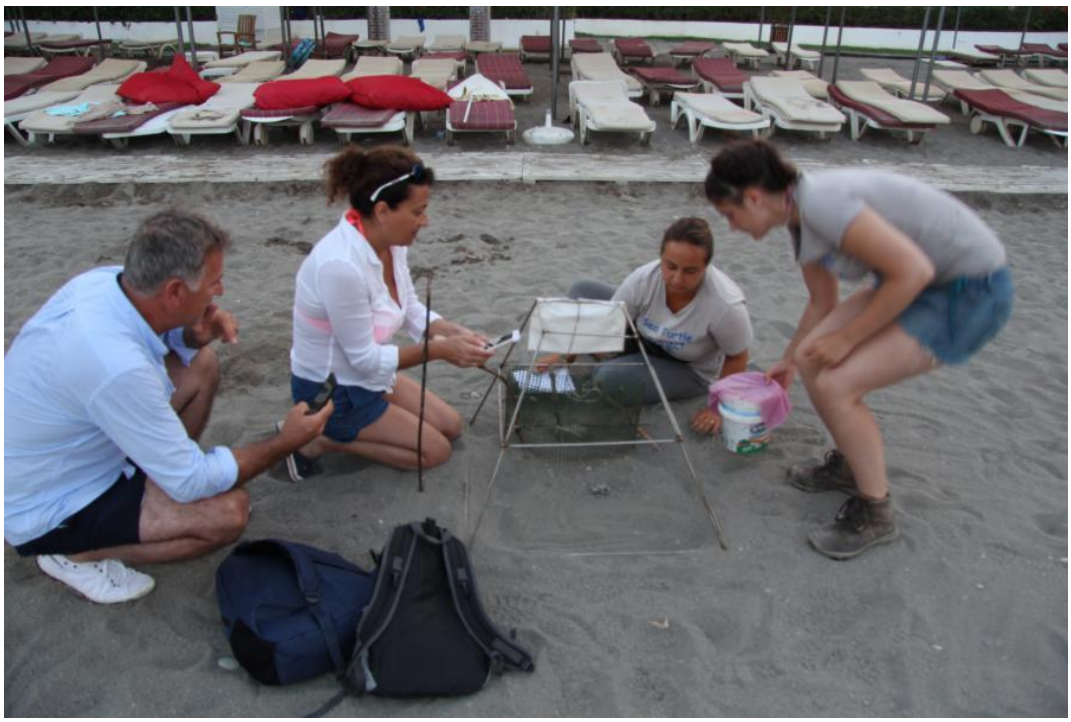

Fig. 34: Tourists watching team at work and taking photographs
Abb. 34: Touristen bei der Arbeit des Teams mitschauen und fotografieren
(Photo: S. Wanzenböck)

Fig. 35: Sunbeds at Karatas Beach Restaurant blocking turtle access to sandy nesting zone
Abb. 35: Sonnenliegen von Karatas Beach Restaurant zu nahe am Meer
(Photo: M.Stachowitsch)

Fig. 37: Small Beach with the extended parking lot
Abb. 37: Small Beach mit dem erweiterten Parkplatz
(Photo: I. Laza)

Fig. 38: Tractor tracks on the beach in front of Tuana
Abb. 38: Fahrzeugspuren am Strand vor Tuana
(Photo: M. Stachowitsch)

Fig. 39: Heavy tractors used on the beach
Abb. 39: Schwergeräte in Verwendung am Strand.
(M. Stachowitsch)

Fig. 40: Parked car very close to the sea on Small Beach
Abb. 40: Geparktes Auto ganz nahe zum Wasser am Small Beach
(M. Stachowitsch)

Fig. 41: Parked car for several days at Small Beach
Abb. 41: Für meherere Tage geparktes Auto am Small Beach
(Photo: M. Stachowitsch)

Fig. 42: Styrofoam bean filling from beanbags in Akgöl
Abb. 42: Styroporkörner aus Sitzsäcken in Akgöl
(Photo: M. Stachowitsch)

Fig. 43: Fishing lines and other fishing items (rubber trousers) found on the beach
Abb. 43: Angelschnüre und andere Angelartikel (Gummihosen) wurden am Strand gefunden
(Photo: M. Stachowitsch)

Fig. 44: Examples for different debris washed ashore
Abb. 44: Beispiele für unterschiedlichen an Land gespülten Müll.
(Photo: M. Stachowitsch)

Fig. 45: Large amounts of litter left behind at the picnic area
Abb. 45: Große Mengen an Abfall werden regelmäßig in der picnic area zurückgelassen
(Photo: M. Stachowitsch)

Fig. 46: Grossly overfilled dumpsters between Barut and picnic area
Abb. 46: Überfüllte Mülltonnen zwischen Barut und picnic area
(Photo: M. Stachowitsch)

Fig. 47: Barut staff gathering trash in the morning in front of Barut beach
Abb. 47: Barut Mitarbeiter sammeln Müll am Morgen von Barut Strand
(Photo: M. Stachowitsch)

Fig. 48: Trash bins on beach in front of Barut. Note wooden walkway blocking turtles on nesting zone
Abb. 48: Mistkübel am Strand vor Barut
(Photo: M. Stachowitsch)

Fig. 49: Dead turtle, apparently hit by harpoon through neck and in the back, near the rear flipper
Abb. 49: Tote Schildkröte, mit Harpunenspuren an der Kehle und der hinteren Flosse
(Photo: I. Laza)

Fig. 50: Small fishing boat in the morning in front of Akgöl nesting hotspot
Abb. 50: Kleines Fischersboot in der Früh bei Akgöl
(Photo: I. Laza)

Fig. 51: Fishing line in Yaniklar on the beach 2014
Abb. 51: Angelschnüre am Strand in Yaniklar 2014 (Photo: M. Herzog)

Fig. 52: Grilled bread on nest found one morning in Akgöl. Bird tracks visible around the bread.
Abb. 52: Gegrilltes Brot wurde in der Früh auf dem Nest gefunden. Vogelspuren rundherum sichtbar. (Photo: I. Laza)

Fig. 53: Repeated human disturbance: sand piled directly on nest at the picnic area
Abb. 53: Wiederholte menschliche Störung direkt über dem Nest bei picnic area
(Photo: A. Kluge)

Fig. 54: Top: predated nest by jackal; Bottom: improvised protection against the predator
Abb. 54: Oben- prediertes Nest von Schakal; unten- improvisierter Schutz gegen den Prädator
(Photos: A. Kluge, M. Lambropoulos)

Fig. 55: Predated eggs by jackal next to nest
Abb. 55: Prädierte Eier vom Schackal neben Nest
(Photo: I. Laza)

Fig. 56: Eggs infested by insect larvae; often found at excavations
Abb. 56: Eier befallen von Insektenlarven; oft im Nest bei Exkavations gefunden
(Photo: I. Laza)

Fig. 57: Top: Pesticide cloud at Barut; Bottom: pest control machine on car in Onur Kamp
Abb. 57: Oben- Pestizidwolke bei Barut; unten- Maschine gegen Schädlinge auf einem Auto in Onur Kamp (Photos: U. Sü, M. Stachowitsch)

Fig. 58: Bloodstains on stones from adult turtle
Abb. 58: Blutspuren von adulter Schildkröte
(Photo: A. Kluge)

Fig. 59: Destroyed cage at Akgöl
Abb. 59: Zerstörter Käfig bei Akgöl
(Photo: A. Kluge)

Predation and protection of loggerhead turtle (*Caretta caretta*) nests by non-invertebrate animals in Yaniklar 2015

Sylvia Wanzenböck and Lukas Fuxjäger

KURZFASSUNG

Der Strand in Yaniklar, in der Nähe der Stadt Fethiye, ist ein sehr wichtiger Niststrand für *Caretta caretta*, die Unechte Karettschildkröte, im Mittelmeergebiet. Ihre Nester sind durch verschiedene Fressfeinde gefährdet. In Yaniklar wurden 2015 die Nester auf den natürlichen Strandabschnitten vermehrt z.B. durch Schakale (*Canis aureus*) geplündert. Es kam zu einem starken Anstieg der Prädation durch Wirbeltiere. In den meisten Fällen wird das Nest nicht auf Anhieb geleert, sondern der Räuber kam in den darauffolgenden Nächten zurück um es komplett zu plündern. Um die Eier vor solchen nicht-Evertebraten Fressfeinden zu schützen, wurden Metal-Schutzkäfige über die Eikammer platziert. Diese Form des Nestschutzes hat den Vorteil, dass sie hochspezifisch ist und gleichzeitig minimal störend ist jedoch ist auch diese Methode nicht zu 100 % zufriedenstellend und sicher. Insgesamt wurden im Jahr 2015, 128 Nester im Bereich Yaniklar (Yaniklar und Akgöl) dokumentiert. Von diesen 128 Nestern wurden 30 Nester von Wirbeltieren geplündert, was 23% aller Nester in diesem Areal entspricht. Insgesamt wurden 9385 Eier in Yaniklar gelegt, von denen 1384 Eier gefressen wurden (15%). 17 Nester wurden durch 1-3 Plünderungsvorgänge komplett geplündert und 12 Nester wurden durch meist 2 Plünderungsvorgänge teilweise geplündert. Am Strandabschnitt von Akgöl wurden ein Nest geplündert. Die Verwendung von Schutzkäfigen half teilweise die Nester vor Plünderung bzw. vor folgenden Plünderungsereignissen nach einem Vorangehenden zu schützen.

ABSTRACT

Yaniklar beach near the city of Fethiye is a very important nesting beach for *Caretta caretta*, the loggerhead turtle, in the Mediterranean. Their nests are endangered by different vertebrae predators. In Yaniklar, the nests on the natural areas of the beach were predated in 2015 by jackals (*Canis aureus*).The number of predation events caused by vertebrae predators increased significantly in 2015 compared to former years. At the most cases the predator didn't empty the whole nest but came back on the following nights to predate them completely. To protect the

eggs from non-invertebrate animals, metal grids were placed over the egg chambers. This form of nest protection has the advantage of being highly specific while being minimally disruptive. But also this method provides not at 100% protection for the nests. In total, 128 nests were recorded on the Yaniklar section (Yaniklar and Akgöl) in 2015. Of these 128 nests, 30 nests were predated by non-invertebrate predators, which represents more than 23% of all nests in this area. A total of 9385 eggs were laid in Yaniklar, of which 1384 eggs were predated (15%). 17 nests were completely predated by 1-3 predation events, and 12 nests were partially predated by mostly 2 predation events. One nest were predated at the Akgöl beach area. The use of the predation cages helped the most time to protect the nests from predation or at least from following predation after an initial event.

INTRODUCTION

The time period after the female loggerhead sea turtles lay their eggs on the beach is a very important but also dangerous period for the developing hatchlings. Predation by mammals is probably one of the most significant biotic threats to the hatching success of the loggerhead sea turtle in Turkey.

Yaniklar beach near the city of Fethiye is an important nesting beach for *Caretta caretta* in the Mediterranean (Baran & Kasparek 1989). This beach can be divided in two main sections to the east and west of Onur Camp (36°41'16.1"N 29°02'51.8"E) next to hotel Botanika and hotel Tuana. The route left from the camp, going east, is named Yaniklar beach, whereas the right side, going west, is known as Akgöl beach (Fig. 1).

The most abundant predators at our study site were the red fox (*Vulpes vulpes*), the jackal (*Canis aureus*) and stray dogs. The tracks of the jackal and the red fox are very similar and are aligned in one row (Appendix Fig. 11). The jackal tracks were a little bit longer than the red fox tracks, and the dog tracks were even longer and not aligned in one row. But not just these three kinds of animals come to the beach also hedgehogs and boars (Appendix Fig. 2) do so to search for food. Often they are attracted by the big amounts of trash and other waste discarded by tourists and local residents. Also on the beach in Yaniklar, in some areas – especially in the picnic area near hotel Barut – the people leave food remains and other trash on the beach (Appendix Fig. 1).

Fig. 1: Oriented from Onur Camp (between hotel Tuana and hotel Botanika), on the left side Akgöl beach and on the right side Yaniklar beach with the picnic area, hotel Barut and Calis Tepe.
Fig. 1: Ausgehend von Onur Camp (zwischen Hotel Tuana und Hotel Botanika), auf der linken Seite der Strand Akgöl und auf der rechten Seite der Strand Yaniklar mit dem Picknickgelände, dem Hotel Barut und "Calis Tepe". (Aufnahme vor Fertigstellung des Hotel Barut)

In this whole region, a team from the University of Vienna, in cooperation with Akdeniz Koruma Dernegi and Haceteppe University, investigated the extent of nest predation by all non-invertebrate animals on *Caretta caretta* hatchlings and eggs. The golden jackal (*Canis aureus*) and the red fox (*Vulpes vulpes*), but also stray dogs and boars can have a devastating impact on loggerhead turtle nests (MacDonald *et al.* 1994, 1) (Appendix: Fig. 1, Fig. 2). Especially the golden jackal and the red fox dig into the nests and break open nearly all of the eggs; remaining intact eggs are typically consumed in the following nights.

In other parts of the world, for example the USA, where loggerhead turtles lay their eggs, also raccoons (*Procyon lotor*), coyotes (*Canis latrans*) and armadillos (*Dasypus novemcinctus*) predate nests (Kurz *et al*. 2011). Another problem for the eggs but especially for the hatchlings are Ghost Crabs (*Ocypodinae*) and birds (Appendix Fig. 3). One conservation possibility is to excavate the eggs and bury them in a special hatching area without predators (so-called hatchery). Nonetheless, the removal of eggs has been found to upset the balance of temperature-induced sex ratios or can lead to higher mortality (Yerli *et al*. 1997). To protect the eggs from different predators, several mechanical nest protection methods have been proposed. These include wire cages (Ratnaswamy *et al*. 1997), wire screens (Yerli *et al*. 1997) and relocation of nests to fenced hatcheries (Talbert *et al*. 1980). The mostly used constructions are galvanized metal screens and

wire grids to protect loggerhead turtle nests (Kurz *et al*. 2011). Also in other nesting areas of Turkey, for example in Patara, Dalyan and Yaniklar, metal grills are used to protect the loggerhead nests from animal predation (Taşkin & Baran 2001, Yerli *et al.* 1997) (Appendix Fig. 4). This form of nest protection has the advantage of being highly specific while being minimally disruptive. In this report we document the predation events and the success and disadvantages of different methods of installing cages in Yaniklar beach for 2015.

MATERIAL AND METHODS

The nests of *Caretta caretta*, the Loggerhead sea turtle, were controlled and checked daily by participants of the sea turtle course of the University of Vienna and by Turkish colleagues from 27.6.2015 until 12.9.2015. Most of the nests were detected when the females dug them on the beach, but some nests were found only by predation or hatching events. The nests were always designated with a capital letter for the nest region (Y = Yaniklar, A = Akgöl) and a number increasing with the nesting date.

The nests found only after predation or a hatching event were designated with a capital letter and an additional "s" for secret nest and a separate numerical order also increasing with the date of discovery (Tab. 1, Tab. 2). Then less disturbed, more natural parts of Yaniklar beach attract a higher number of wild animals and stray dogs, maybe because of fewer people. Beyond hotel Botanika, landward side of Yaniklar beach has remained relatively natural. The forest here extends to the picnic area near hotel Barut. From hotel Barut until Calis Tepe, the area behind the beach was barren and partly obstructed (Fig. 1).

During the morning shift, starting at sunrise, the nests were checked for signs of predation and hatching. If a nest was predated, it was encountered as either partially or completely opened and the predated egg shells were strewn around the nest (Appendix: Fig. 5, Fig. 6). The difference between empty and predated egg shells was that the predated ones were always torn completely open and the normally hatched eggs were only ripped on one side where the hatchling emerged from the egg shell (Appendix Fig. 12). In some cases, the predator didn't empty the whole nest but came back on the following nights. Once the predator found a good nest it came back until the nest was completely empty. If a predated nest was found, the team dug in and looked if there

were still intact eggs left inside the egg chamber. If the nest was completely empty, all egg shells were collected, counted and then thrown back into the egg chamber. The nest was then closed and marked as excavated. If intact eggs still remained in the nest, all predated egg shells were counted and were buried at least 3 m away from the original nesting site. Moreover, the moist sand with remains of the cracked-open eggs was carefully removed from the nest and placed a few meters away from the original nesting site. The sand was then replaced with cool sand from the surrounding area of the nesting site. Sometimes the predator returned and dug in the place where we buried the already predated eggs, following the smell of the broken egg shells and moist sand. To prevent the predator from opening a nest or from returning to an already partially predated nest, predation cages were placed over the egg chamber entrances, centered above the egg chamber. These cages were protective metal grids (1 x 1 m) with a mesh opening of 10 cm. Some were completely flat and some curved on two sides to stop the predator from digging (Appendix: Fig. 4, Fig. 7).

The success of the predation grid depended on how it was placed and secured above the egg chamber. If the grid was on the surface of the sand above the nest, the predator could dig in from aside and predate the nest from that side, but when the grid was dug deeper inside the sand close to the entrance to the egg chamber (10-15cm deep in the sand), where the sand layer was very compact and the hatchlings became stuck at the grid (Appendix Fig. 8).

Another method to place the grid for a nest protection was to dig in the grid 5-10 cm in the sand but ballast it with big stones on the sides, so that the predator was not able to dig out the whole grid and remove it from the egg chamber entrance. The direction oriented toward the waterline was secured by stones that were buried 15-25 cm deep to make it possible for the hatchlings to run to the sea but preventing the predator from digging in from this side. The stones should weigh at least 5-10 kg to prevent the predator from digging in: if they are too small the predator simply dug them out and moved them aside. Heavier stones could not be displaced. In the center of the nest, directly above the egg chamber, the sand surface was lowered so that the mesh grids were visible. The big stones were placed on top of the slope (Appendix: Fig. 9, Fig. 10). The slope should not be too steep, otherwise the hatchlings could have difficulty reaching the seaward-facing exit side.

Two additional common tools used to deter predation by beach-foraging, opportunistic mammalian predators are wire box cages and plastic mash screens (Kurz *et al*. 2011). All these different techniques must be adapted to the specific surroundings and the individual location and situation of the nest.

RESULTS

In total, 128 *Caretta caretta* nests were recorded on the Yaniklar section (Yaniklar and Akgöl) of the Fethiye nesting area in the 2015 nesting season. Of these 128 nests, 30 were predated by non-invertebrate predators. This corresponds to more than 23% of all nests in this area. A total of 9385 eggs were laid in Yaniklar and Akgöl, of which 1384 eggs were predated (15%). In 2014, 61 nests were recorded in Yaniklar, with 4886 laid eggs. Of these 4886 eggs, only 150 eggs were predated (3.1%) (Jopp & Adrion 2014). Importantly, these nests were predated by both insects and non-invertebrate animals. Therefore the estimated number of eggs predated by non-invertebrates is much lower in 2014 than in 2015.

On Yaniklar Beach, 17 nests were completely predated by 1-3 predation events, and 12 nests were partially predated by 1-2 predation events. From all completely predated nests, no hatchling reached the sea. In partially predated nests, no hatchling that had already emerged from the egg died. In the partially predated nests, some hatchlings always reached the sea, but in most nests some hatchlings died (Tab. 2). In Akgöl one nest were partially predated (Y 32).

Eleven of the 15 secret nests (Ys 9, Ys 16, Ys 19, Ys 23, Ys 24, Ys 26, Ys 27, Ys 29, Ys 39, Ys 40, Ys 43) were found based on predation events. At completely predated nests, an average 96% of all eggs were predated: the rest were unfertilized or rotted. In partially predated nests, only 40% of all eggs were predated on average. In two of the entirely predated nests, three predation events occurred. In 15 of all cases, the predator returned a second time, and at 11 nests only one predation event took place (Tab. 1, Tab. 2).

Tab. 1: Overview of all completely predated nests of Yaniklar in 2015 (n.d.: no data, Y = nest found when the female laid it, Ys = secret nest found by predation or hatching)
Tab. 1: Überblick über alle komplett durch Prädatoren geplünderten Nester in Yaniklar im Jahr 2015 (n.d.: keine Daten, Y = Nest gefunden bei Eiablage, Ys = Verborgenes Nest durch Prädation oder Schlupf gefunden)

NestNr.	Excavation Date	Nr. of predated eggs	Total Nr. of eggs	Nr. of predation events	Hatchling reaching sea	Dead hatchling
Y 11	27.07.	81	82	3	0	0
Y 20	18.8.	87	87	2	0	0
Y 25	16.8.	59	59	2	0	0
Y 27	13.8.	88	92	2	0	0
Y 33	16.8.	123	123	2	0	0
Y 35	16.8.	24	24	1	0	0
Y 37	18.9.	41	45	n.d.	0	0
Y 40	22.8.	34	55	2	0	0
Y 41	6.9.	61	61	2	0	0
Ys 16	17.8.	n.d.	n.d.	1	n.d.	n.d.
Ys 19	4.8.	82	82	2	0	0
Ys 23	5.8.	58	63	2	0	0
Ys 26	2.8.	50	53	1	0	3
Ys 27	4.8.	43	43	1	0	0
Ys 29	8.8.	66	66	3	0	0
Ys 40	22.8.	74	75	2	0	0
Ys 43	17.8.	51	51	1	0	0

Tab. 2: Overview of all partly predated nests of Yaniklar and Akgöl in 2015 (n.d.: no data, Y= nest found when the female laid it, Ys = secret nest found by predation or hatching)
Tab. 2: Überblick über alle teilweise durch Prädatoren geplünderten Nester in Yaniklar und Akgöl im Jahr 2015 (n.d.: keine Daten, Y = Nest gefunden bei Eiablage, Ys = Verborgenes Nest wurde durch Prädation oder Schlupf gefunden)

NestNr.	Excavation Date	Nr. of predated eggs	Total Nr. of eggs	Nr. of predation events	Hatchling reaching sea	Dead hatchling
Y 2	1.8.	11	109	1	69	6
Y 8	14.8.	23	73	1	43	7
Y 13	2.9.	11	51	1	41	0
Y 14	28.7.	8	37	2	3	3
Y 18	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Y 32	1.9.	2	57	1	31	0
Ys 2	1.9.	32	97	1	18	1
Ys 9	20.8.	30	88	2	51	2
Ys 14	14.8	52	88	1	31	2
Ys 15	31.9.	23	91	2	69	0
Ys 24	7.8.	73	83	2	5	5
Ys 39	7.9.	79	88	2	9	0
Ys 44	4.9.	18	41	2	9	1

DISCUSSION

In general the situation at Yaniklar beach showed that the predation events are restricted to the beach areas where the landscape behind the beach area is relatively natural and not disturbed by buildings, farmland and human activities. Only one predation event was reported at the Akgöl beach area although most of the adjoining landscape was also relatively natural and quiet (with Lake Akgöl). 30 of the 128 nests were impacted by predation events. All together 1384 eggs were predated, i.e. about 15% of the total egg number. By comparison with the predated eggs in 2014, the value increased extremely. Note, however, that the number of nests laid in the 2015 nesting season was also much higher than in the year before (2014: 61 nests).

The use of the predation cages/grids helped to save the nests from predation or following predation events after a first one. This is evident when comparingthe location of the first-occurring predation events and the timeline of the following predation events. Marking the predation events on the map with the nests clearly reveals that the predator always started its journeys for food beginning from a small path that led out from the hinterland to the beach following the "track of nests" where it was already successful in the previous nights. When it was not successful, because of the predation cages, it moved on until it found an "unprotected" nest or a nest that was not known to us before (unknown secret nest). Especially the partially predated nests were very vulnerable to become completely predated in the following nights after the first predation event. The predator knew that this nest contains food. Especially the smell of the broken eggs that was still present in the affected sand attracted it. This was one reason why we always changed the sand around the nest that had been soaked with egg parts. The smell was a strong centre of attraction for re-predation and potential other predators such as insects, boars, hedgehogs and dogs. The removed sand from the predated nest was nearly always dug up again in the following night.

Other studies, e.g. Yerli *et al.* (1997), report that predation cages were highly effective in protecting the nests. Importantly, the predation cages couldn't always save the eggs. Our field work experience showed that the best way to install a predation grid was to weigh it down with heavy (5-10 kg) stones, and to place these stones on the grids that are buried in about 10 cm depth. The front, which is opened to the waterline, should always be secured with stones buried in 15-25 cm depth in the sand. The sand should gradually slope up to the sides, leaving a gap of about 5-10 cm directly above the upper sand layer of the egg chamber, where the grids of the predation cages are visible. This prevented the hatchlings from being stuck between hard sand layers and the grid mesh when they emerged (Appendix Fig. 6). This construction, when built up as described above is relatively efficient in preventing gold jackals and foxes from digging into the egg chambers of the loggerhead turtles, but even this method cannot guarantee a 100% success. Straying dogs and wild boars could be excluded as predators this year because although they were observed on Yaniklar beach and Akgöl beach, no predation attempt or events by these animals could be documented. On this beach area in Yaniklar we consider the gold jackal (*Canis aureus*) to have been the main predator this year. Jackals, like the most Canidae, are highly adaptable to different environments, with variations in the distribution and abundance of prey

causing variation in the sizes of social groups and home ranges (1). Even though we did not directly observe predation, we found tracks at different parts of the beach and sometimes heard the animal's howl (Appendix Fig. 11). We assumed that at least one individual roamed this area nearly every night and checked potentially interesting nests. The predator always started checking the nests beginning from a small path that came out of the adjoining wood and swamp area. Beginning from one nest, the predator predictably checked one after the other nest for unsecured or poorly secured turtle nests.

It is important to consider that the turtle eggs might be an essential part of the seasonal food for the golden jackal and that the survival success of this predator might depend on the loggerhead turtle eggs in the summer months. Alternatively, this predator may merely use them as a food source because of the easy access. In the Mediterranean and in other parts of the world, sea turtle populations have suffered drastic declines due to human-induced environmental changes, including the introduction of non-native predator species. The number of nests in 2015 was much higher than in the last ten years (Jopp & Adrion 2014). At the same time, the jackal population has also grown in some parts of Turkey.

In conclusion, the use of predation cages/grids against predators such as jackals, foxes and dogs is efficient but also always depends on the surroundings and the effort that is invested in securing a nest with such protective devices.

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APPENDIX

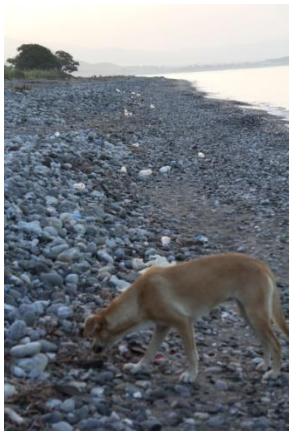

Fig. 1: Trash and leftovers on the beach attract stray dogs and other animals
Fig. 1: Müll und Essensreste am Strand locken streunende Hunde und andere Tiere an.
(Photo: S. Wanzenböck)

Fig. 2: A wild boar (*Sus scrofa*) photographed in 2013 on Yaniklar beach
Fig. 2: Ein Wildschwein (*Sus scrofa*) fotografiert am Strand Yaniklar 2013
(Photo: Yasin Ilemin)

Fig. 3: One potential predator the Ghost Crab (*Ocypodinae*).
Fig. 3: Ein möglicher Fressfeind, die Geisterkrabbe (*Ocypodinae*) (Photo: S. Wanzenböck)

Fig. 4: Predation cage (metal grid).
Fig. 4: Käfig gegen Nesträuber (Metallgitter). (Photo: S. Wanzenböck)

Fig. 5: Predated nest and predated eggs nearby.
Fig. 5: Prädiertes Nest und prädierte Eier

Fig. 6: Secret nest, found due to predation.
Fig. 6: Verborgenes Nest, das durch Prädation

daneben. (Photo: A. J. Laza)

Fig. 7: Predation cage which was curved up on two sides
Fig. 7: Käfig gegen Räuber, welcher an zwei Seiten abgerundet war. (Photo: S. Wanzenböck)

Fig. 9: Nest with correctly installed predation cage.
Fig. 9: Nest mit richtig angebrachtem Gitter gegen Raubtiere. (Photo: S. Wanzenböck)

Fig. 11: Jackal tracks in Yaniklar.
Fig. 11: Schakalspuren in Yaniklar. (Photo: S. Wanzenböck)

gefunden wurde. (Photo: S. Wanzenböck)

Fig. 6: Hatchlings stuckin mesh of predation grid.
Fig. 6: Hatchlinge, die wegen des Gitters stecken geblieben sind.
(Photo: A. J. Laza)

Fig. 10: Correctly installed predation grid, weighted down with stones.
Fig. 10: Richtig angebrachtes Gitter gegen Räuber, mit Steinen beschwert (Photo: S. Wanzenböck)