CARETTA CARETTA HATCHLINGS IN YANIKLAR AND AKGÖL 2016

Simon Kofler

KURZFASSUNG

Das Gebiet Fethiye-Göcek, mit seinen Stränden Yaniklar und Akgöl, ist als SPA (Specially Protected Area) ausgewiesen und ist in der Türkei einer der bedeutenden Niststrände für die Unechte Karettschildkröte *(Caretta caretta).* Auch dieses Jahr arbeitete die Universität von Wien als Gäste der Universität von Pamukkale für den Schutz der unechten Karettschildkröte und den Erhalt ihres Lebensraumes und Nistgebietes. Darüber hinaus wurde das langjährige Sammeln von Nestdaten zu Nisterfolgen und Populationsentwicklungen weitergeführt.

Insgesamt wurden heuer 94 Nester gelegt, wovon 60 in Yaniklar und 34 in Akgöl gefunden wurden. Davon sind 37 Nester teilweise oder zur Gänze Prädatoren zum Opfer gefallen. Besonders viele Nester wurden in Yaniklar prädiert. In den 94 Nestern wurden insgesamt 6323 Eier abgelegt von denen 3386 in Yaniklar und 2549 in Akgöl gelegt wurden. Insgesamt erreichten 3158 Hatchlinge das Meer, was eine Erfolgsrate von 50% ausmacht. Die Erfolgsrate ist im Vergleich zu den vorangegangenen Jahren geringer als der Durchschnitt.

ABSTRACT

The region of Fethiye-Göcek with the beaches Yaniklar and Akgöl is designated as a Specially Protected Area (SPA) and is one of the most important nesting beaches for the Loggerhead turtle (*Caretta caretta).* The University of Vienna, as guests of the University of Pamukkale, worked also this year for the protection of the Loggerhead and the conservation of their habitat and nesting beaches. Furthermore, the collection of nesting data on nesting success and population development was continued.

Altogether, 94 nests were laid, whereby 60 were laid in Yaniklar and another 34 in Akgöl. Of those, 37 nests were partly or fully predated, especially in Yaniklar. In total, 6323 eggs were deposited in those 94 nests, whereby 3386 were deposited in Yaniklar and another 2549 in Akgöl. Altogether 3158 hatchlings reached the sea, which represents a success rate of 50%. This is a decrease of the success rate compared to previous years.

INTRODUCTION

According to the IUCN Red List of threatened Species, published in 1996, the Loggerhead turtle (*Caretta caretta*) was listed as Endangered. Although results of long-term series nest counts show a decrease of 47% in the past years, it is now considered as Vulnerable under current Red List Criteria (IUCN, 2016). The Loggerhead turtle occupies different habitats during its life cycle and migrates over large distances, making it very difficult to estimate the population size (Broderick et al. 2002). Turkey, Greece and Cyprus have the most important nesting beaches for *Caretta caretta* in the Mediterranean (Margaritoulis & Demetropoulos 2003). Female turtles have a strong fidelity to specific nesting sites (Chaupka 2001), i.e. beaches in the region where they hatched themselves, which is called natal homing. Most female Loggerhead turtles have remigration intervals of 2 to 3 years or more (Miller et al., 2003).

The University of Vienna has been working in this region for the past 22 years, in cooperation with different universities in Turkey for the protection and conservation of the Loggerhead turtle. As in previous years, our work took place in Fethiye, with the observed beach regions Çalış, Yaniklar and Akgöl. The beaches of Fethiye are located in southwestern Turkey and are designated as a Specially Protected Area (SPA) and Natural site area (Başkale et al., 2016). Furthermore, Fethiye is one of the most important nesting sites in Turkey for the Loggerhead turtle (Margaritoulis et al. 2003). From the beginning of July until mid-September, the participants of the University of Vienna worked side by side with colleagues from Pamukkale University, which started at the beginning of June. The aim of the program was the protection and conservation of the Loggerhead turtle as well as scientific research.

Tourism development in recent years has increased the risk of losing sea turtle nesting habitats. Different studies have identified the major problems in the area as intensive human activity, sun beds and parasols, light and noise pollution, traffic on the beach and night visitors (Başkale et al. 2012). In addition to these human-caused problems are also natural causes of mortality such as predation, embryonic development failure and inundation (Miller et al. 2003). For the protection of generations of sea turtles, primarily their nesting beaches, marine feeding areas and migration routes should be preserved in their natural state (Katılmiş, 2014).

This contribution presents information on the hatching success of *Caretta caretta* in Yaniklar and Akgöl compared to previous years.

MATERIAL AND METHODS

The daily task was to record nesting data and hatchling activities of *Caretta caretta.* Furthermore, data of adult Loggerhead turtles was recorded such as nesting emergence or non nesting emergence also called “false crawl”. These are tracks of sea turtles when they leave the water, crawl to the beach and return without laying their eggs. After an adult Loggerhead turtle dug a nest and laid there eggs, the straight and curved carapax lengths were measured.

. The students from the University of Vienna and their colleagues from Pamukkale University went together on shifts. In the beginning of the season, they went on dayshifts, which started at 5 a.m., as well as on the nightshifts, until the hatching period started. Afterwards, the latter shifts became too risky because it would have been likely to step on hatchlings. Every morning the participants patrolled and observed the beach of Yaniklar and Akgöl.

During the morning shifts, the participants walked in one line on three different parts of the beach (waterline, mid-beach and back-beach) and looked for tracks of adult turtles, new nests, so-called secret nests, hatchling tracks, lost hatchlings and any other irregularities.

Secret nests of sea turtles were not found by the observer because of several reasons. Either they laid their eggs before the observation period or signs of a nest were overlooked. As a result of hatching or due to predation, these secret nests were found unwittingly.

Furthermore, every known nest were controlled for any signs of hatching activity as well as other disturbances such as nest predation. Also the correct location of each nest were checked regularly because nest markers were occasionally displaced. In regions with a small human impact, the nests were marked with small wooden sticks and stones, whereas metal cages were deployed along stretches with a greater human impact.

If a new nest was found, measurements of the nest were taken, such as the distance to the sea and the nest were marked. Furthermore, GPS measurements were made and the egg chamber was located to verify the nest.

Once a nest started to hatch, the tracks from the nest were counted and recorded. Furthermore, tracks that went in the wrong direction were traced to find lost or stuck hatchlings, to release them to the sea. Three to five days after the last hatching activity, an excavation of the nest were made to see if any hatchlings were stuck in the nest or if there were any other problems. After the excavation all the data of one nest were collected and recorded.

During excavations, which were mostly conducted by Turkish colleagues, the observers dug down to the egg chamber to find dead or living hatchlings and to record remaining eggs in the nest. Living hatchlings were put in a bucket with moist sand, covered with wet towels and were brought to the camp. They were released at the beach of Caliș during the following nightshift

to avoid predation by day-active animals and to maximize their chance of survival. If there were any unhatched eggs left in the nest, they got opened to determine the embryological stage. There are 31 different stages of embryological development which are distinguishable (Crastz 1982). Therefore, a well-equipped laboratory would be needed. To simplify the fieldwork the eggs were classified in the stages early, middle and late which can be distinguished without any special equipment. When an egg had a germinal disc and the embryo has not shown any differentiation of body structures it was in an early stage. When there were any differentiations of body structures and the eyes were visible it was a middle stage and when the embryo was pigmented it was considered as a late stage.

These stages were counted as well as dead or living hatchlings, empty eggshells, unfertilized eggs, eggs with an undefined embryological stage and hatchlings that stuck in the egg. Furthermore, the egg chamber was measured. After the excavation all the data of one nest were collected and recorded.

RESULTS

In total, 60 nests were observed in Yaniklar and another 34 in Akgöl, yielding a total of 94 laid nests. Forty-seven of these nests in Yaniklar and 30 nests in Akgöl were secret nests. Compared to the average of the past 21 years (Tab. 1), this year's result of 94 nests is clearly higher than the mean of 83 over the past 21 years.

Tab. 1: Number of nests in Yaniklar and Akgöl over the past 22 years.
Tab. 1: Anzahl der Nester in Yaniklar und Akgöl der letzten 22 Jahren.

Year	Yaniklar	Akgöl	**Total**
1994	94	22	**116**
1995	133	36	**169**
1996	37	28	**65**
1997	57	28	**85**
1998	78	27	**105**
1999	65	8	**73**
2000	68	23	**91**
2001	79	24	**103**
2002	42	26	**68**
2003	78	17	**95**
2004	25	12	**37**
2005	57	13	**70**
2006	50	9	**59**
2007	55	31	**86**
2008	49	16	**65**
2009	43	34	**77**
2010	45	23	**68**

Tab. 1 (cont.): Number of nests in Yaniklar and Akgöl over the past 22 years.
Tab. 1 (forts.): Anzahl der Nester in Yaniklar und Akgöl der letzten 22 Jahren.

Year	Yaniklar	Akgöl	**Total**
2011	27	17	**44**
2012	48	28	**76**
2013	49	20	**69**
2014	41	20	**61**
2015	78	50	**128**
2016	60	34	**94**
Mean	59	24	**83**

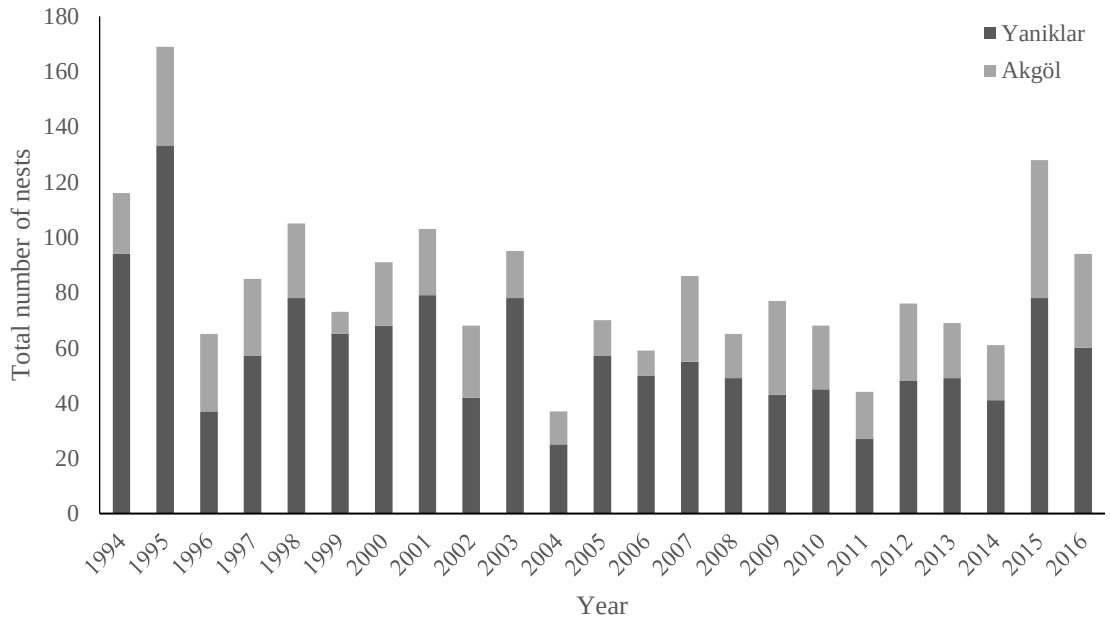

Fig. 1: Total number of nests in Yaniklar and Akgöl from 1994 to 2016.
Abb. 1: Anzahl der Nester in Yaniklar und Akgöl von 1994 bis 2016.

Figure 1 indicates the total number of nests in the period 1994 to 2016 in Yaniklar and Akgöl. The minimum value was recorded in 2004 and the maximum in 1995. Examining the beaches separately reveals a minimum number of 25 nests (Tab. 1) in 2004 and a maximum of 133 nests in 1995 for Yaniklar beach. In Akgöl, the minimum was 8 nests in 1999 and the maximum was 50 nests in 2015.

Tab. 2: Percent of impacted nests of Yaniklar and Akgöl.
Tab. 2: Prozentuelle Aufteilung der negative Einflüsse auf die Nester in Yaniklar und Akgöl.

	Fully pre-dated	Partially Predated	Infested by larvae	Nests without any mentioned impact
Yaniklar	14	15	2	29
Akgöl	0	6	0	28
Total	14	21	2	57

Table 2 presents the different negative influences that affected the nests in Yaniklar and Akgöl in 2016. More than 50% of the nests were affected in Yaniklar this year, mostly by predation. In comparison, Akgöl had a very low percentage of affected nests. In total, 57 nests were not affected by the above-mentioned impacts.

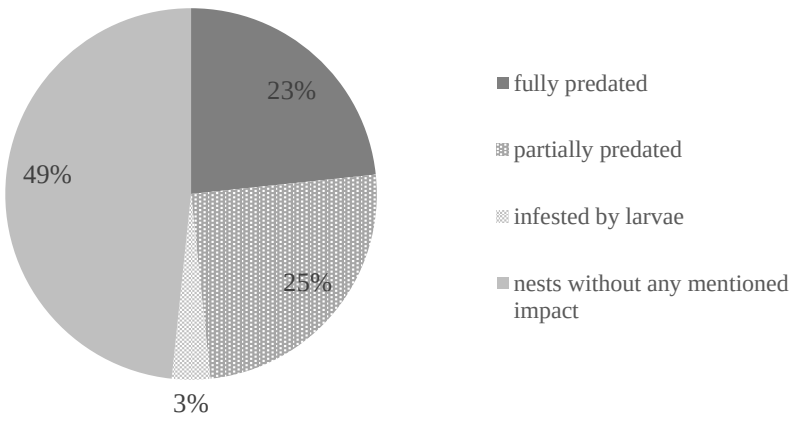

Fig. 2: Type of impacts on the nests at Yaniklar (in %).
Abb. 2: Prozentuelle Aufteilung der negativen Einflüsse der Nester in Yaniklar (in %).

Figure 2 indicates the percentage of impacts on the nests in Yaniklar in 2016. 23% of the nests were fully predated, most likely by carnivores and scavengers such as foxes, dogs, badgers or the golden jackal. Another 25% were partially predated or hatchlings were found dead on the beach or in the nests during excavations, which shows an increasing predation rate compared to last year`s observations. 3% of the nests were infested by different kinds of larvae such as those of Coleoptera, and nearly half of the nests were not affected by the above-mentioned impacts.

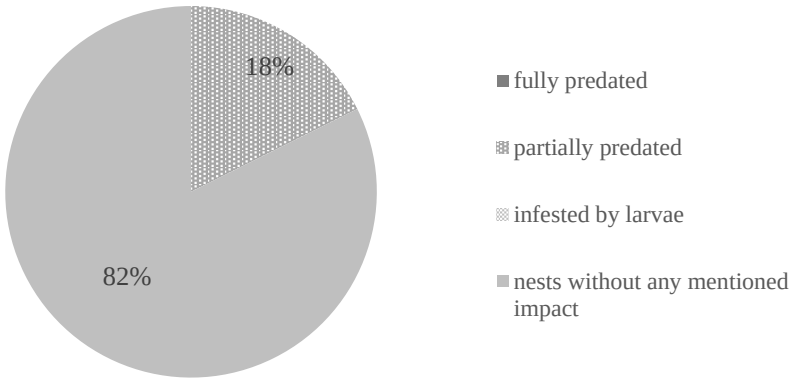

Fig. 3: Type of impacts on the nests at Akgöl (in %).
Abb. 3: Prozentuelle Aufteilung der negativen Einflüsse der Nester in Akgöl (in %).

Figure 3 indicates the percentage of impacts on the nests in Akgöl in 2016. 18% of the nests were predated or hatchlings were found dead on the beach or in the nests during Excavations and 82% of the nests were not affected by any impacts.

Tab. 3: Total number of eggs in Yaniklar and Akgöl.
Tab. 3: Anzahl an Eiern in Yaniklar und Akgöl.

Year	Yaniklar	Akgöl	**Total**
2009	3262	2428	**5690**
2010	3695	1523	**5218**
2011	3464	2178	**5642**
2012	4052	2247	**6299**
2013	3894	1536	**5430**
2014	3408	1478	**4886**
2015	5810	3575	**9385**
2016	3774	2549	**6323**
Mean	3919.9	2189.3	**6109.1**

Table 3 indicates the total number of eggs found during the period 2009 to 2016 on the beaches of Yaniklar and Akgöl, with a maximum of 9385 eggs in 2015 and a minimum of 4886 eggs in 2014. This year, 3774 eggs were found at Yaniklar and 2549 at Akgöl. Altogether 6323 eggs were recorded, which are more the 200 eggs over the average of the past years (but a considerable drop from the record 9385 in 2015).

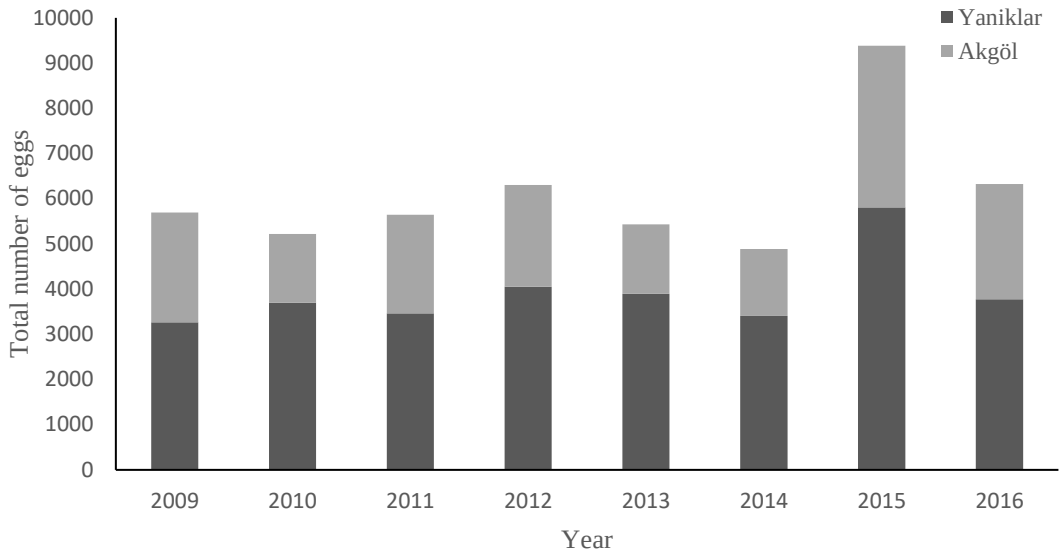

Fig. 4: Total number of eggs in Yaniklar and Akgöl.
Abb. 4: Anzahl von Eiern in Yaniklar und Akgöl.

Examining the beaches separately shows a minimum of 3262 eggs in 2009 and a maximum of 5810 eggs in 2015 for Yaniklar beach (Fig. 4). In Akgöl the minimum was 1523 eggs in 2010 and the maximum 3575 eggs in 2015.

Tab. 4: Average number of eggs per clutch Yaniklar and Akgöl.
Tab. 4: Durchschnittliche Einanzahl pro Gelege in Yaniklar und Akgöl.

Year	Yaniklar	Akgöl	**Total**
2009	75.9	71.4	**73.9**
2010	82.1	66.2	**76.7**
2011	128.3	128.1	**128.2**
2012	84.4	80.3	**82.9**
2013	79.5	76.8	**78.7**
2014	83.1	73.9	**80.1**
2015	74.5	71.5	**73.3**
2016	62.9	75.0	**67.3**
Mean	83.8	80.4	**82.6**

Table 4 presents the average number of eggs per clutch for Yaniklar and Akgöl, with a mean of 83.8 for Yaniklar – a maximum of 128.3 in 2011 and a minimum of 62.9 in 2016. In Akgöl the maximum was 128.1 eggs per clutch also in 2011 and a minimum of 66.2 in 2010. This year both beaches combined had an average of 67.3 eggs per clutch, which is the lowest number of the past 8 years.

Tab. 5: Hatching success of the eggs in Yaniklar and Akgöl in 2016.
Tab. 5 Schlupferfolg der Eier in Yaniklar und Akgöl 2016.

	Hatching success (%)	Hatchlings reached the sea	Unfertilized	Predated/ Dead	Not hatched
Yaniklar	47.56	1603	101	1137	855
Akgöl	70.62	1555	92	163	617
Total	56.86	3158	193	1300	1472

Table 5 indicates the hatching success of the nests in Yaniklar and Akgöl for 2016. The hatching success is the percentage of fully developed hatchlings: 47.56% in Yaniklar and 70.62% in Akgöl (overall average 56.86 %). Altogether, 3158 hatchlings reached the sea from both beaches. Accordingly, nearly 50% (49.94%) of all eggs produced hatchlings that reached the sea. 193 eggs were unfertilized, 1300 eggs were predated or dead hatchlings were found, and another 1472 eggs did not hatch because of various reasons.

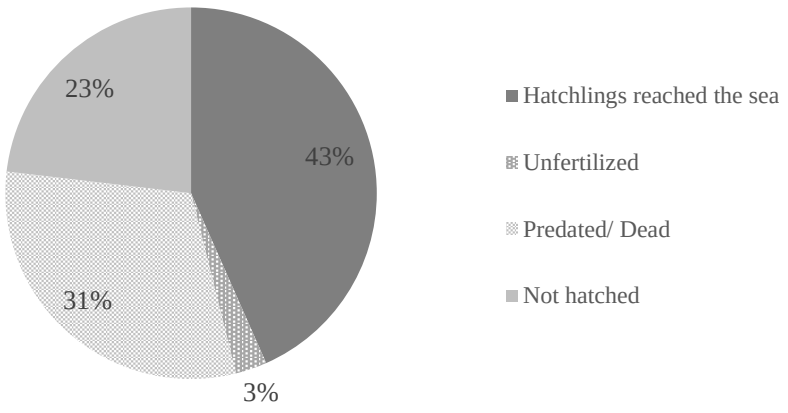

Fig. 5: Percentage distribution of the different categories of eggs of Yaniklar (in %).
Abb. 5: Prozentuelle Aufteilung der unterschiedlichen Kategorien von Eiern in Yaniklar (in %).

The percentage distribution of the different categories of eggs in Yaniklar is displayed in Fig. 5. Altogether 43% of the hatchlings reached the sea, 23% of the eggs were unfertilized, 31% were predated or dead, and 3% did not hatch.

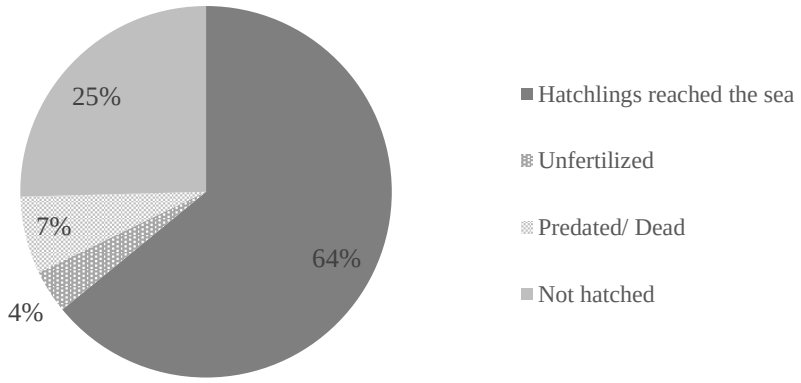

Fig. 6 Percentage distribution of the different categories of eggs of Akgöl (in %).
Abb. 6: Prozentuelle Aufteilung der unterschiedlichen Kategorien von Eiern in Akgöl (in %).

The percentage distribution of the different categories of eggs of the eggs of Akgöl is displayed in Fig. 6. Altogether 64% of the hatchlings reached the sea, 4% of the eggs were unfertilized, 7% were predated or found dead, and 25% of the eggs did not hatch.

DISCUSSION

This year's total nest number (Fig. 1) is higher than the average of the past 21 years. Especially the nest number in Akgöl is clearly higher compared to the average of the past years. Yaniklar had still nearly twice as many nests as Akgöl, due to the different topographical conditions. Akgöl beach is about 1.5 km long and Yaniklar beach has a total length of 3.8 km, providing a larger areas for Loggerhead turtles to lay their eggs. Akgöl also has a large beach area that consists of gravel, which is unsuitable as a nesting site. Most of the nests were concentrated on the end of Akgöl beach, which is a suitable nesting place for turtles and can clearly be defined as a nesting hotspot. However, it also has a major human impact because it is a popular beach for local residents. By deploying metal cages above the nests, it prevented people of stepping or lying on the nest. Also in Yaniklar metal cages were put above nests along stretches with greater human activity.

The number of eggs (Tab. 3) also shows a slightly higher value compared the average of the past years. Examining Yaniklar individually reveals a decreased number of eggs, even though the number of nests is in range of the average. Most marine turtles are non-annual breeders and show variation in the number of laid eggs and the number clutches laid in a season (Broderick et al., 2003), which could be an explanation for the decreasing number of eggs over the past

years. Another explanation could be that smaller female Loggerhead turtles laid a lower number of eggs in the recent years. But we can find a more likely explanation by taking a closer look at the impacts on the nests of Yaniklar (Fig. 2). Accordingly, 23 % of the nests were fully predated by carnivores such as foxes, dogs, badgers and the golden jackal, which occur in this region The effects of predation are the main problem for loss of eggs and hatchlings in the region of Antalya, Turkey (Olgun et al , 2016) and were also mentioned in last year's report on the hatchlings of Yaniklar and Akgöl. One reason for the increasing impact of predators could be the progressive loss of their habitats and their nutritional basis through human activities. Ongoing construction projects for hotels and deforestation are such impacts in Yaniklar.

This year many of the nests were equipped with a metal grid which was dug in the sand. This was a workable and successful approach for Yaniklar, even though this method is very labour intensive. Olgun et al (2016) show that 82.1% nests without metal grid which were predated on one night were depredated the following night, whereby only 34.2% of the caged nests were depredated again.

The number of eggs per clutch (Tab. 4) is also lower than the average of the past years, especially in Yaniklar. This is also explainable by the predation of the nests in Yaniklar. Clutch sizes of *Caretta caretta* nests range between 23 and 198 eggs, with a mean of 112.4 per clutch (Miller et al. 2003). The clutches in Yaniklar (Tab. 4) had a range of 42 – 128 eggs with an average of 62.9; in Akgöl the range was 45-125 with an average of 75.

The hatching success (Tab. 5) for the nests on both beaches was 56.86%. This means that 56.86% of all eggs were fertilized and developed normally. The rest of the eggs were either not fertilized or died in one of the three stages of embryological development.

This year, 1603 (42.5%) hatchlings reached the sea from the beach of Yaniklar and another 1555 (61%) from Akgöl (Tab. 5). Altogether, 3158 hatchlings reached the sea, i.e. nearly 50% of all eggs produced hatchlings that reached the ocean. The lower percentage of hatchlings reached the sea (42.5%) at Yaniklar is also reducible to nest predation. Furthermore, gravel and marine debris were sometimes barriers for hatchlings. Some got stuck and died here due heat or were predated by birds, crabs or other carnivores or scavengers.

Overall, this year's project was an important contribution for the protection and conservation of *Caretta caretta*. Nevertheless, there are many improvements to focus on for next year`s project. Firstly, it will be a challenging target to find the right solutions for the increasing problem with predation in Yaniklar. Secondly, the rising issue with tourism in Akgöl will be major challenge for the protection and conservation of *Caretta caretta.*

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