

Bachelor Thesis

Sea Turtle Mortality in Fethiye, Turkey 2016

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KURZFASSUNG

Gestrandete Meeresschildkröten sind keine Ungewöhnlichkeit an den Küsten der Erde. Zusätzlich zu natürlichen Todesursachen kommen vermehrt Todesursachen anthropogenen Ursprungs hinzu. Eines der Ziele des Projektpraktikums der Universität Wien “Schutz von Meeresschildkröten in der Türkei – Projekt zu angewandtem Naturschutz” in Zusammenarbeit mit der Pamukkale Universität, Denizli, war es Daten über gestrandete Meeresschildkröten zu erheben. Das Programm wurde in Fethiye und Umgebung (Mittelmeerküste) umgesetzt. Daten der Art *Caretta caretta* (unechte Karettschildkröte/Loggerhead turtle) und *Chelonia mydas* (Suppenschildkröte/Green turtle) wurden gesammelt. Während des Sommers 2016, im Zeitraum vom 25.05.2016 bis zum 31.08.2016, wurden insgesamt zwanzig tote Individuen dokumentiert. Von diesen zwanzig Individuen waren elf *Chelonia mydas* und neun *Caretta caretta*. Seit dem Beginn der Aufzeichnungen der Universität Wien im Jahr 2000 wurden dieses Jahr die meisten toten gestrandeten Meeresschildkröten der beiden Arten dokumentiert. Die häufigsten Todesursachen waren Ertrinken durch Beifang in Fischernetzen oder Fischerleinen, durch Propeller verursachte Schnittverletzungen nach Kollisionen mit Booten und mutwillig verursachte Verletzungen durch Menschen.

ABSTRACT

Incidences of sea turtles washing ashore or stranding due to natural or anthropogenic reasons are not uncommon on coastlines around the world. For this reason, one of the objectives of the University of Vienna field course “Sea turtles: Protection of sea turtles in Turkey - Project in applied nature conservation” in collaboration with Pamukkale University of Denizli, was to monitor the dead and injured sea turtles along the coast of Fethiye and surroundings (Mediterranean Sea). The observed species in this area were Loggerhead turtles (*Caretta caretta*) and Green turtles (*Chelonia mydas*). During the monitoring period in summer 2016, data on stranded dead and injured sea turtles were collected. In total, 20 dead adult sea turtles were found this year, of which 11 were *Chelonia mydas* (Green turtle) and 9 were *Caretta caretta* (Loggerhead turtle). This is the highest number of documented stranded sea turtles since the beginning of the monitoring by Turkish universities and the University of Vienna in 2000. The main causes of death were apparently drowning due to gear or debris entanglement, propeller damage due to boat collisions and anthropogenic physical harm.

INTRODUCTION

Three species of sea turtles occur in the Mediterranean Sea: *Caretta caretta* (Loggerhead turtle); *Chelonia mydas* (Green turtle); and *Dermochelys coriacea* (Leatherback turtle). Only *Caretta caretta* and *Chelonia mydas* are known to reproduce in the Mediterranean. Currently *Caretta caretta* is globally listed as Vulnerable, while *Chelonia mydas* and *Dermochelys coriacea* are listed as Endangered in the IUCN Red List of Threatened Species (Casale & Tucker, 2015). Turtle nesting in Turkey mainly occurs in a region over a coast length of 2577 km, of which 606 km are beaches. Based on the nest numbers, Turkey holds the most important green turtle stocks and the second most important loggerhead turtle stocks in the Mediterranean (Casale & Margaritoulis, 2010).

Marine turtles are threatened for numerous reasons. These are mainly anthropogenic: on nesting sites due to construction, beach modification, etc., and at sea due to incidental capture in fishing gear. Additionally marine pollution, habitat degradation, incidents of predation, the and current and future impacts of climate change on marine turtles and their habitats (increasing sand temperatures on nesting beaches affecting hatchling sex ratios, sea level rise, storm frequency and intensity) lead to a decline of sea turtle populations in the Mediterranean Sea (Wallace et al., 2011). Besides overexploitation in the past and incidental bycatch, tourist development in recent decades has added serious threats to the turtle nesting beaches and turtles. Predictions of the growth of tourism in the Mediterranean are from 135 million visits in 1990 to over 300 million in 2025 (Margaritoulis & Demetropoulos, 2003). Nesting sites are especially threatened by the steady growth of tourist interactions on the Mediterranean coastline. Tourist infrastructure, coastline modification, sand extraction and other factors may physically destroy a nesting area. Intensive human activities (e.g. mechanical beach cleaning, light and noise pollution, chairs, sunbeds and umbrellas on the beach, night frequentation) are interfering with the nesting process, the incubation of eggs and the hatchling movement to the sea. Additionally, predators (e.g. dogs, seagulls), whose populations benefit from human presence, prey on nests and hatchlings (Casale, 2008).

MATERIAL AND METHODS

This year's observation period in summer lasted from the beginning of July to mid-September 2016. Participants of the Sea Turtle Field Course and colleagues from Pamukkale University monitored the beaches of Caliş, Yaniklar and Akgöl. Beach patrols took place in morning shifts starting at 6:00 in Caliş and at 5:00 for Yaniklar and Akgöl. Night patrols were held from 10:00 to 02:00 in Caliş. In Yaniklar, night shifts stopped on 10 July due to hatching activities. Data of nests, tracks, adult turtles, events of predation, number of hatchlings, nest excavations, temperature measurements with tiny talks, changes at the beaches of Caliş, Yaniklar and Akgöl as well as data about stranded dead or injured sea turtles were collected. All data were recorded in the field data book and subsequently transferred to a database. Either members of the patrolling team found the dead animal or our team was informed by locals, tourists, the police or hotel/bar owners. Flyers and information sheets, provided by DEKAMER, were handed out by our colleagues from Pamukkale University to inform and educate the local residents. If there was a sighting of a dead or injured sea turtle, the team reached the locality as soon as possible to investigate quickly and minimize the presence of tourists. After the identification of the species and sex of the dead turtle, measurements and photographs were taken to fully document the individual and cause of death. Photographs were taken of visible wounds, debris entanglement, signs of drowning, missing body parts and other abnormalities. The gender was determined by the observation of the tail length (adult only). SCL (straight carapace length) and SCW (straight carapace width) were measured with a wooden caliper. CCL (curved carapace length) and CCW (curved carapace width) were measured with a measuring tape. All measurements and investigation results were documented in the data sheet for dead and injured sea turtles(Appendix). After full investigation and documentation, members of the team buried the carcass or it was collected by the local waste removal service. Injured sea turtles were investigated for visible wounds and causes of stranding; measurements and photographs were taken. Such injured animals were transferred as fast as possible to the DEKAMER – Sea Turtle Research, Rescue and Rehabilitation Center at Iztuzu Beach, Dalyan.

RESULTS

During the observation period in summer 2016, a total of 20 dead turtles were recorded between 25.05.2016 and 31.08.2016. (Tab.1) According to the collected data, 11 of those were *Chelonia mydas* and 9 were *Caretta caretta*. The sex ratio for *Chelonia mydas* was four females, no male and seven undetermined adult individuals. For *Caretta caretta* the sex ratio was six females and three male adult turtles. Two injured *Chelonia mydas* were recorded, but no further data on this individuals are available to us.

1. *Chelonia mydas*: stranding date: 25.05.2016; found by Turkish colleagues inshore (beach), exact location not further described; sex: undetermined; condition: fresh dead; no tag; measurements were not taken; cause of death: gear or debris entanglement/drowned in fishing net. (Fig.1)

2. *Chelonia mydas*: stranding date: 28.05.2016; found by Turkish colleagues inshore (beach), exact location: Yaniklar beach, near Hotel Botanika; sex: female (determination of sex through observation of tail length (adult only); condition: fresh dead; no tag; carapace measurements: SCL: 52 cm; SCW: 45 cm; CCL: 58 cm; CCW: 53 cm; cause of death: gear or debris entanglement (fishing line wrapped very tightly around right front flipper), drowned in fishing net. (Fig.2)

3. *Caretta caretta*: stranding date: 13.06.2016; observers: Musa Azmaz and Yusuf Katlimis; found: inshore (beach), exact location not further described; sex: female (determination of sex through observation of tail length (adult only); condition: decomposed; no tag; measurements were not taken; cause of death undetermined. (Fig.3)

4. *Caretta caretta*: stranding date: 30.6.2016; observers: Fatih Polat and Erkan Seker; found inshore (beach); exact location: Yaniklar beach, Yonca lodge; sex: female (determination of sex through observation of tail length (adult only); condition: fresh dead; no tag; carapace measurements: SCL: 64 cm; SCW: 50 cm; CCL: 71 cm; CCW: 64 cm; cause of death: gear or debris entanglement/drowned in fishing net. (Fig.4)

5. *Chelonia mydas*: stranding date: 06.07.2016; found by Karaot beach establishment owner Murat, exact location undetermined; sex: undetermined; condition: fresh dead; measurements were not taken; not checked for tags; cause of death: visible wound around neck (propeller damage/anthropogenic physical harm). (Fig.5)

6. *Caretta caretta*; stranding date: 07.07.2016; team was informed about the dead marine turtle by police; observers: Musa Azmaz , Erkan Seker, Florian Seidler, Fatma K k; found inshore (beach), location: Caliř, between Jiva beach and minibus station; sex: male; condition: fresh dead; carapace measurements: SCL: 66 cm; SCW: 49 cm; CCL: 71 cm; CCW: 63 cm; cause of death: cuttings on marginal scutes and left front flipper, propeller damage. (Fig. 6)

7. *Chelonia mydas*: stranding date: 09.07.2016; observers: Erkan Seker,, Florian Seidler; stranding location: inshore (beach); exact location not further described; sex: female; condition: fresh dead; no tag; carapace measurements: SCL: 28 cm; SCW 22 cm; CCL: 31 cm; CCW: 29 cm; cause of death: no clear determination of death, no visible wounds, cause of death unknown. (Fig. 7)

8. *Caretta caretta*: stranding date: 12.07.2016; observers: Yusuf Katlimis, Musa Azmaz, Fatma K k, Hamza Gedik, Florian Seidler; found inshore (beach); exact location: Surfblue Fethiye; sex: male; condition: decomposed; carapace measurements: SCL:73 cm; SCW: 51 cm; CCL: 75 cm; CCW: 67 cm; cause of death: gear or debris entanglement/drowned in fishing net. (Fig. 8)

9. *Chelonia mydas*: stranding date: 16.07.2016; observers: Fatih Polat, Hamza Gedik, Florian Seidler; stranding location: inshore (beach), exact location: Caliř, in front of Koca Restaurant; sex: undetermined; condition: decomposed; no tag; carapace measurements: SCL: 26 cm; SCW: 20 cm; CCL: 28 cm; CCW: 24 cm; cause of death: undetermined due to heavy decomposition, head and left front flipper were missing, propeller damage. (Fig. 9)

10. *Chelonia mydas*: stranding date: 17.07.2016; observers: Yusuf Katlimis, Fatih Polat, Florian Seidler; stranding location: inshore (beach); exact location: between Katrancı and G nl kl ; sex: undetermined; condition; decomposed; no tag; carapace measurements: SCL:

40 cm; SCW: 32 cm; CCL: 43 cm; CCW: 38 cm; cause of death: gear or debris entanglement/drowned in fishing net; notes: head and flippers were missing, probably eaten by fish after death. (Fig. 10)

11. *Caretta caretta*: stranding date: 17.07.2016; observers: Yusuf Katlimis, Fatih Polat, Florian Seidler; stranding location: inshore (beach); exact location: between Katrancı and Günlüklü; sex: female; condition: decomposed; no tag; carapace measurements: SCL: 56 cm; SCW: 45 cm; CCL: 61 cm; CCW: 56 cm; cause of death: deep cut on throat, propeller damage or anthropogenic physical harm, two cuts on plastron, boat collision/propeller damage. (Fig. 11)

12. *Chelonia mydas*: stranding date: 23.07.2016; observers: Marie Lamropoulos, Mirjam Jehle, Tanya Polleres, Dana Lambropoulos, Musa Azmaz; stranding location: inshore (beach); exact location: in front of Ceren Hotel; sex: female; condition: decomposed; no tag; carapace measurements: SCL: 49 cm; SCW: 41 cm; (CCL and CCW measurements were not taken); cause of death: propeller damage. (Fig.12)

13. *Caretta caretta*: stranding date: 06.08.2016; observers: Fatih Polat, Musa Azmaz, Simon Kofler, Sarah Degenhart, Hamza Gedik, Doğukan Mutlu, Nazlı Tecimer; stranding location: inshore (beach), exact location not further described; sex: female; condition: fresh dead; no tag; carapace measurements: SCL: 60cm; SCW: 49 cm; CCL: 66 cm; CCW: 63 cm; cause of death: propeller damage. (Fig.13)

14. *Chelonia mydas*: stranding date: 08.08.2016; observers: Doğukan Mutlu, Hamza Gedik, Florian Seidler; stranding location: inshore (beach); exact location: Calış, Cevic beach; sex: undetermined; condition: fresh dead; no tag; carapace measurements: SCL: 27 cm; SCW: 22 cm; CCL: 29 cm; CCW: 27 cm; cause of death: anthropogenic physical harm/boat collision; notes: vertebral and costal scutes missing, prefrontal scales missing. (Fig. 14)

15. *Chelonia mydas*: stranding date: 25.08.2016; observers: Ilke Atman, Emine Yerli Uysal, Sarah Degenhart, Hamza Gedik, Florian Seidler, Fatih Polat; stranding location: inshore (beach); exact location: Akgöl, Karaot beach; sex: undetermined; condition: fresh dead; no tag; carapace measurements: SCL: 24 cm; SCW: 21 cm; CCL: 25 cm; CCW: 26 cm; cause of death: gear or debris entanglement/drowned in fishing net. (Fig. 15)

16. *Caretta caretta*: stranding date: 25.08.2016; observers: Ilke Atman, Emine Yerli Uysal, Sarah Degenhart, Hamza Gedik, Florian Seidler, Fatih Polat; stranding location: inshore (beach); exact location: Yaniklar beach, Oasis street; sex: male; condition: decomposed; carapace measurements: SCL: 83 cm; SCW: 60 cm; CCL: 85 cm; CCW: 70 cm; cause of death: propeller damage; notes: Plastron was missing, no organs, no eyes, marginal scutes lost, only carapace, head and bones remaining. (Fig. 16)

17. *Chelonia mydas*: stranding date: 26.08.2016; observers: Fatih Polat; location: offshore (sea); descriptive location: Fethiye – Kizil ada (Red Island); sex: female; condition: fresh dead; no tag; carapace measurements: SCL: 57 cm; SCW: 48 cm; CCL: 63 cm; CCW: 60 cm; cause of death: boat collision; notes: Sternum was outside, many marginal scutes were broken, costals broken and skull was broken. (Fig. 17)

18. *Caretta caretta*: stranding date: 27.08.2016; observers: Fatih Polat and Paul Kreiner; location: inshore (beach); exact location not further described; sex: female; condition: decomposed; no tag; carapace measurements: SCL: 61 cm; SCW: 52 cm; CCL: 68 cm; CCW: 64 cm; cause of death: drowned (after boat collision); notes: old injuries: 3rd to 4th costal plates and marginal plates broken; new injuries: 2 broken plates on plastron. (Fig. 18)

19. *Chelonia mydas*: stranding date: 29.08.2016; observers: Ilke Atman, Sarah Degenhart, Nazlı Tecimer, Florian Seidler, Paul Kreiner; stranding location: inshore (beach); exact location: Calış beach, Calisto restaurant; sex: undetermined; condition: fresh dead; no tag; carapace measurements: SCL: 45 cm; SCW: 35 cm; CCL: 48 cm; CCW: 45 cm; cause of death: anthropogenic physical harm, signs of physical damage on both front flippers, hole in the head, signs of drowning. (Fig. 19)

20. *Caretta caretta*: stranding date: 31.08.2016; observers: Fatih Polat, Yunus Emre, Paul Kreiner, Florian Seidler, Nazlı Tecimer, stranding location: offshore (sea); descriptive location: Fethiye harbor, Hello büfe café; sex: female; condition: fresh dead; no tag; carapace measurements: SCL: 65 cm; SCW: 51 cm; CCL: 67 cm; CCW: 62 cm; cause of death: gear or debris entanglement/drowned; notes: fishing line around right front flipper, 2 fishing hooks in right front flipper. (Fig. 20)

Tab. 1: Recorded dead and injured sea turtles from 2000-2016 in Çaliş, Yanıklar, Akgöl, Ölüdeniz, Katrancı and Fethiye harbor

Tab. 1: aufgezeichnete tote und verletzte Meeresschildkröten von 2000-2016 in Çaliş, Yanıklar, Akgöl, Ölüdeniz, Katrancı und dem Hafen von Fethiye

Year	Species	Location	Date of find	Sex	Age	Injuries	Probable cause of death
2000	CC	F	31.07. – 31.08.	f	a	alive, injuries on the head	injured by a blunt object
2001	CC	C	n.d.	f	a	swallowed fish hook	fish hook
2002	CC	F	n.d.	n.d.	n.d.	very decomposed, age and sex unknown	n.d.
	CM	F	n.d.	f	n.d.	bursting carapace, broken flipper	ship propeller
2003	CC	Y	04.09.	m	n.d.	decomposed and gnawed, especially in the skull area	n.d.
2004	CM	C	24.08.	m	j	small right hind limb; raw parts of bottom slide of throat	caught in a fisherman's net, drowned
	CC	F	late June	n.d.	n.d.	carapace torn open	ship propeller
2005	no dead turtles recorded						
2006	CC	C	June	f	a	right hind limb missing, perhaps hereditary	n.d.
	CC	C	19.08.	f	a	front extremity and eye missing	n.d.
	CC	C	25.08.	n.d.	n.d.	back part of body missing	n.d.
	CC	Y	July	m	n.d.	head and body skeletonized, hole in skull	ship propeller
	CM	C	September	f	j	one eye missing	n.d.
	TT	C	August	n.d.	n.d.	no external injuries	n.d.
2007	CC	C	07.08	m	a	head injuries, decomposed	
	CM	C	05.08.	f	j	head injuries, parts of the flipper missing	killed by a human
	CM	C	02.09.	f	j	carapace torn open, injury extending down to the plastron	ship propeller
	CM	F	04.09.	m	a	still alive, no external injuries, unable to dive	alive

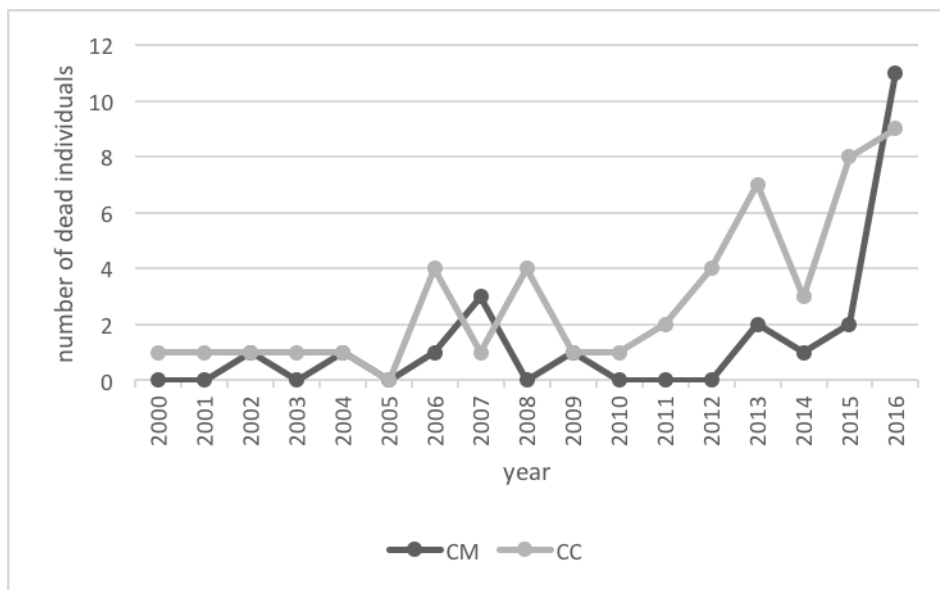
Year	Species	Location	Date of find	Sex	Age	Injuries	Probable cause of death
2008	CC	Y	02.07.	m	n.d.	scars on top of head, cut on the side of the body, carapace damaged	
	CC	C	04.07.	f	n.d.	n.d.	n.d.
	CC	C	15.07.	m	n.d.	fishing line around neck, 80% of carapace missing	caught in fishing net
	CC	F	30.07.	n.d.	n.d.	n.d.	n.d.
2009	CC	C	04.08.	f	a	left flipper entangled in a fishing net, fishing hook	caught in fishing net
	CM	C	05.08.	f	n.d.	n.d.	n.d.
2010	CC	Y	21.07.	f	a	decomposed	strike on the head
	TT	C	16.08.	n.d.	n.d.	hole in the carapace	ship propeller
2011	CC	C	24.07.	n.d.	a	decomposed, cuttings on carapace, head, three flippers and tail missing	boat collision
	CC	Y	27.07.	n.d.	a	hole in the carapace, head missing	strike on the head
	TT	C	June	n.d.	n.d.	decomposed, carapace injuries	n.d.
2012	CC	Y	03.07.	n.d.	j	decomposed, smashed head, holes in bones	killed by a human
	CC	F	03.07.	f	a	swallowed fish hook	fish hook, drowned
	CC	F	09.07.	f	a	swallowed plastic bag	plastic bag, starvation
	CC	C	12.07	f	a	swallowed plastic bag	plastic bag, starvation
2013	CC	F	23.06.	f	a	n.d.	drowned in fisher net
	CC	Y	27.06.	n.d.	n.d.	head and right flipper left	n.d.
	CC	F	28.06.	f	a	propeller damage	ship propeller
	CM	C	17.07.	f	a	left flipper was missing	drowned in fisher net
	CC	Ö	27.07.	n.d.	a	fisherline was around its left flipper	n.d.
	CC	C	01.08.	m	a	cut on carapace	drowned in fisher net
	CC	C	27.08.	f	j	decomposed; tail, eyes and half left front flipper were missing; piece of plastic in pharynx	n.d.
	CC	C	02.09.	m	n.d.	propeller damage, carapace was almost cut in half	ship propeller
	CM	Y	13.09.	m	a	cut on right side	ship propeller

Year	Species	Location	Date of find	Sex	Age	Injuries	Probable cause of death
2014	TT	Y	05.07.	f	a	n.d.	n.d.
	CC	C	18.07.	f	a	blood in nose and mouth	fish hook
	CM	C	26.07.	f	a	bruises, inner bleeding and bloody eyes	dynamite fishing
	CC	C	28.07	m	a	upper layer of carapace came off, back of carapace cut off, open wounds on carapace and thorax	ship propeller
	CC	F	26.08.	f	a	lower jaw missing, three holes in carapace, right front flipper entangled in a fishing net	shot after being caught in fishing line
2015	CC	n.d.	06.06.	n.d.	n.d.	n.d.	n.d.
	n.d. (propable TT)	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	CC	Y	11.06.	m	a	turtle decomposed, damage on plastron	cause of death unclear
	CM	Y	12.06.	f	a	inner organs pressed outside	string around neck (and around a stone), killed on purpose
	CC	F	20.06.	n.d.	a	deep cut through carapace	boat collision
	CC	C	21.06.	n.d.	n.d.	turtle decomposed, head and extremities missing, only bones and dermis were left	n.d.
	CM	C	04.07.	f	a	deep cut on throat, two holes in carapace	cut on throat by lines or hooks, external forceful impact
	CC	C	21.07.	f	a	wound on neck, drowning symptoms	caught in net, drowned, hit on neck
	n.d.	F	22.07.	n.d.	n.d.	n.d.	n.d.
	CC	A	25.07.	f	a	lower jaw missing	n.d.
	CC	Y	27.07.	m	a	air under carapace, fisher net and hook around right front flipper	alive
CC	Y	09.08.	f	a	rear flipper decomposed	n.d.	

Year	Species	Location	Date of find	Sex	Age	Injuries	Probable cause of death
2016	CM	n.d.	25.05.	n.d.	n.d.	n.d.	drowned in fishing net
	CM	Y	28.05.	f	A	gear or debris entanglement, fishing line very tight around right front flipper	drowned in fishing net
	CC	n.d.	13.06.	f	n.d.	n.d.	undetermined
	CC	Y	30.06.	f	A	n.d.	drowned in fishing net
	CM	Y	06.07.	n.d.	n.d.	visible wound on neck	propeller damage
	CC	C	07.07.	m	A	cuttings on marginal scutes and left front flipper	propeller damage
	CM	C	09.07.	f	A	no visible wounds	drowned in fishing net/plastic ingestion
	CC	C	12.07.	m	A	no visible wounds	drowned in fishing net
	CM	C	16.07.	n.d.	J	head and left front flipper missing, advanced decomposition	undetermined
	CM	K	17.07	n.d.	J	head and flippers were missing, eaten by fish after death	drowned in fishing net
	CC	K	17.07	f	A	cut on throat and cuts on plastron	propeller damage
	CM	C	23.07.	f	A	n.d.	propeller damage
	CC	C	06.08.	f	A	n.d.	propeller damage
	CM	C	08.08	n.d.	n.d.	vertebral and costal scutes missing, prefrontal scales missing	anthropogenic physical harm/boat collision
	CM	A	25.08.	n.d.	J	no visible wounds	drowned in fishing net
	CC	Y	25.08.	m	A	Plastron missing, no organs left, marginal scutes lost	propeller damage
	CM	F	26.08.	f	A	Sternum was outside, many marginal scutes broken, costals broken, skull broken	boat collision
	CC	n.d.	27.08.	f	A	2 broken scutes on plastron, costal scutes broken, marginal scutes broken	drowned

Year	Species	Location	Date of find	Sex	Age	Injuries	Probable cause of death
2016 cont.	CM	C	29.08.	n.d.	n.d.	signs of physical harm on front flippers, hole in head, signs of drowning	anthropogenic physical harm
	CC	F	31.08.	f	A	fishing line around right front flipper, fishing hooks in flipper	drowned
CC	<i>Caretta caretta</i>	C	Çaliş	f	female		
CM	<i>Chelonia mydas</i>	Y	Yanıklar	m	male		
TT	<i>Trionyx triunguis</i>	F	Fethiye	a	adult		
		A	Akgöl	j	juvenile		
		Ö	Öludeniz	n.d.	no data		
		K	Katramci				

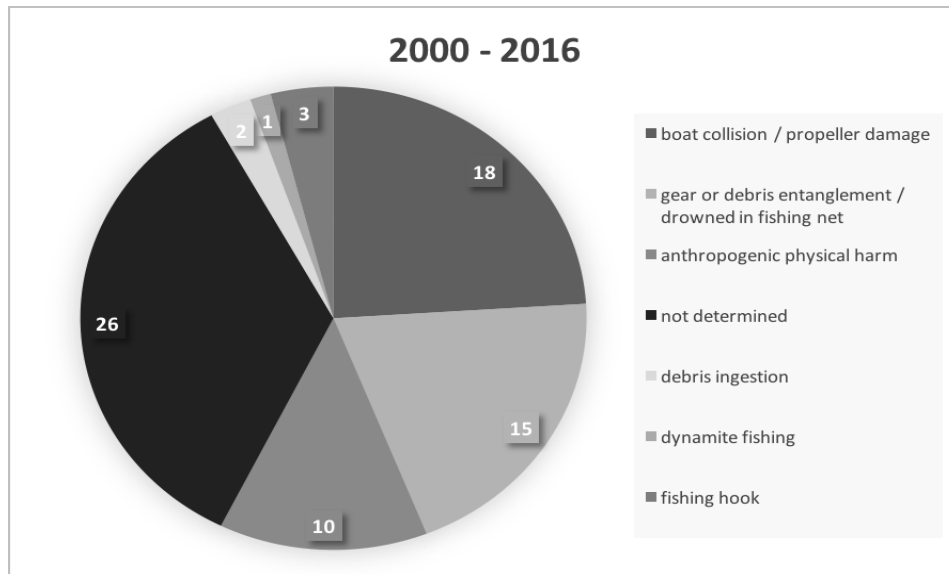
The data collected during the field course in summer 2016 show the highest number of stranded marine turtles since the beginning of monitoring the beaches around Fethiye, Turkey, by Turkish universities with support by the University of Vienna in 2000. (Tab.2)



Tab.2 Number of dead sea turtles of the species *Caretta caretta* (CC) and *Chelonia mydas* (CM) from 2000 until 2016

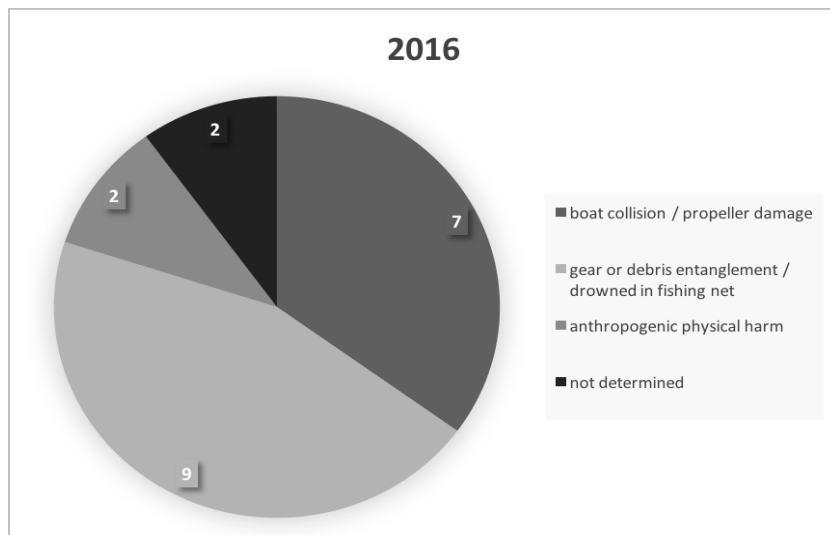
Tab.2 Anzahl toter Meeresschildkröten der Arten *Caretta caretta* (CC) und *Chelonia mydas* (CM) von 2000 bis 2016

Since the beginning of the monitoring program in Fethiye, data on a total 75 dead individuals has been collected. In detail, twenty-six of them died due to propeller damage/boat collision, 15 due to gear or debris entanglement or drowned in fishing nets, 10 from other anthropogenic physical harm or intentional killing, 2 from debris ingestion, 1 due to dynamite fishing and 3 after swallowing fishing hooks. The cause of death could not be determined for 26 of them (Tab. 3).



Tab. 3: Numbers of dead sea turtles from 2000 to 2016, grouped by causes of mortality
 Tab. 3: Anzahl toter Meeresschildkröten, klassifiziert nach Todesursachen im Zeitraum von 2000 bis 2016

The data collected in 2016 shows that 7 of the 20 sea turtles died due to propeller damage/boat collision, 9 due to gear or debris entanglement or drowned in fishing nets, 2 due to other anthropogenic physical harm and for 2 individuals the cause of death could not be determined. (Tab. 4) The main causes of death in 2016 according to collected data were drowning due to gear or debris entanglement, propeller damage due to boat collisions and intentional anthropogenic physical harm.



Tab.4 Numbers of dead sea turtles in 2016, grouped by causes of mortality
 Tab 4 Anzahl toter Meeresschildkröten, klassifiziert nach Todesursachen 2016

DISCUSSION

The number of recorded dead turtles presented here is merely a minimum estimate. Dead turtles not washed ashore, not located or reported and the short monitoring period are the main reasons contributing to a high number of unrecorded cases. Ongoing and steady improving cooperation with local hotel/bar/restaurant owners, local police and coastguard as well as tourists play a key role in locating and reporting stranded individuals, enabling us to collect data about them. Due to sensibilisation of the locals and tourists about the topic in general, the cooperation with conservation workers is improving and thereby more and more dead recorded individuals are the result. The steadily rising number of dead sea turtles is also the result of rising populations due to conservation programs for more than twenty years on the nesting sites of Fethiye and surroundings. Due to intensive long-term conservation the population of sea turtles in the Mediterranean is increasing. The available long-term series of nest counts (used as an index of population abundance; mostly from protected beaches) show an overall increase over the past three generations when all Loggerhead nesting sites in the Mediterranean are considered together (Casale, 2015). A correlation between the growing population and recorded dead individuals is noticeable. The investigation of the twenty dead individuals shows that anthropogenic impact (fishing activities, tourism, debris) on their habitat is the main factor of unnatural sea turtle mortality in the Mediterranean Sea.

One of the main reasons for sea turtle mortality is incidental bycatch in various fishing gear. With over 150,000 captures per year and probably over 50,000 deaths per year, fishing practices in the Mediterranean clearly have an enormous impact on the populations of *Caretta caretta* and *Chelonia mydas* (Casale, 2008). Nine out of twenty recorded deaths in 2016 are the result of fishing activities. Four pertain to *Caretta caretta*, five to *Chelonia mydas*. Three main categories of fishing gear are involved: Trawls (nets towed by boats), longlines (lines with baited hooks left at sea), nets (left at sea). These are the most used fishing strategies and the ones with evidence of interaction with sea turtles (Nedelec & Prado, 1990). Due to the feeding habits and diet of *Chelonia mydas*, this species is very commonly captured in fishing nets because of high fishing activities in seagrass areas. For *Caretta caretta*, with an omnivorous diet, even more threats from different fishing practices occur. Especially pelagic and demersal longlines have attractive bait for sea turtles. Additionally, recreational fishing activities by smaller vessels contribute to the high number of incidental captures. Further, incidentally captured turtles are apparently also sometimes killed intentionally by fishermen after they become entangled in their nets or on their fishing hooks. In some cases, deliberate killing of captured sea turtles may be to end the suffering after serious injuries due to fishing hooks, etc. In other cases, human anger and cruelty may be involved. The analysis of the collected data from 2016 shows that two of the recorded dead sea turtles died from intentional killing by humans. Both of them were *Chelonia mydas*. Another reason of high sea turtle mortality in the Mediterranean Sea is boat collisions. Fethiye and its local beaches in Caliş, Yanıklar and Akgöl are well known to foreign and local tourists. As a result of growing tourism demands, local hotels, bars, agencies, etc. offer a wide variety of activities that potentially threaten sea turtles at sea and on land. Sea turtles spend time on the water surface to breath and rest between their dives. At this point they are vulnerable to boat collisions, especially from speed boats and especially in waters highly frequented due to tourism and watersport activities. Importantly, however, it is difficult to determine if the cut wounds from propellers are the actual cause of death or if the turtle was hit by the vessel after it died from other causes. Our data on the dead sea turtles in summer 2016 show that seven turtles show severe injuries through propeller cuts from collision with boats. Three of them were identified as *Chelonia mydas* and four of them as *Caretta caretta*. These injuries are described in Tab.1. Finally, marine debris is a major threat to sea turtles in the Mediterranean Sea (and elsewhere). Different types of debris (e.g. oil/tar, paper, styrofoam, wood, plastic, hooks, lines and ghost nets/lines) are common threats marine turtles must face. Although this year's data shows no recorded death due to debris ingestion, it cannot be completely excluded. For more

detailed determinations, necropsies would have to be made on each dead individual without a clear cause of cause of death. Our team, however, is not qualified to conduct such examinations.

DEKAMER

Two of the recorded sea turtles were injured *Chelonia mydas*. One of them was transferred to the DEKAMER – Sea Turtle Research, Rescue and Rehabilitation Center at Iztuzu Beach, Dalyan, where it died after a few days of treatment. The other individual died on the way to the center. The first sea turtle rescue center in Turkey was founded in 2008 in collaboration with Environmental Protection Agency for the Special Areas, General Directorate of Natural Protection and National Parks, Dalyan Municipality and Pamukkale University. The main tasks of DEKAMER are to take on injured sea turtles from the surrounding areas, treat and rehabilitate them, and ultimately release them. Public information and educational work are also key duties. The Rescue and Rehabilitation Center contains a veterinary station for acute cases, and 16 diving tanks for various treatments. The small tanks (4 square tanks and 4 circular tanks with a depth of 80 cm) are used for severely injured turtles in the beginning of their treatment, because they should not move much. The big diving tanks (6 of them with a diameter of 2.2 m to 2.5 m with a depth of 1.4 m; one with a diameter of 4 m and depth of 1.2 m and one with a diameter of 2.6 m with a depth of 4 m) are used to rehabilitate the turtles in diving. The tanks also provide enough space for the turtles to regain their fishing abilities on living prey. The tanks are filled with seawater with a salinity around 40-45 and a water temperature of minimum 15 degrees Celsius. Sea turtle metabolism is dependent on the water temperature and it is important for medical treatment of the injured sea turtles. The critical water temperature for sea turtles is around 12 degrees Celsius. Once an injured sea turtle is taken into treatment, the procedure of anamnesis involves morphology checks, behavioral tests and blood tests (pers. comm. F. Polat). After first investigation of the injured animal, special treatments are applied. Depending on the turtle's condition, antibiotics, antiviral, antifungal and antiparasite medication are given to the animal. Furthermore, vitamin B groups are injected to boost the immune system and to reduce infections. Vitamin B groups also strengthen the nerves after spinal or brain damage. If the injuries involve fractures in the carapace (e.g. due to boat collisions), the use of special bone cement is common. However, not every wound has to be treated with this type of glue because sea turtles are able to rebuild their carapace on their own if the crack is not too big and inner organs are not damaged. On

such cases, special food treatment is provided. The additional food treatment, containing crabs, shells, salt and chicken eggs to cover the high protein and calcium demands, is added to their normal diet depending on the treated species. If the animal does not eat for a longer period of time, debris or plastic ingestion could be the reason. In these cases, oil is fed to the turtles for faster digestion.

RECOMMENDATIONS

General strategies to reduce marine turtle mortality should be further introduced and implemented. Public awareness and education are key factors in sea turtle conservation programs. Negative impacts on nesting sites and on the sea itself due to anthropogenic activities can only be reduced through public awareness and educational programs. In fact, Turkey has abundant legislation and regulations to promote the conservation of marine turtles. As elsewhere, strict enforcement of these regulations is a weak point (Casale & Margaritoulis, 2010). Furthermore, the lack of studies about the interaction of fisheries and marine turtles prevents an estimation of the real numbers of incidental bycatch resulting in mortality. Regarding incidental capture and mortality in fisheries, more research should be undertaken into new and alternative fishing gear (e.g. TEDs, circle hooks, different baits to reduce attractiveness to turtles) to prevent sea turtle bycatch. Finally, more information about sea turtle populations as well as about the migratory behavior in the Mediterranean needs to be a topic of further research and monitoring programs.

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Downloaded on 15 October 2016.

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Downloaded on 19 October 2016

APPENDIX

DEAD OR INJURED SEA TURTLES

Observer: Stranding date and time:

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

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

Sex: undetermined Male Female

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

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

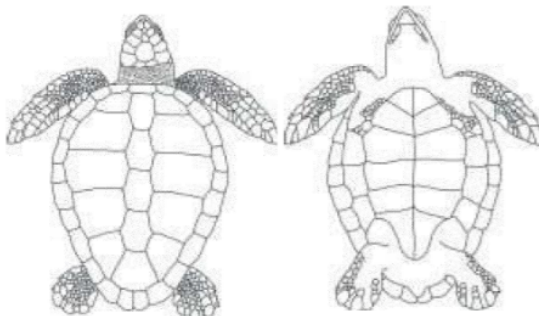
Tags: Checked for tags? Yes No Tagnumber:
Tag location:
Return adress:

Carapace measurements: CCL SCW
CCL CCW

Photos taken? Yes No

Nr. of photos:

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



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



Fig. 1a and b: Stranded *Chelonia mydas*, cause of death: drowned in fishing net, (Photos: Pamukkale University)

Abb.1a und b: Gestrandete *Chelonia mydas*, Todesursache: Ertrunken in Fischernetz. (Foto: Pamukkale Universität)



Fig. 2a and b (close-up): Stranded female *Chelonia mydas*, died due to fishing gear entanglement, fishing line around right front flipper (Photos: Pamukkale University)

Abb. 2a und b (Nahaufnahme): Gestrandete weibliche *Chelonia mydas*, Fischerleine eng um rechten Vorderflipper gewickelt sichtbar, (Fotos: Pamukkale Universität)



Fig. 3 a (side view) and b (frontal view): Stranded female *Caretta caretta*, cause of death undetermined; (Photos: Pamukkale University)
 Abb.3 a (Seitenansicht) und b (Frontansicht) Gestrandete weibliche *Caretta caretta*, Todesursache unklar;(Fotos: Pamukkale Universität)



Fig.5 a (side view), b (top view), c (frontal view), d (close-up of head): Stranded female *Caretta caretta*, drowned in fishing net, (Photos:Pamukkale University)
 Abb. 5 a (Seitenansicht), b (Ansicht von oben), c (Frontansicht), d (Nahaufnahme Kopf): Gestrandete weibliche *Caretta caretta*, Ertrunken in Fischernetz, (Fotos: Pamukkale Universität)



Fig.6 a (side view), b (side view of wound), c (top view) Dead *Chelonia mydas*, visible wound on neck, cause of death: anthropogenic physical harm, (Photos provided by local bar owner)

Abb.6 a (Seitenansicht), b (Seitenansicht Verletzung), c (Ansicht von oben) Tote *Chelonia mydas*, sichtbare Verletzung am Nacken, Todesursache: Anthropogene Attacke, (fotografiert von Karaot beach Besitzer)



Fig.7 a (front view), b (back view), Dead male *Caretta caretta*, visible cut on marginal scutes (c) and on left front flipper (d) (Photos: F. Seidler)

Abb.7 a (Frontansicht), b (Hinteransicht), Tote männliche *Caretta caretta*, sichtbare Schnittverletzungen an Marginalplatten (c) und linkem Vorderflipper (d) (Fotos: F. Seidler)



Fig.8 a (side view), b (plastron), c (close-up head) , d (close-up side view) Dead *Chelonia mydas*, no visible wounds, cause of death: drowned, (Photos: F. Seidler)

Abb.8 a (Seitenansicht), b (Plastron), c (Nahaufnahme Kopf), d (Nahaufnahme Carapax seitlich) Tote *Chelonia mydas*, keine sichtbaren Verletzungen, Todesursache: Ertrunken (Fotos: F. Seidler)



Fig.9 a,b (side view), c (close-up throat), d (close-up head) Dead male *Caretta caretta*, Cause of death: drowned in fishing net (photos: F. Seidler)

Abb.9 a,b (Seitenansicht), c (Nahaufnahme Hals), d (Nahaufnahme Kopf) Tote männliche *Caretta caretta*, Todesursache: Ertrunken in Fischernetz (Fotos: F. Seidler)



Fig.10 a (buried carapace), b (view on plastron), c (top view), d (close-up carapace) Stranded *Chelonia mydas*, cause of death: undetermined due to advanced decomposition, head and left front flipper missing, missing parts, propeller damage (photos: F. Seidler)

Abb.10 a (Carapax vergraben), b (Plastron), c (Ansicht von oben), d (Nahaufnahme Carapax) *Chelonia mydas*, Todesursache unklar aufgrund starker Verwesung, Kopf und Flipper fehlen, fehlende Extremitäten, Propellerverletzungen (Fotos: F. Seidler)



Fig.11 a (top-view carapace), b (front-view), c (back-view), d (close-up) Stranded *Chelonia mydas*; ; cause of death: gear or debris entanglement/drowned in fishing net; notes: head and flippers were missing, probably eaten by fish after death (photos: F. Seidler)

Abb.11 a (Carapax), b (Vorderansicht), c (Rückansicht), d (Nahaufnahme) Gestrandete *Chelonia mydas*; Todesursache: Ertrunken in Fischernetz, Kopf und Flipper fehlen, nach dem Tod von Fischen abgefressen (Fotos: F. Seidler)



Fig.12 a (side- view carapace), b (front-view), c (close-up wound on throat), d (plastron) Dead female *Caretta caretta*, visible deep cut on throat, propeller damage or anthropogenic physical harm, two cuts on plastron, (boat collision/propeller damage) (photos: F. Seidler)
 Abb.12 a (Seitenansicht Carapax), b (Frontansicht), c (Nahaufnahme Verletzung am Hals), d (Plastron) Tote weibliche *Caretta caretta*, sichtbarer fataler Schnitt am Hals, Propellerverletzung; zwei Schnittwunden am Plastron (Bootskollision/Propellerverletzung) (Fotos: F. Seidler)



Fig.13 a (top-view), b (close- up head), c (view on plastron), d (close-up carapace) female *Chelonia mydas* after boat collision, propeller damage visible (photos: M. Lambropoulos)
 Abb.13 a (Ansicht von oben), b (Nahaufnahme Kopf), c (Plastron), d (Nahaufnahme Carapax) weibliche *Chelonia mydas* nach Boots-kollision, Propellerverletzungen deutlich sichtbar (Fotos: M. Lambropoulos)



Fig.14 a (close-up wound on carapace), b (top-view) Stranded female *Caretta caretta*, died due to propeller cuts on carapace

(Photos: F.Seidler)

Abb.14 a (Nahaufnahme Verletzung am Carapax), b (Ansicht von oben) Gestrandete *Caretta caretta*, Todesursache: Propellerverletzungen am Carapax

(Fotos: F. Seidler)



Fig.15 a (front-view), b (top-view), c (back-view), d (side-view) Stranded *Chelonia mydas*, anthropogenic physical harm/boat collision; notes: vertebral and costal scutes missing, prefrontal scales missing (Photos: F. Seidler)

Abb.15 a (Vorderansicht), b (Ansicht von oben), c (Rückansicht), d (Seitenansicht) Gestrandete *Chelonia mydas*, Verletzungen anthropogenen Ursprungs/Bootkollision; einige Vertebralplatten, Costalplatten sowie Prefrontalplatten fehlen; (Fotos: F. Seidler)



Fig.16 a (top-view), b (back-view), c (plastron), d (close-up head) Stranded *Chelonia mydas*, cause of death: gear or debris entanglement/drowned in fishing net (Photos: F. Seidler)

Abb.16 a (Ansicht von oben), b (Rückansicht), c (Plastron), d (Nahaufnahme Kopf)

Gestrandete *Chelonia mydas*, Todesursache: Ertrunken in Fischernetz; (Fotos: F. Seidler)



Fig.17 a (side-view), b (close-up side-view), c (close-up head) Stranded male *Caretta caretta*, propeller damage; notes: Plastron missing, no organs, no eyes, marginal scutes lost, only carapace, head and bones remaining (Photos: S. Degenhart)

Abb.17 a (Seitenansicht), b (Nahaufnahme Seitenansicht), c (Nahaufnahme Kopf)

Gestrandete männliche *Caretta caretta*, Propellerverletzungen; Plastron fehlt, keine Organe oder Augen mehr vorhanden, Marginalplatten fehlen, nur Carapax, Kopf und Knochen (Fotos: S. Degenhart)



Fig.18 a (top-view), b (view on plastron) dead female *Chelonia mydas*, cause of death: boat collision; notes, many marginal scutes were broken, costals broken and skull was broken (Photos: Pamukkale University)

Abb.18 a (Anicht von oben), b (Plastron) Tote weibliche *Chelonia mydas*, Todesursache: Kollision mit Boot; einige Marginalplatten gebrochen, Costas und Schädelknochen gebrochen; (Fotos: Pamukkale Universität)



Fig.19 a (front-view), b (side-view) stranded female *Caretta caretta*, cause of death: drowned (after boat collision); notes: old injuries: 3rd to 4th costal plates and marginal plates broken; new injuries: 2 broken plates on plastron (Photos: F. Polat)

Abb.19 a (Frontansicht), b (Seitenansicht) gestrandete weibliche *Caretta caretta*, Todesursache: Ertrunken nach Kollision mit Boot, einige Costalplatten und Marginalplatten gebrochen, frischere Verletzung: Zwei gebrochene Platten an Plastron; (Fotos: F. Polat)



Fig.20 a (top-view), b (front-view), c (plastron), d (close-up, hole in head) stranded *Chelonia mydas*, cause of death: anthropogenic physical harm, signs of physical damage on both front flippers, hole in the head, signs of drowning (Photos: F. Seidler)

Abb. 20 a (Ansicht von oben), b (Frontansicht), c (Plastron), d (Nahaufnahme, Loch im Kopf)
 Gestrandete *Chelonia mydas*, Todesursache: Verletzung anthropogenen Ursprungs, Spuren von Gewalteinwirkung an beiden Vorderflippers, Ertrinkungserscheinungen; (Fotos: F. Seidler)

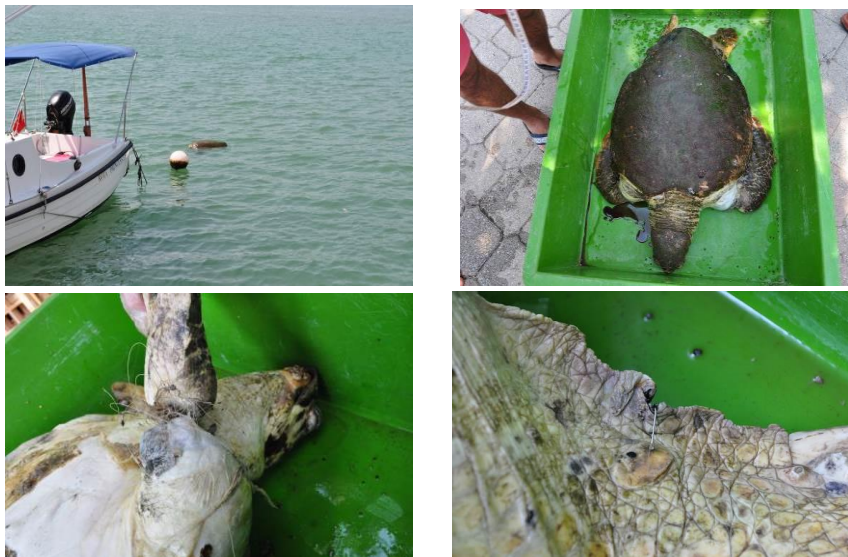


Fig.21 a (floating carcass), b, (top-view), c (close-up left front flipper), d (close-up right front flipper) female *Caretta caretta*, found in Fethiye harbor, cause of death: gear or debris entanglement/drowned; notes: fishing line around left front flipper, 2 fishing hooks in right front flipper (photos: F. Polat)

Abb.21 a (treibender Kadaver), b (Ansicht von oben), c (Nahaufnahme linker Vorderflipper), d (Nahaufnahme rechter Vorderflipper) weibliche *Caretta caretta*, gefunden im Hafen von Fethiye, Todesursache: Ertrunken aufgrund von Verhedderung in Fischerleine, zwei Fischerhaken im rechten Vorderflipper sichtbar; (Fotos: F. Polat)