
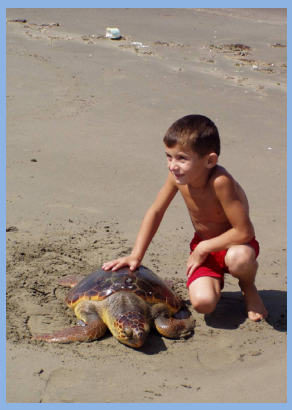

Monitoring and Conservation of Important Sea Turtle Feeding Grounds in the Patok Area of Albania 2008-2010

PROJECT REPORT

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Project Leader and co-Funder

MEDASSET Mediterranean Association to Save the Sea Turtles

Project Partners

Funders

THE PANTON TRUST

THE SPEAR CHARITABLE TRUST

THE J.F COSTOPOULOS FOUNDATION

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M. White, I. Haxhiu, E. Kararaj, M. Mitro, L. Petri, E.Saçdanaku, B.Trezhnjevna, L. Boura, K. Grimanis, P. Robinson, L. Venizelos. 2011. Monitoring and Conservation of Important Sea Turtle Feeding Grounds in the Patok Area of Albania 2008-2010. Final Project Report. A project of MEDASSET in collaboration with H.A.S., Albania; University of Tirana; ECAT, Albania. Supported by: GEF/SGP, Tirana; RAC/SPA (UNEP/MAP); UNEP/MAP.

EXECUTIVE SUMMARY

Within the framework of MEDASSET's sea turtle conservation programmes in the Mediterranean the project **"Monitoring and Conservation of Important Sea Turtle Feeding Grounds in the Patok Area of Albania"** was carried out during **2008-2010** based at the Patok Lagoon area of Drini Bay, on the northern coast of Albania, in the Adriatic Sea. The project included sea turtle research and conservation, capacity building and awareness raising. This report describes the activities undertaken, the results, conclusions and recommendations deriving from the project.

Project partners included: University of Tirana; University of Adnan Menderes-Department of Biology, Turkey; Herpetofauna Albanian Society and ECAT–Tirana. The project was funded by MEDASSET, the Global Environment Facility's Small Grant Programme (GEF/SGP), the Regional Activity Centre for Specially Protected Areas (RAC/SPA), the United Nations Environment Programme Mediterranean Action Plan (UNEP/MAP), the British Chelonia Group (BCG), the J.F. Costopoulos Foundation (Greece), the Spear Charitable Trust (UK) and the Panton Trust (UK).

RESEARCH

The Albanian coast has received very little attention in the past regarding its sea turtle populations although their presence in Albanian waters has been known since at least 1960. **The project aimed to assess if the Drini Bay area was an important sea turtle feeding ground and to systematically investigate the population structure captured incidentally in "stavnike" fish traps**: a particular type of static fish-trap used in Patok. The project also reviewed the fishing methods in the area, monitored fish catch and the availability of food resources for turtles, recorded other important species present and studied the environmental factors that could affect the presence of sea turtles in the area.

Data were collected during the summer months (June-September) in all three years. The fish traps yielded a remarkable **407 sea turtles**, which were studied and released: 402 were loggerhead turtles ***Caretta caretta*** and 5 green turtles ***Chelonia mydas,*** confirming that Albania is included in the range states for *C. mydas.* **25.7%** of the captured sea turtles were **males** (112: 35 adults, 77 adolescents).

Researchers fitted numbered metal **tags** to the flippers of **396** of the turtles, so that they can be identified if seen again in the future. This will help scientists understand some of that particular animal's life-history, such as how often it returns to the same location. During the project, fifty four turtles were captured more than once within the same season, suggesting **short term residency** in the Bay. Thirty-two turtles were caught again during different field seasons (inter-annually), suggesting that **Albania forms part of their migratory route**.

In order to further investigate the migration and marine distribution of turtles found in Albanian waters, three loggerhead turtles (two males and one female) were fitted with transmitters on September 12th 2009 and the **first satellite tracking programme** of sea turtles in Albania was launched from Patok. The programme is expected to last until September 2011 and has already provided **information on the different overwintering strategies and clear evidence for the timing of the annual remigration of the two males**. Maps and information are available at "Turtle Tracking" webpage, at www.medasset.org

DNA samples were collected for analysis during the 2009-10 fieldwork with the aim to better understand whether or not the turtles foraging in the area are from the same genetic stock or if they originate from different reproductive populations.

The project concludes that **Drini Bay is a regionally and nationally important habitat that is used by sea turtles for foraging, as a refuge and as part of a key migratory corridor between the Ionian and Adriatic Seas.**
Drini Bay is used:

- by both adult and adolescent loggerhead turtles *Caretta caretta*
- occasionally **by green turtles *Chelonia mydas*** for foraging or migration
- by juvenile loggerheads, and perhaps green sea turtles *C. mydas* as a **developmental habitat**
- *by C. caretta* as an **over-wintering habitat**
- by a significant assemblage of **male loggerhead turtles *C. caretta*** suggesting that they may use the area as a **developmental and foraging habitat**. This discovery has **increased importance** due to our presently limited

understanding of the distribution and marine ecology of male sea turtles; and the threatened impact of global **climate change**, which may force embryonic sex-ratios towards female-dominance.

An important finding was that entrapped turtles were not deterred from foraging locally, despite being handled out of the nets. Also, "stavnikes" have proved to usually be non-lethal for turtles. It was noted that hooked turtles were very rare, as were turtles with amputated limbs. The principal **concerns** identified for turtles in Drini Bay include: incidental injury caused by interaction with fisheries and boat strikes; the presence of marine leeches and high-loadings of epibiota and the unknown effects of anthropogenic pollution. A **waste pollution survey** was conducted in the coastal zone of Drini Bay and upstream in five rivers during 2009-2010: the widespread presence of marine litter in Drini Bay, in conjunction with the omnivorous nature of *Caretta caretta* makes it likely that they will consume plastic and other debris. The illegal use of **dynamite** for explosive-fishing was monitored during 2008-2010 and reported to the Authorities; this was the first recorded evidence and consequently an enforcement operation was undertaken in September 2010.

CAPACITY BUILDING AND AWARENESS RAISING

The project achieved some measure of success in building capacity in Albania. Fulfilling its second main goal the project **trained 11 Albanian university students as Research Assistants,** thus providing young biologists with hands-on training and instilling the capacity to the next generation of Albanian scientists to monitor the sea turtle population along their coast. The project also offered a unique opportunity to over 250 Albanian university students to attend workshops at Patok. Research on sea turtles was brought closer to internationally-acceptable standards, but can be improved further. In 2009, MEDASSET sought to build capacity within a local NGO, the Herpetofauna Albanian Society, sharing fundraising and project management know-how. Throughout the project, locals and tourists were informed about the sea turtles' plight and awareness was also raised through local and national media. The project researchers worked with the fishermen and continually demonstrated good animal-handling skills, while advocating best conservation practices and care towards the animals. The project's results were disseminated internationally via several channels (media and press, general public, scientific conferences and publications)

FUTURE NEEDS

The few recaptures of previously-tagged sea turtles, suggest that saturation-tagging is far from achieved and **the population in Drini Bay has yet to be completely understood.**

Due to limited resources only two sets of "stavnike" fish traps, that were deemed the greatest contributors for bycatch, were studied in the present project. It is not possible to extrapolate from these data, but rather an impact assessment should be undertaken at each "stavnike" trap to report true bycatch levels.

A bycatch assessment including trawls, nets, long-lines, small scale and artisanal fisheries is necessary in order to thoroughly study the degree of sea turtle fisheries interaction in Albanian waters. Waste and pollution pose another major threat for the sea turtle population that needs to be investigated and mitigated. Further training of local scientists and fishermen education will also be beneficial to sea turtle conservation in Albania.

The findings and conclusions of this three-year project led to the formulation of recommendations and a **"National Sea Turtle Management Strategy"**; a document which will be submitted to the Albanian Authorities in 2011. The current report provides an overview of the project's key recommendations which MEDASSET will aim to assist the Authorities in implementing.

The long-term aim of this project is for Drini Bay to be recognised as a nationally and regionally important foraging and developmental habitat for sea turtles in the Mediterranean and that these endangered species are fully protected under Albanian national law.

1. INTRODUCTION

1.1. Sea Turtles

Marine turtles are emblematic flagship species that inspire coastal and marine conservation, and fascinate people that view them as the pre-eminent symbol for all enigmatic oceanic creatures. They are also regarded as a "keystone or indicator" species and their extinction should cause serious concern regarding the health of the oceans. Their intricate biological cycle makes them an "umbrella" species for conservation, as their protection leads to the preservation of multiple habitats and linked ecosystems.

Three of the seven species of sea turtles are found throughout the Mediterranean. The loggerhead (*Caretta caretta*) and green turtles (*Chelonia mydas*) nest here, and the giant leatherback (*Dermochelys coriacea*) is an occasional visitor. Kemp's Ridley (*Lepidochelys kempii*) is a very rare migrant from Mexico[1]. It is estimated that only about 339-360 green and 2.280-2.787 loggerhead nest annually in the Mediterranean[2].

Both species (*C. caretta* and *C. mydas*) are classified as 'endangered' in the IUCN Red list of threatened species. Although they have natural predators, by far the greatest threats in the Mediterranean to these ancient mariners are mankind's activities: irresponsible and unsustainable coastal development, loss of habitats, injury or death due to vessel collision, pollution (especially plastics, lights, heavy metals or persistent chemicals), fisheries bycatch mortality, especially interaction with long-lines, gill nets and trawls that have a major impact on sea turtle populations. Additionally, they may be extremely vulnerable to the future impacts of climate change[3].

Marine turtles have been studied for more than 3 decades in the Mediterranean[4] and most nesting beaches in the region have now been identified. The marine ecology of turtles, however, is poorly studied[5], although these animals actually spend the majority of their lives at sea. Scientific knowledge that can inform decision making and planning is still scarce and research must be pioneered to gain real understanding of how sea turtles migrate, forage and interact with fisheries throughout the Mediterranean Sea.

1.2. Sea turtle research in Albania

Socioeconomic conditions

Albania is bordered by Montenegro to the northwest, Kosovo to the northeast, the Former Yugoslav Republic of Macedonia to the east and Greece to the south. It has a coast on the Adriatic Sea to the west and on the Ionian Sea to the west and southwest. Albania was an ally of the Soviet Union and China and was ruled under dictatorships from 1944 until 1990. For about 50 years, the regime applied the policy of self-isolation, leaving the country in great economic poverty. In 1991 a multiparty democracy was established and the freedom to travel abroad became less restrictive. Albania has a population of 3,170,048[6] and a GDP per capita of $3,911[7] which is the lowest gross domestic product (GDP) per inhabitant compared to any of the current European Union (EU) Member States[8]. It is now considered to be a country in transition and is a potential candidate of the E.U.

Despite its richness in biological and landscape diversity, **Albania is considered to have the highest rate of biodiversity loss in Europe[9].** Uncontrolled human activity and pressure from low socioeconomic standards have extensively damaged the ecological values of the coastal area[10].

[1] Tomas *et al.* 2003
[2] Broderick *et al.*2002
[3] Poloczanska *et al.* 2009.
[4] Groombridge, 1990; Margaritoulis *et al.* 2003
[5] Bjorndal, 1999; White, 2007
[6] 2008, Albanian Institute of Statistics
[7] 2008, World Bank
[8] Eurostat
[9] Scandiaconsult Natura AB and The Regional Environmental Centre for Central and Eastern Europe, July 2000
[10] RDS, 2005; REAP, 2006

Sea turtles in Albania

The Albanian coast has received very little attention in the past regarding sea turtle populations. In the Balkans, sea turtle nesting is monitored in Greece[11], while foraging and overwintering habitats are monitored in Croatia[12] and Slovenia[13]. Turtles passing through Albania's coastal and offshore waters when migrating between habitats in these three countries and their interaction with fishing activities have been poorly monitored until now.

The presence of marine turtles in Albanian waters has been known since at least 1960[14]. Research in the Patok area had been conducted by the Herpetofauna Albanian Society (H.A.S) through two projects: "Marine Turtle Conservation: Protection, public awareness and tagging" 2002-2005; "Monitoring of Sea Turtles in Patok area" 2005–2007.

In 2005, MEDASSET conducted the first collaborative project in Albania's marine environment (with GEF/SGP, Tirana University, Albanian Ministry of Environment): "A Rapid Assessment Survey of important Marine Turtle and Monk Seal habitats in the coastal area of Albania"[15], which laid the groundwork for the present Project.

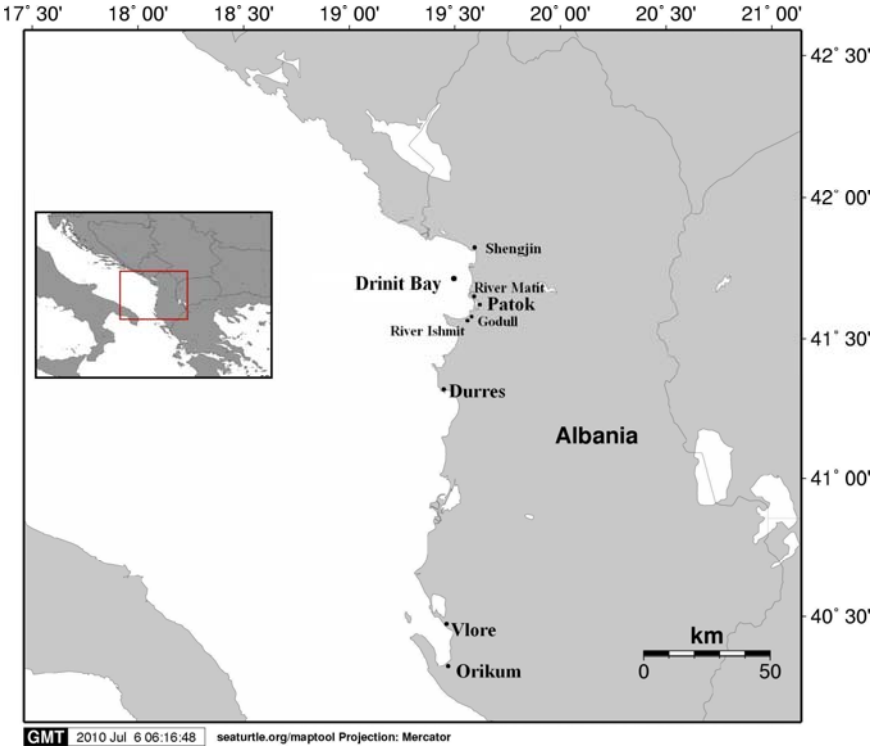


Fig. 1: Map of Albania and Research Location. **Patok**: [N41°38.191'; E019°35.327'] An area rich in biodiversity and an important feeding ground for sea turtles. Located in the Adriatic Sea (Mediterranean Basin) off the northern coast of Albania

2. AIMS AND OBJECTIVES

The three-year Project "Monitoring and Conservation of Important Sea Turtle Feeding Grounds in the Patok Area of Albania 2008-2010" **aimed to contribute to sea turtle and habitat conservation, population dynamics, monitoring migratory routes, capacity building, environmental education and awareness-raising in Albania.**

[11] e.g. Margaritoulis and Rees, 2001
[12] Lazar, 1995; Lazar and Tvrtkovic, 1995; Lazar *et al.* 2000, 2004a, 2004b
[13] Ziza *et al.* 2003
[14] Zeko & Puzanoi 1960; Haxhiu 1979, 1980, 1981, 1985, 1995, 1998, 2010; Groombridge 1990; Haxhiu & Rumano 2005, 2006.
[15] White *et al.* 2006

Project Objectives:

1. Implement a **sea turtle research programme** in the Drini Bay area (population estimates, tagging, recording measurements, size-classes and physical conditions). Monitor bycatch in 'stavnike' fish-traps. Record the distribution of sea turtles, geographically and temporally (including migration and overwintering data) and relate these to physical parameters such as sea surface temperature.
2. **Reduce fisheries bycatch**, destructive fishing practices and over-fishing.
3. Progress **public awareness-raising** in the broader Patok area**: develop and deliver training courses, media coverage, environmental education, and demonstration activities.**
4. Improve the **capacity** of Albanian scientists to monitor the marine turtle population in local waters and become self-sustaining in terms of its sea turtle research and conservation endeavours. Improve the capacity of government bodies, university students and NGOs as a means to ensure environmental sustainability.
5. Assess the high levels of anthropogenic **pollution** that impact on the foraging habitats in Drini Bay.
6. Provide **policy and management recommendations** to local & national authorities.
7. Provide the scientific community and international organisations with useful **new information** regarding sea turtles and the ecological importance of Drini Bay.

The project directly contributes to the implementation of the Strategic Action Programme for the Conservation of Biological Diversity in the Mediterranean Region (SAP BIO) and of the Action Plan for the Conservation of Mediterranean Marine Turtles to which MEDASSET is a partner (under the United Nations Environment Programme Mediterranean Action Plan (UNEP/MAP) and to which Albania is a contracting party.

The **long-term aims** of this project are for Drini Bay to be recognised as a nationally and regionally important foraging habitat for sea turtles in the Mediterranean; and that these endangered species are fully protected under Albanian national law.

Beneficiaries

- Albanian scientists and university students
- Albanian NGOs and authorities.
- International scientific community.
- Local community and visiting tourists.
- Local fishermen groups.

3. SUMMARY OF ACTIVITIES AND OUTCOMES

Outline of Project Activities:

- ✓ Sea turtle research, tagging and data collection
- ✓ Sea turtle satellite-tracking
- ✓ DNA profiling
- ✓ Capacity Building, Education and Awareness Raising
  - Training of Project Researchers
  - Student field-trips from Tirana University
  - Building capacity within Albanian organisations
  - Awareness-raising and educational outreach activities
- ✓ Pollution surveys
- ✓ Dissemination of results and Project visibility
- ✓ Drafting of Recommendations on management and protection measures.

Summary of Project Outcomes

* Data collection (population estimates, tagging, morphometric measurements, sex, size-classes and physical conditions) for **407** sea turtles.
* Sea turtle field trips for almost 250 biology students from Albanian Universities (150 in 2008; 74 in 2009); 13 in 2010).
* Training of **11** different students as Research Assistants.
* **2** local pollution surveys.
* Monitoring migratory routes of **3** sea turtles through **satellite-tracking**.
* **DNA profiling** of the sea turtle population found in the Drini Bay area. 43 samples collected for analysis.
* **Raising awareness** among fishermen and locals.
* Production and distribution of **awareness-raising material** (leaflets, stickers, posters, t-shirts).
* Coverage in **Albanian Media**.
* Two **webpages** in English, Greek and Albanian.
* Publication of **2** scientific papers and **5** abstracts in conference proceedings
* **3** Progress and **3** Annual Project Reports.
* **6** Presentations at international conferences, publication of press releases and news articles.
* In submission/preparation:
  - Paper for Marine Turtle Newsletter (in press)
  - Poster presentations at the 31st International Sea Turtle Symposium (April, 2011 San Diego, USA) and the 4th Mediterranean Conference on Marine Turtles (November 2011, Naples, Italy)
  - Sea Turtle Management Strategy, to be submitted to the Albanian Authorities (2011)
  - Scientific papers on: 3-year's foraging research; DNA analysis; satellite tracking results (2012)

4. PROJECT PARTNERS

This three-year project was carried out within the framework of **MEDASSET's** sea turtle conservation programmes in the Mediterranean. MEDASSET - the Mediterranean Association to Save the Sea Turtles, founded in 1988, is an international NGO registered as a charity and private company in the UK and as a Non Profit Organisation in Greece. MEDASSET plays an active role in the study and conservation of sea turtles and their habitats throughout the Mediterranean, through scientific research, environmental education, political lobbying and raising public awareness. The organisation has been a Partner to the Mediterranean Action Plan (MAP) of UNEP and a Permanent Observer-member of the Bern Convention at the Council of Europe since 1988. In 2009, MEDASSET was awarded Partner status for the implementation of UNEP's Action Plan for the Conservation of Marine Mediterranean Turtles.

Main project partners:

University of Adnan Menderes-Department of Biology (partner during 2009-10). The university was founded in 1992. The biology department consists of 5 different sections and the Zoology section closely cooperates with the Molecular Biology section. In 2006, a modern molecular biology and genetic research laboratory was constructed cooperatively by these two sections. The recent studies in this lab mainly focus on molecular phylogeny and population genetics of chelonians, fresh water fishes, reptiles and amphibians.

University of Tirana - Museum of Natural Sciences (partner during 2008-10). The University of Tirana, founded in 1957, was the first University in Albania. The Museum of Natural Sciences (MNS) of the University's Faculty of Natural Sciences is directed by Dr. Lefteris Kashta, and represents the most specialized research institution of fauna and flora diversity in Albania. Current research activity focuses on taxonomic, ecological, ethological and zoogeographical issues; as well as extensive botanical research. The MNS includes a botanical garden and the National Herbarium.

Herpetofauna Albanian Society (H.A.S) (partner in 2009) was established in 2001 and is directed by Prof. Dr. Idriz Haxhiu; this society includes Professors, Doctors and specialists in Biological Sciences, Biologists, Biology Teachers and Students. The specialists of H.A.S have participated in many meetings, conferences, congresses,

symposia and seminars organized within Albania and abroad. Activities are related to the protection and monitoring of the environment and different species, especially those that are endangered. The Project "Marine Turtle Conservation: Protection, public awareness and tagging" was conducted between 2002-2005.

ECAT, Tirana (partner in 2008): The Environmental Centre for Administration and Technology is a non-profit organisation developed to assist local governmental and non-governmental organisations, as well as industries and educational institutions, in the development and implementation of projects, programmes of action, and policy instruments to improve the environment.

4.1. Endorsements

Ministry of Environment, Forest and Water Administration, Nature Protection Policy, Tirana, Albania, Director: Dr. Sajmir Hoxha. The Ministry submitted its endorsement of the project and expressed its support towards its execution.

4.2. Funders

The Project was co-funded by **MEDASSET** and:

Global Environment Facility Small Grants Programme (GEF/SGP) supports activities of non governmental and community-based organizations in developing countries towards climate change abatement, conservation of biodiversity, protection of international waters, reduction of the impact of persistent organic pollutants and prevention of land degradation while generating sustainable livelihoods. Funded by the Global Environment Facility (GEF) as a corporate programme, SGP is implemented by the United Nations Development Programme (UNDP) on behalf of the GEF partnership, and is executed by the United Nations Office for Project Services (UNOPS).

UNEP/MAP, United Nations Environment Programme Mediterranean Action Plan, aims to assist the Mediterranean countries to assess and control marine pollution, to formulate their national environment policies, to improve the ability of governments to identify better options for alternative patterns of development and to optimize the choices for allocation of resources.

UNEP/MAP's RAC/SPA, (Regional Activity Centre for Specially Protected Areas) was established by the contracting Parties to the Barcelona Convention and its protocols, with the aim of assisting Mediterranean countries in the implementation of the Protocol concerning Specially Protected Areas in the Mediterranean. RAC/SPA's mission is to assist the Parties in establishing and managing specially protected areas, conducting programmes of scientific and technical research, conducting the exchange of scientific and technical information between the Parties, preparing management plans for protected areas and species, developing cooperation programmes among the Parties, and preparing educational materials designed for various groups.

The J.F. Costopoulos Foundation, a non-profit charitable institution, founded in 1979, on the occasion of the centenary of Alpha Bank, then operating as Credit Bank, in memory of its founder John F. Costopoulos by its then Chairman, the late Spyros Costopoulos and his wife Eurydice. The Foundation continuously supports the safeguarding and promotion of the Greek culture, education, scientific research and the arts both in Greece and abroad.

BRITISH CHELONIA GROUP (BCG) aims to provide chelonia keepers with the support needed to ensure that their captive animals receive quality husbandry; to raise funds from members, and from the public, to finance chelonia rescue, research and conservation projects worldwide; to discourage the importation and purchase of wild caught specimens, in favour of responsible captive breeding.

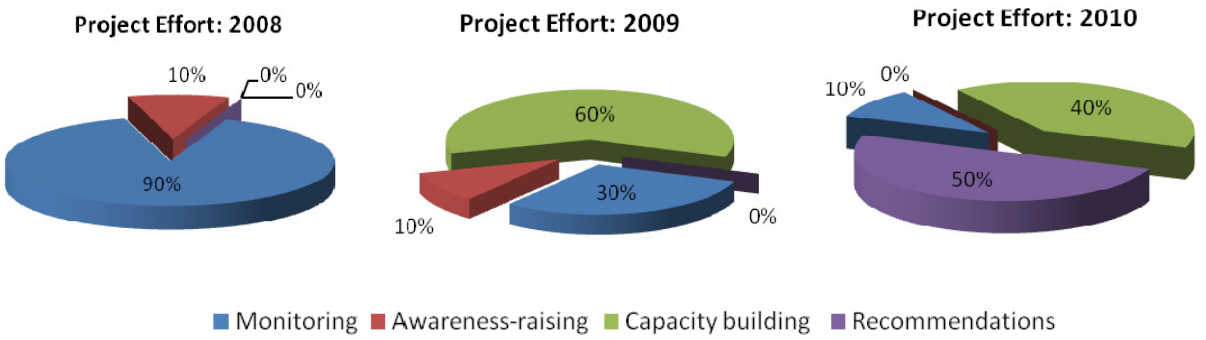
The **Spear Charitable Trust**, the **Panton Trust** and a third UK Charity that wishes to remain anonymous, provided support towards the project.

5. PROJECT TEAM

- Dr Michael White (Lead Researcher and Technical Manager - MEDASSET)
- Prof. Dr. Idriz Haxhiu (Project Researcher & national liaison coordinator in 2008-2009 - Director of H.A.S.)
- Liza Boura (Project Manager – MEDASSET), Kostis Grimanis (Director - MEDASSET), Prue Robinson (2008 Project Manager, MEDASSET)
- Prof. Dr. Oğuz Türkozan, Prof. Dr. Fevzi Bardakci, Can Yilmaz - PhD Candidate (DNA analysis - Adnan Menderes University, Turkey)
- David Oakley (Satellite data management - PhD Candidate in Sea Turtle Conservation and Biology, Southampton Solent University, UK)
- Field Research Team: Esmeralda Kararaj, Enerit Saçdanaku, Lazjon Petri, Marina Mitro, Bekim Trezhnjevna, Dhurata Përkeqi, Xhevat Gërdeci
- Blerina Vrenozi (2009 GEF fund management and administrative support, Museum of Natural Sciences, Tirana University).

6. PROJECT EFFORT

2008 → Baseline surveys and training.
2009 → Emphasis on Capacity building and awareness raising.
2010 → Emphasis on training and formulating recommendations



In **2008**, Dr. White designed a marine turtle research programme that was suitable for the local conditions. The research programme consisted of:

- collection of morphometric data to determine
  - size-classes of turtles (i.e. the population structure);
  - species of turtles present;
  - habitat purpose (e.g. foraging, mating, overwintering, refuge);
- a tagging programme to identify remigrants or intra-annual site fidelity;
- photo-recognition data;
- assessment of fish catch (to determine correlation between target species and the presence of turtles);
- abiotic factors, such as SST and wind direction.

This was accompanied by awareness-raising activities and capacity-building (training of Project Researchers; and hosting field-trips for students from Tirana University.

In **2009**, the sea turtle research programme continued, the method was evaluated and proven to be adequate for the local conditions. Additional activities were initiated to provide better insight into the population dynamics of turtles using Drini Bay:

- satellite-tracking study of three loggerhead turtles for a two-year period (migratory movements and overwintering habitats);
- DNA sample collection & analysis (contributing to the regional efforts to understand Mediterranean sea turtles).

The main focus of the 2009 phase was capacity-building; this occurred at various levels:

- University student training

- Government institutional organisation (issuing CITES permit)
- Instigating management practices in a local NGO (H.A.S.)

In **2010**, sea turtle data collection and student training continued, although on a smaller scale, as the project's main aim was to produce a proposal for a sea turtle management strategy for the Albanian authorities: so that policy can be formulated and implemented that will protect sea turtles and their habitats throughout Albania's territorial waters.

7. STUDY AREA

In the northernmost part of the Western Lowlands of Albania there is a lagoon at Patoku [N41°38.191; E019°35.327]. A narrow causeway runs across wetlands (marsh) and the inner lagoon to a small piece of land: this was where the project team established the field base to monitor the loggerhead sea turtles that forage in the Drini Bay area.

The local area is characterised by five main habitats: a wetland, an inner lagoon, an outer lagoon, a small barrier island and a shallow sea – Gjiri i Drini. Five sediment-laden rivers (Bunës, Drini, Mati, Droja and Ishmi) enter Gjiri i Drini bringing large amounts of terrestrial garbage, mostly plastics, into the coastal zone (see below). Lumi i Ishmi enters the bay just north of Kepi i Rodonit (aka Kepi i Skenderbej).

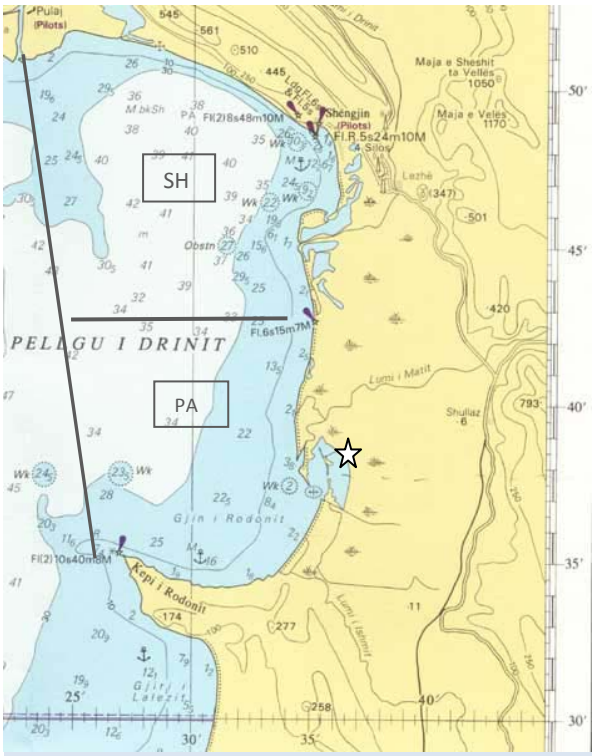


Fig. 2: (A star marks the causeway across the inner lagoon to Patoku field-station. Hellenic Hydrographic Service chart adapted by Dr. White)

Gjiri i Drini

Drini Bay is a shallow sea (maximum depth in survey area is 47 m) which is about 30 km north to south. It has a sand/mud substratum dominated by molluscs and crustaceans. The bay was divided into two main research areas: Shengjini (SH) and Patoku (PA).

SH: Shengjini - Northernmost part of Gjiri i Drini:

- Western border is a line from the border with Montenegro, mouth of Lumi i Bunës, to the tip of Kepi i Rodonit (Skenderbeg Head) [Navigation light: FL (2) 10s 40m 8M].
- Eastern border is the Albanian coast (includes lagoons and wetlands).
- Northern border is coastline from Bunës to Shengjin (includes Thrown-sand beach, and a wetland area, Velipojë).
- Southern border is a line of latitude (approx: N 41° 43') connecting transect (western border) to a light on the eastern shore [FL6s 15m 7M].
- Maximum depth is about 42 m.
- Two rivers enter this area: Bunës and Drini.

PA: Patoku. Southernmost part of Pellgu i Drini; also known as Gjiri i Rodonit:

- Western border is the same transect as SH (mouth of Lumi i Bunës to the tip of Kepi i Rodonit (Skenderbeg Head) [Navigation light: FL (2) 10s 40m 8M].
- Eastern border is the Albanian coast, with Patoku Lagoon being roughly central.
- Northern border is a line of latitude (approx: N 41° 43') connecting transect (western border) to a light on the eastern shore [FL6s 15m 7M].
- Southern border is Kepi i Rodonit.
- Maximum depth is about 42 m.
- Three rivers enter this area: Mati, Droja and Ishmi.

This is a very impoverished coastal area, with very minimal infrastructure, very limited environmental awareness, especially poor transport links and no waste disposal facilities. There are no permanent residents at Patoku but some small cafes and restaurants have been erected for visitors who come to the coast for the day, especially in the summer months.

Extensive fishing occurs throughout Drini Bay. Artisanal fishing is the main economic activity in the bay, especially in the remote southern areas where the project is based. There are a few trawlers based at Shengjini, the only port in the bay; which also has an emerging tourism industry that is especially popular with Kosovars. There is tourism infrastructure at Tales and Vain. At Tales the visitor season is only from mid-July until the 1st September (i.e. about 6-7 weeks); for the rest of the year the only activities are artisanal fisheries. What is particularly noteworthy about Tales is that during the holiday season the beaches are cleaned every day, there are ample rubbish containers and portable toilets; and all of the cafes and bars are built behind the beach.

Fisheries in the study area:

Trawlers (trata): the first trawlers were observed fishing near to the mouth of Lumi i Mati on the 16th of July 2008; they are based in Shengjini. Turtles are known to be captured in this gear[1].

Longliners (from Shengjini): not a common method fishing method in Drini Bay, but believed to fish occasionally at 'battla' sea mounts. Hooked turtles were very rare (see below) and these were taken from stavnikes.

Nets (mrezh): used in shallow waters (4-6 m depth); occasionally turtles are captured in these nets.

Octopus pots: a ceramic pot is lowered to the seabed on a line, marked with a floating plastic bottle, and examined periodically to see if an octopus has hidden inside.

By hand: one young fisherman chases after fish in the shallows or lagoons and grabs them in his hands. He can catch about 5 kg of fish in 20 minutes.

Dynamite: although illegal two men were seen probably placing dynamite charges near to Tales Beach (05/07/2008); nearby many dead fish floating at the surface were observed. Explosions have been heard coming from seawards on several mornings (usually 6-10 explosions). A report (17/07/2008) was received that a dead tagged turtle was seen in that area following explosions; however, the cause of death is unknown. (See below for 3-year summary)

Bilanç: a large type of net suspended from fixed poles that is lowered onto the floor of a riverbed, and then winched up periodically to check for fish.

Kalemero: a similar device to Bilanç but smaller and usually operated by hand; also used in rivers or lagoons.

Eels (*Anguilla anguilla*): several different types of trap, similar to keep-nets, were used for eels in the lagoons, one type – known as *'pinar'* can be used from 1st September. Fishermen were also observed stabbing eels with tridents from small boats.

Shellfish: an unusual method is used whereby people walk through the lagoon feeling for bivalves in the sand with their toes, then they pick them up and collect in a bag. Push-nets & drag-nets.

Stavnike (see below)

Fig. 3: Bilanç in mouth of Matit river.

Fig. 4: Pinar being erected in inner lagoon at Patoku

Fig. 5: Kalemero

Fig. 6: Trawler fishing very close to the Patoku beach; water depth is about 5-6 m.

8. SEA TURTLE POPULATION MONITORING AND DATA COLLECTION

8.1. Turtles as fisheries bycatch: 'stavnikes'

The project's fundamental *'modus operandi'* was to monitor turtles that were caught incidentally by fisheries (i.e. 'bycatch'); and in particular from a method of fishing that uses traps, which are known as *'stavnikes'*. Stavnikes are a type of fish-trap, originating in Russia that arrived in Albania around 30 years ago, and were forgotten until about 2002; when the Patoku fishermen started to use them again. A rectangular enclosure is erected in shallow water (depth 5-6 m) some distance offshore, consisting of long wooden posts (length 8-10 m, diameter 10-15 cm) forced vertically into the seabed, with nets secured to them in an arrangement that allows easy access into the traps for fish and other marine animals. The number of posts required depends upon trap-size, but the design is always similar.

A stavnike is divided into sections (reception area, ante-chamber, and collection chamber), which is repeated to form a double unit. A long barrier net extends from the fish-traps to the beach (Ishmi stavnike was 1800 m offshore; Mati only 200 m); the traps are constructed to allow entry from either side of the barrier net. When fish or turtles encounter the barrier they have three choices: to turn left, right, or to go back the way they came; an area they may have just foraged. Turning beachwards leads them into shallower water, but any animals entering the traps' reception area are guided into successive chambers; escape from these is difficult although not impossible.

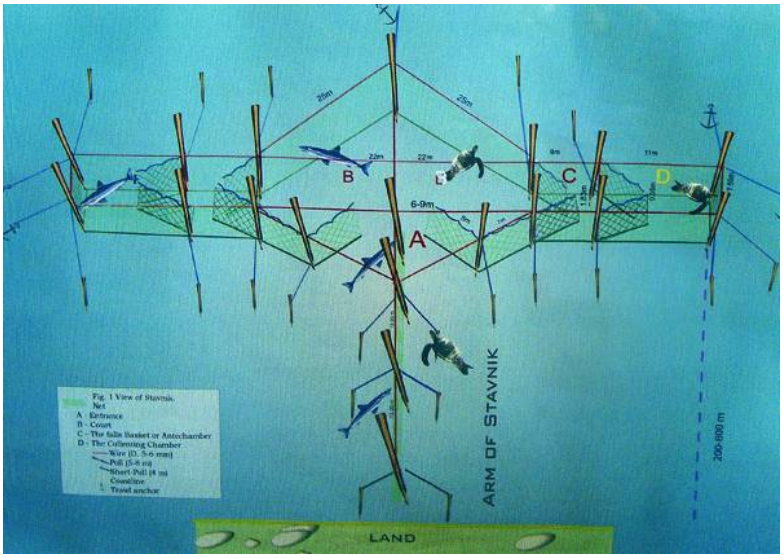


Fig. 7: Typical design of a stavnike fish-trap (Photo: I. Haxhiu).

In 2008 the entire bay was visited by boat to count stavnike traps; there were 18 sets of stavnikes throughout Gjiri i Drini (see text box); this survey was not repeated in other years. Two groups of stavnike fishermen (Rakipi Martini – Ishmi traps; and Çal – Mati traps) had their bases near to the field-station in Patoku Lagoon, and so their fish and turtle catch could be monitored easily; and provided 99% of the bycatch data.

Traps were emptied early each morning; harvesting was not possible in strong winds or heavy seas. Working from a small boat inside the enclosure, the fishermen slowly raised the bottom net by hand, reducing the size of the collection chamber, until the catch could be emptied into the boat. Any turtles were lifted manually into the boat, which could be difficult with larger animals. Space in the boats is limited and occasionally tagged turtles were released, in which case morphometric data were not collected; apart from those data collected at tagging.

Fig. 8: Emptying the collection chamber of Ishmit stavnike

Fig. 9: Lifting a loggerhead from Ishmit stavnike into the boat.

Fig. 10: Loggerhead in stavnike

Fig. 11: One of three stavnikes at Thrown-sand beach

Fig. 12: Vain stavnike very close to shore

Other stavnikes in Drini Bay

There were 18 sets of stavnikes throughout Drini Bay in 2008. A Global Positioning System was used to fix the location of key points (e.g. stavnike fish-traps) within the study area (Garmin GPSMap 60C; software: Garmin MapSource; Atlantic Blue Chart; WGS 84: see Annexe 1 of 2008 Project report, White *et al.* 2009, for GPS locations).

- *Vain stavnike:* visited on the July 5th 2008. This trap is very near to the beach (50 m). Fishermen reported finding turtles in the traps; virtually all of these turtles were untagged.
- *Tales stavnike:* visited on the July 5th 2008. This trap is very near to the beach (50 m). Fishermen reported finding turtles in the traps; virtually all of these turtles were untagged.
- *Stavnikes at Kepi i Rodonit:* There were seven sets of traps along the northern side of the peninsula; the team spoke with several of these fishermen, but they very rarely have any turtles in their traps.
- *Kune-Çesku (*Shengjin*):* this is the only stavnike to fish all year round. This trap is very interesting in that the barrier-net is removed during the summer months, perhaps because of its proximity to the Shengjini tourist beach, and only re-erected during the winter months. One fisherman, Çesku, has a good understanding of global biodiversity and environmental issues. A turtle was tagged from this stavnike in September 2008.
- *Kune-Prela:* this trap was situated on the seawards side of the coastline between Shengjini bay and Vain Nature Reserve; it is a difficult shore to reach from the landwards side. The Prela group have a small depot in the mouth of Lumi i Drini. They did catch turtles but the project lacked resources to monitor them.
- *Kune:* there are two other stavnikes near by, but the fishermen could not be located.
- *Thrown-sand beach:* there were three stavnikes very close to the shore in the northernmost part of the bay. Logistical limitations prevented the team from visiting these traps, but the fishermen were contacted by phone and asked to report any turtle bycatch. No reports were received.

Fig. 13: Kuna-Drinit stavnike and trawler in the background

Fig. 14: Vain stavnike: they are much less organised than the Ishmit fishermen

Fig. 15: Matit fishermen returning from stavnike

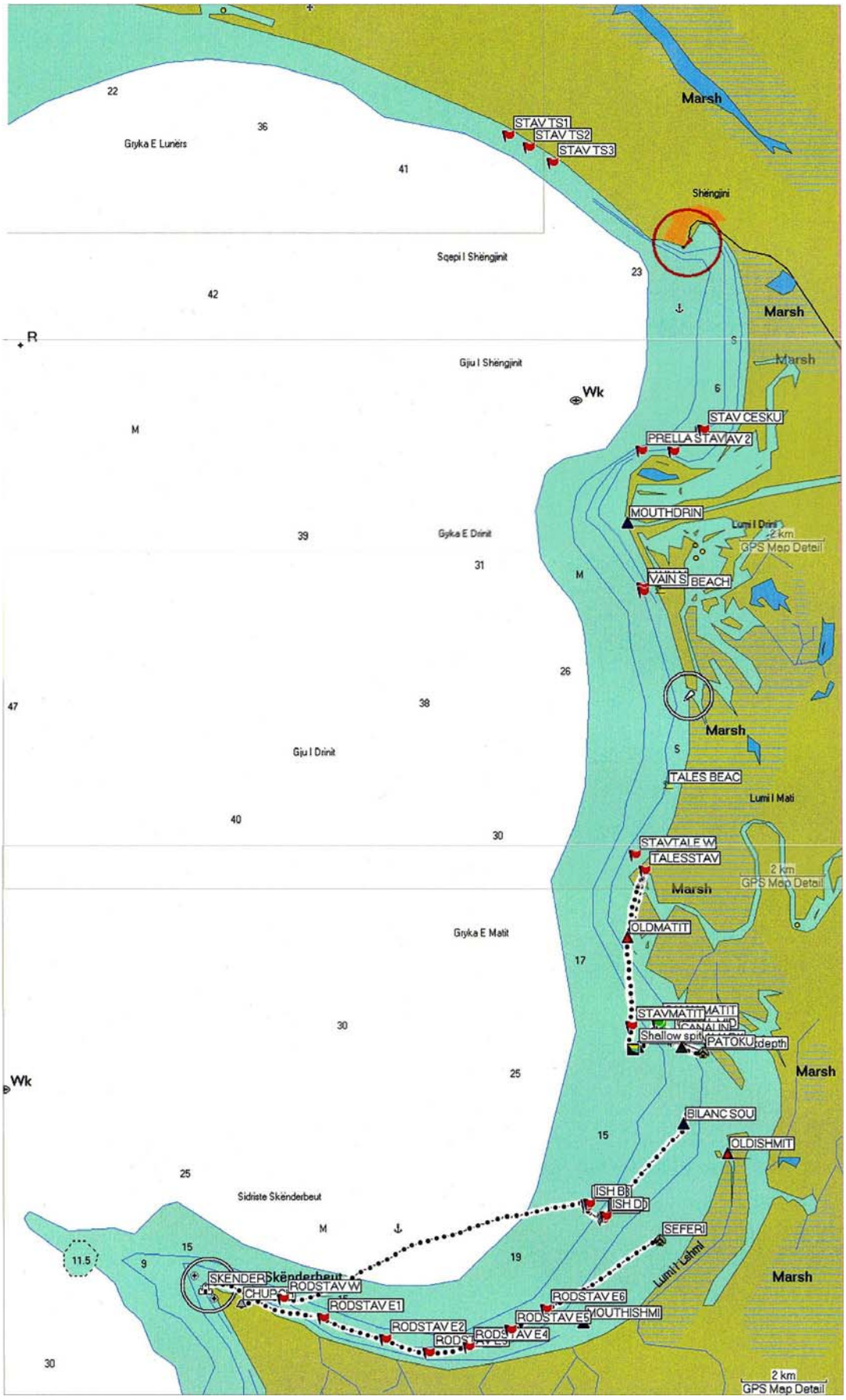


Fig. 16: Drini Bay: A Global Positioning System (Garmin GPSMap 60C; software: Garmin MapSource and Atlantic Blue Chart) was used to fix the location of key points, such as stavnike fish traps, within the study area. The red flags indicate stavnikes observed during 2008 (Data by M. White).

8.2. Data Collection Periods

In 2008, data collection started on the 1st of June and ended on 24th July, when heavy weather destroyed the stavnikes. In 2009, fieldwork began on 15th June 2009 until 4th September (Çal stavnike was dismantled at the end of July, damaged by dynamite fishing).

In 2010 data collection started on 17th June and all stavnikes continued fishing until 1st September (thus the increased sample size); a High Pressure system was over the country and every day was hot, clear, and with mostly calm seas. Mati stavnike (Çal fishing group) started fishing in April and Ishmi (Rakip Martini's fishing group) at the end of May; the first sea turtle being caught as bycatch on 9th April 2010. During the period 9th April to 12th June, before the Patoku field-base was operating, turtles were tagged and measured at Patoku once each week by two environmental biology M.Sc. students from Tirana University (Vilma Piroli & Lazjon Petri, both conducting research towards their master thesis; supervisor: Prof. Haxhiu). These researchers collected data from 44 turtles that had been captured in Drini Bay; and from two more at Durres – Albania's main port (Haxhiu & Piroli, unpublished data).

8.3. Data collected

Turtles, usually captured as bycatch in stavnikes, were transported to the field-base at Patoku. Species confirmation was based on standard keys (Dodd, 1988; Marquez, 1990; Eckert *et al.* 1999; Wyneken, 2001). Data recorded from each turtle included:
i) Morphometrics: CCL & CCW (Eckert *et al.* 1999); plastron-cloaca; TTL; and the distance from the tip of the tail to the posterior margin of the carapace.
ii) Epibiota. Injuries and health assessment.
iii) Turtles were tagged with a single Stockbrand's titanium tag, usually on the right fore-flipper.
iv) Photo-recognition (PF & FP numbers; carapacial scute counts; photographs).

Abbreviations:
CCL: Curved Carapace Length
CCW: Curved Carapace Width
TTL: Total Tail Length
FP: Fronto-parietal index
PF: Prefrontal scales
SST: Sea Surface Temperature

NOTE: As an indicator of the stage of sexual development three measurements were recorded from the tail ventrally[16]: i) Distance from posterior margin of plastron to midline of cloacal opening (Plas-clo); ii) Distance from tip of tail to posterior margin of the carapace (+/- cara) ; iii) TTL

8.4. The studied population

Since the project began in June 2008, 407 "new" turtles were studied i.e. turtles that did not carry a flipper-tag. The project tagged **393 loggerhead turtles *Caretta caretta*** and **3 green turtles *Chelonia mydas*.** Note: 11 turtles were not tagged: 3 *C. caretta* and 1 *C. mydas* were too small to tag; 1 *C. caretta* escaped from an outside pond; 1 *C. caretta* was dead, but CCL & CCW were obtained; 5 turtles (4 *Cc* & 1 *Cm*) were reported by phone. In 2008, 103 turtles were captured in the two stavnikes (these were all *C. caretta* apart from one *C. mydas*), one from a net (mrezh) at Godull, one from Çesku's stavnike at Kune, and one was found as it crossed some land between the outer and inner Patoku lagoons. There were 137 *C. caretta* during the 2009 field season. In 2010, 152 sea turtles were caught as bycatch in stavnikes and were measured and tagged, including 3 *C. mydas*.

8.5. Size-classes of turtles

The majority of turtles captured in Drini Bay were in the 50-70 cm size-classes (Mean CCL = 64.5 cm; SD = 9.2 cm; CCL range = 30.0 – 84.5 cm; n = 387 turtles). Smaller turtles were rare (and included 2 of the migrating *C. mydas*), as were large turtles; the biggest animal had a CCL of 84.5 cm. As mentioned, the increased sample size in 2010 was because both sets of stavnikes continued fishing into September, whereas in 2008 fishing ended in late-July; and in 2009 Mati traps finished at the end of July, Ishmi traps about four weeks later. **Table 1** reports the number of turtles in each 10-centimetre size-class based on the CCL.

[16] Casale *et al.* 2005; White *et al.* 2008, 2010c

Table 1. CCL size-classes (White 2007) are shown for turtles studied and tagged in Drini Bay (2008-2010).

	CCL								
Year	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**Total**
2010		3	6	33	60	42	8		**152**
2009		1	7	30	54	40	5		**137**
2008			2	27	46	21	2		**98**
Total	**0**	**4**	**15**	**90**	**160**	**103**	**15**	**0**	**387**

8.6. *Chelonia mydas*

One juvenile *C. mydas* was captured in Ishmi stavnike (04/06/2008 CCL = 39 cm[17]); and another one was captured by fishermen at Orikum, central Albania (06/10/2009 CCL = 30 cm); this latter animal was measured and photographed by a Project–trained researcher. In 2010, three more *C. mydas* were captured in stavnikes (23/06/2010 CCL = 33 cm; & CCL = 67 cm; 21/07/2010 CCL = 65.5 cm). The two larger animals are adolescent males; a new life-stage of this species in the Adriatic (White pers. com.). These data are highly important. The recent review of *C. mydas* in the Adriatic Sea by Lazar *et al.* (2004a) showed there was a historical misunderstanding amongst Adriatic fishermen that larger turtles were *C. mydas* and the smaller ones *C. caretta*; so some of the *C. mydas* records are believed now to have been *C. caretta*. A further three live *C. mydas* were reported from Albanian waters (SGP/GEF, Tirana Office) during 2003 [31/05/2003 CCL = 27 cm; 14/08/2003 CCL = 29 cm; 03/09/2003 CCL = 67 cm]; Haxhiu reports about 15 [CCL <50.0 cm][18].

The 5 live juveniles measured here confirm that *C. mydas* does venture into eastern Adriatic waters; Dr White advised that the range of *C. mydas* in the Mediterranean now needs to be reviewed. Albania was not included in the range states for *C. mydas* in the Convention for Migratory Species. MEDASSET has now rectified this by using the *C. mydas* reported here.

8.7. Flipper-tagging

The first turtle tagging project in Albania began at the end of 2002, using Dalton's plastic Rototags (provided by RAC/SPA, Tunis). There were 100 pairs of tags (i.e. 2 tags with the same serial number to facilitate double-tagging), however, the Albanians decided to use 1 tag per animal and applied 100 to the anterior flipper, and another 100 to a posterior flipper; the records were clear however (Gace pers. com.). Suggett & Houghton (1998) provided evidence that Rototags can increase the risk of turtles becoming entangled in fishing gear, and so this project used Stockbrand's titanium tags (these tags lock into a closed u-shape). The first titanium tag was applied in July 2008; these tags were marked with an Albanian address, in order to reinforce the conservation message; fishermen thought that the Rototags had been applied in Tunisia due to the RAC/SPA address marked on the tag. When Roto-tagged turtles were recaptured, the plastic tags were removed and replaced with a titanium tag. Tags have been registered with the International Sea Turtle Tag Inventory of the Archie Carr Centre for Sea Turtle Research (ACCSTR), to assist in reporting recapture data for turtles.

A turtle in Libya: in November 2010 a diver in the Gulf of Sirte, Libya, reported the presence of a turtle **(AL0045)** that was tagged and released at Patoku on June 16th 2009: at release it measured CCL= 69 cm and it may be an adolescent male loggerhead. This is the first international report of a live turtle tagged in Albania.

Fig. 17: 2009, turtle too small to tag

Fig. 18: 2009, smallest turtle head photo-recognition

Fig. 19: *Chelonia mydas* found at Orikum, 2009.

Fig. 20: *C. mydas* captured in 2008. It was tagged, released and recaptured 3 weeks later.

[17] White *et al.* 2008
[18] Haxhiu & Rumano 2005; 2006; Haxhiu 2010

Fig. 21: The extended tail of an adult male loggerhead

Fig. 22: The developing tail of an adolescent male.

Fig. 23: Removing a rototag

Fig. 24: Albania's first Stockbrand's tag

8.8. Presence of males

In each year there were substantial numbers (27%) of male turtles present in the bycatch. Between 2008-2010, 112 males were tagged (35 adults; 77 adolescents). As the distribution and marine ecology of male turtles is poorly understood; this unusual assemblage can be considered an important and highly-significant finding[19].

8.9. Recaptures

Turtles that were caught more than once in the same field-season were referred to as *'recaptures'* (i.e. intra-annual); they were not expected to have grown noticeably in that period. In 2008 there were 22 recaptures, with one loggerhead being caught 5 times in two months. In 2009 there were 19 recaptures; in 2010 only 13; however, there were some issues with data-collection in this year (see section 8.15.2).

8.10. Remigrants

Previously-tagged turtles were captured inter-annually (referred to herein as *'remigrants':* turtles that were caught again during different field seasons, that are believed to have re-migrated into the bay; although they may have remained in local waters throughout the intervening period and had not been re-encountered*).* It can be seen that these *remigrants* represent a small proportion of each year's bycatch; typically less than 10%. In 2008 there were 8 loggerheads; 13 loggerheads in 2009; and in 2010 another 11. However, as described below (see *'deviation from research methodology'*), data were not recorded correctly by the Albanian researchers between April and mid-June 2010; which may affect this estimation.

8.11. Incremental growth of remigrants

Incremental growth rates were calculated for CCL and CCW using the following method:
i) Measurement at recapture - Measurement at tagging e.g. (CCLr-CCLt) cm
ii) Interval between tagging and recapture in years (e.g. 14 months = 1.17 years)
iii) Growth rate = i/ii cm/yr
As described in section 8.15.2, in 2010 there were 6 data deficient records; these were omitted from the statistical analysis. The following data are from White *et al.* (*in prep*):

- **CCL growth rate** varied between 0.0 cm/yr and 4.9 cm/yr
  (Mean 1.7 cm/yr; SD 1.4 cm/yr; n = 26 loggerheads).
- **CCW growth rate** varied between 0.0 cm/yr and 2.8 cm/yr
  (Mean 1.1 cm/yr; SD 0.8 cm/yr; n = 26 loggerheads).

8.12. Health status

Stavnikes seem to be the most 'turtle-friendly' type of fishing gear yet observed. This is because no damage is caused to the turtles when they enter the traps; they are free to swim around inside the traps and, crucially, they can surface to breathe; they can also feed on other species within the trap enclosure. The vast majority of turtles were healthy and uninjured at capture. A small number (n=9) had existing carapace damage; in one case very severe [W1441]; these injuries are usually due to boat-strikes, or caused by wire-ropes; probably from trawling-gear. Three turtles had missing limbs (1 fore-limb, 1 rear limb, 1 half a rear limb). One turtle [W1438] found in the stavnikes had swallowed a hook and monofilament line. Because the

[19] White *et al.* 2010c

hook was visible in the animal's throat, Dr White and one of the Mati fishermen removed it, applied antiseptic, and then released the turtle into the lagoon, where it swam off rapidly (27/09/2010).

A small number of turtles were damaged when they were manhandled into the boats (fresh minor cuts and scute or scale damage); but a commonly observed injury was superficial damage to the dorsal surface of the head. It is believed that this is caused by fishermen turning turtles onto their backs, or throwing them onto concrete. The project includes recommendations in the proposed National Sea Turtle Management Strategy on the mandatory requirements for safe-handling of turtles and their transportation. This should be accompanied by an awareness-raising programme and fishermen-training courses.

In all three years many turtles (50%) presented high loads of epibiota; particularly barnacles. These probably are indicative of benthic/neritic habitat-use and, perhaps, extended periods of resting on the seafloor. In contrast, the smaller oceanic-phase turtles tended to have a clean carapace.

Fig. 25: Severely-damaged carapace of a loggerhead [W1441]

Fig. 26: Monofilament fishing line found in turtle

Fig. 27: Head damage

Fig. 28: Hook extracted safely from W1438

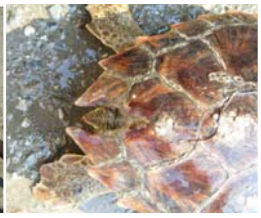


Fig. 29: Carapace injury, probably from trawl wire

Fig. 30: Heavy barnacle loading

Fig. 31: Leech species blood-sucking parasite from neck of a turtle

Fig. 32: Close-up of leeches

Fig. 33: Colony of *lepas spp.* on the plastron of a loggerhead.

Fig. 34: Epifaunal & algal growth on posterior part of carapace of a C.caretta indicate front may have been buried (hibernation)

8.13. Photo-recognition

A consequence of the Albanian practice of only using a single flipper-tag per turtle is that, inevitably, some of these tags will be lost; and the turtle population will then be overestimated. To mitigate this, the lead researcher used photo-recognition techniques and also taught local scientists how to use them, so that a much better morphological picture could be developed for each individual animal[20]. This technique uses a combination of the number of dorsal head-scales; the number and pattern of carapace scutes; and the size-class and any identifiable sexual characteristics. (See 2008 Project report, White *et al.* 2009b, for more details). Photo-recognition was used to successfully re-identify individuals that had lost tags (see section 8.15.1).

8.14. Potential nesting beach surveys

The beaches at Tales were walked once or twice each week between June and October 2010 searching for signs of nesting activity or tracks, either of females coming ashore to lay their eggs or emergent hatchlings; nothing was found. These beaches, between Rivers Drini and Mati, are extremely suitable for nesting. The sand is clean, of sufficient depth for egg-clutches to remain above the water-table, warm, and mostly clean beneath the surface; there is little vegetation, and thus few roots going through the sand. The beaches are wide and with easy access from the sea; and, apart from a seven-week period in the summer during July and August, are almost deserted.

[20] White 2006, 2007

8.15. Deviation from research methodology

8.15.1. Application of tags and tag losses

In 2009 and 2010, tagging training was reinforced, because several tags had been incorrectly fitted and lost, or would have soon been lost; these were replaced correctly. The benefits of photo-recognition were self-evident and four turtles that had lost their tags were successfully re-identified. In 2010 there were two turtles with only the bottom part of a Rototag (the address half) present; at some point the numbered part was lost or perhaps removed (these would have been tagged prior to late-2008); photo-recognition data were not collected in those days.

8.15.2. Data collection methodology

Dr White identified the following problems in the turtle bycatch data-set collected by Albanian researchers in April-June 2010:
i) There was no understanding of "Sea Areas" (see study area map, section 7, p.12); all records were allocated a 'PA' prefix, which denotes capture in the southern half of Drini Bay;
ii) Each encounter was allocated a new record number, whereas the monitoring system had been designed to report recaptures of turtles: by using the original record number and a suffix for each subsequent encounter (e.g. PA100; PA100(a); PA100(b) etc.).
iii) Point (ii) meant that there were few incremental-growth data. When a turtle had an existing Stockbrand's titanium tag, the animal was not re-measured; although date and place of recapture were recorded under a new serial number. Incremental-growth data (CCL & CCW) *were* collected for turtles that had previously been tagged with a Dalton's plastic Roto-tag (i.e. before late-July 2008) as they were retagged with Stockbrand's tags.
iv) This meant that recaptured individuals could have several different record numbers; with the only common link being a flipper-tag number.
v) Consequently it was difficult to report how many turtles had actually been studied; the sequential numbers in the original recording system had provided this tally.
vi) If a turtle lost its tag (i.e. there was no tag but a tag-scar was present) then several data records would become unusable – Albanian policy was only to apply a single tag, instead of the more-usual two, in order to save money – and turtle population numbers would be overestimated.

Dr White taught Vilma Piroli (MSc student) how to resolve most of these discrepancies. Data-records were renumbered (Dr White provided the entire three year's records so that Ms Piroli could understand recaptures and incremental-growth) and missing or incorrect data were calculated whenever possible; unfortunately some data were not recoverable. The project's records were brought up-to-date and Ms Piroli became the data-sheet manager for 2010.

This incident reinforces the conclusion that a training course in research techniques is required in Albania, especially for undergraduate and graduate students, before scientists begin a field-research study; and that a research plan is submitted for approval beforehand (MEDASSET's National Sea Turtle Management Strategy).

8.16. Miscellaneous events

On the 20th September 2008 the project team released an adolescent male loggerhead from Orikum, near Vlore, where it had been kept in a small pool in a hotel's garden for 15-18 months. The animal was well-fed and there was a continuous flow of seawater to its tank. It had been captured originally in fishing gear and had lost its right fore-flipper, probably due to tissue necrosis.

On the 30th July 2010 a loggerhead turtle (CCL = 70 cm) that had been caught in Mati stavnike, laid a clutch of eggs in the pool where she was retained overnight; before being measured and tagged. The eggs were discoloured and had lost their firmness, but were of normal size. One of the eggs was opened with a scalpel-blade and the yolk was of normal appearance. It is possible that the stress of being captured caused the turtle to deposit these eggs prematurely.

9. Environmental Ecology

9.1. Abiotic factors

Certain environmental parameters were measured each day at Patoku during the **2008-2009** summer field seasons so that a comprehensive understanding of the coastal zone could be achieved. (See 2008-9 Project reports for measurements). The most important was the sea surface temperature (SST); the Mean Monthly SST was >26.5°C during the period when turtles were captured as bycatch[21]; so water temperature was not a limiting factor for the presence of turtles in the foraging areas. There are no direct temperature data for the winter months at Patoku; however, SST at Venice in the northern Adriatic may fall as low as 9°C; therefore it seems likely that SST in Albanian waters will be somewhere between that in Venice and those reported from the Ionian[22]; so the possibility of turtles being cold-stunned (cold stunning events have been reported in recent years; see references in Casale and Margaritoulis 2010) cannot be ruled out if they stay in Drini Bay over winter. The wind speed and direction (as well as cloud-cover) were also recorded on most field-days; these would later prove to be important in the plastic pollution survey.

In 2010 the weather patterns were broadly similar to the other years, with the predominant wind direction being Maestrali; and the Mean SST was more than 26°C for the summer field-season. Physical parameters were measured on 34 days during this field season. Table 2 shows that for most of the time the wind was blowing into the bay: NW (19 days); W (12 days). This concurs with the previous two years data; and is what causes any river-borne debris to remain entrained within Drini Bay[23]. Monthly Mean SSTs are given in Table 3. Throughout the field season these were above 26°C. In August there was a high pressure system over the entire country with every day being hot and dry.

Table 2. Wind Direction measured at Patoku (2010)

Wind	June	July	August
North			
Northeast			
East			1
Southeast			
South	1		
Southwest	1		
West	4	2	6
Northwest	4	5	10
Records	**10**	**7**	**17**

Table 3. Monthly Mean SSTs at Patoku (2010)

SST (°C)	June	July	August
Mean	26.4	31.8	29.6
St. Dev	3.2	1.6	1.8
Minimum	21.5	30.5	26.0
Maximum	31.5	35.0	33.0
Records	**10**	**7**	**17**

9.2. Other species present in Drini Bay

Dolphins (probably *Tursiops truncatus*) are resident in Drini Bay, particularly in the northern areas: they have been reported to enter Lumi i Drini during high water. It is possible that otters *Lutra lutra* also use the Patok area for foraging, as mounted specimens (i.e. 'stuffed') were seen in a nearby restaurant. Patoku, Kune, and Vain Lagoons are important habitats for birds; the Patoku lagoons support a rich variety of birds, some apparently resident (e.g. Kingfisher *Alcedo atthis*; Little Egret *Egretta garzetta*), and others migratory (Greater Flamingo *Phoenicopterus ruber*; Great White Egret *Egretta alba*; Cormorant *Phalocrocorax carbo*). Swallows *Hirundo rustica* were observed to build nests using the mud from the foreshore by the field-station; they reproduced successfully.

9.3. Availability of food resources

The habitats in Drini Bay and Patoku inner and outer lagoons are neritic/benthic. Incidental beach surveys in the broader Patok area showed that Drini Bay is an extremely-rich habitat for benthic fauna; there is an

[21] White *et al.* 2009b
[22] White 2007
[23] White *et al.* 2010b

abundance of gastropods and bivalves, as well as several crustacean species (e.g. shrimps and crabs); the strandlines consist of thousands of empty shells. So there are ample and widespread food resources on the sand substratum that are available for the omnivorous loggerheads; as well as extensive mussel-beds *Mytilus galloprovincialis*; for which the project now has direct evidence (faecal remains) showing that *Caretta caretta* consumes them locally. Furthermore, these more-sessile prey items are probably easier for turtles to capture than the fairly fast-moving crabs (White pers. com). A point raised by the Albanian Authorities was that if the pollution flowing from Ishmi River into Drini Bay was eliminated, then the crab populations, which prefer more polluted waters might fall (Dr. T. Bino pers. com.). Because crabs are a food resource for loggerheads then these turtles might also move elsewhere to feed.

Fig. 35: *Squilla manta*

Fig. 36: Bivalves on Godull beach

Fig. 37: Crabs

Fig. 38: Whelk eggs

Fig. 39: Loggerhead faecal sample indicating benthic foraging.

Fig. 40: Neogastropoda in loggerhead faeces

Fig. 41: Mostly *Mytilus* - adult male loggerhead faecal sample

Fig. 42: Faecal sample: all benthic fauna

9.4. Monitoring fish catch

Catches were monitored in 2008-9 in three ways:

i) direct observation at the traps,
ii) direct observation of the catch when the boats returned to Patoku
iii) discussions with different fishermen about their catch (i.e. anecdotal evidence).

In 2008, 30 fish were identified to species level (Rakaj 1995), and their Albanian names were registered (Annexe 5 of 2008 Project Report, White *et al.* 2009b). Patoku Lagoon was observed to be an important reproductive habitat for different fish species (fry frequented waters as shallow as 1 cm). Migratory eels *Anguilla anguilla* are present in the lagoons, particularly during the spring and autumn. A significant incident, communicated to www.oceansunfish.org, was the recording of the capture of two Ocean sunfish *Mola mola* (30th June 2008, 6th July 2008; see 2008 Project Report, White *et al.* 2009b, for more details).

Fig. 43: Torpedo ray *Torpedo torpedo*

Fig. 44: Blue crab *Callinectes sapidus;* a North American immigrant at Patoku field-station.

Fig. 45: Sorted catch

Fig. 46: Dolphinfish *Coryphaena hippurus*

Fig. 47: *Mola mola* from Cal stavnike; weight 300 kg.

10. SATELLITE TRACKING

10.1. Rationale

At Patoku 99% of the turtles that were measured and tagged, are collected from stavnikes; however, these traps are dismantled in late-summer. This means that there are few, if any, bycatch data records[24] available for the period when sea temperatures are lower. Underwater visibility in Gjiri i Drini is usually zero and so it is not even possible to observe turtles directly at sea[25]. Overwintering data are now being received via satellites (described below) and the research team expects to be able to relate these transmitted data with other factors, such as oceanographic current movements[26] and sea temperature. The presence of large numbers of male turtles in the bycatch at Drini (27% of records) is probably the most interesting aspect of the research, as little is known of their life-style, marine ecology, or distribution (White pers. com. 2009).

So, to address this research gap, the project began the first satellite-tracking programme in Albania – deploying (UHF) transmitters on 3 turtles in September 2009. This has the potential to continue until September 2011, assuming that the transmitters and turtles remain intact. Data-retrieval arrangements were established with ARGOS (CLS), the satellite provider, so that the project's researchers could monitor the location, behaviour and spatial movements of the turtles. The data manager (David Oakley) has set up a project on www.seaturtle.org and the data are now being uploaded to the STAT programme (Coyne & Godley, 2005). The website allows easy access for public awareness-raising and thus the turtles' locations can be followed online. MEDASSET has also developed the webpage: ***Turtle Tracking*** with information and maps, in English, Greek and Albanian.

10.2. Attachment of transmitters

Transmitters were attached to three *Caretta caretta*:

- Two adolescent males
- One short-tailed turtle, possibly an early adult female

The attachment method is described in White *et al.* 2009b (project report).

- Release Time and Date: CET 1300, 12th September 2009
- Release point: Latitude N41° 37.424, Longitude: E019° 34.652

10.3. Biographical details of telemetered turtles

10.3.1. "Shpresa"

This turtle was first captured on the 26th May 2007 in Ishmi stavnike, Patoku (Haxhiu pers. com.) and re-captured on the 13th August 2009, once again in the Ishmi stavnikes. During a 27-month interval the incremental growth was 11.0 cm for CCL; and 6.0 cm for the CCW which is considered substantial growth. An interesting identifiable feature is that her lower beak is split into two parts (i.e. cleft). Dr White measured the tail in 2009: these measurements provide some information about the likely sex of a turtle. So what appears to be the case is that this turtle is a female; and may either be mature or approaching maturity.

Key facts:

- Record no: PA239.
- Female, possibly early adult
- CCL = 76.0 cm; CCW = 67.0 cm
- Tail: Plas-clo = 17.0; TTL = 21.0; +/- cara = -1.0 cm
- Lower beak is cleft
- Flipper tag: left anterior AL0154 Stockbrand's titanium
- Remigrant & recapture: First capture 26/05/2007 (Dalton's Rototag W1136]; 2nd capture 13/08/2009; 3rd capture 30/08/2009
- "Shpresa" in Albanian means "Hope"
- Argos No.: PTT 97646

At the time of her second capture she was covered in leeches (blood-sucking parasites). Dr White kept her in freshwater for three days during which time osmotic differences killed the leeches and they fell off. She was released on the 16th August 2009. Two weeks later she was captured again in the Ishmi stavnikes, which

[24] Godley *et al.* 1998
[25] White 2007, White *et al.* 2006
[26] Girard et al 2006, Kavvadia *et al.* 2006

indicates that it is likely she had stayed in the Patok area feeding on benthic animals, such as crabs and bivalves.

She is important because she is a 'remigrant' (i.e. she has been found at the Patok area in more than one year) and a recapture (she was found more than once in 2009). These two pieces of information suggest that she returns to the Patok area in different years, or that perhaps she lives nearby for much of the time. It is expected that her transmitter data may help to answer these questions.

10.3.2. "Patoku"

In 14 months interval between Patoku's two captures in the Ishmi stavnikes, the incremental growth was 3.0 cm for CCL; and 2.0 cm for the CCW. He has two interesting features: an extra vertebral scute; and the 4th costal scute on the right side of his carapace is split into two.

Dr White also measured the tail in both years and it appears that this turtle is an adolescent male: but maybe only from the year 2009.

- 2008 Tail data: Plas-clo = 12.0; TTL = 16.5; +/- cara = +1.5 cm
- 2009 Tail data: Plas-clo = 14.5; TTL = 19.5; +/- cara = +2.5 cm

Key Facts:

- Record no: PA069.
- Male, adolescent (2009 is first year of adolescence)
- CCL = 66.0 cm; CCW = 61.0 cm
- Tail: Plas-clo= 14.5; TTL= 19.5; +/- cara= +2.5 cm
- Vertebral scutes: 6 (extra between V4/V5); Right costals: 6 (CR4 split in 2)
- Flipper tag: right anterior AL0150 Stockbrand's titanium
- Remigrant: 1st capture 01/07/2008 (tagged with Dalton's Rototag W1421]; 2nd capture 02/09/2009 tag replaced
- Named in honour of the Patoku community, host of the project.
- Argos No.: PTT 97648

10.3.3. "Guximtari"

First captured on the 29th August 2009 in Ishmi stavnike. The tail measurements indicate that this is an adolescent male. He has an interesting feature on his carapace: the foremost scute ('nuchal') is split into two; this is very rare.

Key Facts:

- Record no: PA241.
- Male, adolescent
- CCL = 69.5 cm; CCW = 65.0 cm
- Tail: Plas-clo = 15.0; TTL = 19.0; +/- cara = +3.0 cm
- Nuchal scute = 2 (very rare)
- Flipper tag: right anterior AL0153 Stockbrand's titanium
- First capture 29/08/2009
- His name means "Brave" in Albanian
- Argos No.: PTT 97647

Patoku's and **Guximtari's** satellite data should be very interesting, as very little is known about the distribution and marine ecology of male turtles. Researchers have seen adult males mating with females in different parts of the world; however, almost nothing is known about adolescent males[27]. Research at Patoku may well provide some important information about this life-stage, because the project has measured 77 adolescent male loggerheads over the three years of study.

Fig. 48: Researchers attaching transmitters

Fig. 49: All 3 turtles prior to release & research assistants

Fig. 50: Patoku (PA069)

Fig. 51: Guximtari (PA241)

[27] White 2007

10.4. Route maps to date

Maps are produced using Maptool programme , a product of www.seaturtle.org

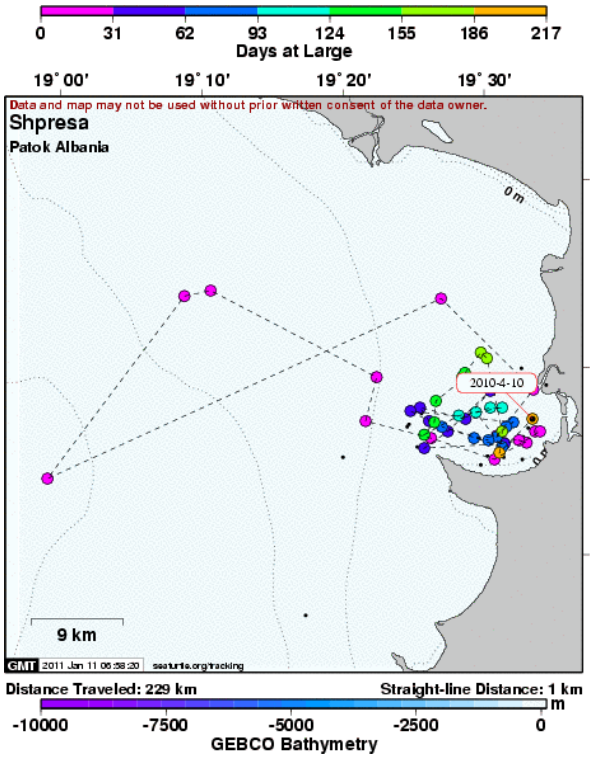


Fig. 52: Transmitted data indicate behaviour of an individual exhibiting fidelity to a neritic foraging habitat.

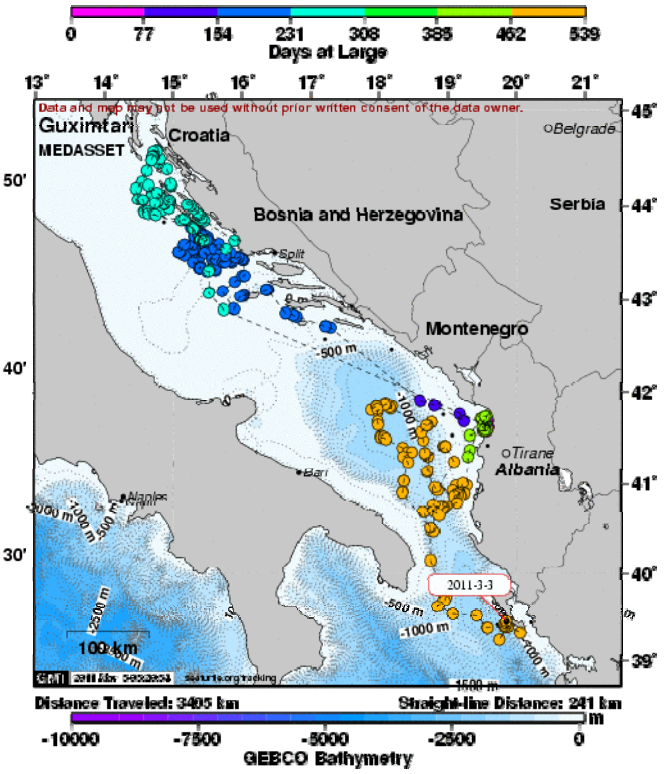


Fig. 53: Transmitted data display behaviour associated with foraging in coastal neritic environments with springtime onshore movement and annual remigration.

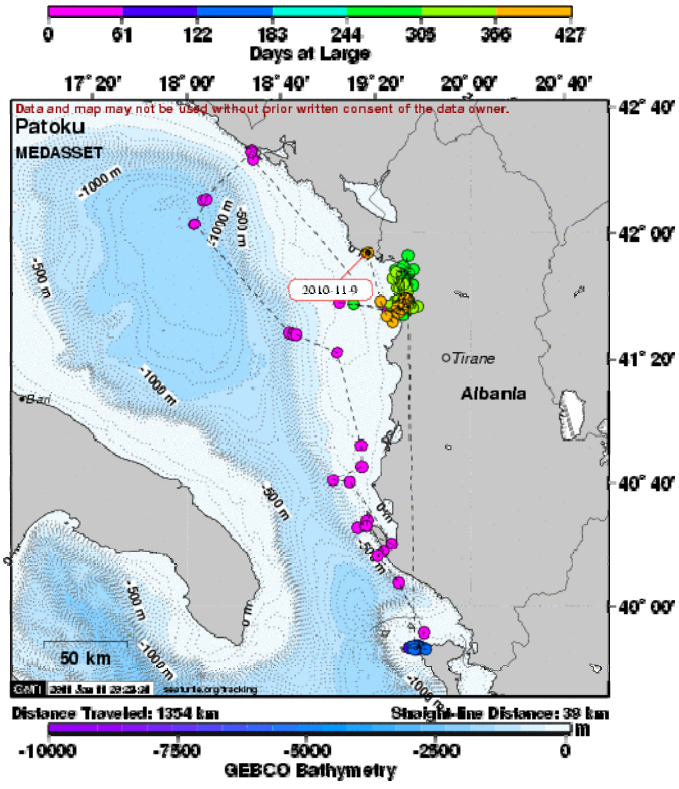


Fig. 54: Transmitted data display consistent coastal foraging behaviour and annual remigration pattern.

10.5. Data Summary

This satellite tracking study is now in its second year: all three transmitters are still working and up-linking regularly. What is particularly interesting is that all three telemetered turtles were back in Drini Bay during 2010. They chose different overwintering strategies: Shpresa, the female, stayed in the bay all winter; Guximtari headed north to Bosnia-Herzegovina and Croatia; Patoku headed south to Kerkyra (Corfu, Greece). Patoku provided the first evidence for the timing of a return journey: he was in Kerkyra on April 1st 2010 and then was caught in a stavnike at Drini Bay on 24th April 2010. At the beginning of February 2011 Guximtari headed southwards to Corfu, Greece where Patoku overwintered in 2010. This indicates that Drini Bay is an important all year round coastal environment for the turtles.

Table 4. Transmitter Data (updated on 05.03.2011)

Tag	Deployed	Last loc	Days ago	At large	Distance travelled	Current distance from release point
97646 Shpresa	12/09/2009	11/04/2010*	329	211 days	229km	1km
97647 Guximtari	12/09/2009	04/03/2011	2	538 days	3405km	241km
97648 Patoku	12/09/2009	10/11/2010*	116	424 days	1354km	39km

*Uplinked in 2011 but not of sufficient class

Table 5. Argos satellites provided the location data.
Location class ranked in order of accuracy, from 3, 2, 1, 0, A, B and Z. (Updated on 05.03.2011)

Tag	Locs	3	2	1	0	A	B	Z	Total
97646 Shpresa	167	4	5	9	6	44	97	2	347
97647 Guximtari	686	46	85	79	35	136	303	2	866
97648 Patoku	367	5	9	13	14	79	243	4	822

Table 6. Location accuracy of the Argos system as defined by location class.

Class	Type	Estimated error	Number of messages received per satellite pass
3	Argos	< 250m	4 messages or more
2	Argos	250m < x <500m	4 messages or more
1	Argos	500m < x < 1500m	4 messages or more
0*	Argos	> 1500m	4 messages or more
A	Argos	No accuracy estimation	3 messages
B	Argos	No accuracy estimation	2 messages
Z	Argos	Invalid location	

A problem from Drini Bay is that there seems to be some sort of 'transmission anomaly' locally. This means that although data are uplinked to the satellite, these are not of a sufficient 'class' for Argos to confirm the location. Poor fixes have been reported for all three turtles, however, Shpresa is the most-affected as she remains in the bay; the Argos Website shows her last fix in April 2010, but the device still uploads data. This suggests that she is still alive and surfaces to breathe; whereas if she was dead and stranded ashore somewhere then the device would be transmitting constantly, because the salt-water switches would be dry i.e. 'in transmit mode'.

This research continues to generate data in 2011, which should allow the researchers to contrast and compare the animals' inter-annual movements and behavioural patterns: i.e. do these individuals reside mainly at Drini Bay; and do they follow the same strategies during successive winters; or are there other

contributing factors such as SST, current flow, food availability; or something similar that determines their migratory behaviour?

11. DNA PROFILING

DNA profiling was deemed necessary and an added value component of the project, to better understand the differences between the various Adriatic areas and whether or not the turtles foraging[28] or overwintering in the Adriatic are from the same stock or come from different reproductive populations (Libya, Turkey, Greece, Italy, Cyprus, Tunisia; or outside the Mediterranean)[29]. Mitochondrial DNA (mtDNA) has proven particularly effective for detecting population structure in marine turtles[30].

Initially, the national laboratory in Tirana, where human genetic material is processed, was asked if they could sequence samples of sea turtle skin, but they concluded that it was not possible to do this work in Albania. As part of the regional effort to understand sea turtle populations, analysis was carried out by the laboratory of Dr. Oguz Turkozan, Prof. Bardakci; and PhD candidate Can Yilmaz of Adnan Menderes University, Turkey. CITES permits were obtained from the Albanian and Turkish governments for the samples to be exported to the laboratory overseas.

Tissue sampling protocol

i) The sampling location was proximal and ventral to the anterior flipper (axilliary region). The site was wiped with antiseptic (Betadine), and then a small section of skin was removed using a new scalpel blade (to minimise cross-contamination).
ii) The sample was placed into a tube and filled with 96% ethanol; which was changed after 10 days.
iii) The tube was labelled with: serial number of sample (e.g. X1); place (Patoku); record number of turtle (e.g. PA200); species (Cc); date; CCL; and sex if known.
iv) Forceps were sterilised between animals (dipped in alcohol and held in lighter flame).
v) Data were entered into an Excel spreadsheet (Flipper-tag number was included).
vi) Used blades were placed into a 'sharps' bottle for safe disposal later.

In 2009 tissue samples from *Caretta caretta* (n = 28) for genetic profiling were collected. Dr. White sampled a further 15 turtles in 2010: 12 *Caretta caretta* and 3 *Chelonia mydas*. Due to budget restrictions in 2010 only selected turtles were sampled: all three green turtles and mainly adult-sized *Caretta caretta*; which should provide better profile matching (most DNA profiling studies in the Mediterranean region so far have focused on nesting beach sampling i.e. adult females).

Results and findings will be published in an appropriate journal in 2011 and presented at suitable conferences.

12. DYNAMITE FISHING

Evidence for the occurrence of dynamite-fishing in Drini Bay was collected by Dr White throughout the three-year project. Whenever explosions were heard, the time, number of explosions and their direction were noted; water-spouts resulting from the explosions were never seen.

There were several distinct changes in usage patterns during 2010: the first being that all explosions took place in the vicinity of Kepi Rodonit and the mouth of River Ishmi (i.e. the south-eastern corner of Drini Bay). Previously it was also used at Tales, but this site now has a small, yet successful, emerging tourism industry that may have curtailed dynamite-use there. The illegal use of dynamite for fishing in 2010 exceeded the total usage from the previous two years (540 charges in 2010, n = 24 days; 124 charges in 2008, n = 18 days; 57 charges in 2009, n = 15 days). The pattern of detonation also changed, with more charges being placed each time; the maximum in a single set was 33. The maximum in 2008 was 10 charges; and 9 charges in 2009. Forensic examination of the data showed the timing of explosions was also remarkably consistent: mostly around 0830, which could have led to the apprehension of the perpetrators.

[28] Laurent *et al.* 1998; Maffucci *et al*. 2006
[29] Bowen *et al.* 1993, 1995; Laurent *et al.* 1993; Fitzsimmons, 1996; Bolten *et al.* 1998
[30] Harry 1983; FitzSimmons *et al.* 1999; Pont *et al.* 2006; Carreras *et al.* 2007

In September 2010 all the data were passed to the Ministry of the Environment and the Border Police; this data-set was the first real evidence available to them; previously it had all been anecdotal. See Annex 1 for dynamite use log: Tables A1-3.

Covert operation (15th September 2010): The Border Police implemented a covert operation in the areas of Tales, Godull, Kepi Rodonit and Lalezi Bay to try and apprehend illegal fishers. During that particular operation no one was found with explosives, but subsequently the use of explosive-fishing seems to have reduced. It will be noted that there were explosions on the morning of the 15th September, yet none of the special operatives heard them. It is possible that they were in their vehicles and patrol boats at the time.

Dr White had several meetings with Senior Officials to determine if the explosions heard during the three years could have been from some other source, rather than illegal fishing. The Navy destroy munitions from time to time, but the dates and timings showed that their activities did not coincide with Tables A1-3 (T. Bino, Deputy Minister of Environment, pers. com). The mining industry was also consulted; it has very strict rules to control the use of dynamite. Procurement of explosives nationally is under the control of the Ministry of Defence. Authorised users, such as mines, are permitted to buy explosives from a distribution centre under the control of the Ministry of the Interior. The mines issue specific permission to the 'blasters' e.g. authority to set four charges at a date and time. So it seems that unless there is 'underhand' dealing in legal explosives, the charges used for explosive-fishing are obtained illegally ('black-market') or home-made.

13. NEARSHORE TRAWLING

Trawlers from Shengjin are frequently observed fishing close to the beaches of Drini Bay. Fisheries Regulations No.1 prohibits this activity within three nautical miles of the coast, or shallower than the 40-metre isobath. All of the study area was shallower than 47 metres. Photographs were taken of different ships, and at different times of the day, showing that nearshore trawling is not an isolated incident, but the common practice. Conversations with trawlermen suggest that turtles are captured in their nets, especially south of River Drini, but this is unquantified and not reported. White *et al.* (2006) included some anecdotal data for this problem.

This nearshore fishing activity was reported to the Ministry of Environment, but at present it is not in a position to act because of a lack of resources. It was reported that the EU is assisting Albania with the Vessel Monitoring System, the so-called 'blue-box' technology, whereby all vessels longer than 12 metres will be fitted with a satellite-tracking device, and their whereabouts will be known automatically (R. Kristo, Directorate of Water Resources and Fisheries, pers. com. 2010).

Fig. 55: Trawler too close to the shore

Fig. 56: Early morning trawling

Fig. 57: Trawler near Tales beach

14. ANTHROPOGENIC POLLUTION

During surveys of Drini Bay for sea turtles, and identifying their local habitats, it was noted that the entire coastline was littered with plastic debris. In 2009, to determine the worst-polluted areas, a survey using quadrat-counts of debris (10 × 10 m quadrats) was conducted at eleven locations around the bay. The heaviest pollution was adjacent to the outflow of Ishmi River (1595 items) and at Godull (1095 items); 90% of the debris was made from plastics. These were mostly manufactured plastic items. It seems unlikely that all of this litter originated from Godull. Substantial numbers of plastic fragments, including polystyrene, were also present. The cleanest areas were Patoku barrier-island (41 items) and Ulcinj (58 items); the latter is in Montenegro on the western side of Bunës River. (See 2009 Project Report White *et al.* 2010a and White *et al.* 2010b for methodology).

Fig. 58*:* Pollution at mouth of Ishmi river

Fig. 59: Marking out quadrats at Godull

Fig. 60: Some of Quadrat No.20 garbage

Fig. 61: Waste at Patoku inner lagoon

Following on from this initial assessment Dr White extended this research in 2010 to try and identify the sources of some of the pollutants (see Annex 2 for methodology, results and photos). Several inland areas were visited so that an understanding could be reached about how waste was managed, or not managed; what state the rivers, streams and countryside were in; how plastic materials and sewage-effluent were disposed of; and what levels of infrastructure were available for waste-collection and its disposal. These rivers and streams were observed to transport sewage and other waste, especially manufactured plastic items, from inland areas to the sea.

Fier: Dr White and a project researcher observed extensive areas of mostly plastic debris all along the banks of the small river (Gjanica) in the town of Fier. Much of this was thrown into the river by the market-traders, whose stalls form a 'shanty-town' along its banks. Waste, including food, was also thrown from houses, bridges and pathways into this river; rats were present on both banks and seen swimming across Gjanica. Sewage-effluent from buildings along the river was discharged directly into the water. Further downstream this river joins into the Semani River that then flows westwards to the sea north of Vlore; which is a known sea turtle habitat (this project's data).

When it rains heavily many streets in Fier are flooded, to a depth of more than 0.5 m in early-October 2010 , and the river frequently overflows its banks, inundating houses, schools and business premises nearby. So not only is there disruption to the social structure of the town, but there is an increased risk to public health from the widespread distribution of raw sewage effluent into public areas.

As a first step to change this situation: photographic evidence was collected of the plastic waste and the sewage outlets; and a sample of river water, along with samples from other rivers[31], has been analysed at the Microbiology laboratory, Tirana University. The results[32] will be used to raise awareness in the local council and communities; and passed to the Regional Environment Agency (REA). Until 1976 this river was clean, used by the locals for swimming, and had good populations of fish (M. Hysko, Professor of Microbiology, Tirana University, pers. com.) See Annex 3 for methodology and conclusions.

[31] Rivers: Drini, Mati, Tirana, Gjola & Gjanica were sampled for microbiological pollutants.
[32] Annex 3 of this document

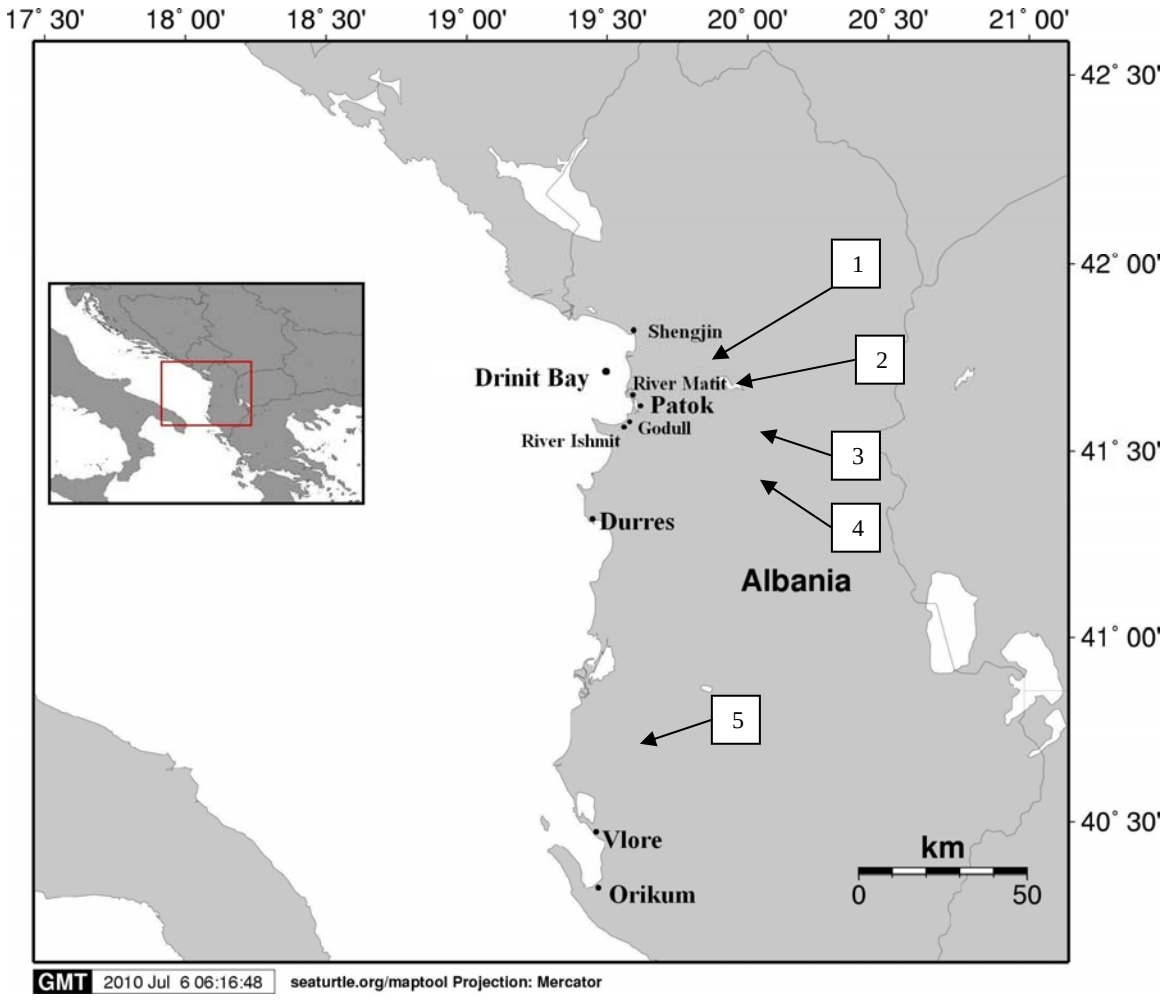


Fig. 62: Map of northern Albania showing the approximate positions of water sampling points for five rivers: 1 Drini; 2 Mati; 3 Gjola; 4 Tirana; 5 Gjanica. (Map drawn with MapTool; a product of www.seaturtle.org)

Berat: This ancient town is a World Heritage Site (UNESCO). The River Osumi flows through the valley and later joins the Semani River. The streets of Berat are litter-covered, and the drainage systems are in a state of disrepair; there are rudimentary recycling bins, but there is lack of awareness about correct use (i.e. waste is thrown into any bin, not into the designated one).

Berat REA consists of two people, with very little funding; and are thwarted in their efforts to undertake their work by the Municipality (Bashkia). The Municipality's position is that the problem does not exist, until there is some analytical evidence of pollution (e.g. concentrations of pollutants; or micro-organisms, such as Coliforms). Apart from the 2002-2004 survey of river-borne chemicals[33] there have been no studies conducted to-date, and so Dr White suggested that MSc students from the Microbiology laboratory at Tirana University could undertake water-sampling as part of their fieldwork; and that these results will be passed to the REA; this offer was gratefully accepted. This fieldwork will probably begin in 2011, although funds are very limited.

The castle precinct has many churches that span the centuries; there is a small community living in houses within the castle walls (about 1500 people); and some bars, cafes and museums. There are waste-paper bins available throughout the grounds, but these are not used. Instead, all of the waste is thrown over the castle walls creating a reeking mass of rubbish; large amounts of plastic litter the hillsides all the way down to the river (this was brought to the attention of the REA). A powerful approach to mitigate this problem would be to impress upon UNESCO that their Berat site needs to include cultural and educational measures, as well as

[33] Miho *et al.* 2005




Fig. 63*:* Garbage thrown over Berat Castle wall

Fig. 64: Fier: waste thrown on river banks

Fig. 65: Lezhe waste containers

Fig. 66: Very clean Korce centre

building renovation and preservation. A visit was also made to the foothills of Mount Tomori, near Berat. The very isolated villages there have few facilities. There are no waste-collection facilities and everything, including sewage effluent, is thrown or piped into the small streams that then flow down to the rivers; the roads are just muddy tracks.

It can be seen that trying to address the problem of anthropogenic debris in the coastal zone requires an integrated approach. The waste originates from across the entire country, is transported by the riverine system (e.g. Rivers Gjanica, Lana, Tirana, Gjola and Ishmi), and eventually reaches the sea (e.g. at Godull). The two biggest challenges are the lack of infrastructure for waste management and sewage treatment[34]; and the prioritisation of these matters by the different regions. The REAs are meant to implement and administer environmental law; but the Municipalities collect the tax-revenues and decide what to spend this money on; unfortunately environmental issues are usually of very low priority.

Korçe: This town is in the mountains, about 40 km from Pogradec and Lake Ohrid. Korçe is unusually clean. The Municipality has developed the area, maintaining its ancient cobbled-streets, even as the waste-water systems are being replaced; it has well-managed waste-disposal facilities, on-street car parking; and its parks are green and clean. Until about two years ago the nearby lakeside communities, including Pogradec, disposed of their waste and sewage effluent directly into Lake Ohrid. In 2010 there is a growing tourism industry, including lakeside beaches and swimming areas; and it is believed that waste and sewage are now being well-managed (Petri pers. com.).

15. CAPACITY BUILDING, EDUCATION AND AWARENESS RAISING

15.1. Training Students as Project Researchers

In **2008**, Dr. White trained Tirana University student Enerit Saçdanaku and provided additional training to Prof. Haxhiu on comprehensive morphometric data collection (previously only CCL & CCW were measured). Training included: sexual development and adolescence determination based on tail morphometric-data; use of photo-recognition to identify individual turtles and how to use this technique to minimise the tag-loss problem; allocation of turtles into size-classes; health assessment and epibiotic loading; handling techniques and minimising damage to the animals; optimum tagging practices. Enerit Saçdanaku was also provided with a detailed explanation of sea areas used for this study; detailed explanation and practice of data entry, analysis and back-ups; he was trained to measure abiotic factors; assess daily fish-catch; and use GPS.

The project devised a system that enabled the training of more students at Patoku in **2009**. This involved researchers changing over at varying intervals. The seven trainees in 2009 were: Enerit Saçdanaku; Lazjon Petri; Bekim Trezhnjeva; Marina Mitro, Esmeralda Kararaj and Dhurata Përkeqi from Tirana University and Xhevat Gërdeci from Shkodra University.
Students were instructed in:

[34] Annex 3 reports that the water samples (apart from Mati) were of 'bad' or 'very bad' quality for both total coliforms and faecal coliforms (EC Bathing water quality directive 2006/7/EC).

- sea turtle biology and ecology (Lutz & Musick 1997; Miller, 1997, Lohman *et al.* 1997; Bolten & Witherington 2003; Lutz, Musick & Wyneken 2003);
- the importance of the Patok zone (Haxhiu & Rumano 2005; White *et al.* 2006, 2008, 2009);
- data-collection methods and morphometrics (Eckert *et al.* 1999; White 2007);
- photo-recognition (White 2006, 2007);
- tagging (Balazs 1999);
- animal-handling and safety skills.
- Their theoretical knowledge was enriched with practical training, including GPS use.

Researchers observed fish-catch, visited stavnikes, walked two beaches (Mati and the barrier island) and were present during tissue-sampling for the DNA study; they were also involved in leaflet-distribution and awareness-raising activities. In August, the research-team began quadrat-sampling to compare the widespread litter problem, predominantly plastics, in the coastal zone[35]. In September, they assisted in the attachment of UHF satellite transmitters to three loggerheads (see section 10). The group developed into a very competent research team.

Capacity-building continued in **2010** with Dr White teaching two 5-day intensive courses on the biology and ecology of turtles to pairs of students from Tirana University; the number of students was limited due to budget constraints. Students completed a written/oral examination at the end of each course. The four students in 2010 were: Vilma Hasi (1st year biology); Vilma Piroli, Tamara Besatari, Irma Agolli (all MSc students in Environmental Biology).

The presence of female students at Patoku should be regarded as an important capacity-building milestone, as the majority of students in the Faculty of Natural Sciences are girls; and a significant cultural breakthrough for Albania: there are many restrictions placed upon women in Albania, and they lack equal opportunities.

All of the students trained in each year were highly motivated, very interested and completely reliable. Despite frequently long working hours, these researchers met every challenge willingly and cheerfully. Certificates were awarded to the students that completed the Research Training Course at Patoku (2009). Student transport and subsistence costs were covered throughout the project and a small allowance was also provided in 2008-9.

Biology students from Albanian Universities used this project's data for their M.Sc. (Master diploma; Supervisor: Prof. Dr. Haxhiu):

- E. Saçdanaku: Taxonomy of loggerhead turtles *Caretta caretta* in Drini Bay 2008 (Tirana University).
- Xh. Gërdeci: Taxonomy of loggerhead turtles Caretta caretta in Drini Bay 2009 (Shkodra University).
- N. Kacorri: Data on the habitat conditions and bioindicators of Mati River 2010 (UFO University).
- V. Piroli (in preparation): Taxonomy of loggerhead turtles *Caretta caretta* in Drini Bay 2010 (Tirana University).
- L. Petri (in preparation): The variety and dynamics of species caught by Stavnikes; and environmental values and impacts of this tool in comparison with other fishing methods. (Tirana University).

Fig. 67: Trainee measuring sea turtle

Fig. 68: Trainees moving turtle

Fig. 69: 2009 research trainees with certificates

[35] White *et al.* 2010b

Fig. 70: Student field trip and project trainee explaining research methods

Fig. 71: Research team and Orikum school teachers

Fig. 72: Local fishermen helping remove barnacles from turtles prior to release

15.2. University Student field-trips

During 2008-10, over 250 biology students from the University of Tirana visited the field-station at Patoku for a practical demonstration of sea turtle handling, morphometrics, photo-recognition techniques, and lectures on biology, ecology and the presence of sea turtles at Drini Bay.

15.3. Local fishermen

The fishing communities are a vital audience for environmental education. The project worked very hard to build some level of harmonious co-operation with the fishing communities, especially at Patoku; this was always fragile. The fishermen's priority was to make additional income rather than caring for the endangered status of the sea turtles they caught. Nonetheless, the project researchers continually demonstrated good handling skills and advocated best practices and care towards the animals. On several occasions the project provided the fishermen with information that was completely unknown to them, for instance when an Ocean Sunfish was found in Mati stavnike; they had never seen such a strange creature. They also consulted the project team about their falling fish catches and global climate change.

The fishermen lack concern for the environment and its ecological balance. Two examples are: trying to persuade the isolated communities that are using dynamite about the severe impact caused on their shallow ecosystem; and when the mrezh fishermen at Godull find crabs in their net, i.e. every day, they smash the crustaceans to pieces, as it takes too long to remove them individually by hand; Prof Haxhiu has been telling them for years that this is a problem. The removal of an abundant or dominant species from the food web means that other, perhaps less welcome, species may proliferate and could even cause severe environmental changes.

Researchers taught the fishermen how to identify green turtles *Chelonia mydas* and leatherbacks *Dermochelys coriacea*, so that a better understanding of the marine distribution and habitat use of turtles in the Adriatic Sea can be developed. MEDASSET's National Sea Turtle Management Strategy lays out some options for improving the way that fishermen handle endangered animals, including educational reinforcement and law enforcement measures.

15.4. Awareness-raising activities

Project posters, stickers, t-shirts and leaflets in Albanian were produced in 2008 and 2009 (Annex 4). These were distributed to university students, the media, the local community, fishermen, bars and restaurants, and the general public at Patoku, Tales, Velipojë, Divjake, Shengjin, Kune, Godull, Orikum, Vlore, Durres, and Tirana; and whenever the opportunity arose in the various towns visited, including at Ulcinj, Montenegro, during the coastal pollution survey. The Tirana University team continued to distribute materials outside of the field-season. The research team's daily interaction with the local community at Patoku meant that the team and its mission became well known, and could deliver sea turtle education frequently; it remains to be seen how effective this was.

Fig. 73: Trainee placing project information poster

Fig. 74: Martini fishing association wearing project t-shirts

Fig. 75: Project team explaining the project to locals at Godull

15.5. Building capacity within Albanian organisations

In 2009, within the aim to build capacity within local NGOs, it was decided to focus some of the project effort on building project management capacity within the Herpetofauna Albanian Society (H.A.S.), the only Albanian organisation at that time with any experience of monitoring sea turtles. H.A.S. became a budget-holder (GEF/SGP funds) in 2009 and was involved in project management. With the help of MEDASSET and GEF/SGP, H.A.S. was shown:

- how to manage accounts and report to GEF/SGP.
- the importance of remaining within a project budget and financial planning.
- how to set financial priorities (i.e. allocating money between 1st, 2nd & 3rd payments)

Some tasks and concepts were very challenging for the H.A.S. team and there were several time-consuming communication difficulties between the two NGOs. In 2009, H.A.S. also took responsibility for coordinating student field trips, the selection of students for research training, collaboration with fishermen groups, events and media coverage at Patoku.

CITES

In 2009 this project initiated the procedure at the Ministry of Environment, Department of Biodiversity, for issuing a CITES permit to export samples from a protected species. Experience in issuing these permits did not exist within the Ministry; under the project partners' guidance the process was established. As further evidence of the project's organisational capacity-building, in 2010 the Ministry requested the submission of a letter of request to export scientific samples; following which they issued a formal CITES permit; in full accordance with the Convention (i.e. there is now an Albanian national documentation system for CITES).

16. DISSEMINATION OF RESULTS

During 2008-10 the Project has been presented through:

- MEDASSET's English e-newsletter and Greek newsletter. Information about the Project is included on a special webpage at www.medasset.org. Research at Patok is presented by MEDASSET at various events, conferences and media interviews in Greek and/or English.
- "Turtle Tracking" webpage presents information and maps on the satellite tracking programme, in English, Greek & Albanian. *(http://www.medasset.org/cms/index.php?option=com_content &view=article&id=91&Itemid=82)*
- http://www.seaturtlestatus.org (SWOT) includes an overview of this research project.
- MEDASSET issued 6 press releases during the project in English and Greek; these were re-transmitted via various email lists, websites and newsletters, including: CTURTLE@lists.ufl.edu; medturtle@lists.seaturtle.org; www.eurocharity.org; www.global500.org; www.eucc.nl (Coastal & Marine Union), Countdown 2010, Project Aware, etc.
- Two interim project reports, 2008 Project Report (White *et al.* 2009b) and 2009 Project Report (White *et al.* 2010a), have been produced and are available through MEDASSET's website (www.medasset.org).

➢ Media Coverage in Albania was plentiful throughout the project and the press frequently covered student field trips:

* In 2008, a documentary on the sea turtle tagging, including researchers' interviews, was broadcasted on "KOHA" national TV station. The channel also filmed the Chairman of Lezhe Prefecture presenting an award to Dr. Michael White for his services to Albania. "SHQIP" Newspaper published a two-page article about the project, highlighting the problem of terrestrial garbage. "Top Channel News" broadcasted a 15-minute item on the project and covered the release of the captive turtle from a hotel at Orikum, south of Vlore.
* In 2009, media attended the student (RA) certificate award ceremony. The launch of the satellite tracking programme was covered by Reuters and the following Albanian TV Channels: Top Channel, Lezhe TV, News 24, Klan TV, Ora News, TV Shijak, TV Koha and TVSH.
* In 2010, TOP Channel News filmed the student field trip to Patoku.

➢ Conferences & Publications:

* Dr. White attended the following meetings to present papers or posters on the project:
  - 3rd International Conference on Biological and Environmental Sciences, Tirana, 2008, as keynote speaker and presenter of the paper "Monitoring Stavnike Fish-Traps and Sea Turtle Bycatch at Patoku, Albania" (White *et al.* 2008)
  - 3rd Mediterranean Conference on Marine Turtles, Hamammet, Tunisia, 2008: "Monitoring and Conservation of Important Sea Turtle Feeding Grounds in the Patok Area of Albania" (White *et al.* 2009b).
  - 29th International Symposium on Sea Turtle Biology & Conservation (ISTS), Brisbane, February 2009: "Patoku: Monitoring an Important Sea Turtle Foraging Ground in Albania" (White *et al.* 2009a). Prue Robinson (MEDASSET) presented the poster "Building Bridges: Sea Turtle Capacity Building and Environmental Education Outreach, Patoku Albania" (White *et al.* 2009c)
  - 30th ISTS, Goa, India, April 2010: "Plastic debris at an important sea turtle foraging ground in Albania" (White *et. al* 2010b) and "Male loggerheads at a foraging & developmental habitat in Albania" (White *et. al* 2010c).
* MEDASSET presented the project at the Conference on Marine Biodiversity in Albania, Tirana, 21-22 May 2010.
* "An overview of MEDASSET'S Role in Sea Turtle Research and Conservation in Albania" (White *et al.* 2010d); was published in the TESTUDO, the Journal of the British Chelonia Group.
* "MEDASSET's Three-Year Project: Monitoring an Important Sea Turtle Foraging Ground in Drini Bay, Albania" is *in press,* in the Marine Turtle Newsletter's Mediterranean Special Edition.
* Dr. White will present the poster "Sea Turtles in Northern Albania: Key Results of a Three-Year Research Programme (2008-2010)" at the 31st Annual Symposium on Sea Turtle Biology and Conservation, San Diego, USA, 12-15 April 2011.
* Papers will be presented at the 4th Mediterranean Conference on Sea Turtles, Naples, Italy, November 2011.
* A paper on the analysis of the three-year foraging data is in preparation and will be published in a suitable journal, as well as results of the satellite-tracking programme, the DNA profiling study, and the

Fig. 76: Trainee talking to media on launch day of satellite tracking programme

Fig. 77: Student field trip and media at Patoku research field station

Fig. 78: Prof. Dr. I. Haxhiu explaining the project's work to media

Fig. 79: Poster presentation for 30th International Sea Turtle Symposium, Goa, India, 2010

project's sociological experiences and achievements.

➢ The project's results will also be communicated to major databases, e.g. MPA Global, World Database on Marine Protected Areas, UNEP-WCMC, SWOT, OBIS-SEAMAP (Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations), etc.

17. POLICY AND MANAGEMENT RECOMMENDATIONS FOR ALBANIAN AUTHORITIES

In order to assist Albania in improving its sea turtle conservation policies and deliver useful recommendations, during September–October 2010, Dr White and MEDASSET focused on researching the institutional and legal framework in Albania in order to determine any sea turtle conservation policies in place. The investigative process was based on a review of existing legislation; identification of the various stakeholders involved, especially at national and regional governmental-levels; meetings with relevant central, regional and local administration officials to understand current positions and plans (Ministry of Environment, Fisheries inspectors, Ministry of Tourism, Ministry of Defence, Ministry of Public Works, Regional Environmental Agencies, staff from the Museum of Natural Sciences and from Tirana University, Veterinary professionals from the Agricultural University, Tirana); evaluation of any oversight and inspection procedures in place; and finally an assessment of how these disparate elements could be synthesised into a workable and enforceable protective strategy.

Albania lacks a National Action Plan or specific legislation for the protection of sea turtles and their critical habitats (S. Hoxha, pers. com. 2010). A recommendation of the "Action plan for the conservation of Mediterranean marine turtles" (UNEP/MAP RAC/SPA 2007) is that such legislation should be implemented. Nevertheless, existing legislation, which is comprehensive and well-written, could easily be extended to provide the legal framework for the effective protection of these endangered species and their habitats. These laws include: Biodiversity and Wildlife laws; Fisheries and Aquaculture laws and Fishery regulation #1; and numerous veterinary laws. At present these do not explicitly refer to marine turtles, however, they do provide a framework for prevention of harm to wild animals; migratory species; habitat protection; permit issuance, inspection and control of research activities; and enforcement and penalties for infringement. These can be extended by regulation by the Ministry of Environment. In 2007, sea turtles were recognised by national law as endangered.

As a result of the meetings with Dr White during the review process, the Fisheries Inspector for Patok, Dr. Vath Gabili based at Laç, who reports directly to the Director of Biodiversity at the Ministry of Environment (Dr Sajmir Hoxha) has for the first time, included comments about sea turtles in his reports to the Ministry and stated that national sea turtle legislation needs to be implemented.

Based on the sea turtle data collected during 2008-2010 and the institutional and legal framework review, A proposed National Sea Turtle Management Strategy for Albania is being drafted and will be submitted to the Albanian Authorities in 2011. See the following section for an outline of the recommendations.

18. CONCLUSIONS AND RECOMMENDATIONS

18.1. Conclusions

18.1.1. Sea turtles in Drini Bay

The project's findings show that Drini Bay is an important summer foraging ground for sea turtles; the benthos is rich in food resources: small invertebrates, bivalves and crustacea. It may also form part of a migratory corridor for turtles moving between the Ionian and Adriatic Seas.

Male sea turtles captured at Patoku, suggest that they may use the area as a developmental and foraging habitat. This discovery has increased importance due to our presently limited understanding of the

distribution and marine ecology of male sea turtles; and the threatened impact of global climate change, which may force embryonic sex-ratios towards female-dominance[36].

Captures of juvenile turtles at Patoku suggest that this area may be used as a developmental habitat by loggerheads, and perhaps green sea turtles; this is an important finding because the pelagic life-stages and marine population structures, especially in the Mediterranean, are not well-known[37].

Bycatch: An important finding was that entrapped turtles were not deterred from foraging locally, despite being manhandled out of the nets, and then being landed for measuring and tagging. Also, stavnikes have proved to usually be non-lethal for turtles, because they are able to surface and breathe normally (White *et al.* 2008). Stavnikes can only be applicable elsewhere as a means of sea turtle bycatch reduction if suitable environmental conditions exist, such as shallow water depth and soft substratum, weak current-flows and a very small tidal-range.

The majority of turtles captured were untagged; in the present study the project has tagged 396 animals. Recaptures of previously-tagged animals, *'remigrants',* are very few (n = 32 in 3 years), which suggests that this population is far from being understood; and that saturation-tagging is far from achieved.

Satellite telemetry synopsis to date: The telemetry study so far shows that 'Shpresa' has barely moved from Drini Bay; she went out to deeper waters in September 2009, but since then has remained in the area; she was captured once in May 2010 (stavnike), and her transmitter seemed to be working correctly. This turtle is the one most affected by the transmission anomaly near to Rodoni. Consequently her last good fix from Argos was in April 2010. 'Patoku' was a traveller from the start: he initially went north towards Croatia, then came back to Drini Bay, next headed south, where he overwintered at Corfu. There were transmission difficulties there too; one reason could be that the high cliffs in the area may have interfered with the signals; another is that perhaps he just made extended dives, which would mean that the transmitter could not uplink; as it switches off when underwater. Once 'Patoku' returned to Drini Bay in April 2010, where he was captured in stavnikes at least three times; Dr White checked his transmitter and took photographs, but all seemed well. 'Guximtari' stayed in the bay initially for some months, then headed northwards to Bosnia-Herzegovina and Croatia for the 2010 winter and spring periods; he returned to the Drini area in summer 2010 and has been transmitting regularly. At the beginning of February 2011 Guximtari headed southwards to Corfu, Greece where Patoku overwintered in 2010. This indicates that Drini Bay is an important all year round coastal environment for the turtles. What will be most interesting is to see how the three turtles behave during this second winter period: will they repeat their previous patterns, or move elsewhere?

No nesting has been observed in the project study area.

Albania will now be included as a range state of *Chelonia mydas* and the two adolescent male green turtles are a new life-stage for the Adriatic Sea.

The principal concerns for the health and well-being of sea turtles in Drini Bay are: incidental damage caused by interaction with fisheries and other boats (boat-strikes); the presence of marine leeches (ecto-parasites); high-loadings of epibiota (barnacles); superficial injuries caused by poor handling (e.g. turtles being thrown by fishermen onto concrete, or being kept upside-down on their carapace); the unknown effects of pollution. It was noted that hooked turtles were very rare, as were turtles with amputated limbs (n = 3).

Because of limited resources only two sets of fish traps were studied in the present project; however, these stavnikes seemed likely to be the greatest contributors for bycatch. Several other traps had never caught any turtles. Therefore it is not possible to extrapolate from these data, but rather an impact assessment should be undertaken at each trap to report true bycatch levels.

The project concludes that turtles are using Drini Bay and the Patok area as a habitat for foraging, and recommends that Drini Bay is recognised as being a regionally and nationally important critical habitat that

[36] Davenport 1989
[37] Bolten and Balazs, 1982; Frazer and Schwartz, 1984; Bolten *et al.* 1992, 1993; Bolten, 2003a; Lazar *et al.* 2004a, 2004b

is used by sea turtles throughout the year:

i) for foraging
ii) as a refuge
iii) as part of a key migratory corridor between the Ionian and Adriatic Seas

Drini Bay is also used:

iv) by adult and adolescent loggerhead turtles *Caretta caretta*
v) by a significant assemblage of male loggerhead turtles *Caretta caretta*
vi) as an over-wintering habitat for *Caretta caretta*
vii) occasionally for foraging or migration by green turtles *Chelonia mydas*.

18.1.2. Drini Bay - some concerns

The illegal use of dynamite for explosive-fishing in Drini Bay during 2010 exceeded the total use from the previous two years. Dr White provided the Authorities with data on explosions that he collected during 2008-2010; this was the first real evidence that the National Authorities had, and consequently an enforcement operation was undertaken in September 2010. An ongoing educational programme that explains the impact of dynamite on the seabed is now required; and periodic enforcement activities should be pursued.

The widespread presence of marine litter in Drini Bay, in conjunction with the omnivorous nature of *Caretta caretta* makes it likely that plastic and other debris will be consumed by these turtles. Lazar & Gračan 2010 showed that more than a third of the 54 turtles they examined had ingested marine debris of some kind, including plastic bags, wrapping foils, ropes, polystyrene foam and fishing line. They noted that the high occurrence of debris intake represents a factor of concern for loggerheads in the Adriatic Sea; one of the most polluted sea floors along European coasts. Freggi *et al.* 2010 found that over 60% of the loggerheads (n = 500) at Lampedusa Rescue Centre, Italy, had consumed anthropogenic waste; of which 70% had consumed plastic. Despite continual advice from project staff, the restaurants and cafes at Patoku continue to dump all of their garbage directly into the lagoon; much of this waste is plastic.

UNDP's Climate Change Programme (www.ccalb.org) has been studying the rivers Drini and Mati and their adjacent zones, including at Kune-Vain and Patoku-Fushëkuqe lagoons; and will shortly submit recommendations concerning mitigation and adaptation measures for the impacts of climate-change to the national government. Any of their findings that are relevant to sea turtles and their habitats should be included in the Sea Turtle Management Strategy.

18.1.3. Management options for protection of the wider Drini Bay area

A full Environmental Impact Assessment should be carried out in order to determine the fauna and flora that are present; the extent and level of existing impacts; and the likely effect of future impacts. The ports and shipping traffic should be included in the EIA. There should be a review of any existing or impending Integrated Coastal Zone Management (ICZM) planning and operations; following which, appropriate measures can be formulated to enhance this structure

A **feasibility study** should be conducted to identify the most appropriate management options for the bay e.g. Marine Protected Area (MPA). In particular, the study should investigate whether to develop and implement a single protective category for all of Drini Bay, or if 'zoning' is a more suitable and enforceable alternative:

i) Zoning has some merits, even for sea turtles, because there are few reports of bycatch from the northernmost areas of Shengjin and Velipoje; and this means that the Port of Shengjin could continue to operate normally; within the provisions of MARPOL.

ii) The most protective zone should extend southwards from the mouth of Drini River to the northern shore of Kepi Rodonit, as this is the area where fishermen say they catch most sea turtles; and include water depths shallower than the 50-metre isobath (although government may decide on the 40-metre isobath based on their existing legislation). Fishing activities should be strictly licensed; and regulations actively enforced; with sanctions and area closures applied as appropriate. The protection of sea turtles and their habitats should be **explicitly included** in any legislative or management measures.

iii) At present there is no justification in Drini Bay for establishing an absolute protection zone (i.e. an area where no activities are permitted, except for scientific purposes).

iv) The plan will need to carefully consider permitted activities and ways of improving the livelihoods and opportunities for local inhabitants, especially the younger generation; these could include alternative methods of income-generation, such as ecotourism, organic-food production; identifying skill-gaps in areas such as environmental management, sustainable development, and environmental education; and the provision of higher education or further training

v) A key element of this process is raising environmental-awareness: this will take time and should start in schools and local authorities. Albanians need to develop an understanding that a clean, healthy environment is also beneficial for their personal health and well-being; as well as enhancing socio-economic opportunities, through tourism for instance.

18.1.4. Marine Protected Areas (MPA) in Albania

Albania had no protective measures in its maritime space, other than control of the State borders. An important new development for Albania is that the first Marine Protected Area was proclaimed in 2010 (Government Decree no. 289, dated 28/04/2010 "On the proclamation as National Park of the Natural Marine Ecosystem around Karaburuni Peninsula and Sazani Island" covering an area of 12,570. 82 ha.). Dr White was consulted by the management committee for the Karaburuni-Sazani Marine National Park in June 2010; he advised that the Park's Operational Guidelines should explicitly include the protection of sea turtles and their habitats within the MPA.

18.1.5. Capacity Building and Education

MEDASSET's project has achieved some measure of success in building capacity in Albania. Research on sea turtles was brought closer to internationally-acceptable standards, but can be improved further. There are now 11 young biologists with hands-on training of sea turtle data collection, previously there was only one. The big issue is that there are not many employment opportunities, especially in the natural sciences, and so the project-trained researchers are likely to specialise in other areas, such as business studies, that will provide them with employment. Of course, reinforcement and further training would be an asset; e.g. researchers need to take care in the future to collect **accurate** data on growth increments: because knowledge concerning the marine phases of sea turtle biology is still sparse and such data are important as a guide to the duration of adolescence or the size of turtles at maturity; and for understanding possible polyphasic growth[38].

Public awareness and stakeholder education increased through the project. Such efforts must be continued in the future through similar projects and campaigns as behaviour and attitude changes are a long-term process. The fishing communities in the area are a vital audience for environmental education. Throughout the project the research team demonstrated correct handling practices and explained the importance and endangered status of the species. Further educational programmes, supervision and oversight are necessary as care for the species is of low priority to this impoverished community.



Fig. 80-82 : Fishermen education and awareness raising needs to be continued in the future regarding handling and care for the species.

[38] Chaloupka 1998

18.1.6. Conclusions for sea turtles in the Mediterranean

The reported sighting of one of the project-tagged turtles in Libya (Gulf of Sirte, November 2010) highlights the fact that we are dealing with migratory animals; hence they are a 'shared-resource'; and that considering the entire Mediterranean Sea as a single Management Unit, whereby turtles and their habitats are protected throughout this range, is a sound strategy (White 2007). Lazar *et al.* 2004a advocated an Ionian-Adriatic Management Unit because loggerheads tagged whilst nesting in Zakynthos have been reported regularly from Croatia.

Monitoring projects in the Mediterranean region have expressed concern over falling numbers of turtles; the possible collapse of the nesting population on Crete for example (Margaritoulis pers. com.). These can perhaps be attributed to the far-reaching impacts of human activities, such as tourist developments on nesting beaches; light pollution; increases in tourist numbers; widespread plastic waste; boating activities; and, of course, fishing. What is difficult to prove is quite how these impacts affect turtles; largely because much of their life is spent at sea and is thus poorly-studied. On the positive side, however, since 2007 there have been a very small number of nests laid by loggerheads along the southern coast of Sicily; there had been no Sicilian nesting for more than 20 years (White pers. com.). This may indicate that a new cohort of reproductive animals has now reached maturity, and is using what may have been their 'natal' beaches. It is possible too that the legislation put in place in the past decades (e.g. Barcelona 1976) is actually having a positive effect.

18.1.7. Conclusions and recommendations on sea turtle conservation policy in Albania

The two major problems in Albania at this stage regarding sea turtle conservation are a general lack of infrastructure and an absence of law enforcement. The first point requires time and resources; the entire country is currently 'under development'. Development and the E.U. are a higher priority at the moment than environmental protection. Regarding absence of enforcement, the legislation has been found to be comprehensive and clearly written, but there is no awareness of it, and very little implementation, compliance or enforcement. Regional Governments that are charged with implementing environmental laws are often understaffed and with very limited resources. Lezhe prefecture for example has responsibility for Drini Bay (excluding the area near Velipoje and Bunës River that Shkoder prefecture administers). At the moment it is trying to improve its entire socio-economic structure: build or repair schools, roads, sewage system, housing, electricity, attract development funds, create jobs, etc. Therefore, the few resources are geared towards creating the basic infrastructure necessary for a structured society and the protection of Drini Bay receives little priority.

18.2. National Sea Turtle Management Strategy

The findings and conclusions of this three-year project led to the formulation of recommendations and a "National Sea Turtle Management Strategy", a document which will be submitted to the Albanian Authorities in 2011. The implementation of the National Sea Turtle Management Strategy will help Albania to contribute to the regional efforts to conserve marine turtles in the Mediterranean Sea. An **outline of the key recommendations** follows:

- A substantial number of sea turtles use Albanian territorial waters (White *et al.* 2006; & this project's reports). At present the sea turtles in Albania are still poorly monitored, with most effort being focused on the northernmost bay (Drini Bay). **Long-term monitoring** programmes and updated management plans are needed.
- Delineation of National Sea Areas: these will allow captures or strandings of turtles to be allocated into each appropriate region; and will provide an overview for each Sea Area and comparability between them i.e. the overall national distribution; and will highlight any priority areas; such as those with a high interaction with fisheries.
- **Future tagging:** currently tagging occurs in northern Albania; however, this project proposes it be extended in the future, so that a better understanding of turtles throughout national sea areas can be developed. The remaining tags and tagging equipment that were purchased during this project are held by

GEF in Tirana[39], and will be available to qualified sea turtle researchers working in Albania. The project has advised the government that the **national standard for flipper-tagging** should be to apply **two tags to each turtle**; one on each anterior flipper[40].

There is an urgent need to establish:

- a national tagging database
- a national Stranding Network
- a network of trained sea turtle researchers throughout Albania; at present there are none in government or the national universities
- national documents on safe-handling and tagging guidelines to which researchers must adhere; a research permit system, operated and implemented by the national Authorities. A strong recommendation from this project is that all research activities should be planned and research proposals submitted to the Ministry of Environment for approval.
- There are no rescue and First-Aid facilities currently in Albania: there should at least be a First Aid station; and a feasibility study should be conducted to assess if and where it is appropriate to establish, equip and man a suitable rescue/rehabilitation facility. Thereon, guidelines, 'Captivity' definitions and inspections procedures are proposed.
- There are no veterinary surgeons trained in sea turtle medicine, nor any animal-keepers trained to care for captive sea turtles: at least two veterinary surgeons should attend a short course in surgical training in the regionally available facilities in the Eastern Mediterranean.

Education:

- Tertiary-level education in Marine Sciences: There is a general lack of marine scientists and Albania does not have a Marine Institute; or tertiary-level marine science courses. There are many recently-qualified science graduates, all very keen to work professionally, but there are very few employment opportunities.
- Public Education and Awareness Programmes are scarce. National campaigns on endangered species protection & waste management are needed. Education and/or training courses for various target-groups should be developed (fishermen, media, judiciary, enforcement agencies, NGOs, Researchers, school-children, government officials, teachers etc). Education of fishermen on safe handling of sea turtles and bycatch reporting especially needs to be continually reinforced as this is a long-term process.

Bycatch:

- The present study only considered "stavnikes": there are other fishing methods in wide use[41]. The complete extent of fisheries bycatch in Albania is unknown.
- An immediate national assessment of the interaction between marine turtles and all types of fishing gear needs to be undertaken to establish the level and type of impact these other fisheries have on present turtle populations in Albania; and, consequently, whether additional measures should be formulated and implemented. The bycatch assessment should include trawls, nets, long-lines, and especially small scale and artisanal fisheries; these latter are often ignored, and, although their individual impact may be small, they may number in the thousands.
- The process of evaluation and compensation envisaged in principle within Albanian Law (Law no.1006, dated 23/10/2008 'On wild fauna protection'; Article 12 "Compensation of damage") be extended to include compensation to fishermen for damaged fishing nets as a result of sea turtle activity in identified areas where interaction between marine turtles and fish stocks is a well established fact. The guidelines for evaluation and compensation are approved by the Minister for the Environment, in co-operation with the Ministry of Finance; and at present these rules only apply to agricultural holdings.
- Sea turtles should not be removed from the marine environment nor be prevented from returning to their marine habitats (except for permitted research purposes); and particularly that sea turtles caught incidentally as bycatch in fisheries should be returned to the sea immediately. Retaining turtles in captivity for tourist attraction should not be allowed.

[39] It is noted that the tag applicator purchased by this project has been returned to the GEF office in Tirana for future use by researchers; the 1500 unused tags that were purchased by this projects have been provided to H.A.S. for safekeeping and are available to all researchers for future tagging in Albania (contact Prof. Haxhiu and the GEF office in Tirana)

[40] UNEP-MAP, RAC-SPA 2007 Appendix II

[41] White *et al.* 2006

- Of great importance is to establish a national system of bycatch-reporting for all fisheries.
- Near-shore trawling: fishing vessels based at Shengjin have been regularly observed to conduct their fishing activities ('trata') close to the eastern shore of Drini Bay. It is recommended that an awareness-campaign is implemented immediately for members of the professional fishing-community, to explain the threats to sea turtles; to show how to report bycatch-data; reminding them of conditions in fishing licences; and of regulations regarding enforcement of fisheries and aquaculture laws; to demonstrate safe-handling techniques for sea turtles. The next step is to vigorously enforce the legislative measures enacted.

Plastics/pollution:

- Infrastructural needs: a national waste management strategy needs to be prepared; the private sector needs to be encouraged to invest and participate in waste management; a clear set of guidelines should be issued to municipalities and communities on correct waste disposal procedures; Regional Environment Agencies need resources in order to implement legislation; deposition of waste and release of residual waters, especially into rivers, should only be allowed through a strict waste management plan and by licence; recycling facilities are required throughout the country; the availability of plastic consumer goods should be reviewed and recyclable materials advocated instead.
- Anthropogenic pollution needs to be prevented from entering Drini Bay, and any other identified sea turtle habitats; an ecotoxicological assessment of River Ishmi outflow needs to be conducted at the earliest opportunity[42]; in accordance with provisions in Law nr. 8405, dated 17/09/1998.
- A national television media campaign advocating responsible waste management should be implemented.
- There is no facility at Patoku for keeping turtles in order to collect faecal samples, and so it has not yet been possible to determine directly if, and to what extent, marine debris impacts upon turtles during their benthic foraging in the area. Based on the findings of Freggi *et al.* 2010 and Lazar & Gračan 2010 showing that loggerheads do ingest debris, and in particular plastics, there is an urgent need for future research in this field in Drini Bay.

- **Dynamite**: The prohibition on using dynamite for fishing in coastal waters needs to be actively enforced (Fisheries and Aquaculture Law 7908, dated 04/05/1995). Authorities should conduct enforcement operations at irregular intervals; but that also an environmental-awareness campaign is actively pursued in these very isolated locations to explain the damage that is caused by using explosives underwater.

Legislation:

- The "Protection of wild fauna" Law nr. 10 dated 23/10/2008 should be amended so that migration and migratory routes includes marine migratory animals and their migratory corridors; at present it only refers to migratory birds.
- The management committee for the Karaburuni-Sazani Marine National Park must explicitly include the protection of sea turtles and their habitats within the Park's Operational Guidelines (Government Decree no. 289, dated 28/04/2010 "On the proclamation as National Park of the Natural Marine Ecosystem around Karaburuni Peninsula and Sazani Island" covering an area of 12,570. 82 ha.).

The document also provides a framework for the Authorities that have jurisdiction in the marine environment, and who would be able to implement the proposed sea turtle conservation strategy; as well as management options for protection of the wider Drini Bay area.

19. CONSTRAINTS AND LESSONS LEARNT

Collaboration with fishermen

The research team lived and worked with the fishermen and developed a good relationship with them. However, the groups requested money in return for bringing the team the turtles from their stavnikes. The fishermen are poor, sometimes their catch is very small (2-3 kg), they work hard - for long hours, turtles in the nets can cause damage and prevent fish from being caught, and they have to buy fuel to get to their stavnikes or nets. Although these costs had not been anticipated in the budget design, the team decided to provide the fishermen with some money for their time and fuel. It was emphasized that the project was not

[42] See coastal pollution survey findings in White et al (2010b)

buying turtles from them, as this was illegal, but compensating for their effort and additional costs due to overweight on their small boats. Unfortunately this could lead them to believing that turtles are an income source. Despite strong efforts, the project was not successful in having their unpaid collaboration; due to their financial situation and Albanian culture. Future researchers will need to take these conditions into account and either budget for these payments or acquire a boat and accompany the fishermen to their stavnikes to monitor and release turtles at the traps. There is no culture of volunteering or contributing without pay among the older generation.

Local conditions

In common with other impoverished developing countries, Albania suffers from a lack of infrastructure, resources and organisation.

No facilities are available in Patoku for turtles to be kept, even for a few hours; therefore, data should be collected on the spot and turtles released immediately. Future researchers should either budget to stay at Patoku, or be able to visit each day when the fishermen return to their base; or budget for the construction of suitable pools/tanks where turtles could be retained for a few hours until researchers arrive. Such tanks should be under the direct care of trained staff, with veterinary approval and oversight by the Environmental Inspectorate. A mandatory requirement is that such tanks have a clean seawater supply (there is no such supply now and Patoku Lagoon is extremely polluted: bleaches, oil and fuels, sewage and garbage are disposed directly into the very shallow waters). Researchers should not expect to be working within internationally-acceptable standards at Patoku. Instead, the best approach is to remain highly-flexible; for instance, during rainfall there is often no electricity, so data-entry should be opportunistic and always backed-up. A solar-charger is ideal for cell-phones and small cameras. Universities lack facilities (e.g. no chemicals or equipment in laboratories) and research funds. Regional Government is often understaffed and with very limited resources. At National Government level there are few specialists yet, especially for the Marine Sciences.

The process of immigration is subject to change and so should be reviewed before foreign researchers arrive in the country; permits should be obtained or organised beforehand; the process of residency is not difficult, but it is time-consuming (several weeks).

What became apparent is that there are very few jobs in the environmental sector; very little interest from government; an absence of funding; and difficult bureaucratic procedures to be contended with. Nonetheless, the project has prepared a strong team of researchers, so that when the opportunities appear they now can be sourced nationally.

What is required is a commitment by government to push for positive change. If Albania seeks an international tourist market, it has to clean up the country and its coastal waters[43]; which will also improve the lives and health of its population and the environment in which they live. This requires infrastructure & investment; but also a major shift in national-awareness: that the environment is important.

[43] EC Bathing waters directive (2006/7/EC)

20. ACKNOWLEDGEMENTS

Dr. White would like to thank Dr Taulant Bino (Deputy Minister for Environment) for his advice and assistance; Also: Dr Sajmir Hoxha & Elvana Ramaj (Dept. of Biodiversity); Majlinda Lami (Director of Tourism); Tirana University staff: Dr Sajmir Beqiraj; Prof. Margarita Hysko, Prof. Ferdinand Bego; Dr Lefteris Kashta (Director of Museum of Natural Sciences); Agricultural University (Veterinary Faculty): Dr Luli Dhaskali; UNDP: Arian Gace (SGP/GEF); Dr Violeta Zuna; Mirela Kamberi & Dr Eglantina Bruci; & Jak Gjini. Also: Roland Kristo (Director of Fisheries); Dr Vath Gabili (Fisheries Inspectorate); Anila Kala & Jonida Leshi (REA Berat); Edvin Pacara; Dr Endri Haxhiraj; Nevenka Camovic; Association for the Protection of Aquatic Wildlife in Albania; and of course the support team at MEDASSET in Athens; David Oakley for managing the telemetry data; and Dr Oguz Turkozan and colleagues at Adnan Menderes University for their genetics work. Deepest thanks go to our project researchers, who met every challenge willingly and cheerfully: Thank You All.

Lily Venizelos would like to give a special mention to Prof. Haxhiu who alerted her on the existence of sea turtles in Albanian waters, which prompted MEDASSET to initiate this three-year project. Warm thanks to all of the fishermen who have cooperated with the project, and the local people who have shown interest in our work at Patoku. Thanks also to the partners of the project: ECAT Tirana (2008), the Herpetofauna Albanian Society (2009) and the University of Tirana (2008-2010). We are grateful for the facilitation and endorsement of the project by the Albanian Ministry of Environment and to Bardh Rica (Chairman of Lezhe regional government), the councillors of Lezhe region and Ded Kerraj (Fushëkuqe Municipality). Many thanks to the Albanian local and national media for presenting the project to viewers and readers. Thanks to volunteer Lau Najera for assisting in the legislation review process.

Last but not least, we wish to thank our funding partners: RAC/SPA and Atef Ouerghi for their continuous support since 2005; Tatjana Hema and UNEP/MAP for co-funding the project in 2005, 2009 and 2010; Anne Rowberry and the British Chelonia Group (BCG) for their support in 2009-2010; the J.F. Costopoulos Foundation (Greece), the Spear Charitable Trust (UK), the Panton Trust (UK) and the UK Charity that wishes to remain unnamed, for supporting the 2010 project. A special thanks to Arian Gace for his help and the Global Environment Facility's Small Grant Programme (GEF/SGP) for co-funding the project in 2005, 2008 and 2009.

We wish to acknowledge use of the Maptool programme for the maps in this document. Maptool is a product of www.seaturtle.org

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22. ANNEXES

Annex 1: Dynamite fishing

Table A1. Dynamite fishing in 2008. 'Explosions' refers to the number of charges per set; Ishmi is the southeastern corner of Drini Bay; Mati and Tales are more northerly.

Date	Time	Explosions	Place	Notes
05/07/2008	0945	N/A	Tales	Tales to Mati: saw charges being placed
05/07/2008	1000	N/A	Mati	Many dead fishes
07/07/2008	0730	10	Tales	
14/07/2008	0830	7	Tales	
16/07/2008	0740	6	Tales	Report of dead turtle on beach, no details
22/07/2008	0700	N/A	Mati	Prof. Haxhiu reported many dead fishes
23/07/2008	0735	10	Tales	
28/07/2008	0740	4	Tales	Probably more
05/08/2008	1230	6	Tales	
06/08/2008	0740	8	Ishmi	
06/08/2008	0842	3	Tales	
13/08/2008	0723	9	Ishmi	
14/08/2008	0726	7	Ishmi	
15/08/2008	0733	4	Ishmi	Probably more (noise interference)
20/08/2008	0635	7	Ishmi	
21/08/2008	0734	8	Ishmi	
22/08/2008	0741	10	Ishmi	
25/08/2008	0822	7	Ishmi	
28/08/2008	0742	7	Ishmi	
12/09/2008	0742	11	Ishmi	

Table A2. Dynamite fishing in 2009.

Date	Time	Explosions	Place	Notes
19/06/2009	1105	9	Ishmi	
10/07/2009	0842	5	Ishmi	May have been more
15/07/2009	0831	3	Ishmi	
17/07/2009	0849	6	Ishmi	
23/07/2009	1515	4	Ishmi	
25/07/2009	0915	2	Ishmi	
25/07/2009	1003	2	Ishmi	
28/07/2009	0730	1	Mati	Mati stavnike damaged
29/07/2009	0945	2	Ishmi	
29/07/2009	1225	1	Mati	

31/07/2009	0912	1	Mati	
02/08/2009	1030	8		Ishmi or Mati; uncertain due to wind
02/08/2009	1430	2	Tales	
03/08/2009	0833	1	Ishmi	
04/08/2009	1015	1	Ishmi	
16/08/2009	0900	1		Ishmi or Mati; uncertain due to wind
29/08/2009	0845	5	Ishmi	
05/09/2009	0630	3		Ishmi or Mati; uncertain due to wind

Table A3. Dynamite fishing in 2010.

Date	Time	Explosions	Place	Notes
17/06/2010	1305	10	Ishmi	1st day at Patok
17/06/2010	1400	2	Ishmi	
13/07/2010	0819	28	Ishmi	Pattern of detonation changed
19/07/2010	0838	20	Ishmi	
26/07/2010	0835	15	Ishmi	
27/07/2010	0818	18	Ishmi	
30/07/2010	0820	23	Ishmi	
03/08/2010	0834	24	Ishmi	
04/08/2010	0841	26	Ishmi	Very still today
05/08/2010	0910	21	Ishmi	
06/08/2010	0845	17	Ishmi	At least 17
10/08/2010	0827	23	Ishmi	
12/08/2010	0826	26	Ishmi	Very still today
13/08/2010	0830	31	Ishmi	
16/08/2010	0918	26	Ishmi	Explosions were later this morning
26/08/2010	0825	25	Ishmi	
27/08/2010	0819	33	Ishmi	
30/08/2010	0837	26	Ishmi	
03/09/2010	0843	25	Ishmi	
08/09/2010	0816	24	Ishmi	Dr White away for two days
13/09/2010	0819	19	Ishmi	
14/09/2010	0810	25	Ishmi	
15/09/2010	0850	26	Ishmi	Border Police covert operation
17/09/2010	0821	27	Ishmi	

Annex 2: 2009 Report on visible pollution in Drini Bay

An initial assessment of the visible pollution found on the beaches of Drini Bay, Albania

MEDASSET Technical Report

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ABSTRACT
During surveys of sea turtle foraging habitats in northern Albania it was noticed that plastic litter was present on all of the beaches. Most of the coastal zone in Drini Bay is sparsely populated and road access is poor. Four large rivers enter the bay; sediment, human sewage and anthropogenic waste are probably transported into the bay via the riverine system. Quadrat counts of debris were conducted at eleven locations around the 30-km bay. The heaviest pollution was at Godull and adjacent to the outflow of Ishmi River, where 90% of the debris was made from plastics. Drini Bay is proving to be an important feeding ground for endangered loggerhead turtles *Caretta caretta* (Linnaeus 1758) and so the accumulation of large amounts of marine litter, especially plastics, is an important environmental concern for these omnivorous animals. The Ionian and Adriatic seas converge at Albania; and it seems likely that Albania's pollution will also have an impact in the coastal zones of neighbouring countries, particularly Montenegro, Greece, and possibly Italy and Croatia.

KEY-WORDS: Plastic, marine litter, Albania, anthropogenic impacts, Coastal Zone, Loggerhead turtle *Caretta caretta*, foraging

INTRODUCTION

Gjiri i Drinit (Drini Bay; Fig. 1) - the northern-most bay of Albania – has recently been shown to be an important foraging ground[44] for loggerhead turtles *Caretta caretta* (Linnaeus 1758); very occasionally green turtles *Chelonia mydas* (Linnaeus 1758) have also been captured locally (Haxhiu and Rumano, 2005; White *et al*. 2008; 2009; Mitro pers. com. 2009). Turtles are measured and tagged as part of a research programme established by MEDASSET (Mediterranean Association to Save the Sea Turtles) in association with Tirana University to monitor fisheries-bycatch in the Drini Bay area of Albania.

Outflow from four large rivers (Bunës, Drini, Mati and Ishmi) transports anthropogenic waste and sediment into Drini Bay, which is about 30 km north to south. Many of the beaches in the bay are heavily polluted with debris; predominantly plastics. Ishmi River enters the bay at Gjiri i Rodonit, in the southeastern corner [N41° 34.663; E019° 33.438] adjacent to Kepi i Rodonit (Cape Rodoni or Skënderbej). There is a most foul odour near to the mouth of Ishmi; a large discoloured (brownish) plume extends out to sea for almost one kilometre; and the beaches are littered with man-made waste. Considerable quantities of dead marine invertebrates (prawns, bivalves and crabs) have been observed along the strand nearby at Godull. Further northwards the other three rivers (Bunës, Drini and Mati) that enter the bay appear somewhat cleaner. There is an emerging tourist industry at a small port town, Shengjini, in the northeastern corner of the bay; this has become a very popular destination for Kosovars.

In an attempt to identify the worst-affected areas, our sea turtle researchers from Patoku field-station used quadrats to compare the amount of debris on beaches in different parts of Drini Bay.

At present the national government appears not to have addressed this issue, and so our study is believed to be the first quantification of the litter problem in Drini Bay's coastal zone; and our findings will be forwarded to the Albanian Government and the Barcelona Convention (1976).

[44] See reports and papers at www.medasset.org

MATERIALS AND METHODS

Study Area: Drini Bay

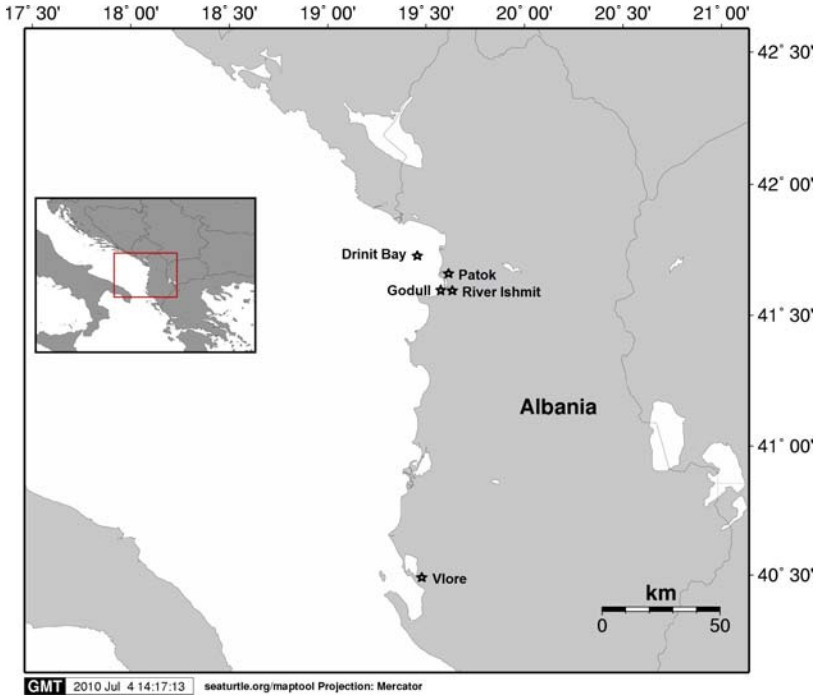

Fig. 1. The northern part of Albania; the sea turtle research-station was at Patok. River Ishmi enters Drini Bay at Godull, adjacent to Kepi Rodoni. (Map prepared by David Oakley with MapTool www.seaturtle.org)

Quadrats

Quadrats (10 × 10 m) were laid out from a randomly-selected point (Fig. 2) at each sampling site (Fig. 4). Two quadrats were used at every location; each pair of quadrats (i.e. an area 20 × 10 m) shared a common baseline, with one being to landwards of it and the other closer to the sea; in several instances quadrats extended into the surf-zone (Figs. 2 & 3). The items found in each quadrat were counted into categories (e.g. plastic bottles, carrier bags, hard plastic, organic material etc.). Photographs were taken before cleaning began and also of the total waste collected from each site (Fig. 2). GPS waypoints were used to mark the centre of each quadrat. (Fig. 3). Road access was frequently difficult and so each site was only assessed once.

Fig. 2. Layout for quadrat-sampling (top); a second quadrat would be to landwards of the yellow base-line. Total debris collected from a quadrat at Ulcinj, Montenegro (bottom).

Fig. 3. GPS waypoints were used to mark each quadrat (top). Sometimes the quadrats extended into the surf-zone (bottom).

Wind-speed and direction

The wind-speed and direction (Fig. 5) were measured daily during the summer (June-September) at our Patoku field-station, which is about five kilometres north of Godull. These abiotic factors, along with sea surface temperature (SST), were part of the marine turtle research programme (acknowledged below).

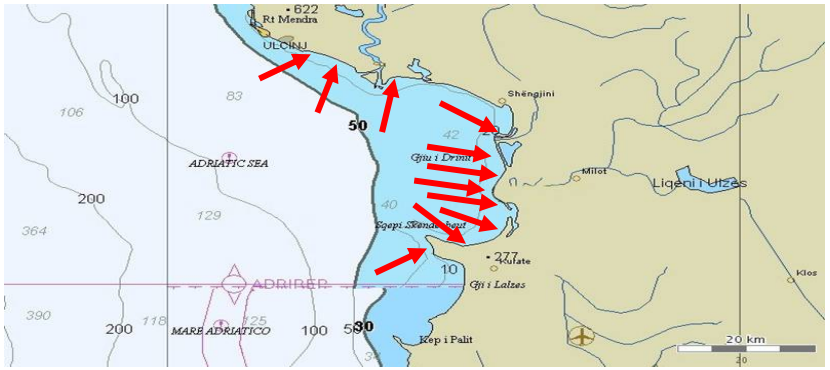

Fig. 4. Quadrat-sampling was undertaken at 11 sites around Drini Bay to determine the areas worst-affected by anthropogenic waste. (Map adapted from Argos.com)

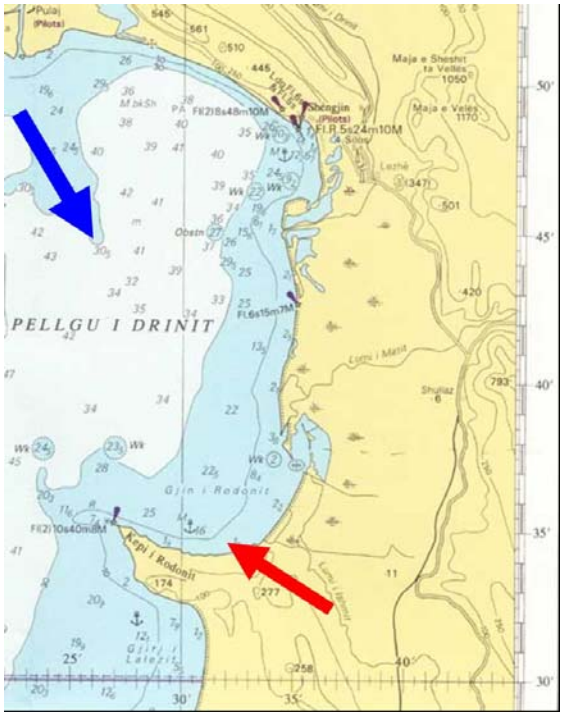

Fig. 5. Red arrow indicates outflow of River Ishmi into Drini Bay; blue arrow shows predominant wind-direction (northwest). (Hellenic Hydrographic map)

RESULTS

Eleven sites in the Drini Bay area were surveyed, between 17th August and 8th September 2009, using a pair of quadrats at each location; one quadrat to seawards and the other to landwards of a common baseline that had been randomly selected.

Table 1. Pairs of quadrats (10 × 10 m) were laid out at eleven locations: from Ulcinj in the north to the southern side of Kepi i Rodonit. The debris in each quadrat was counted (total number of items per quadrat) and the % of plastic items calculated. Sometimes the seawards quadrats were assessed first to suit changing tidal conditions.

	Land			Sea		
Place	**Quadrat**	**Items**	**Plastic %**	**Quadrat**	**Items**	**Plastic %**
Ulcinj	Q1	61	21.31	Q2	44	52.27
Ulcinj (S)	Q3	27	33.33	Q4	31	45.16
Velipoje	Q5	34	67.65	Q6	117	76.92
Kune	Q8	42	92.86	Q7	105	79.05
Vain	Q9	99	86.87	Q10	33	63.64
Tales	Q11	48	87.50	Q12	14	57.14
Tales (S)	Q14	56	71.43	Q13	75	50.67
Patok	Q15	16	68.75	Q16	25	32.00
Godull	Q18	829	94.33	Q17	266	89.10
Ishmi	Q20	1447	87.91	Q19	148	87.84
Rodoni	Q21	192	82.29	Q22	13	69.23

Table 1 reports the total number of items counted in each 10 × 10 m quadrat. Subsequently the % of plastic items present was calculated for each quadrat and location (Figs. 4 & 6). See supplementary material for debris categories (e.g. plastic bottles, hard or soft plastic fragments, organic material etc.). The worst impacted areas were at Godull and adjacent to River Ishmi's outflow where plastic items were ubiquitous (e.g. Quadrats 18 & 20; Fig. 7)). The cleanest areas were at Ulcinj, Montenegro, (Fig. 2) and on the seawards side of Patoku's barrier island, just south of River Mati (Fig. 2). Single factor ANOVA showed no significant difference in the amount of plastics present when all of the seawards vs. the landwards quadrats were compared.

The wind direction was recorded at Patoku on 83 days between 15th June and 24th September 2009. The Maestrali (northwesterly) was blowing on 54 days (65% of records; Fig. 5). When westerly winds were included (17 days), then for 86% of the records the wind was blowing from seawards into Drini Bay.

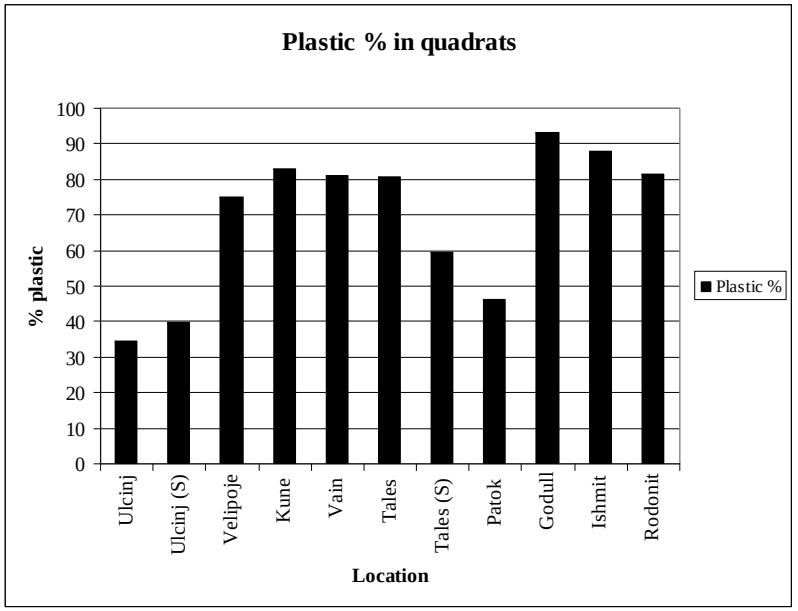

Fig. 6. The percentage of plastic items in quadrat-pairs at each location. The cleanest sites were at Ulcinj, and the seawards side of Patok's barrier island, just south of Mati River outflow. All other sites had >60% plastic, with Godull, Ishmi and Rodonit being the worst (>80%), followed by the zones around Shengjini (Velipoje. Kune, Vain and Tales).

Fig. 7. Vast amounts of anthropogenic waste were present at the outflow of River Ishmi.

DISCUSSION

Plastic debris was present at each sampled site, with the greatest concentrations being adjacent to Ishmi River and Godull in the southeast of Drini Bay, and also at Shengjini in the northeastern corner.

Godull is a very isolated and impoverished artisanal fishing community. There is no fresh water or electricity and the houses are built mostly of wood, plastic and tarpaulins. Gjiri i Drinit is an important artisanal fishing-ground; fished mostly with gill-nets, fish-traps, and home-made explosives or dynamite; there are trawlers based at Shengjini. Most of the debris on the beaches consisted of manufactured plastic items, such as storage-containers, shoes, crash-helmets, bottles for water or other beverages, garden furniture, televisions, toys, and a mannequin. There were also substantial numbers of fragments of hard and soft plastic, which included polystyrene. It seems most unlikely that all of this litter originated from Godull (Gregory 2009). Plastic items were observed in the Ishmi outflow and in the waves all along the Godull beaches.

The Kune zone, immediately south of Shengjini, is also heavily impacted with plastics, particularly bottles, shoes and plastic carrier-bags. These have most probably come from the nearby beaches that serve the emerging tourism industry; there are many small kiosks and food outlets along the beaches, but there are few waste disposal arrangements and the entire area is littered with plastics and other waste. A little further south at Vain, either side of Drini River, and at Tales the beaches were mostly littered with hard plastic items that appeared to have been marine-borne for at least some of the time.

The seawards side of the barrier island at Patoku, just south of Mati River, was also fairly clean. A footbridge was constructed in 2008 that allows people to reach the island (previously access was only by boat); the litter that they left (melons and drink-cans) was clearly different from the sea-borne debris accumulated along the shore.

The southern side of Kepi i Rodonit in Lalezi Bay, near to the westernmost point, was assessed using one pair of quadrats. Plastic debris was widespread, especially along the back of the narrow beaches near to the vegetation line.

Most of this debris appeared to have arrived by sea – plastic bottles, tubes, and shoes; the only human habitation was a fishing hut near to several anchored small boats. Underwater visibility was 5-6 metres (a sharp contrast with the turbidity of Drini Bay); the seabed was gravel on a clay substratum, seagrass (*Posidonia oceanica*) and green algae were widespread, and there were some nearshore rocks.

There were no significant differences between the debris quantified in the seawards versus the landwards quadrats during the present study. It seems that marine-borne waste is deposited upon the shore, there were usually two or more strandlines reflecting high and low water, and then, once dry, the lighter items were blown to the back of the beach by the wind. It is possible that some debris re-enters the sea, which initially would probably be wind-borne; the tidal range in the Mediterranean is only about 25 cm.

The predominant wind direction in Drini Bay was Maestrali (northwest), thus it seems that any debris, whether it has emerged from Ishmi or entered the sea elsewhere in the bay, becomes trapped in the Godull area and along the northern shore of Kepi i Rodonit (White *et al*. 2009; 2010a). Some of this debris appears to travel around the western point of the cape, before being deposited onto its southern beaches by wave-action. However, it is possible that the debris in Lalezi Bay originated further south at Durres; Albania's major port.

Two of us (MW and ES) also went to Ulcinj, Montenegro, to assess the beaches on the western side of Bunës River (Velipoje is on its eastern side in Albania). These quadrats produced smaller amounts of debris, although still mostly plastics; however, the seawater was cleaner (underwater visibility >5 m). Along Plazh i Madh (Big Beach) there were also four locations displaying Blue-Flag Awards (www.blueflag.org); there are none in Albania. We noted that behind the beaches there were substantial amounts of plastics, some of which had been collected elsewhere and then the bags were just dumped in remote locations. Waste was also thrown over cliffs along the rocky shores. At Ulcinj the waste-disposal infrastructure, which included recycling facilities, was very good and the town is very clean.

The percentage of plastic items (bottles, tubes, fragments, polystyrene, synthetic-sponge etc.) in each quadrat pair (Figs. 2 & 6; Table 1) showed that the two cleanest locations were Ulcinj and the seawards side of Patoku's barrier island, immediately south of Mati outflow. This suggests that the widespread plastic debris found in Drini Bay did not arrive there from either Ulcinj or River Mati, but instead originated from other sources, such as riverine, marine or terrestrial, whether these were in the bay or elsewhere. We have not conducted experiments using 'tagged' samples of waste to track their possible routes via the rivers; and so cannot identify categorically the origins for the waste.

The impact of debris, or other pollutants, upon sea turtles locally and their habitats is less clear - we had tagged >245 loggerheads and one green turtle between June 2008 and September 2009; one of us (MW) conducted three SCUBA dives in Drini Bay, but the sub-surface visibility is usually close to zero (White *et al*. 2006). Elsewhere, sea turtles are known to have ingested plastics (Fritts 1982; Venizelos and Smith 1997; Witherington and Hirama, 2006) and other debris encountered in the marine environment (Balazs, 1985; Venizelos and Smith 1997; Starbird and Audel 2000; Tomas *et al*. 2002). The widespread presence of marine litter in Drini Bay, in conjunction with the omnivorous nature of *Caretta caretta* makes it likely that plastic and other debris will be consumed by these turtles (Balazs, 1985; Gramentz 1988; Schulman and Lutz 1995; Godley *et al*. 1998, 1999; White 2007; Freggi *et al*. 2010). There is no facility at Patoku where turtles could be kept for perhaps a week in order to collect their faecal samples, and so it has not yet been possible to determine directly if, and to what extent, marine debris impacts upon turtles during their benthic foraging in the area (Barnes *et al*. 2009; Gregory 2009; Ryan *et al*. 2009; White *et al*. 2010a). Only one dead turtle had been encountered, but a necropsy was not performed.

Plastic debris is a highly visible sign of the anthropogenic waste that was observed flowing from River Ishmi into Drini Bay, and could be assessed immediately with little equipment (White *et al*. 2010a). However, the foul smell emanating from Ishmi's outflow suggests that other sources of contamination, particularly microbiological organisms, are likely to be present in the water, and perhaps in riverine and marine sediments, as well as fauna and flora; these pollutants should be identified and quantified through detailed ecotoxicological analyses (Miho *et al*. 2005).
Recent reports note that 98% of human sewage in Albania is untreated and is usually discharged directly into rivers or ponds near to human habitation (RDS 2005; REAP 2006). In the case of Tirana, Albania's Capital, and its neighbour Kamez, it would appear that the sewage effluent is transported via the riverine system: Rivers Tiranes, Lana, Terkuza and Limuthi feed into Gjola, which along with Zeza becomes the Ishmi that then enters Drini Bay. Local fishermen were observed using two different types of net construction (bilanç and kalemero) in the Ishmi river mouth. Inhabitants from nearby villages use the Godull beaches for recreation: sunbathing and picnicking amid the widespread debris and swimming in the visibly polluted sea (White *et al*. 2010a).

This initial survey has shown that man-made waste, notably plastics, is widespread throughout Drini and Lalezi Bays. The problem is likely to worsen as the present decade's production of plastics almost equals the entire global output from the previous century (Thompson *et al*. 2009). With the exception of Tales, waste-disposal facilities are poor or non-existent, including Patoku where the waste from the restaurants is just thrown into the inner lagoon, or occasionally burned. The longevity of plastics is estimated to be hundreds to thousands of years (Barnes *et al*. 2009). If the underwater marine environment is more heavily impacted than the surface zone, which Goldberg (1997) and Stefatos *et a*l. (1999) indicated was the case, then the true scale of pollution is likely to be much greater. An environmental-awareness campaign throughout Albania could greatly reduce the litter problem in the coastal zone and allow mitigation measures and

resources to be directed towards the worst affected areas (Ryan *et a*l. 2009). The first recycling project in the country began in Lezhe (Bashkia Lezhë, and Kadeli shpk 2009) and could be duplicated elsewhere. We recommend that a detailed analytical study is conducted in Drini Bay, particularly of the outflow from River Ishmi, in order to properly quantify the impacts of anthropogenic litter, the concentration levels of other contaminants, and to determine the possible risks to human and environmental health.

Geographically Albania is situated where the Ionian and Adriatic Seas converge. It seems likely that Albania's pollution will have some, yet to be quantified, impact upon the coastal zones, and coastal or transitional waters of neighbouring countries, such as Montenegro, Croatia, Greece and perhaps Italy. EU Member States are subject to the EC Directive on bathing water quality (2006/7/EC), and so addressing the issues of pollution now may help Albania's candidacy for EU accession in the future.

ACKNOWLEDGEMENTS

These observations were made while conducting surveys (of sea turtle habitats in Drini Bay) during the three-year marine research programme "Monitoring and Conservation of Important Sea Turtle feeding Grounds in the Patok Area of Albania" which was established by the Mediterranean Association to Save the Sea Turtles (MEDASSET www.medasset.org) within the framework of its conservation programmes in the Eastern Mediterranean, and was carried out in conjunction with the University of Tirana, with the endorsement of the Ministry of Environment, Tirana. 2008-2009 fieldwork was funded by: MEDASSET; Global Environment Facility – Small Grants Programme (GEF/SGP); Regional Activity Centre – Specially Protected Areas (RAC/SPA); United Nations Environment Programme – Mediterranean Action Plan (UNEP/MAP); British Chelonia Group (BCG). Thanks to Prof. Haxhiu (Herpetofauna Albanian Society) for arranging media-coverage at Godull; and also for explaining the flow of the riverine system from Tirana. Thanks to Bardh Rica (Chairman of the Regional Government at Lezhë) for his advice on disseminating the results; and to Arian Gace (GEF-SGP) for helping with Albanian literature. Thanks to David Oakley (Southampton University) for preparing the map of Drini Bay, using MapTool: a product of www.seaturtle.org

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Annex 3: Report on river-water sampling in 2010

Preliminary water-sampling to assess the level of biological pollutants from five rivers in Albania.

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Introduction

During a 3-year monitoring programme[45] of sea turtles that forage in Drini Bay, northern Albania, it was noted that all the beaches in this 30-km bay were heavily polluted with anthropogenic waste, particularly plastics (White *et al*. 2010a). In 2009 quadrat surveys of visible waste were conducted at eleven different sites around the bay, so as to pinpoint the worst affected areas; the outflow of River Ishmi and the adjacent beaches of Godull and Cape Rodoni were the most heavily polluted (White *et al*. 2010a). It was clear that the debris, which was mostly manufactured plastic items, did not originate in the very impoverished area of Godull, but was most likely to have been transported there by the four rivers that enter Drini Bay: Ishmi, Mati, Drini and Bunës. Water-sampling was not conducted in 2009, as there were no analytical facilities available, however, it was assumed that other pollutants (biological and chemical) were also likely to be present; because there was a foul odour at the mouth of Ishmi and a discoloured plume of water that extended from the outflow almost one kilometre out to sea.

The present study was undertaken in collaboration with the Department of Microbiology, Tirana University, and we analysed water samples that were collected from five different rivers. High levels of faecal coliform bacteria and heterotrophic bacteria were present in all samples, and, although this is only the first step, it extends our knowledge of the levels of anthropogenic pollutants that have an impact upon Albania's coastal zone. Four of the sampled rivers ultimately discharge into Drini Bay; which is now known to be a critical-habitat for sea turtles in the Mediterranean (White, Boura & Venizelos 2010). The fifth river, Gjanica, joins Semani River, which enters the sea to the north of Vlore; sea turtles have been confirmed from this habitat too (White pers. obs.).

Materials and Methods

1) Sampling technique:
Faecal coliform bacteria samples should be collected and transported in an insulated-container to the laboratory, usually on the sampling day. The faecal coliform samples need to be tested within 48 hours from the time the first sample in the field was taken. Water was collected by hand, using sterilised containers, from five rivers (Fig. 1):

Lumi Mati: Sampling point **(Latitude: N41°.41.015 Longitude: E019°.40.230)** was the south bank of the river; just to the west of the autostrada bridge, and adjacent to a large gravel-extraction facility. Water flow was fast, and the banks and water were very clean. [Sampled at 09:45, 22/10/2010; water temperature = 13.0°C]

Lumi Gjanica: Sampling point **(Latitude: N40°.43.618 Longitude: E019°.33.760)** was in Fier, near to a bunker on the eastern bank of the river, just to the north of the small foot-bridge at the northern end of the market (not the larger bridge with stalls on it by the Orthodox Church). Water flow was fast, there was garbage everywhere, some of which was thrown into the water; and rats were observed on both banks and swimming in the river. Sewage effluent is discharged directly into the river from nearby houses and hotels.
[Sampled at 13:30, 21/10/2010; water temperature = 17.0°C]

Lumi Gjola: Sampling point **(Latitude: N41°.28.029 Longitude: E019°.41.535)** was just off the road from Kruje to Vore; there is a small right-hand turn-off (signposted to 'Ishem') about 500 metres after Nord Park Kompleks; the sample was collected beneath the small bridge there. Water flow was medium, there was substantial garbage, including in the trees (from the previously high water levels); rats were present on both banks; and garbage was thrown from the bridge as the sample was being taken.
[Sampled at 17:10, 21/10/2010; water temperature = 16.5°C]

Lumi Tirana: Sampling point **(Latitude: N41°.23.906 Longitude: E019°.42.264)** was under the autostrada bridge on the way from Rinas Airport to Tirana; the site is a short distance after Epoka University and can be accessed from either side of the road. Lorries drive down a small track and dump waste directly into the river beneath the road bridge. Water flow was fast and garbage was widespread on the banks and in the water.
[Sampled at 10:45, 22/10/2010; water temperature = 14.5°C]

Lumi Drini: Sampling point **(Latitude: N41°.45.832 Longitude: E019°.37.966)** was the south bank of the river; just to the west of the autostrada bridge near to Lezhe; actually on the small road to Ishull Lezhe & Vain Lagoon; there is a large red/yellow/blue building nearby. The sample was collected next to a 'kalemero' fish trap. Water flow was slow and there was very little waste in the water or on the banks.
[Sampled at 09:20, 22/10/2010; water temperature = 15.0°C]

[45] Mediterranean Association to Save the Sea Turtles (2008-2010)

Note: a planned sample from Lumi Ishmi (Godull) could not be collected as the area was inaccessible after heavy rain and extensive flooding.

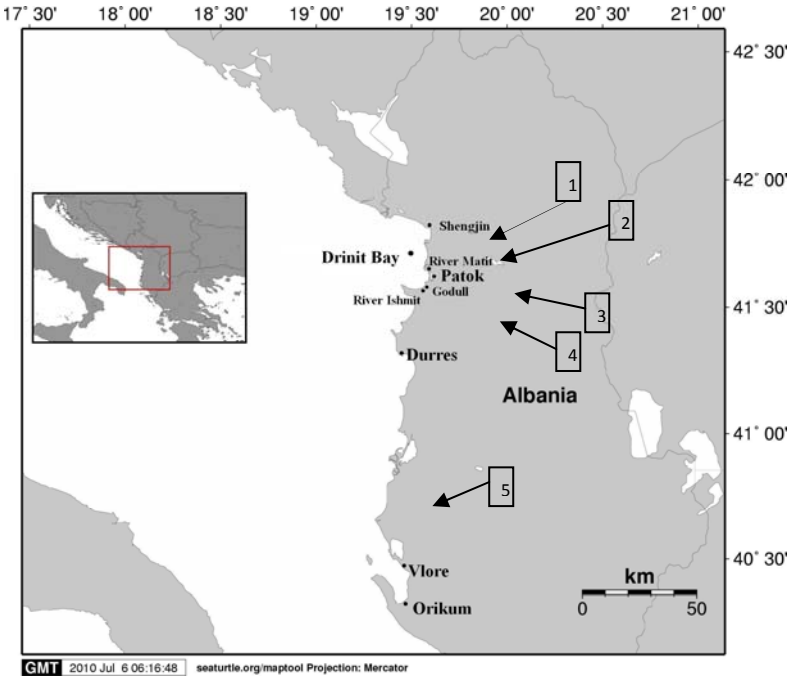


Figure 1. Map of northern Albania showing the approximate positions of water sampling points for five rivers: 1 Drini; 2 Mati; 3 Gjola; 4 Tirana; 5 Gjanica. (Map drawn with MapTool; a product of www.seaturtle.org)

2) Laboratory and Analytical techniques:

Faecal Coliform Bacteria Parameter and Total Coliform Bacteria

Faecal coliform bacteria are microscopic organisms that live in the intestines of all warm-blooded animals, and in animal wastes or faeces eliminated from the intestinal tract. Faecal coliform bacteria may indicate the presence of disease-carrying organisms which live in the same environment as the faecal coliform bacteria. Total coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of man and warm-blooded and cold-blooded animals. They aid in the digestion of food. A specific subgroup of this collection is the faecal coliform bacteria, the most common member being *Escherichia coli*. These organisms may be separated from the total coliform group by their ability to grow and use lactose sugar at elevated temperatures (44-45ºC) and are associated only with the faecal material of warm-blooded animals.

3) Tests, Media and incubation temperatures:

a) Faecal Coliforms: The MPN **(Most Probable Number)** test and the nutrient Media EC were used; the incubation was at 44.5ºC

b) Heterotroph Bacteria: The method was the Petri Dishes Plating; that used the YEA Nutrient Media; the incubation was at 37.0ºC

c) Total Coliform Bacteria: The MPN (Most Probable Number) test and the nutrient Media LB were used; with the MacConkey pour-plating method; the incubation was at 37.0ºC.

The measurement is expressed as: "the number of organisms per 100 mL (CFU/100ml)"

4) Reference Standards:

ISO 7899-1 was used and also EC Directive (2006/7/EC) *"concerning the management of bathing water quality"*

Table 1. Standard for faecal coliforms (*Standartet e koliformëve fekalë në lumenj për pëcaktimin e pastërtisë së ujit).* ISO 7899-1

Faecal coliforms	Very good quality	Good quality	Bad quality	Very bad quality
Cfu/100ml	250-500	500-1000	1000-2000	Mbi 2000

Table 2. Standard for total coliforms (*Standartet e Koliformëve totalë ne lumenj për përcaktimin e pastërtisë së ujit).* ISO 7899-1

Total coliform	Very good quality	Good quality	Bad quality	Very bad quality
Cfu/100ml	1250	2500	5000	10000

Results

Table 3. Bacterial counts are given for: Faecal Coliforms; Heterotroph Bacteria; and Total Coliforms; which were present in water samples obtained from five rivers: Mati, Gjanica, Gjola, Tirana and Drini. Results are expressed as CFU/100ml (the number of organisms per 100ml). Mati was the least-polluted; Tirana the most-polluted. The low number of Heterotrophs in Gjanica may be a consequence of other, unidentified, pollutants that limited their growth.

River	Faecal Coliforms CFU/100ml	Heterotroph Bacteria CFU/100ml	Total Coliforms CFU/100ml
Mati	1.2×10^2	3.0×10^5	1.3×10^2
Gjanica	1.4×10^3	5.0×10^4	1.5×10^3
Gjola	5.2×10^3	2.7×10^5	5.5×10^3
Tirana	1.2×10^4	3.1×10^5	1.3×10^4
Drini	5.1×10^3	2.5×10^5	5.3×10^3

Table 3 shows that River Mati was the least-polluted for both faecal coliforms and total coliforms. River Tirana is the most-polluted for both faecal coliforms and total coliforms. In terms of Heterotrophic bacteria the River Gjanica produced the lowest count; an order of magnitude lower than the rest; the counts from the other rivers were broadly similar.

Discussion

Environmental Impact:
The presence of faecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the faecal material of man or other animals. At the time this occurred, the source water may have been contaminated by pathogens or disease-producing bacteria or viruses which can also exist in faecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis, hepatitis A; and Weil's Disease. The presence of faecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Faecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

The least-polluted river is Mati: both the faecal coliform and the total coliform counts were in the 'very good' range. This finding is supported by the quadrat-sampling of plastics that was undertaken by White *et al*. (2010a), during which the two cleanest sites were immediately south of Mati outflow and at Ulcinj, Montenegro. One of the reasons for low levels of pollutants could be that Mati passes through areas with low population densities. Taken together these two studies (visible pollution and bacterial contamination) suggest that River Mati has the least impact on Drini Bay.

River Drini was 'very bad' for faecal coliforms and 'bad' for total coliforms. The river is used for waste-disposal, and plastics are commonly observed in the section at Lezhe; however, the water and river-banks are fairly clean.

Because River Ishmi could not be sampled at this time, although it was clearly the most-polluted site for debris in Drini Bay (White *et al*. 2010a), it is not possible immediately to confirm its exact impact in the coastal zone. However, River Ishmi is fed by both Tirana and Gjola rivers. The most-polluted river was Tirana: being 'very bad' for both faecal coliform and total coliform counts; by an order of magnitude above the other samples. Waste is dumped directly into this river, sometimes from lorries; including adjacent to the sampling-site. The river was seen to transport floating plastic items, which extended for more than a kilometre of the water's flow. A short distance downstream (2-3 km) this river enters the Lana river (which flows through Tirana City) to become Gjola; waste is also dumped directly into Gjola river. The faecal coliform and total coliform counts for Gjola are both 'very bad'; thus it seems likely that Ishmi will also have high coliform counts: whether from direct discharges or introduced from Tirana and Gjola rivers. Ishmi will be sampled at a later date.

Further south, near to Vlore, the River Gjanica passes through the town of Fier. During the winter months this river frequently overflows, flooding streets, houses, schools and the adjacent countryside. It was this river that initiated the present study. Results from Gjanica showed that the river was 'bad' for faecal coliforms, yet 'good' for total coliforms. However, the count of Heterotrophic bacteria was the lowest for any of the present samples; by an order of magnitude lower. This could be due to the presence of other, perhaps chemical (Miho *et al*. 2005), pollutants that were not assessed within the present study; these may have inhibited bacterial growth.

Public health concerns

The present findings raise several concerns regarding public health and safety. The first is that public bathing occurs in the Vlore sea areas and also at Drini Bay. Although Albania has not yet acceded to the European Union, it is a candidate Member and will have to implement EU legislation. The 'Bathing Waters' Directive (2006/7/EC) requires that members of the public at bathing areas are notified about the potential risks to their health from pollutants; this includes the presence of tarry residues, glass, plastics, rubber, or other waste (Article 9). The Directive also identifies impacts to transboundary waters (Article 10); the four rivers that enter Drini Bay are likely to have some impact on Montenegro, particularly at Plazh i Madh, just to the west of Bunës River. …

The widespread distribution of waste, including food-stuffs is very likely to affect public health. Not only is there a foul smell from decaying food, but rats were very attracted to

these areas. The worst example was at Fier (Gjanica), with three large rats being observed within ten minutes; one on either bank, the third swimming across the river. These animals are a known vector for Weil's Disease; and this river does overflow into a nearby school and business premises. A proper Environmental Impact Assessment (EIA) should be conducted during the winter months to quantify the true impacts here.

Limitations of the present survey & future research

i) The sampled rivers were of slightly different temperatures: Gjanica was the warmest (17°C); Mati the coolest (13°C). Future laboratory studies can investigate if this has any great effect on these particular bacterial-counts.
ii) Chemical pollutants were not assessed, as we lacked analytical facilities for this work. Gjanica had the lowest count of Heterotrophs (an order of magnitude lower than the other samples). Could this be due to a high loading of chemicals in the water that limited their growth? Samples should be collected further upstream of a petro-chemical complex on Gjanica, so that the extent of industrial impacts can be identified.
iii) The most-polluted river was Tirana; sampled about 3 km upstream of its confluence with Lana River. Samples are now required from Lana itself, upstream and downstream of the Tirana confluence. These should show how much Tirana river-water is diluted by mixing with Lana. The next step will be to sample River Terkuza, which then joins these others (Tirana and Lana) at the Gjola section (Gjola results are reported here). We should then be able to determine whether Tirana river is a bigger contributor of pollutants, into what will become River Ishmi, than the Lana/Terkuza section. The reason that this is of interest is that waste is being actively dumped into Tirana river at the sampling point (near Epoka University on the airport road): lorries drive under the bridge and empty garbage straight into the river; this then flows down to Ishmi, and then into Drini Bay (our turtle foraging habitat). If Tirana river is the biggest contributor: then the way ahead is to find out which Municipality is responsible, and the Regional Environmental Agency (REA) who should oversee them; and where they are supposed to be dumping the waste under environmental permit. A case can then be made to the Ministry of Environment.
iv) The same approach can be used for sea areas north of Vlore. Gjanica was observed to be a considerable source of pollution (e.g. plastics and sewage); this is the responsibility of Fier Municipality and its REA. This river joins into Semani, which has already passed through Berat - as River Osumi - and another REA, so by sampling the pollutant-levels upstream and downstream of where Gjanica comes in at Mbrostar, the impacts can be correctly attributed to each river, and each municipality urged to take responsibility for its environment.

Unfortunately at present, Albania is undergoing nationwide infrastructural development; which means that funds for environmental concerns are minimal. Yet, the country seeks to improve the socio-economic status and well-being of its population, and would like to have international tourism; also its future is most likely to be within the European Union. By implementing effective waste-management schemes, cleaning up rivers, coastal-zones and the surrounding countryside, it seems likely that Albania could achieve those aims within a few years. However, this will require direct action throughout the country.

Literature cited:

EC Directive (2006/7/EC) *"concerning the management of bathing water quality"*
Miho A, Çullaj A, Hasko A, Lazo P, Kupe L, Bachofen R, Brandl H, Schanz F, Baraj B. (2005) Environmental state of some rivers of Albanian Adriatic Lowland. Tiranë
White, M; L. Boura; L Venizelos (2010) An overview of MEDASSET's role in sea turtle research and conservation in Albania. Testudo 7(2): 43-54.
White M, Haxhiu I, Kararaj E, Përkeqi D, Petri L, Saçdanaku E,. Boura L, Venizelos L (2010a) Plastic debris at an important sea turtle foraging ground in Albania. Book of Abstracts, 30th Annual Symposium on Sea Turtle Biology and Conservation, International Sea Turtle Society, Goa, India.

Top: River Drini sampling point.
Bottom: Garbage from restaurants thrown into Patoku inner lagoon.

Top: Mati sampling point.

Bottom: Lana river in Tirana

Top: Gjola sampling point; plastic in the trees was from recent flooding

Bottom: 'Middle-man' for plastic consumer goods; many of these end up in the coastal zone

Tirana river sampling-point (top) is beneath the autostrada bridge (bottom); lorries dump garbage directly into this river, which later joins Ishmi & enters Drini Bay

Top: Fixing locations with GPS.
Bottom: waste near Gjanica sampling point

Top: Berat Castle, UNESCO World Heritage Site: garbage is thrown over the walls and ends up in the River Osumi (below), which later joins with Gjanica and enters the Adriatic Sea just north of Vlore.

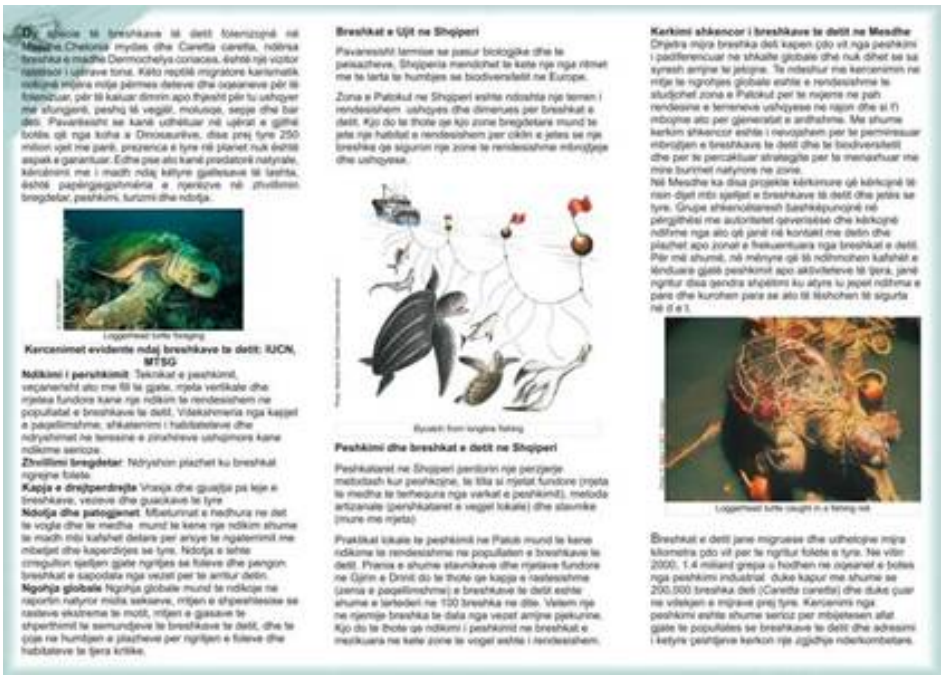
Top: Fier market & River Gjanica; garbage is thrown directly into the river.
Bottom: collecting water sample from Gjanica

Annex 4

Educational Material

LEAFLET

Front



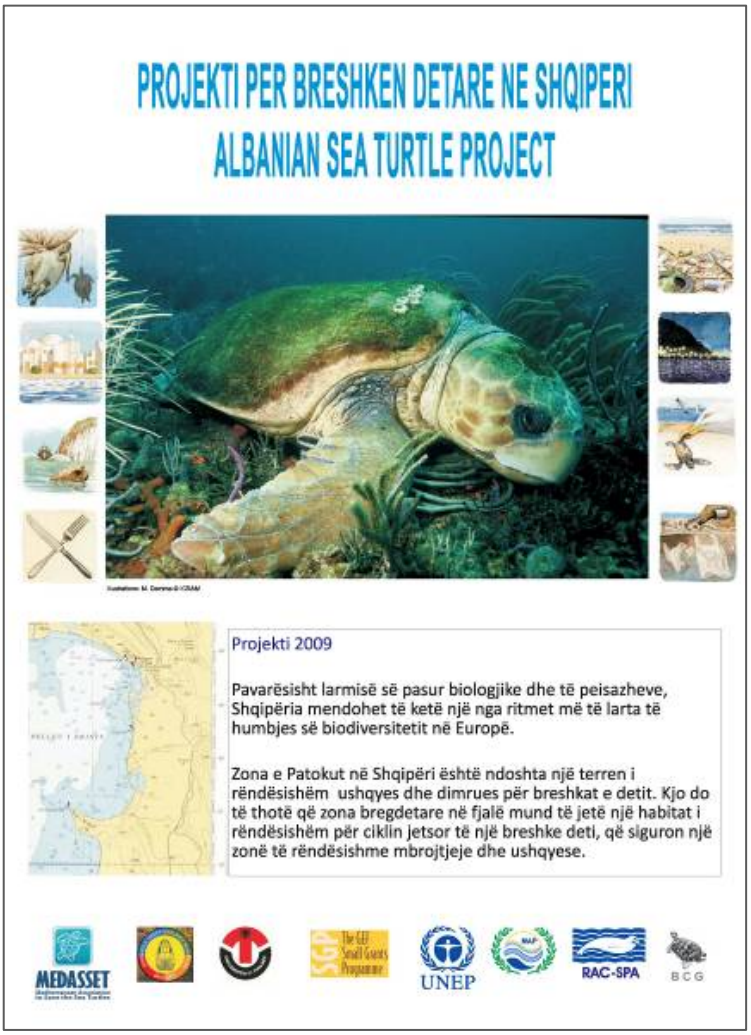
Breshkat e Ujit ne Shqiperi

Peshkimi dhe breshkat e detit ne Shqiperi

Kerkimi shkencor i breshkave te detit ne Mesdhe

Back

Poster



Sticker

T-Shirt