

Dear friends,

On September 29th our last team of Earthwatch volunteers for year 2006 left the field station in Vonitsa. Together, we did six months of hard work, we enjoyed very special moments, and we experienced events that are now part of the project's history.

It has been a memorable year, and we already miss the long hours spent with you scanning the calm surface of the Amvrakikos Gulf in search of dorsal fins, our inspiring discussions while reviewing the day's activities, and our memorable dinners.

Your contribution to the project has been essential not only because of your commitment and the quality of your work, but also for the enriching experience of sharing with all of you the beautiful Amvrakikos Gulf and its amazing dolphins.

What started in 2001 as a preliminary study conducted with the most basic means has turned into an established and fully functional long-term project. This is something that we could hardly achieve without Earthwatch and the involvement of people like you. People with very diverse backgrounds and nationalities but sharing a common interest in nature conservation.

In 2006 we welcomed 12 Earthwatch teams, totalling 48 volunteers. This was a great opportunity and made a real difference for us. We look forward to continuing this journey for many more years!

Thank you again for believing in this project and for sharing with us your enthusiasm and dedication.

The "Dolphins of the Ionian Sea" team

EARTHWATCH INSTITUTE FIELD REPORT

Project Title:

Dolphins of the Ionian Sea (from year 2007: Dolphins of Greece)

Principal Investigators:

Giovanni Bearzi (1)

Joan Gonzalvo Villegas (2)

Position/Affiliations:

(1) President, Tethys Research Institute; Contract Professor of Cetacean Conservation, University of Venice, Italy

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Research Site:

The Amvrakikos Gulf is the largest and one of the most important wetlands in Greece. It covers an area of approximately 400 km², stretching over about 60 km. The gulf, situated in north-western Greece (38°58'35"N; 20°57'51"E), has a maximum depth of 60 m and develops along 256 km of coastline. It is virtually a closed basin, whose only link to the open Ionian Sea is a narrow and shallow channel 600 m wide. The gulf waters are renewed very slowly, through a process that takes nearly one year to complete.

Local Management Status of the Research Site:

The Amvrakikos Gulf has been designated as a Sensitive Area in conformity with the Urban Waste Water Treatment Directive and has been recommended for designation as a Vulnerable Zone in conformity with the Nitrates Directive. The northern shore of the Amvrakikos Gulf was also designated as a Ramsar site in 1975, as a Special Protection Area (SPA), and in part as a Game Reserve. On November 28th 2006, the Amvrakikos Gulf became a national park of 1,300 km². Unfortunately, the proposed management measures imply little specific protection, and only basic protection measures apply to wetlands and lagoons.

Scientific names of primary species being studied:

Common bottlenose dolphin (*Tursiops truncatus*)

Key Research Objectives:

Long-term monitoring of dolphin groups through field research methods including boat surveys and individual photo-identification, to detect population trends, identify critical habitat, and gain insight into ways of mitigating the present threats.

Research focusing on the impact of fishing and on dolphin-fisheries interactions.

Data Collection and Results

- a) Give a concise account of the data you have collected during the past field season.

A total of 86 daily surveys were conducted from a 5.8m inflatable craft with rigid hull powered by a 100HP four-stroke outboard engine. The navigation effort totalled 3300km. Table 1 shows the research effort in the gulf between April-September 2006, when field work was carried out with Earthwatch volunteers.

We made a total of 64 sightings of bottlenose dolphins (*Tursiops truncatus* - the only cetacean species observed in the Gulf). Dolphin behaviour was sampled at intervals of 5 minutes throughout the sightings. Variables recorded include distance from boat, longest dive, directionality of swim, activity (aerial, socialising, surface-feeding, stationary, degree of interaction with fish farms etc.).

A total of 19 samples of fish scales drifting at the surface following dolphin foraging events were collected and stored for diet studies.

39 sightings of loggerhead sea turtles (*Caretta caretta*) were recorded during the surveys at sea. All dead turtles were photographed and measured whenever possible.

Seagulls and terns of various species are especially abundant throughout the gulf, and consistently associated with dolphins during surface foraging. A total of 17 sightings of pelicans were recorded. These included the white pelican (*Pelecanus onocrotalus*) and possibly the endangered Dalmatian pelican (*P. crispus*). Pelicans were photographed to allow for species identification by bird specialists. Other unusual bird species sighted during the surveys were recorded. These included shearwaters (including Cory's shearwater *Procellaria diomedea* and Manx shearwater *Puffinus puffinus*), herons (especially the grey heron *Ardea cinerea*, often seen in the proximity of fish farms), unidentified Anatidae, kingfishers *Alcedo atthis* and several other unidentified bird species. Birds interacting with dolphins during surface foraging and other activities were routinely photographed. This will facilitate future analyses on the bird species involved and on the seasonality and pattern of interactions.

Year	days at sea	days with dolphins	Km surveyed total	Km surveyed on effort	time spent with dolphins	sightings		behavioural samples
						Tt	Cc	
2006 (Apr-Sep)	85	61	3300	1,199	85h 38min	64	39	765

Table 1. Summary of research effort conducted between April-September 2006 in the Amvrakikos Gulf. Tt = *Tursiops truncatus*; Cc = *Caretta caretta*.

Individual photo-identification based on long-term natural marks on the dolphins' dorsal fins was performed extensively with a digital camera equipped with a 70-200mm f2.8 zoom lens. In April-September 2006 we took 6735 digital photos, of which 3247 were selected and filed for photo-identification analyses. These photos were added to a previous catalogue of 12353 images.

b) What progress have you made towards achieving your original objectives?

The Tethys Research Institute has been conducting research in the Amvrakikos Gulf since 2001. However, 2006 was by far the most productive year. Earthwatch funding and the participation of volunteers allowed us to increase the research effort substantially and improve the data collection standards. The survey effort was standardised and made more systematic, so that a number of sampling biases deriving from uneven effort and area coverage could be avoided. While data collected until 2005 are now being published in the scientific literature, the systematic effort started in 2006 will allow us to gain a better understanding of the ecology, distribution, movements and conservation status of the dolphin population inhabiting the gulf. One season of data is inappropriate to make conclusions, but interesting aspects emerged from the 2006 study, including the unexpected possibility of movements in and out of the gulf in some seasons. Data collected in 2006 will also allow us to validate previous mark-recapture analyses, identify trends in abundance and assess reproductive success.

A friendly relationship was developed with local fishermen, and this helped us to gather information that would be difficult to obtain otherwise. Collaboration was facilitated by the fact that the principal field investigator (Gonzalvo) settled in Vonitsa in March 2006. Furthermore, the regular presence of Earthwatch volunteers and researchers around the harbour stimulated local curiosity. Communication with local fishermen allowed us to obtain information on the different interactions between dolphins and artisanal fisheries. Direct observations from fishing boats were also conducted.

c) Please provide a summary of your results (even if they are preliminary).

Consistent monthly surveys in the Amvrakikos Gulf and in the adjacent Ionian Sea open waters during April-September 2006 (with Earthwatch volunteers) confirmed the initial assumption that dolphins inhabiting the gulf are members of a population that is largely closed. No sightings ever occurred in the open sea waters outside of the gulf across 350+ km of dedicated survey effort. In addition, dolphin groups moving outside of the gulf through the Preveza channel were never observed. Conversely, encounter rates of dolphins within the gulf were high, averaging 7 groups / 100 km.

New information resulting from the collaboration established with local fishermen shed light on dolphin-fisheries interactions:

1. Dolphins interact with fishing gear (trammel nets and set gillnets) on a regular basis. Some fishermen claim that dolphins interact with their fishing gear on a daily basis, causing damage to both the nets and the catch.
2. Holes in the nets reported to have been the result of dolphin attacks were repeatedly observed. Many of these holes are made by dolphins. Damaged fish was observed and photographed. Although in several cases the origin of fish damage was unclear (possible causes include damage by marine invertebrates or marine turtles), in some cases the damage was clearly caused by dolphins.
3. New trammel nets used to catch shrimp, used between April-December, are claimed to cost about 150 Euro per unit. Each net is composed of approximately 18-23 units, and every unit has a length of 60 m, totalling about 1-1.4 km of net. Replacing fishing gear due to damage caused by dolphins or other animals is therefore costing significant money to local artisanal fishermen. A quantitative assessment of the damage is one of the purposes of ongoing investigations.
4. When asked how much money is lost due to interactions with dolphins, fishermen mentioned sums ranging between 800-1000 Euro per year.
5. Shrimps represent the main target and source of income for artisanal fishermen operating in Vonitsa. There is a fishing closure for shrimps in July, when most fishermen target fish or repair/upkeep their boats, engines and nets.
6. Although several fishermen complain about gear depredation and damage caused by dolphins, when asked what are the main factors threatening the Amvrakikos Gulf fisheries and ecosystems, they report that the most serious problems are caused by fish farms, by the new marina in Preveza (which has reduced the opening of the Amvrakikos Gulf - possibly reducing water exchange with the open sea), and by illegal trawling that reportedly takes place at night.
7. Although fishermen consistently lament gear damage caused by dolphins, many of them pointed out that these animals are protected by national laws, and the possibility of killing them in retaliation does not seem to be considered.

8. Some fishermen claimed that dolphin numbers decrease during the winter. However, this may relate to the fact that during that season they go at sea less often due to adverse weather conditions.
9. When asked about nets being damaged or depredated by sea turtles, fishermen maintain that this occurs mostly in the summer, when turtle numbers within the gulf reportedly increase. Fishermen claim that sea turtles produce much more damage than dolphins, because of their way of depredating the nets. Dolphins would bite the fish and tear off the net; sea turtles would stay in the net and make large holes by moving their flippers.

Significance/Benefits of Research

a) What is/are the significance/benefits of your research at the following levels?

- local (in the area of the research site)

In 2006, teachers of schools located in the villages around the study area (Vonitsa, Paleros and Mytikas) were contacted and meetings were organised, resulting in a number of talks and lectures for local students. Presentations included PowerPoint and video projections on dolphin research and conservation issues. A total of 865 students and children (age range: 4-18 yrs) attended the presentations given by Tethys personnel (Table 2).

Location	Date	Audience	Age range	Level
Vonitsa (Town Hall)	16/05/2006	70	16-18	Detailed
Vonitsa (High school)	18/05/2006	150	12-15	Detailed
Vonitsa (Primary School 1)	19/05/2006	175	4-8	Easy
Vonitsa (Primary School 2)	19/05/2006	150	9-11	Intermediate
Paleros (Primary School)	16/05/2006	120	6-12	Easy
Paleros (High School)	16/05/2006	130	12-15	Detailed
Mytikas (Primary school 1)	26/05/2006	35	5-9	Easy
Mytikas (Primary school 2)	26/05/2006	35	10-12	Intermediate
Vonitsa - Dolphin Day (sea front)	30/07/2006	150	5 +	Detailed
Mytikas - Dolphin Day (Cultural Centre)	01/08/2006	40	5 +	Detailed
Paleros - Dolphin Day (Cultural Centre)	06/08/2006	150	5 +	Detailed

Table 2. List of educational talks given in the area between March-August 2006. Total audience was 865 children (school talks) and about 340 locals (Dolphin Day talks).

Three “Dolphin Days” were organised in Vonitsa, Mytikas and Paleros in summer 2006. Drawings made by local children were put on display following lectures at local schools, featuring dolphins and the threats they face. Activities for local kids were organised, including body painting and games. Videos on cetaceans were displayed to launch the evenings, also including footage from the study area. The Dolphin Day organised in Paleros was also actively attended by Earthwatch volunteers, who were involved in activities with children (e.g. body painting). Presentations were centred around the status of dolphins in Greek coastal waters. Following these events, members of the local municipalities expressed interest in a long-term collaboration with Tethys, aimed to raise awareness of nature conservation.

A summary of the different activities developed is provided in table 2 (see appendix).

- national

Work by the Tethys Research Institute in the eastern Ionian Sea, started in 1991, shed light on the status of local dolphins and identified the main threats affecting the animals. This has resulted in a number of international conservation initiatives, many of which were endorsed by ACCOBAMS (UNEP's Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area). Collaboration with WDCCS - The Whale and Dolphin Conservation Society, OceanCare and other international conservation organisations produced a series of public awareness and conservation actions intended to increase dolphin protection in Greece.

- international

As a result of the work done by Tethys Research Institute, the Scientific Committee of ACCOBAMS has recently (November 2006) recommended to the Parties (virtually all Mediterranean and Black Sea Nations) to consider the Amvrakikos Gulf as a candidate Marine Protected Area, specifically to protect bottlenose dolphins.

b) How do your findings contribute to issues of sustainability?

The fact of being present year-round in the study area and becoming part of the local community has allowed us to organise educational and public awareness initiatives (see above). This is intended as a first step to raise environmental awareness among the local community in an area where nature conservation has been long neglected.

Dissemination of Results

a) Have you provided details of results from your research to or within:

- Scientific papers (indicate status; e.g., peer reviewed or in progress/press)

Bearzi G. 2004. Investigating food-web interactions between Mediterranean coastal dolphins and fisheries in "natural laboratories". CIESM Workshop Monographs 25:71-76.

Bearzi G., Agazzi S., Bonizzoni S., Costa M., Azzellino A. In press. Dolphins in a bottle: abundance, residency patterns and conservation of bottlenose dolphins *Tursiops truncatus* in the semi-closed eutrophic Amvrakikos Gulf, Greece. *Aquatic Conservation: Marine and Freshwater Ecosystems*.

- Management plans and reports (in progress or completed)

Bearzi G., Agazzi S., Bonizzoni S., Costa M. 2005. Ecosystem structure and dolphin-fisheries interactions in a "natural laboratory": the Amvrakikos Gulf, Greece. Report to the Regional Activity Centre for Specially Protected Areas (RAC/SPA) on the activities conducted between July 2001 - November 2005 (MOU #17/RAC/SPA/2005). Tethys Research Institute. 23 pp.

Also dissemination of information in the scientific literature and provision of sound data and management proposals to the relevant organisations concerned with the protection of marine biodiversity (including ACCOBAMS, IUCN, CMS, RAC-SPA).

- Presentations (given or planned)

Bearzi G., Costa M. 2005. Population status of common bottlenose dolphins (*Tursiops truncatus*) in the central Mediterranean: insight from studies in the northern Adriatic and eastern Ionian Seas. Workshop "How can science best inform managers: the role of field studies in the conservation management of European bottlenose dolphin populations", 19th Annual Conference of the European Cetacean Society. La Rochelle, France, 7 April 2005.

Also a number of presentations for audiences ranging between 50-100, including:

2006 - Invited expert, 4th ACCOBAMS Scientific Committee Meeting, Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, Monaco

2006 - Invited speaker, Conference "AdriaWatch - Cetaceans, sea turtles and sharks of the Adriatic Sea", Cattolica, Italy

2006 - Invited speaker, Festa del Delfino (5th Edition), Lacco Ameno, Isola d'Ischia (Italy)

2006 - Invited expert. IUCN and ACCOBAMS workshop for the Red List assessment of cetaceans in the ACCOBAMS area. Monaco (Principality of Monaco)

2005 - Invited speaker, "Coastal dolphins of the Mediterranean: insight from studies in the northern Adriatic and eastern Ionian Seas", Symposium "Fish and More" organised by the University of Thessaloniki (Greece)

2005 - Invited expert, 3rd ACCOBAMS Scientific Committee Meeting, Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, Cairo (Egypt)

- Popular articles or films (in progress or completed)

2003 - 14 min documentary film "Dolphin People" featuring research and conservation activities by Tethys around the island of Kalamos and in the Amvrakikos Gulf, Greece (in Italian with English scrolling text)

2004 - 3.5 min QuickTime video on the decline of Mediterranean coastal dolphins (in English) - <http://www.tethys.org/coastaldolphins/index.htm>

- Books, chapters, illustrations

None

Volunteer Tasks and Accomplishments

- a) How did the volunteers contribute ideas, skills, expertise and motivations beyond that which you anticipated?

Earthwatch volunteers contributed actively to the collection and handling of research data. They were also regularly involved in discussions on different aspects of the research and contributed ideas on ways to improve data collection methods and public awareness actions.

The fact of welcoming culturally-diverse people with different backgrounds and expertise has offered chances for improved project management.

Participation by Earthwatch volunteers has contributed to accomplishing the project's goals by providing the research team with enough motivation to keep high research standards and do hard work in the field on a daily basis. The research team enjoyed the contagious enthusiasm of volunteers and were themselves getting enthusiastic even under circumstances that would risk being seen as "routine" if only professional researchers were there.

- b) How have volunteers helped you to achieve your research or educational objectives? Please give specific and quantitative measures of the volunteers' contribution to your data collection.

Between April-September 2006, volunteers surveyed a total of 3300 km and helped to make a total of 64 dolphin sightings. They also recorded a total of 765 samples of dolphin behaviour on a palmtop computer, and helped to count the dolphins at regular intervals and spot other dolphin groups at a distance.

Once back at the field base, the volunteers cropped an impressive 3247 digital photos, based on guidelines provided by the research team. Volunteers also made a preliminary matching of the photos, identifying recognisable animals through long-term natural marks on the dolphins' dorsal fins, resulting in the positive identification of several individuals. On average, two hours per day were dedicated to photo analyses.

Project Development

- a) What logistical or scientific challenges have you encountered in the past season and how will you address them during the next field season?

Although in its first year with Earthwatch, the Tethys Research Institute had 20 years of previous experience with volunteers. Working with Earthwatch volunteers offered challenging opportunities to increase previous standards, taking advantage of the suggestions made by the Earthwatch team, and particularly by project manager Jen Alger. Much feedback was received from the volunteers and this was almost invariably positive and encouraging. Through direct experience and talks with volunteers, a series of changes were made during the research season, and all suggestions were taken into consideration.

- b) Have you used any additional methods/strategies to meet your research objectives? If so, please describe them.

The initial research programme was enriched through the inclusion of regular surveys of coastal fish farms, and one survey/month in the adjacent Ionian Sea open waters, to investigate specific aspects of dolphin behaviour and movement patterns. In the future, it is planned to keep up this kind of monitoring and combine it with the daily visual surveys in the gulf.

- c) How will you develop your research in the coming field season?

Apart from the new survey routines outlined above, all the data collection protocols will remain the same as in 2006. As this is intended to be a long-term monitoring, changes in research protocols over time are a potentially important source of bias.

Educational Opportunities

- a) Does your project directly or indirectly involve the following groups in your research topic?

- Local communities

Three "Dolphins Days" were organised in summer 2006 specifically to involve the local community. A regular collaboration with local fishermen has also been developed. For 2007, the village of Paleros has been chosen to organise a new Dolphin Day following positive feedback and interest by local authorities and collaborators. Concentrating the efforts in a single city rather than dispersing it across several locations, as done in 2006, and developing a local "tradition" for Dolphin Days and a long-term relationship with city authorities represents the preferred strategy. Paleros is also an appropriate place to promote efforts to protect dolphins and improved ecosystem management.

- Students

Collaboration with local school teachers in 2006 resulted in a series of lectures and talks delivered to more than 800 local children (Table 2). The success of this initiative led to a permanent collaboration with the local educators, who were enthusiastic about the idea of including dolphin and

environmental conservation issues in their courses. Researchers from Tethys will be providing them with information and educational tools.

- Early career scientists

Researchers from the Tethys Research Institute have supervised a great number of students, and many have eventually joined the organisation. In the context of research in western Greece, there are several students who are currently enrolled in thesis projects, either for their graduate, MSc or Doctoral studies. A number of others have already completed their work under the supervision of Tethys experts.

- Other groups

- b) Please tell us the ways your research helps these groups better understand the conservation of a sustainable environment.

Largely through the personal example of committed researchers who choose to dedicate their lives to the study and conservation of the marine environment. But also through lectures and presentations on marine conservation topics, scientific publications, popular articles, participation in international marine conservation meetings and preparation of management plans.

- c) Has your project helped lead to the completion of Masters' theses, or other educational research findings?

Yes. A total of 12 students have been or are currently involved in thesis projects related to the work done by the Tethys Research Institute in Greece.

Partnerships

- a) List partnerships or collaborations with other organisations that you have developed or maintained in the past season.

Agreement on the Conservation of Cetaceans of the Mediterranean Sea, Black Sea and contiguous Atlantic Area (ACCOBAMS)

Marie-Christine Van Klaveren, Giuseppe Notarbartolo di Sciara

Aristotle University of Thessaloniki, Greece

Kostas Stergiou, Athanasios Tsikliras

Cetacean Specialist Group, IUCN Species Survival Commission

Randall R. Reeves

Cultural Center Mytikas, Greece

Georgia Katsounis

Fisheries Center, University of British Columbia, Vancouver, Canada

Daniel Pauly, Maria Lourdes Palomares, Chiara Piroddi, Vassiliki Karpouzi

Fishermen Cooperative, Vonitsa, Greece

Dimitrios Cutsubas

Greenpeace, Greece

Sofia Tsenikli

Ministry for the Environment, Physical Planning and Public Works, Greece - Nature Management Section

Eleni Tryfon

Ministry of Agriculture, Greece - General Directorate of Development & Protection of Forests and Natural Environment, Directorate of Aesthetic Forests, Woodland and Hunting
Giorgos Handrinou

Municipality of Vonitsa, Greece
Katerina Karampa

Municipality of Paleros, Greece
Nikos Soldatos

OceanCare, Switzerland
Sigrid Lüber

Pelagos Cetacean Research Institute, Greece
Alexandros Frantzis, Voula Alexiadou

Pew Institute for Ocean Science
Ellen Pikitch

University of Barcelona, Spain - GRUMM (Group of Study and Conservation of Marine Mammals)
Alex Aguilar

University of Durham, U.K., Department of Biological Sciences
Ada Natoli

University of Padova, Italy - Department of Experimental Veterinary Science
Bruno Cozzi

University of Patras, Greece
Dimitrios Moutopoulos

Whale and Dolphin Conservation Society (international)
Nicolas Entrup

World Wildlife Fund (WWF), Greece
Giorgos Paximadis

b) How have these organisations contributed to your project objectives?

By providing funding, logistic support, institutional support, contributions in kind, expertise, consultancy or other kinds of direct involvement by their members/staff.

c) How do you anticipate these organisations will use the results generated by the project, and in what timeframes?

In a variety of ways ranging from scientific research to management proposals, from the identification of conservation strategies to public awareness initiatives and media work.

Acknowledgements

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