Accord sur la Conservation des Cétacés de la mer Noire, de la Méditerranée et de la zone Atlantique adjacente, conclu sous l'égide de la Convention sur la Conservation des Espèces Migratrices appartenant à la Faune Sauvage (CMS)

Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area, concluded under the auspices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS)

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CONSERVATION STATUS OF BOTTLENOSE DOLPHIN *(Tursiops Truncatus)*: ASSESSMENT USING MORPHOLOGICAL AND GENETIC VARIATION

Report to ACCOBAMS scientific committee
September 3, 2004

"CONSERVATION STATUS OF BLACK SEA BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*): ASSESSMENT USING MORPHOLOGICAL AND GENETIC VARIATION".

Principal investigator: MS. Karine Viaud

Biology Department, San Diego State University, San Diego, U.S.A (kaviaud@hotmail.com)

Collaborators:

Dr. A. J. Bohonak, Biology Department, San Diego State University, San Diego, U.S.A

Dr. R. L. Brownell Jr., National Marine Fisheries Service- NOAA, Monterey, U.S.A

Dr. A. Komnenou, Faculty of Veterinary Medicine, Aristotle University of Thessaloniki, Greece

Dr. L. M. Mukhametov, A. N. Severtsov Institute of Ecology and Evolution, Russia

Participants: **Dr. Holsbeek,** Free University of Brussels, Belgium; **Dr. Bompar and Dr. Cesarini**, Groupe d'Etude des Cetacees de la Mer Mediterrannee, France; **Dr. Beaubrun**, Universite des Sciences de Montpellier, France; **Mr. Tardy**, Laboratoire Mediterraneen de Cetology, France; **Dr. Ridoux**, Centre de Recherche sur les Mammiferes Marins de La Rochelle, France; **Dr. Robineau**, Musee d'Histoire Naturelle de Paris, France; **Dr. Frantzis**, Pelagos Cetacean Research Institute, Greece; **A. Scheinin**, Israeli Marine Mammal Research and Assistance Center, Israel; **Dr. Podesta**, Museo civico di storia narurale di Milano, Italia; **Dr. Cancelli**, Museo civico di storia narurale di Siena, Accademia dei Fisiocritici, Italia; **Dr. Poggi**, Museo civico di storia narurale di Genova, Italia; **Dr. Affronte**, Fondazione Cetacea Onlus, Riccione, Italia; **M. Menghini and Dr. Manfrini**, Corpo Forestale Dello Stato Stazione di Boscomesola of Codigoro, Italia; **Dr. Agnelli and Dr. Borri**, Zoological museum La Specola, Firenze, Italia; **Dr. Sequeira**, Instituto da Conservação da Natureza, Portugal; **Dr. Moldoveanu**, National Institute for Marine Research and Development "Grigore Antipa", Romania; **Mrs. Plotoaga and Mrs Bologa**, Complexul Muzeal de Stiinte ale Naturii Constanta, Romania; **Dr. Pavlinov**, Zoological Museum, Moscow State University, Moscow, Russia; National Marine Fisheries Service, SWFSC, U.S.A.

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International And National Legal Aspects: *Tursiops Truncatus Ponticus*
Its Conservation And Its Future

Sue Fisher, Campaigns Manager, WDCS

*At the eleventh meeting of the Conference of the Parties (CoP) to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), in April 2000, the USA and Georgia submitted a proposal for the protection from international commercial trade of the Black Sea population of bottlenose dolphin (*Tursiops truncatus ponticus*). **[…]***

WDCS (the Whale and Dolphin Conservation Society) which has studied trade in bottlenose dolphins for the captivity industry for many years, confirmed that there is a substantial international commercial trade in live bottlenose dolphins from the Black Sea. WDCS has documented the export from the region of more than 70 bottlenose dolphins between 1990 and 2001. Of these, at least 32 have since died. Traders themselves put the export figures even higher; claiming that 98 bottlenose dolphins have been transported in the last ten years. **[…]**

In the twentieth century, populations of *Tursiops truncatus ponticus* (and other Black Sea cetacean species) were dramatically reduced by large scale hunting for their oil and meat. Over 5 million animals from three species are believed to have been killed. Hunting has now been banned by all range states (although some poaching continues), but the cetaceans are most profoundly threatened today by human-induced degradation of their marine environment, including industrial disturbance, over-fishing and the impacts of introduced species and marine pollution. **[…]**

As required by the CITES treaty, the CITES Secretariat consulted with the Secretariats of ACCOBAMS and the Convention on Migratory Species (CMS) on the proposed 'uplisting' in 2000 – to obtain scientific data and ensure coordination with any conservation measures enforced by these bodies in respect of *Tursiops truncatus ponticus*. Both Secretariats supported the listing of the subspecies on Appendix I, believing that it would be consistent with the degree of protection intended by the contracting parties to CMS and ACCOBAMS.

At the CoP in April 2000, the proposal was unfortunately withdrawn. However, the range states negotiated a 'Decision' of the Parties: Decision 11.23 trade data, and has been the focus of a Working Group of CITES' Animals Committee since then. International commercial trade in *Tursiops truncatus ponticus* has continued since the last CoP, and the new trade data (in addition to new biological data collected in the interim) will be included in a revised draft of the 'uplisting' proposal which is anticipated to be submitted to the 12th CITES meeting in November 2002. **[…]**

In 2002, the first meeting of the Parties to ACCOBAMS adopted a Resolution on Tursiops truncatus ponticus which decides to strictly enforce the prohibition of deliberate taking and keeping of Black Sea Tursiops truncatus, bans its importation from the ACCOBAMS area range States and Calls upon the CITES Parties to provide a better protection to this population by inter alia upgrading it to appendix I.

Aspects Jurisdiques Nationaux Et Internationaux : *Tursiops Truncatus Ponticus*
Son Statut De Conservation Et Son Avenir

Sue Fisher, Campaigns Manager, WDCS

Lors de la onzième réunion de la conférence des Parties (COP) CITES (Convention sur le commerce international d'espèces de faune et de flore sauvages menacées d'extinction), en avril 2000, les Etats-Unis et la Géorgie ont soumis une proposition pour la protection de la population du Grand dauphin de la Mer Noire (*Tursiops truncatus ponticus*) vis à vis du commerce international. **[…]**

La WDCS (Whales and Dolpins Conservation Society) qui a étudié pendant de nombreuses années le commerce des Grands dauphins destiné à leur maintien en captivité, a confirmé l'existence d'échanges commerciaux internationaux importants des Grands dauphins de la Mer Noire. La WDCS a répertorié l'exportation de plus de 70 Grands dauphins de la région entre 1990 et 2001. De ces derniers, au moins 32 sont morts. Les commerçants eux-mêmes ont apporté des chiffres d'exportation encore plus élevés ; déclarant que 98 Grands dauphins ont été transportés ces dix dernières années. **[…]**

Au vingtième siècle, les populations du *Tursiops truncatus ponticus* (et d'autres espèces de cétacés de la Mer Noire) ont été nettement réduites par la chasse à grande échelle pour leur graisse et leur viande. Plus de 5 millions d'animaux des trois espèces auraient été tués. La chasse est maintenant interdite par tous les Etats de la zone (bien que le braconnage subsiste), mais les cétacés sont plus profondément menacés aujourd'hui par la dégradation de l'environnement marin liée aux activités humaines, y compris les perturbations industrielles, par la sur-pêche ainsi que par les impacts des espèces introduites et de la pollution marine. **[…]**

Selon les recommandations des Parties à la CITES, le Secrétariat CITES a consulté les Secrétariats d'ACCOBAMS et la Convention sur les espèces migratrices (CMS) sur l'»uplisting» proposé en 2000, afin d'obtenir des données scientifiques et assurer la coordination avec toutes les mesures de conservation du *Tursiops truncatus ponticus* édictées par ces Organisations. Leurs deux Secrétariats ont soutenu l'inscription de la sous-espèce sur l'annexe I, estimant que cela serait cohérent avec les mesures de protection adoptées par les Parties contractantes à la CMS et à l'ACCOBAMS.

A la 11ème COP en avril 2000, la proposition a été malheureusement retirée. Cependant, les Etats de la zone ont négocié une «Décision» des Parties: la Décision 11.23 (décisions re-numérotée ultérieurement 11.139 et 11.91), qui a été adoptée à l'unanimité par la COP. Cette résolution qui a encouragé la collecte des données complémentaires biologiques et commerciales a été l'objet d'un groupe de travail du Comité animal de la CITES. Les échanges internationaux à des fins commerciales du *Tursiops truncatus ponticus* ont continué depuis, la dernière COP, et les nouvelles données commerciales (en plus de nouvelles données biologiques rassemblées entre temps) seront incluses dans un projet de proposition révisée «d'uplisting» qu'il est prévu de soumettre à la 12ème COP de la CITES en novembre 2002. **[…]**

En 2002, la première Réunion des Parties à l'ACCOBAMS, a adopté une Résolution concernant le Tursiops truncatus ponticus qui décide de strictement prohiber la capture délibérée et la conservation en captivité du Tursips truncatus de la Mer Noire, d'interdire son importation dans les Etats de la zone géographique d'ACCOBAMS et invite les Parties à la CITES à assurer une meilleure protection à cette population entre autres en la promouvant à l'annex I.

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Dr. L. M. Mukhametov, A. N. Severtsov Institute of Ecology and Evolution, Russia

Participants
Centre de Recherche sur les Mammiferes Marins, La Rochelle, France
National History Museum of Paris, France
Museo civico di storia narurale di Milano, Italia
Museo civico di storia narurale di Siena, Accademia dei Fisiocritici, Siena, Italia
Museo civico di storia narurale di Genova, Italia
Fondazione Cetacea Onlus, Riccione, Italia
Corpo Forestale Dello Stato Stazione di Boscomesola of Codigoro, Italia
Zoological museum, la Specola, Firenze, Italia
Museo Nacional de Ciencias Naturales, Madrid, Spain
Zoological Museum, Moscow State University, Moscow, Russia

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Dr. Beaubrun, Dr. Bompar, Dr. Cesarini, Dr. Ridoux, Dr. Robineau, Mr. Tardy, France
Dr. Frantzis and Dr. Komninou, Greece
Dr. Affronte, Dr. Podesta, Dr. Poggi, Dr. Agnelli, Dr. Borri, Italia
Dr. Sequeira, Portugal
Dr. Pavlinov, Russia
Dr. Birkun, Ukraine

1/ Background information and problem statement:

The bottlenose dolphin (*Tursiops truncatus*) is one of three species of cetaceans living in the Azov-Black Sea basin. Until the 1970's Black Sea cetaceans were mainly threatened by dolphin fisheries. Since then, anthropogenic impacts from pollution, diminishing food resources, live catches, diseases and physical injuries have continued to kill Black Sea cetaceans (Birkun *et al*. 1992). Despite many studies of bottlenose dolphins elsewhere, data on Black Sea populations are scarce. Two main researchers described Black Sea cetacean morphology (body and skull size) and compared their results with published data from other oceans (Barabash-Nikiforov 1940 and 1960, Kleinenberg 1956). Although those studies used a large number of specimens, they led to opposite conclusions concerning the morphological uniqueness of Black Sea bottlenose dolphins. Barabash-Nikiforov (1940) went so far as to suggest that the Black Sea bottlenose dolphins constitute a separate subspecies: *Tursiops truncatus ponticus*. More recently, a worldwide study on bottlenose dolphin genetic patterns that included some Black Sea samples suggested the isolation of the Black Sea population from Mediterranean populations (Natoli *et al*. 2003). However, due to the low sample size from the Black Sea, this study could not conclude that Black Sea bottlenose dolphins are genetically unique, and had limited impact on their conservation status. Thus, the overall status of Black Sea bottlenose dolphins remains unclear and attempts to protect them have failed (CITES 2000, 2002).

2/ Objectives of the project:

Preserving populations that are biologically unique and geographically isolated is recognized as an international priority for conservation. Thus, international agreements and management plans that will protect Black Sea bottlenose dolphins first require a demonstration that they are isolated from Mediterranean populations, and establish whether they are evolutionary unique. For that purpose, we tested whether Black Sea bottlenose dolphin populations are genetically and morphologically distinct from the Mediterranean populations. Collection and analysis of bottlenose dolphin genetic material and morphological measurements were undertaken in cooperation with representatives from countries surrounding the Black Sea.

3/ Morphological analysis:

Methodology:
Seventy-six bottlenose dolphin skulls from the Black Sea (27), the Mediterranean Sea (27) and the Atlantic Ocean (22) were sampled for 26 cranial measurements (Perrin *et al.* 1994). Measurements were taken only from adult specimens. The primary criterion of adulthood was cranial maturity (fusion of maxillaries and premaxillaries). For multivariate analysis, missing values (11.5% of the total data set) were estimated using the expectation maximization method. Principal component analysis (PCA) and discriminant function analysis (DFA) were used to identify factors (multivariate components) that best discriminate the three regions. MANOVA was performed to test for significance morphological divergence among regions.

Results:
Atlantic, Black Sea and Mediterranean bottlenose dolphin skulls are significantly different (MANOVA on 26 measurements, $P < 0.001$). Scatterplots showed that Black Sea specimens had the lowest values for every variable (Fig.1). Skull lengths of Black Sea bottlenose dolphins were an average of 8.5 cm smaller than Atlantic skulls and 6.8 cm smaller than Mediterranean skulls. MANOVA on the principal components indicated that overall skull size (PC1) and the shape of the orbit and external nares (PC3) significantly differentiate the three regions ($P < 0.001$). These results demonstrated that Black Sea bottlenose dolphin skulls are smaller than Mediterranean and Atlantic specimens and display larger orbit and wider external nares relative to their skull size compared to Mediterranean specimens.

The discriminant function analysis indicated that geographic areas (Atlantic, Mediterranean and Black Sea) can easily be discriminated using skull morphometry. Only 13 of the 26 variables are needed to discriminate the regions. Using these variables, 100% classification success was obtained: each skull was assigned to its correct location. The two canonical factors (DF1 and DF2) that significantly discriminate the three regions can be interpreted in terms of skull shape. Relative to their skull size, Black Sea bottlenose dolphins have shorter and wider rostra, and larger postorbital and premaxillaries than Mediterranean and Atlantic specimens.

Morphological conclusions:
Black Sea bottlenose dolphin skulls are not only smaller than Mediterranean specimens, but also differ in shape: Black Sea dolphins have relatively shorter and wider rostra, larger postorbital and premaxillaries, larger orbit and wider external nares than Mediterranean specimens. Because skull and body size usually covary together, it is reasonable to assume that Black Sea bottlenose dolphins also have a smaller body size. Previous studies have suggested that the small body and skull size as well as the robust rostrum of Black Sea bottlenose dolphins could be an adaptation to their coastal habitat and predominant benthic feeding habit (Perrin 1975, 1984).

3/ Genetic analysis:

Methodology:
Ninety-nine tissue samples of bottlenose dolphins (from the Eastern Atlantic, Aegean Sea, Ligurian Sea, Israeli coasts and the Black Sea) were obtained from stranded, bycaught and captive specimens. DNA was extracted using standard Qiagen DNEasy kits. Existing lab protocols were used to amplify the D-loop of the mitochondrial (mtDNA) control region (442 base pairs) using polymerase chain reaction (PCR). PCR products were purified and cycle sequenced using BigDye v.3 and sequenced on an ABI 377 automated sequencer. Sequences were aligned using the program Sequencher v. 4.
General population genetics summary statistics were calculated using Arlequin v. 2.0 (Schneider *et al.* 2001). Evolutionary relationships among haplotypes were determined using phylogenetic (PAUP*) and network parsimony reconstruction (implemented in TCS: Clement *et al.* 2000). Nested clade analysis was performed using Geodis 2.0 to generate hypothesis regarding gene flow and population history (e.g. historical patterns of fragmentation, range expansions: Templeton 1998, Posada *et al.* 2000, Posada and Templeton 2001, Knowles 2002). Genetic isolation by distance was visualized by plotting F_{st} as a function of geographic distance for each population pair (Slatkin 1993), and statistical significance was tested using the IBD program (Bohonak 2002). Long term coalescent estimates of gene flow (number of individuals per generation migrating from one population to another) were obtained using the program Migrate v.4 (Beerli and Felsenstein 2001).

Results:
Mitochondrial DNA diversity was low for the Black Sea population: although 33 unique haplotypes were identified (five of which were shared among regions), only six were found in 43 Black Sea individuals. Φst (which quantifies differences among populations on a scale from 0 to 1) was significantly greater than zero for all Black Sea pairwise comparisons. An exact test also showed significant differences among populations, and pairwise exact tests showed that the Black Sea is genetically different from all other populations (Table 1). These results demonstrate that Black Sea bottlenose dolphins are genetically different from the Mediterranean and Atlantic bottlenose dolphins.
The haplotype network demonstrates the isolation of several Black Sea haplotypes all related to a widespread ancestral allele. These unique Black Sea haplotypes are only one mutation from the ancestral haplotype, suggesting that the Black Sea population has been isolated long enough for genetic isolation, even though it is geologically young. I conclude that gene flow between the Black Sea and the Mediterranean Sea has been low enough in the recent evolutionary past to facilitate genetic differentiation, although one very recent migrant from the Aegean Sea was found in our samples. At multiple levels within the network, nested clade analysis suggests that the Black Sea bottlenose dolphins had limited gene flow with the Mediterranean due to isolation by distance. Statistical analysis of genetic isolation by geographic distance plots showed a significant slope

(Mantel Test; $P < 0.04$), which supports the nested clade analysis inference. Coalescent estimates of migration between the Black Sea and the Mediterranean Sea were between 1 and 10 individuals per generation, representing low movement of individuals between the two seas. Overall, I conclude that bottlenose dolphins historically moved little between the Mediterranean Sea and the Black Sea, which has led to genetic differentiation of the Black Sea.
It has been hypothesized that Black Sea bottlenose dolphins entered the Black Sea during the latest reconnection between the Black Sea and the Mediterranean 7,000-10,000 years ago (Kleinenberg 1956). My results qualitatively support the hypothesis of Black Sea colonization by Mediterranean bottlenose dolphins during the middle to late quaternary period.

Genetic conclusions:
Black Sea bottlenose dolphins have low mtDNA genetic diversity and are genetically distinct from the Mediterranean and Atlantic populations. My results support the hypothesis that Black Sea bottlenose dolphins have been isolated on a time scale that is long ecologically, but young geologically. Migration of bottlenose dolphins between the Mediterranean Sea and the Black Sea might seems to be restricted because of limited individual movement.
Because of increasing activities such as boat traffic during the past century within the Turkish straight system (Ozturk and Ozturk 1996, 1997, 2002) it is reasonable to believe that bottlenose dolphin migration between the Black Sea and Mediterranean Sea may have decreased below historical levels.

4/ Conclusions and recommendations:

Black Sea bottlenose dolphins differ from Mediterranean and Atlantic bottlenose dolphins by their skull size and shape and probably (as suggested by previous studies) by their body size. They comprise the smallest specimens in the three regions examined. Skull shape differences could be an adaptation to their coastal life and benthic feeding habit.
Black Sea bottlenose dolphins are genetically different from the Mediterranean and Atlantic populations. Although we have not yet done a formal analysis of time since colonization, my results qualitatively support geologic evidence for development of the Black Sea in the late Quaternary. Studies of human activities within the Turkish straight system suggest that historically low levels of movement between the Black Sea and the Mediterranean Sea may have further decreased in the past 100 years, although we cannot estimate these parameters with our data.
This study provides sufficient evidence to designate the Black Sea bottlenose dolphins a genetically and evolutionary unique unit worthy of protection. Therefore, these dolphins should be recognized as a valid subspecies, *Tursiops truncatus ponticus* Barabash-Nikiforov, 1940.

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Table 1. Genetic differentiation between pairs of localities using mitochondrial DNA data

Φst values are reported above the diagonal. Values significantly greater than zero ($p < 0.05$) are reported with "*". Exact test p-values are reported below the diagonal. Med1: Ligurian Sea, Med2: Aegean Sea, Med3: Israeli coast

Locality	Eastern Atlantic	Med1	Med2	Med3	Black Sea
Eastern Atlantic		0.159*	0.052	0.532*	0.509*
Med1	0.054 +/- 0.01		-0.018	0.689*	0.178*
Med2	0.035 +/- 0.00	0.226 +/- 0.01		0.574*	0.336*
Med3	< 0.001	< 0.001	0.000		0.899*
Black Sea	0.000	0.001 +/- 0.001	0.004 +/- 0.00	0.00	

Figure 1. Scatterplot of skull length (mm) vs. preorbital width. Each point represents an individual from the Black Sea (crosses), Mediterranean Sea (oblique lines) and Atlantic Ocean (circles).