CHAPTER 10 THE STATE OF CETACEAN POPULATIONS (A. Birkun)

Alexei Birkun, Jr.

Brema Laboratory, Simferopol, Ukraine

10.1. Introduction

There are only few taxonomic groups of marine mammals in the Black Sea fauna that include three cetacean (odontocete) species/subspecies - the harbour porpoise (*Phocoena phocoena relicta*), the short-beaked common dolphin (*Delphinus delphis ponticus*) and the common bottlenose dolphin (*Tursiops truncatus ponticus*) - and one pinniped species, the Mediterranean monk seal (*Monachus monachus*). The quality of the Black Sea ecosystem is dependent, in particular, on the survival and welfare of these top predator populations. It is difficult to foresee all negative consequences for the regional biodiversity, if cetaceans disappear as it has almost happened with the monk seal (Öztürk, 1992, 1996; Kıraç and Savaş, 1996; Güçlüsoy et al., 2004).

The present state of Black Sea cetacean populations is not quite clear or encouraging in spite of certain research and conservation progress achieved during last decade, since the two essential instruments have been adopted in 1996 - the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), and the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (BS SAP). The insufficiency of scientific information includes population abundance, distribution, migrations, critical habitats, anthropogenic and natural threats as well as some basic aspects of life history and pathology.

In the past, the most important factor for the depletion of cetacean populations was commercial dolphin fishery. Mass legal killing (= devastating overexploitation) of Black Sea dolphins and porpoises peaked in the 1930s and 1950s; it was banned in 1966 in the USSR, Bulgaria and Romania, and in 1983 in Turkey. Currently, the most obvious threats affecting Black Sea cetacean populations are accidental mortality in fishing gear; habitat degradation causing the reduction of prey resources; water pollution and epizootics resulting in cetacean mass mortality events. All these factors are directly or indirectly dependent on enhanced (and poorly managed) human activities in the sea and in the entire Black Sea Basin.

The present chapter describes the state of Cetacean populations and emphasizes the need for multidisciplinary research that, with adequate financial and technical support, provides a reliable basis for developing and implementing efficient conservation and management strategies. Cetaceans do not know state borders as they are migratory species, so regional efforts are necessary and all the Black Sea countries need to be in co-operation.

10.2. Harbour porpoise (*Phocoena phocoena relicta* Abel, 1905)

10.2.1. Taxonomy and genetics

The Black Sea harbour porpoise is the sole representative of the family Phocoenidae and genus Phocoena in the Black Sea fauna (Table 10.1). It is recognized as a subspecies possessing morphological and genetic () differences from other *P. phocoena* subspecies and populations elsewhere in the world (*e.g.,* Tzalkin, 1938; Rosel *et al.,* 1995, 2003; Fontaine *et al.,* 2005), except the Aegean Sea in the northeastern Mediterranean (Rosel *et al.,* 1995). Black Sea and Aegean harbour porpoises have identical mtDNA sequence in the hypervariable control region (Rosel *et al.,* 2003) and may constitute separate subpopulations of this subspecies (*P. p. relicta*). At the same time, no fine population structure was indicated so far within the Black Sea proper despite the fact that genetic polymorphism at 11 microsatellite loci was examined in 61 individuals sampled in the western (Bulgaria), eastern (Georgia) and northern (Ukraine) areas of the basin. According to Fontaine *et al.* (2005), the Black Sea population displays a lower genetic diversity compared to those of Atlantic.

Table 10.1. Taxonomic status of Black Sea marine mammals

Taxonomic categories	**English common names of Black Sea marine mammals**			
	Harbour porpoise	Short-beaked common dolphin	Common bottlenose dolphin	Mediterranean monk seal
Class	mammalia			
Order	Cetacea			Carnivora
Sub-order	Odontoceti			Pinnipedia
Family	Phocoenidae	Delphinidae	Phocidae	
Genus	Phocoena	Delphinus	Tursiops	Monachus
Species	P. phocoena	D. delphis	T. truncatus	M. monachus
Subspecies	P. p. relicta	D. d. ponticus (?)	T. t. ponticus	-

10.2.2. Distribution

Geographic range of the Black Sea harbour porpoise includes the Black Sea proper, Azov Sea, Kerch Strait (e.g., Tzalkin, 1938), Marmara Sea, Bosporus Strait (Öztürk and Öztürk, 1997), northern Aegean Sea (Frantzis *et al.,* 2001; Rosel *et al.,* 2003) and also, very likely, the Dardanelles Straits connecting the Marmara Sea and Aegean Sea (however, no solid information is available until now from the Dardanelles) (Table 10.2). The Black Sea population is completely isolated from the nearest conspecific population in the northeastern Atlantic by wide range hiatus in the Mediterranean Sea (Frantzis *et al.,* 2001).

One hypothesis is that harbour porpoises entered the Black Sea basin in the Pleistocene, after the Mindel glaciation (about 400-500 thousand years ago), when the Black and Mediterranean Seas were connected for the first time (Kleinenberg, 1956). Another hypothesis is that they entered the Black Sea much later, in the Holocene, approximately 7,000 years ago, when the last (present) connection between the two seas was established (Frantzis *et al.,* 2001). Either way, the species came to the Black Sea via the Mediterranean which, therefore, must have had its own harbour porpoise population in remote times (although now extinct).

Table 10.2. Geographic range of Black Sea cetaceans

Water body (sea or strait)	Country	Cetacean species (subspecies)		
		P. p. relicta	D. d. ponticus	T. t. ponticus
Black Sea	Bulgaria	+	+	+
	Georgia	+	+	+
	Romania	+	+	+
	Russia	+	+	+
	Turkey	+	+	+
	Ukraine	+	+	+
Kerch Strait	Russia	+	+?1	+
	Ukraine	+	±1	+
Azov Sea	Russia	+	-	±
	Ukraine	+	-	±
Bosporus	Turkey	+	+	+
Marmara Sea	Turkey	+	+	+
Dardanelles	Turkey	+?2	Nd	+?3
Aegean Sea (NE Mediterranean)	Greece	±2	Nd	+?3
	Turkey	+?2	Nd	+?3
Other parts of the Mediterranean Sea		-	Nd	±3

"+" - regular occurrence (numerous reiterated records);

"±" - rare or casual occurrence (several records are known);

"-" - no records available in spite of considerable observation effort undertaken over a long period of time;

"+?" - suspected occurrence (solid scientific data are required to prove this assumption based on indirect evidence);

"Nd" - no data (there are no any direct or indirect research data s uggesting penetration of Black Sea common dolphins into the Mediterranean through the Dardanelles, although, in theory, such probability exists);

1_ a live stranding of *D. d. ponticus* was recorded in Kerch city, Ukraine, in August 1994 (Birkun *et al.,* 1999); similar cases could happen in the Russian Kerch Strait also, but no respective study was conducted there;

2 _ according to the genetics (Rosel *et al.,* 1995, 2003), *P. p. relicta* occurs in the Greek Aegean Sea, i.e. beyond the Dardanelles Straits and the northern part of the Turkish Aegean Sea; however, its presence in these "intermediate" waters was not confirmed yet by reliable observations;

3 _ bottlenose dolphins (*T. truncatus*) were recorded in the Dardanelles (Öztürk and Öztürk, 1997), they are also known in the Greek and Turkish Aegean Sea (Beaubrun, 1995; Frantzis et al., 2003). However, the genetics of bottlenose dolphins from these localities were not studied yet and, thus, the suspected presence of *T. t. ponticus* individuals among them is not confirmed. At the same time, one individual from the western Mediterranean was found to be a possible immigrant from the Black Sea population (Natoli *et al.,* 2005).

The range of the Black Sea subspecies covers territorial waters and exclusive economic zones of Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine in the Black Sea; internal waters of Ukraine in the Black Sea (including the Dnieper-and-Boug Liman and Karkinitsky Bay); internal waters of Russia and Ukraine in the Azov Sea and Kerch Strait; internal waters of Turkey including the Bosporus Strait, the Marmara Sea and, probably, the Dardanelles Straits; territorial waters of Greece and, as expected, Turkey in the northern Aegean Sea. Sometimes, harbour porpoises can be sighted in the Danube, Dnieper, Don and Kuban Rivers, their estuaries, deltas and tributaries (e.g., in the

Danube in 1984-1989 and 2003 or in the Ingulets, a confluent of the Dnieper, in 1999) as well as in coastal freshwater, brackish and saline lakes and lagoons connected with the sea, including the Yalpug and Sivash lakes, Berezansky and Grigorievsky lagoons, Tendrovsky, Yagorlytsky and Jarylgachsky bays, and the Gulf of Taganrog (Tzalkin, 1940a; Geptner *et al.,* 1976; Birkun, 2006a). All these sites are situated in Ukraine and Russia, on the northern and northwestern coasts of the Black Sea and round the Azov Sea.

It might be assumed that the population of *P. p. relicta* consists of three or more subpopulations (which are not confirmed by means of genetic study yet) including those which spend the most part of year in geographically and ecologically different areas including the Azov Sea, northwestern Black Sea, and the Turkish Straits System (including the Sea of Marmara, the Bosporus and, possibly, the Dardanelles). Another subpopulation is thought to be resident in the northern Aegean Sea of the Mediterranean.

10.2.3. Abundance

The total population size is unknown. Past Black Sea region-wide estimates of harbour porpoise absolute abundance, based on strip transect cetacean surveys carried out in the USSR in 1967-1974 (Zemsky and Yablokov, 1974) and in Turkey in 1987 (Çelikkale *et al.,* 1989) have been discredited by the Scientific Committee of the International Whaling Commission (IWC) due to irremediable methodological and interpretative problems (Smith, 1982; IWC, 1983, 1992; Klinowska, 1991; Buckland et al., 1992). Some other estimates, conducted in 1975-1993 (Mikhalev *et al.,* 1978; Yukhov *et al.,* 1986; Sokolov *et al.,* 1990; Mikhalev, 1996; Yaskin and Yukhov, 1997), also suffered from inadequacies of survey design, record keeping and statistical analysis. Nevertheless, it was generally recognized that during most of the 20th century the abundance of harbour porpoises in the Black Sea was higher than that of bottlenose dolphins and less than that of common dolphins; besides, before the mid 1990s the harbour porpoise was considered the predominant cetacean in coastal waters of the northern and eastern Black Sea (Tzalkin, 1940a; Kleinenberg, 1956; Geptner *et al.,* 1976; Yaskin and Yukhov, 1997).

More recently, however, the bottlenose dolphin has become prevalent in inshore waters of the northern Black Sea (Birkun *et al.,* 2004c). It was estimated that sighting score of bottlenose dolphins increased five times in 1997 and 1998 in comparison with 1995 (see Section 10.4.3 for details), whereas the number of harbour porpoises on record declined dramatically. Mass incidental mortality in bottom-set gill nets was the most likely cause of the marked decrease in harbour porpoise abundance (Birkun *et al.,* 2004b,c; Birkun, 2005).

A series of line transect cetacean surveys have been conducted recently to estimate harbour porpoise absolute abundance in different regions (Birkun *et al.,* 2002, 2003, 2004a, 2006b; Krivokhizhin *et al.,* 2006). In particular, aerial surveys were conducted in the Azov Sea, Kerch Strait (July 2001 and August 2002) and northeastern shelf area (August 2002); vessel-based surveys were performed in the Kerch Strait (August 2003), the entire 12-miles zone of the Ukrainian and Russian Black Sea (September-October 2003), the southern portion of Georgian territorial waters (January 2005), and central part of the Black Sea between the Crimea peninsula, Ukraine, and Sinop province of Turkey

(September-October 2005). Results of those surveys (Table 10.3) suggest that present population size of *P. p. relicta* is at least several 1000s or, rather, some 10,000s. Very low concentrations of harbour porpoises (too scanty for customary statistic analysis) were determined at the height of summer in the Kerch Strait and over the northeastern Black Sea shelf area (Birkun *et al.,* 2002, 2003).

10.2.4. Habitat and ecology

Harbour porpoises inhabit mainly shallow waters (0-200 *m* deep) over the continental shelf around the entire perimeter of the Black Sea, although they may also expend quite far offshore in deep water area (*e.g.,* Mikhalev, 2004b). For instance, in late September - early October 2005, sizeable groups were recorded in the central Black Sea, beyond the shelf edge some 38-215 *km* from the nearest coast over depths of 450-2,170 *m* (Krivokhizhin *et al.,* 2006). During warm periods they are present in the Azov Sea and Kerch Strait (Tzalkin, 1940a; Kleinenberg, 1956; Birkun *et al.,* 2002) and in the Marmara Sea and Bosporus (Öztürk and Öztürk, 1997). Both of these small seas as well as the northwestern Black Sea shelf zone represent geographically disjunctive breeding-calving-feeding areas while the straits (the Kerch Strait and Bosporus) serve as migration corridors.

Harbour porpoises undertake penduliform annual migrations, leaving the Azov Sea (Tzalkin, 1938) and northwestern Black Sea (Birkun, 2006a) before winter and returning in spring. These animals have never been recorded along the Bosporus in January, February and March (Öztürk and Öztürk, 1997). The primary overwintering area of Black Sea harbour porpoises is the southeastern Black Sea (Birkun *et al.,* 2006b) that covers southern territorial waters of Georgia between Cape Anaklia to the north and the Turkish border near Sarp to the south, and eastern Turkish territorial waters. These are also well-known overwintering grounds of the Black Sea and Azov Sea anchovy populations (*Engraulis encrasicolus ponticus*)- a principal prey species for harbour porpoises during the cold season (Kleinenberg, 1956). It is possible that most of the Black Sea porpoise population congregates there every year. In January 2005, the density estimated in Georgian waters was 1.54 porpoises per km^2 (CV = 26.5%; Birkun *et al.,* 2006b), *i.e.* 6-39 times higher densities reported for any other Black/Azov Sea area surveyed in summer or autumn (Table 10.3).

The ecology of Black Sea harbour porpoises and other cetaceans residing in this basin is rather peculiar owing to the high degree of geographical isolation of their habitat, relatively low water salinity, significant seasonal fluctuations of water temperature, as well as a large amount of anoxic waters below 100-250 *m*.

Table 10.3. Estimates of Black Sea cetaceans density (individuals per 1 km^2) and absolute abundance in the selected maritime areas (values of 95% confidence interval are enclosed in brackets)

Surveyed area and observation effort	Survey platform	Research period	Estimates uncorrected for availability or detection bias						References
			harbour porpoises		common dolphins		bottlenose dolphins		
			density	abundance	density	abundance	density	abundance	
Turkish Straits System (Bosphorus, Marmara Sea and Dardanelles)	vessel	October 1997	na		na	773 (292-2,059)	na	495 (203-1,197)	Dede (1999), cited after: IWC (2004)
		August 1998	na		na	994 (390-2,531)	na	468 (184-1,186)	
Azov Sea in whole; 40,280 km2 / 2,735 km	aircraft	July 2001	0.07 (0.03-0.16)	2,922 (1,333-6,403)	0 no sightings		0 no sightings		Birkun et al. (2002)
Southern Azov Sea (within above area); 7,560 km2 / 413 km	aircraft	July 2001	0.12 (0.04-0.36)	871 (277-2,735)	0 no sightings		0 no sightings		Birkun et al. (2003)
Southern Azov Sea (the same area); 7,560km2 / 716 km	aircraft	August 2002	0.12 (0.06-0.27)	936 (436-2,009)	0 no sightings		0 no sightings		Birkun et al. (2003)
Kerch Strait in total; 890 km2 / 353 km	aircraft	July 2001	na small sample size: 5 sightings / 12 animals		0 no sightings		0.09 (0.03-0.22)	76 (30-192)	Birkun et al. (2002)
		August 2002	na small sample size: 4 sightings / 4 animals		0 no sightings		0.10 (0.04-0.27)	88 (31-243)	Birkun et al. (2003)
Kerch Strait; 862 km2 / 310 km	vessel	August 2003	0.06 (0.01-0.28)	54 (12-245)	0 no sightings		0.15 (0.08-0.28)	127 (67-238)	Birkun et al. (2004a)
NE shelf area of the Black Sea; 7,960 km2 / 791 km	aircraft	August 2002	na small sample size: 8 sightings / 15 animals		na small sample size: 1 sighting / 1 animal		0.10 (0.04-0.26)	823 (329-2,057)	Birkun et al. (2003)
NW, N and NE Black Sea (Ukrainian and Russian territorial waters); 31,780 km2 / 2,230 km	vessel	September-October 2003	0.04 (0.02-0.09)	1,215 (492-3,002)	0.17 (0.09-0.31)	5,376 (2,898-9,972)	0.13 (0.08-0.22)	4,193 (2,527-6,956)	Birkun et al. (2004a)
SE Black Sea within Georgian territorial waters; 2,320 km2 / 211 km	vessel	January 2005	1.54 (0.89-2.65)	3,565 (2,071-6,137)	4.18 (2.16-10.11)	9,708 (5,009-18,814)	0 no sightings		Birkun et al. (2006b)
Central Black Sea beyond territorial waters of Ukraine and Turkey; 31,200 km2 / 660 km	vessel	September-October 2005	0.26 (0.06-1.27)	8,240 (1,714-39,605)	0.15 (0.05-0.51)	4,779 (1,433-15,945)	0 no sightings		Krivokhizhin et al. (2006)

"na" - not available.

The mean group size varies from 1.4 to 10.7 in different areas (Birkun *et al.,* 2002, 2003, 2004a; Krivokhizhin *et al.,* 2006). Along paths of seasonal migration, harbour porpoises may remain for a few days in different sites (usually bays abundant in fish), forming dense aggregations consisting of some hundreds of individuals. Such accumulations were recorded off the southern coast of Crimea in December-January 1994 (Laspi Bay), March 1995 (near Cape Meganom) and April 2005 (between Cape Aya and Cape Fiolent) (A. Birkun, Jr. and S. Krivokhizhin, unpubl. data). Sometimes, early and rapid ice formation arising immediately after warm "indian summer" puts obstacle on the way of their evacuation from the Azov Sea and, thus the ice entrapment causes mass mortality events (Kleinenberg, 1956). Such die-off has happened in November 1993 (Birkun and Krivokhizhin, 1997). Black Sea harbour porpoises do not avoid waters with low salinity and transparency; they may occur in the estuarine and fluvial environment represented by brackish bays, lagoons, rivers and their estuaries (see Section 10.2.2; all records belong to warm season and northern half of the basin).

Table 10.4. Target fish species of Black Sea cetaceans (+ - prey species confirmed by identification of food residues in stomach contents of the cetaceans; ± - suspected prey species listed on base of indirect evidences)

Fishes	**Cetaceans**		
	P. p. relicta	D. d. ponticus	T. t. ponticus
Thornback ray, Raja clavata	-	-	+ c,g,h
Black Sea sprat, Sprattus sprattus phalaericus	+ l,m	+ c,d,e,g,h,i,j,m	-
Black/Azov Sea shad, Alosa spp.	+ f,g,m	+ h	-
Black Sea anchovy, Engraulis encrasicolus ponticus	+ c,f,g,h,i,m	+ c,d,e,g,h,i,m	+ c,g,h,i
Black Sea garfish, Belone belone euxini	-	+ m	-
Black Sea whiting, Merlangius merlangus euxinus	+ f,g,l,m	+ c,d,e,g,h,m	+ c,g,h
Pipefish, Syngnathus schmidti	-	+ c,h	-
Pipefish, Syngnathus typhle	-	+ c,h	-
Pelagic pipefishes unidentified, Syngnathidae gen. sp.	-	+ c,d,g,h	-
Striped mullet, Mugil cephalus	-	-	+ c,g,i
Golden mullet, Liza aurata	+ f	-	-
Far-east mullet, Liza haematocheila syn. Mugil so-iuy	+ m	-	± k,m
Black Sea mullets, Liza spp. (other than L. haematocheila)	+ g	± b	+ c,g,h,i
Black Sea silverside, Atherina boyeri syn. A. pontica	+ f,g	-	-
Bluefish, Pomatomus saltatrix	-	+ g,h	-

a, - Meyer (1794);, b, - Malm (1933);, c, - Kleinenberg (1936); d, - Tzalkin (1937);, e, - Malm (1938);, f, - Tzalkin (1940a); g, - Tzalkin (1940b);, h, - Kleinenberg (1956);, i, - Tomilin (1957); j, - Tarasevich (1958);, k, - Birkun and Krivokhizhin (1996);, l, - Tonay and Öz (1999); m, - Krivokhizhin et al. (2000); , n, - Bel'kovich (2001).,

Table 10.5. Life history parameters of Black Sea cetaceans

Parameters		Cetaceans					
		P. p. Relicta		D. d. ponticus		T. t. ponticus	
		raw original data	Defaults for porpoise a	raw original data	defaults for long-lived odontocete a	raw original data	defaults for long-lived odontocete a
Sexual maturity Age / first reproduction, years	female	3-4 b	4	2-4 c,d	7	12 e	7
	male	3.5-4 b		3 c,d		11 e	
Longevity (max agef), years		at least 12 b	20	20-22 d	70	25-30 g	70
Percentage of the population that is reproductively mature, %		na	52-55	na	68-90	na	68-90
Average age of parents in the popu-lation (generation time), years		6♀ and 6.7♂ b	9-10	15♀ d	21-33	26♀ and 19♂ e	21-33
Gestation time, months		9-10	Na	10-11 c	na	12 i	Na
Average interbirth interval, years		1 g	Na	1.3-2.3 j	na	from 2-3 to 6 g	na
Maximum potential annual rate of popula-tion increase, %		na	2	na	2	na	2
Birth rate k		na	0.4	na	0.1	na	0.1
Non-calf survival rate (SA) l		na	0.89	na	0.99	na	0.99
Survival rate in the first year of life (S0)m		na	0.62	na	0.84	na	0.84

[a] - The ACCOBAMS and IUCN Workshop on Red List Assessment of Cetaceans in the ACCOBAMS Area (Monaco, 5-7 March 2006; Reeves and Notarbartolo di Sciara, 2006) noted that reliable data and analyses of vital rates are unavailable for the populations of cetaceans in the Black Sea. Therefore, Philip S. Hammond (Sea Mammal Research Unit, St. Andrews, UK), based on the unpublished draft by Barbara L. Taylor (Southwest Fisheries Science Center, La Jolla, USA), has prepared a table of "defaults" for key parameters which are quoted here as "defaults for porpoise" and "defaults for long-lived odontocete";

[b] - BLASDOL (1999); [c] - Kleinenberg (1956); [d] - Kleinenberg and Klevezal' (1962); [e] - Klinowska (1991); [f] - maximum age at which 1% of a population remains alive;

[g] - Tomilin (1957); [h] - Tzalkin (1940a); [i] - Geptner *et al.* (1976); [j] - Perrin and Reilly (1984);

[k] - Birth rate is defined as the number of female births per female per year: 1 female per female every 2.5 years for porpoise, 1 female per female every 10 years for long-lived odontocete (including *D. d. ponticus* and *T. t. truncatus*); it is assumed that for long-lived odontocete reproductive senescence begins (no reproduction occurs) after age 50;

[l] - SA is defined as survival rate of all ages after the first birthday, and calculated to give 1% survival at maximum age;

[m] - S0 is calculated as a multiplier of SA (0.7 for porpoise and 0.85 for long-lived odontocete);

"na" - not available.

According to the data presented in Table 10.4, at least 18 fish species have been recorded in the stomach contents of *P. p. relicta* (Kleinenberg, 1936, 1956; Tzalkin, 1940a,b; Tomilin, 1957; Tonay and Öz, 1999; Krivokhizhin *et al.,* 2000) . They included four fishes which could be recognized as the most important prey: the anchovy (*E. e. ponticus*), sprat (*Sprattus sprattus phalaericus*), whiting (*Merlangius merlangus euxinus*) and gobies (Gobiidae).

10.2.5. Life history

In general terms, the Black Sea harbour porpoise is a relatively short-lived animal with the highest reproduction ability in comparison with other Black Sea cetacean species (Table 10.5).

Table 10.6. Known (documented) threats to Black Sea cetaceans[1]

Threat		Cetaceans		
		P. p. relicta	D. d. ponticus	T. t. ponticus
Harvesting (dolphin fishery) for fuel, materials, medicine and food		past	past	past
Harvesting (live capture) for scientific, military and leisure activities		past	past	ongoing
Accidental mortality caused by fisheries-related bycatch (mainly entanglement)		ongoing	ongoing	ongoing
Accidental mortality caused by explosion of gas-output platform		past, future (?)	unknown	unknown
Persecution (frightening and killing) by fishermen with fire-arms and pyrotechnics		unknown	unknown	ongoing
Unregulated release of captive animals and spontaneous escapes from captivity		unknown	unknown	past, future (?)
Habitat degradation (reduction of prey resources) caused by fisheries		ongoing	ongoing	ongoing
Habitat degradation (reduction of prey resources) caused by invasive alien species		ongoing	ongoing	ongoing
Water pollution (agricultural, domestic, industrial, etc.) affecting habitat and cetaceans		ongoing	ongoing	ongoing
Pathogens and parasites including those which cause cetacean mass mortality events		ongoing	ongoing	ongoing
Natural disasters (temperature extremes) causing cetacean die-offs by ice entrapment		past, future (?)	unknown	unknown
Intrinsic factors:	restricted range of the subspecies	ongoing	ongoing	ongoing
	relatively low reproduction ability	no	no	Ongoing

[1] - Besides threats listed in this table, there are some other threats suspected to be essential factors affecting Black Sea cetacean populations (*e.g.,* disturbance/ noise caused by marine traffic and other human activities, collisions with shipping, habitat degradation caused by man-made modification of the seabed and coasts, global warming, *etc.*). However, these factors were not investigated yet in the Black Sea region, and their study represents important task in view of further application of the results for cetacean conservation.

The life span is not studied well; perhaps, it is similar to conspecifics in the North Atlantic, estimated as long as 24 years (Read, 1999). Based on the counts of dentinal growth layers, maximum age of the bycaught Black Sea harbour porpoises was found as 10-12 years, whereas gross and histological signs suggested sexual maturity in males and females at the earliest age of 3.5-4 and 3-4 years, respectively (BLASDOL, 1999). In conformity with these data, the mean age of parental individuals comes to 6.7 years in males and 6.0 years in females. However, these values seem to be influenced (shortened) by past and ongoing threats and, thus, do not reflect natural generation length, which is probably similar to the generic generation time of about 9-10 years estimated for

Phocoena spp. (Table 10.5). According to data collected during the period of extensive Black Sea cetacean fishery (when thousands of *P. p. relicta* individuals and hundreds of their embryos/foetuses have been examined), the mating occurs mainly in summer; mature females become pregnant almost annually, with a gestation period of 9-10 months and usual birth of one calf between May and early August; the nursing/lactation period lasts 4-6 months (Tzalkin, 1940a; Kleinenberg, 1956; Tomilin, 1957; Geptner *et al.,* 1976). Somewhat different terms are known for the harbour porpoise, *P. phocoena,* from other areas: gestation - 10-11 months, lactation - at least 8 months (Read, 1999).

10.2.6. Past and ongoing threats

Up to 1983, the uncontrolled directed takes were primary threat to the population. Large numbers of harbour porpoises, as well as other Black Sea cetaceans, were taken during the 20th century by all Black Sea countries for manufacturing the lamp-oil, currier's oil, engine and lubricating oils, vitamin-D-containing medicines, paints, varnishes, soap, cosmetics, tinned meat and sausages, leather-shoe wares, "fish" meal for poultry, bone fertilizer and glue (Silantyev, 1903; Kleinenberg, 1956; Berkes, 1977; Buckland *et al.,* 1992; Birkun, 2002a). A total number of killed individuals is unknown. However, it is generally acknowledged that all Black Sea cetacean populations including the harbour porpoise were badly reduced by the dolphin fishery (IWC, 1983, 1992, 2004). Catches of harbour porpoises were numerically less than common dolphins until 1964 when they became dominant (Smith, 1982). From 1976 to 1981, harbour porpoises were believed to account for 80% of the total catch of cetacean fisheries in Turkey, with 34,000 to 44,000 taken annually (IWC, 1983). During last 15 years, since 1991, there was no evidence of illegal directed takes which were reported formerly (IWC, 1992). Nevertheless, it could be suspected that the population which did not recover till now continues to be depressed due to other, ongoing, threats.

At present, incidental catch in fishing nets is the most important threat and major source of human-induced mortality of *P. p. relicta* (*e.g.,* Birkun, 2002c). All three Black Sea cetacean species are known to be taken as bycatch, but incidental takes of harbour porpoises evoke the greatest concern. Harbour porpoise bycatches represent the majority (95%) of cetacean entanglements on record; however, absolute numbers of population losses caused by fishing operations were not estimated. Preliminary indications suggest that annual level of harbour porpoise bycatches is hardly sustainable and can be numbered by thousands of individuals. The porpoises are caught in a variety of fisheries, although 99-100% of bycatches occur in the bottom-set gillnets for turbot (*Psetta maxima maeotica*), spiny dogfish (*Squalus acanthias*) and sturgeon (*Acipenser* spp.) with a peak in April-June during the turbot fishing season. The bycatches occur in the Azov Sea and Kerch Strait and throughout shelf area of the Black Sea including territorial waters of riparian countries. Almost all (910.9%) recorded bycatches are lethal (BLASDOL, 1999). Illegal, unreported or unregulated (IUU) fishing is widespread in the Black and Azov Seas suggesting that significant share of bycatches takes place due to this human activity.

Large-scale pelagic and small-scale coastal fisheries affect Black Sea harbour porpoises also indirectly, by force of excessive exploitation of those fish species which represent the basic prey. First of all, this concerns anchovies in the Black Sea and gobies in the

Azov Sea. In particular, the overfishing combined with the eutrophication and population explosion of alien raptorial ctenophore *Mnemiopsis leidyi* led to dramatic decline of anchovy abundance in the late 1980s and early 1990s (Prodanov *et al.,* 1997; Zaitsev and Mamaev, 1997; Birkun, 2002b,c). The reduced prey availability concurred with two mass mortality events (in 1989 and 1990) impacted on all three Black Sea cetacean species but mostly on *P. p. relicta* (Birkun, 2002e). Severe pulmonary nematodosis, caused by *Halocercus* spp. and complicated by bacterial super-infection, was recognized as a primary cause of deaths that eliminated mainly young animals. The malnutrition along with bioaccumulation of POPs could provoke those epizootics, suppressing the resistance of porpoises to pathogens. High concentrations of organochlorines and relatively low concentrations of toxic trace elements have been detected in P. p. relicta by different authors (Birkun et al., 1993 ; Madhusree *et al.,* 1997; Tanabe *et al.,* 1997a,b; Glazov and Zhulidov, 2001; Joiris *et al.,* 2001; Das *et al.,* 2004). The contamination of Black Sea harbour porpoises by DDTs and HCHs in the 1990s was higher than that reported for this species elsewhere in the world (Tanabe *et al.,* 1997a); thus water pollution could be considered as a major problem on its own.

Black Sea harbor porpoises were also threatened by ice entrapment in the Azov Sea (see Section 10.2.4). Besides, in August 1982, the explosion of drilling platform in the Azov Sea caused mortality of over 2,000 porpoises (Birkun, 2002d). Another potential threat is the morbillivirus infection. Serological examination of bycaught animals revealed positive morbillivirus-neutralizing antibody titers in harbour porpoises from Bulgarian, Georgian and Ukrainian waters (Müller *et al.,* 2002). This suggests the persistence of morbilliviruses in the population, with possible outbreaks of devastating epizootics in future.

The cumulative data on past and ongoing threats to Black Sea harbour porpoises can be found in Table 10.6.

10.2.7. Population trend

In the 20th century, abundance of Black Sea harbour porpoises was considerably reduced by massive direct killing for the cetacean-processing industry which continued till 1983 (see section 10.2.6). However, the number of animals taken was not recorded accurately; much of the catch data was recorded as numbers of animals undifferentiated to species level (all three Black Sea cetacean species were targeted) and in the form of wet weight aggregates (*e.g.* pounds or tons of dolphin/porpoise landed). Nevertheless, it could be inferred from the available data that the population size of *P. p. relicta* was reduced due to the direct kills by some hundreds of thousands when the total ban on dolphin fishery has been introduced in the Black Sea. It could be suspected also that the population did not recover during the subsequent period (1983-2006) and, most likely its state became much worse and its size even diminished owing to the escalation of ongoing major threats, such as the fisheries-related bycatch, human induced habitat degradation, *etc.* These threats, including the bycatch in bottom-set gillnets, are poorly managed in most Black Sea countries; so, further decline of the population seems to be highly likely.

10.3. Short-beaked common dolphin (Delphinus delphis ponticus)

10.3.1. Taxonomy and genetics

The Black Sea common dolphins are recognized as a well isolated discrete population possessing clear genetic differences from *D. delphis* in the eastern and western Mediterranean (Natoli, 2003, cited after: IWC, 2004; Natoli, 2004). This cetacean is the sole representative of the genus *Delphinus* and one of two Delphinidae species in the Black Sea fauna (Table 10.1). The subspecies name, *D. d. ponticus,* was given based on some morphological features (Barabasch, 1935) which were criticized at least as inessential (*e.g.,* Kleinenberg, 1956). Subsequent comparative skull morphometrics (Amaha, 1994; Amaha *et al.,* 1996) and genetic analysis of nine microsatellite DNA loci (Natoli 2003, cited after: IWC, 2004) suggested differences between Black Sea and Mediterranean common dolphins, although no significant differentiation was revealed at the mitochondrial level, probably, owing to small sample size (Natoli, 2004). Thus, clear conclusion on taxonomic (subspecies) status of Black Sea common dolphins is still unfeasible (A. Natoli, pers. comm.). However, according to available data, it is likely that gene flow between the Black Sea and Mediterranean Sea is rare or non-existent, and the Black Sea population deserves to be treated as a discrete unit for conservation purposes (IWC, 2004).

10.3.2. Distribution

The range of the Black Sea common dolphin population is represented by the almost entire Black Sea (Table 10.2) including territorial waters and exclusive economic zones of Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine, and internal waters of Ukraine in Karkinitsky Bay (Kleinenberg, 1956; Geptner *et al.,* 1976; Birkun, 2006a); and by internal waters of Turkey including the Bosporus Strait and Marmara Sea (Öztürk and Öztürk, 1997). Common dolphins do not occur in the Azov Sea and normally avoid the Kerch Strait, although a single live stranding was recorded there in 1994 at the time of morbillivirus epizootic (Birkun *et al.,* 1999). There is no reliable information on *D. delphis* presence on possible two-way transit between the Black Sea and Mediterranean Sea through the Turkish Straits System.

10.3.3. Abundance

The population size of Black Sea common dolphins is still unknown. Previous estimates, based on strip transect aerial and boat surveys conducted in 1960s-1980s, have been grimly criticized by the IWC Scientific Committee owing to methodological and interpretative imperfections (see Section 10.2.3 for references). However, it was widely acknowledged that originally and during almost two thirds of the 20th century the abundance of common dolphins in the Black Sea was by far higher than the abundance of bottlenose dolphins and harbour porpoises (Tzalkin, 1940b; Kleinenberg, 1956; Geptner *et al.,* 1976). During last decade (1997-2006) several line transect surveys have been conducted to estimate common dolphin abundance in the Turkish Straits System (Dede, 1999, cited after: IWC, 2004); northern, northwestern and northeastern Black Sea within the bounds of Russian and Ukrainian territorial waters (Birkun *et al.,* 2004a);

southeastern Black Sea within Georgian territorial waters (Birkun *et al.,* 2006b); and central Black Sea between territorial waters of Ukraine and Turkey (Krivokhizhin *et al.,* 2006). These abundance estimates (Table 10.3) suggested that current population size of *D. d. ponticus* is at least several 10,000s. The highest density of common dolphins (4.18 animals/km^2; CV = 31.4%) was revealed in the Georgian Black Sea in January 2005 (Birkun *et al.,* 2006b).

10.3.4. Habitat and ecology

Common dolphins are distributed mainly offshore and visit shallow coastal waters following seasonal aggregations and regular mass migrations of the preferred prey, small pelagic fishes, first of all, the Black Sea anchovy (*E. e. ponticus*) and Black Sea sprat (*S. s. phalaericus*) (Tzalkin, 1940b; Kleinenberg, 1956; Geptner *et al.,* 1976; Bushuyev, 2000; Bushuyev and Savusin, 2004; Mikhalev *et al.*, 2004). However, a full list of fishes consumed by *D. d. ponticus* contains not less than 11 species (Table 10.4). Winter aggregation of anchovies in the southeastern Black Sea and, to a lesser degree, to the south of Crimea sets suitable conditions for overwintering accumulations of these cetaceans. Summer concentrations of sprats in the northwestern, northeastern and central Black Sea also attract common dolphins to different feeding grounds. The cetaceans avoid waters with low salinity, and this can be a reason why they never occur in the Sea of Azov and, normally, in the Kerch Strait. The mean size of common dolphin groups recorded in 2003-2005 varied from 2.9 to 5.4 (S. Krivokhizhin, pers. comm.), and many such groups can be observed in places very close to each other.

10.3.5. Life history

Some original data regarding the life history of Black Sea common dolphins and relevant default estimates for long-lived odontocetes are present in Table 10.5. Given the small sample size (17 individuals), the estimated life span (20 years) and average age (15 years) of sexually mature females (Kleinenberg and Klevezal', 1962) can be considered as tentative parameters for preliminary analysis only. Besides, these parameters as well as the age of sexual maturity in females (2-4 years) (Kleinenberg, 1956; Kleinenberg and Klevezal', 1962) are likely biased because of convenience (unrepresentative) sample affected by "schooling segregation" of Black Sea common dolphins (Perrin and Reilly, 1984).

10.3.6. Past and ongoing threats

Known threats affected Black Sea common dolphins are listed in Table 10.6. Last century, the population was collapsed by the directed takes. A total number of killed animals is unknown, but it was estimated that before the mid-1950s the share of common dolphins killed and processed in the former Soviet Union reached 94.8% of all Black Sea cetaceans taken (Tzalkin, 1940b; Kleinenberg, 1956). Based on this value, it was calculated that USSR and Bulgaria have caught and landed about 179,000 common dolphins during the last six years of cetacean fishery (1961-1966), while this number was as high as 1,392,000 (Zemsky, 1996) or probably more during the preceding 30 years

(1931-1960). Between 1976 and 1981, *D. d. ponticus* was believed to account for 15-16% of the Turkish catch, estimated as 250,000 of all three species (IWC, 1983).

The reduced prey availability has been considered as ongoing major threat affecting the Black Sea common dolphins since the late 1980s (Bushuyev, 2000). Of two mass mortality events eliminated unknown but certainly large numbers of common dolphins in winter-spring 1990 and summer-autumn 1994 (Krivokhizhin and Birkun, 1999), the latter was considered to be due to the result of a morbillivirus epizootic (Birkun *et al.,* 1999). However, both die-offs concurred with drastic decline in abundance of both principal prey species, the anchovy (*E. e. ponticus*) and sprat (*S. s. phalaericus*), severely affected by overfishing combined with the consequences of water pollution (*e.g.,* eutrophication and water hypoxia) and population explosion of alien raptorial ctenophore *M. leidyi* (Zaitsev and Mamaev, 1997). This may suggest a cause-effect relationship between prey scarcity and common dolphin mass mortality.

Other known threats, including bycatch in pelagic trawls, parasitic invasions, accumulation of xenobiotics and live-capture for dolphinaria (Birkun, 2002a,b,c,e) are of secondary importance (at least for the present).

10.3.7. Population trend

According to the data described in Section 10.3.6, the population collapsed due to long-term dolphin fishery overexploitation in all Black Sea countries by the mid-1960s. However, the extermination continued until 1983 when cetacean hunting has been ceased finally in Turkey. The numbers of animals taken were not recorded properly, thus the overall population losses were not estimated. Nevertheless, it could be inferred that the population size of Black Sea common dolphins was reduced by the directed kills at least in half. Besides, it could be suspected that during the subsequent period (1983-2006) the population might have a tendency to increase but, possibly, with low success owing to mass mortality events (in 1990 and 1994) and pronounced depletion of common dolphin's primary prey within the same period. No doubt that the population has not fully or even substantially recovered from the survived stress till now, and further decline could be predicted if degradation of the Black Sea environment goes worse.

10.4. Common bottlenose dolphin (Tursiops truncatus ponticus)

10.4.1. Taxonomy and genetics

The Black Sea bottlenose dolphin is the sole representative of the genus Tursiops and one of two Delphinidae species in the Black Sea fauna (Table 10.1). It was recognized as a subspecies on the basis of morphological differences from Atlantic and Pacific conspecifics (Barabasch-Nikiforov, 1960; Geptner *et al.,* 1976). The genetic data support the subspecies status of *T. t. ponticus* based on clear differentiation of the Black Sea population from other bottlenose dolphin populations and subpopulations in the eastern Mediterranean, western Mediterranean, southern and northern parts of the northeastern Atlantic (Natoli *et al.,* 2005; A. Natoli, 2006, pers. comm.). According to those data, the Black Sea population is effectively isolated from the Mediterranean ones by ecological barrier in the Turkish Straits System, although limited gene flow between

the both seas is probable, and possible vagrant from the Black Sea population was detected in the western Mediterranean (Natoli *et al.,* 2005).

10.4.2. Distribution

The range of Black Sea bottlenose dolphins (Table 10.2) includes the entire Black Sea; Kerch Strait along with adjoining southern part of the Azov Sea (Tzalkin, 1940b; Birkun *et al.,* 1997; Sokolov, 1997) and the Turkish Straits System (Kleinenberg, 1956; Beaubrun, 1995; Öztürk and Öztürk, 1997). In view of political geography, the range of this subspecies includes territorial waters and exclusive economic zones of Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine in the Black Sea; internal waters of Ukraine in the Black Sea (including the Dnieper-and-Boug Liman, Karkinitsky Bay and Donuzlav Lake); internal waters of Russia and Ukraine in the Kerch Strait and Azov Sea; internal waters of Turkey including the Bosporus Strait, Marmara Sea and Dardanelles. There are a few records of bottlenose dolphins entering rivers, *e.g.* the Danube in Romania (Police, 1930, cited after: Tomilin, 1957) and Dnieper in Ukraine (Birkun, 2006a).

Population structure within the Black Sea is likely (Bel'kovich, 1996) with several sub-subpopulations or "semi-resident" communities including those that spend most part of the year in geographically and ecologically different areas, *e.g.* northwestern Black Sea, coastal waters off the southern Crimea, Kerch Strait and adjoining portions of the Black Sea and Azov Sea, shelf waters off the Caucasian coast, Turkish Black Sea, and Turkish Straits System.

10.4.3. Abundance

The population size of *T. t. truncatus* is unclear in spite of numerous (but imperfect in view of the applied methodology and thus unreliable) estimates accomplished in the former USSR and Turkey before the mid-1990s (see more information in Section 10.2.3). Nevertheless, the abundance of bottlenose dolphins was considered as the smallest of the three cetacean populations in the Black Sea during most of the 20th century (Tzalkin, 1940b; Kleinenberg, 1956; Geptner *et al.,* 1976; Yaskin and Yukhov, 1997). However, bottlenose dolphins became relatively prevalent in coastal waters of the northern Black Sea round the Crimea peninsula in the last quarter of the 1990s.

Over the period from 1990-1999, a total of 397 primary cetacean sightings were recorded in a coastal (20-60-km-wide) area surrounding the Crimean peninsula from the Karkinitsky Bay to Kerch Strait (Birkun *et al.,* 2004c). The surveys were carried out in 1995, 1997 and 1998 by means of sailing and motor yachts covering distances from 255 to 934 *km* (10,371 km of observation effort in total). It was estimated that sighting score of *T. t. ponticus* individuals increased in five times in 1997 and 1998 in comparison with 1995, whereas numbers of harbour porpoises on record have declined. Relative abundance of the both coastal species, evaluated as a *Tursiops/Phocoena* ratio, suggested clear trend towards the predominance of bottlenose dolphins: June 1995 - 0.8/1; June 1997 - 0.9/1; June-July 1998 - 6.8/1; September 1998 - 12.9/1. The difference between the last two figures could be explained by autumn accumulation of bottlenose

dolphins in the waters closed to the southern extremity of the Crimea (between Cape Fiolent and Cape Sarych). Almost daily patrolling in that area in September-October 1997 and August-December 1998 confirmed the predominance of bottlenose dolphin abundance in comparison with harbour porpoises by 7-26 times. Bottlenose dolphin herds numbering hundreds of animals migrate every autumn to this relatively small area from the northeastern and, probably, other parts of the Black Sea (Birkun *et al.,* 2004c; Birkun, 2006a).

A series of line transect surveys, supported by the "Distance" sampling and analysis (Buckland *et al.,* 1993), have been conducted since 1997 to estimate bottlenose dolphin (and other cetaceans) density and absolute abundance in different parts of the range, including the Turkish Straits System (Dede, 1999, cited after: IWC, 2004), Kerch Strait, and Russian and Ukrainian territorial waters in the Black Sea (Birkun *et al.,* 2002, 2003, 2004a). These estimates, summarized in Table 10.3, suggested that the population size at present is not less than several 1000s.

10.4.4. Habitat and ecology

Bottlenose dolphins are distributed across the Black Sea shelf area and far offshore (Beaubrun, 1995; Yaskin and Yukhov, 1997; Mikhalev, 2004a). In the northern Black Sea, they form scattered communities of some tens to approximately 1.5 hundred animals in different places round Crimea including the Kerch Strait and coastal waters off the western and southern extremities of the peninsula (Zatevakhin and Bel'kovich, 1996; Birkun *et al.,* 2004a; Birkun, 2006a). The sizeable accumulations are known also off the Russian Caucasus (O. Shpak and A. Kryukova, pers. comm.) and close to the Turkish coast (S. Krivokhizhin, pers. comm.). Bottlenose dolphins typically aggregate during autumn, winter and spring in relatively small area at the southern Crimea between Cape Sarych and Cape Khersones (Birkun et al., 2006b). According to the results of two-year photo-identification study, this overwintering accumulation consisted of animals from other, "summer", concentrations. The mean size of bottlenose dolphin groups varied from 2.0 to 2.9 in different surveyed areas (Birkun *et al.,* 2002, 2003, 2004a).

Bottlenose dolphins are primarily piscivorous in the Black Sea, taking both benthic and pelagic fishes, large and small. At least 13 fish species have been reported as prey of *T. t. ponticus* off the Crimean and Caucasian coasts (Table 10.4) including several species of mullets (*Mugil cephalus, Liza aurata and L. haematocheila*) which admittedly represent the most preferable diet. Deliberately introduced far-east mullet, *L. haematocheila* (syn. *Mugil so-iuy*), is an example of the influence of aquaculture on Black Sea cetacean forage resources. The introduction of this species, originated from the Sea of Japan, was carried out during 1972-1984 in the lagoons and coastal waters of the northwestern Black Sea and the Sea of Azov (Zaitsev and Mamaev, 1997). Since the late 1980s this fish became abundant and widespread throughout the region. Bottlenose dolphins and harbour porpoises include this new species in their diet (Krivokhizhin *et al.,* 2000).

10.4.5. Life history

The ACCOBAMS and IUCN Workshop on Red List Assessment of Cetaceans in the ACCOBAMS Area (Monaco, 5-7 March 2006) noted that reliable information on vital rates is unavailable for the populations of cetaceans in the Black Sea (Reeves and Notarbartolo di Sciara, 2006). Thus, the data on wild Black Sea bottlenose dolphins (see Table 10.5 and text below) should be recognized as preliminary and, most likely, biased. Any use of them for scientific and conservation purposes demands meticulous care and verification.

The Black Sea bottlenose dolphin is considered as a cetacean with a life span of 25-30 years or more with relatively low reproduction rate (*e.g.,* Tomilin, 1957). The average age of parents in the population is unknown; but it possibly extends to 26 years in females and 19 years in males (Klinowska, 1991). The interval between births is from two or three to six years (Tomilin, 1957), but in captive females the reproductive cycle can be as short as two years (Ozharovskaya, 1997). It was assumed that one female is unlikely to produce more than eight calves in her lifetime (Tomilin, 1984, cited after: Ozharovskaya, 1997). Sexual behaviour can be observed during the whole year with a peak in spring and early summer. The ovulatory season (maximum five spontaneous ovulations per year) extends from March to October with a peak in June; the highest concentrations of testosterone in captive males were recorded in July and the lowest in January (Ozharovskaya, 1997). Gestation lasts 12 months; twinning was not recorded in Black Sea bottlenose dolphins, thus, litter size is invariably one; lactation can last from four months to more than 1.5 years (*e.g.,* Tomilin, 1957).

10.4.6. Past and ongoing threats

In the past, commercial killing was the main human activity affected the population, although the catch of bottlenose dolphins was usually less than those of common dolphins and harbour porpoises. Bottlenose dolphins were taken by all Black Sea countries for manufacturing various products mentioned in Section 10.2.6. A total number of killed animals is unknown, however, it is generally acknowledged that all Black Sea cetacean populations, including the bottlenose one, were reduced by the dolphin fishery (IWC, 1983, 1992, 2004). It was roughly estimated that a share of bottlenose dolphins constituted 0.5% of aggregate numbers of Black Sea cetaceans killed and processed in the USSR between the early 1930s and mid 1950s (Tzalkin, 1940b; Kleinenberg, 1956). At the same time, the statistics of Black Sea cetacean fishery were commonly expressed as total weight or total numbers of animals in the catch without species differentiation. Later on, this value (0.5%) was applied (with groundless extension of temporal and spatial frames of its use) for the re-computation of the recorded annual numbers of pooled cetacean catches/landings into the absolute numbers of *T. t. ponticus* directed catches in the Soviet Union (1931-1966) along with Bulgaria (1958-1966) (Zemsky, 1996). As a result, a total of 8,327 bottlenose dolphins were estimated during that 36-year period, with yearly variation from two (in 1944) to 738 (in 1938) individuals. In particular, the derived annual rates in 1946, 1961 and 1966 were 79, 304, and 30 bottlenose dolphins, respectively (Zemsky, 1996).

All these figures seem very dubious (i.e. utterly underestimated) given the three known facts: (a) more than 3,000 bottlenose dolphins were caught during a single day in one

location close to the southern Crimea in spring 1946 (Kleinenberg, 1956); (b) the Bulgarian cetacean fishery was concentrated almost exclusively on *T. t. ponticus* and about 13,000 individuals of this subspecies were taken in 1961 (Nikolov, 1963, cited after: Sal'nikov, 1967); (c) only one dolphin processing factory in Novorossiysk, Russia, processed 53 bottlenose dolphins (27 males and 26 females including 63% of pregnant and 10.4% of lactating animals) in April 1966 (Danilevsky and Tyutyunnikov, 1968).

Thus, taking into consideration the unknown but presumably significant levels of the Romanian and Turkish catch, it could be inferred that the number of bottlenose dolphins killed before the mid 1960s was very high, in some periods even exceeding the kills of the other two species. From 1976 to 1981, bottlenose dolphins were believed to account for 2-3% of the total catch of cetacean fisheries in Turkey with 34,000 to 44,000 taken annually (IWC, 1983; Klinowska, 1991). That makes up between 680-1,320 individuals per year or between 4,080-7,920 individuals during those six years alltogether. No reliable information on illegal commercial killing of Black Sea bottlenose dolphins is available after the ban on cetacean fisheries in 1983. The isolated cases of deliberate killing and harassment (frightening by pyrotechnic means and fire-arms) occurred as a result of adverse interaction between dolphins and coastal fisheries. For instance, at least two bottlenose dolphins were recorded shot in Balaklava, Ukraine, in 2004 (S. Popov, pers. comm.).

Since the mid 1960s, hundreds (probably over one thousand) of bottlenose dolphins have been live-captured in the former USSR, Russia, Ukraine and Romania for military, commercial and scientific purposes (Birkun, 2002a). The capture operations sometimes were accompanied by the accidental death (usually unreported) of additional individuals. In recent years, up to 2002, the live-capture of 10-20 animals took place annually in May-June in the Kerch Strait, Russia. During the 1980s-2000s the number of facilities for dolphin show and "swimming with dolphins" programs has vastly increased in Black Sea countries. The export of bottlenose dolphins from Russia and Ukraine for permanent and seasonal shows has also expanded, for example, to Argentina, Bahrain, Byelorus, Chile, Cyprus, Egypt, Georgia, Hungary, Iran, Israel, Kuwait, Lebanon, Lithuania, Morocco, Oman, Romania, Saudi Arabia, Syria, Turkey, United Arab Emirates, Vietnam, and former Yugoslavia countries. A few captive animals were exported from Georgia to Yugoslavia and then re-exported to Malta. According to CITES statistics, at least 92 individuals were removed from the Black Sea region within 1990-1999 period (Reeves *et al.,* 2003).

At present, incidental catch in fishing gear is probably the major threat to *T. t. ponticus,* although these animals have never been the predominant species in national bycatch statistics, and their share in cetacean bycatches recorded in Black Sea countries during the 1990s comes to 3% at the most (Birkun, 2002c). Absolute numbers of the population losses caused by fisheries were not estimated; however, it was supposed that at least 200-300 individuals are taken annually as bycatch in Turkey (Öztürk, 1999). Bottlenose dolphins are known to be caught in a variety of fishing nets including bottom-set gillnets for turbot (*P. m. maeotica*), spiny dogfish (*S. acanthias*), sturgeons (*Acipenser spp.*) and sole (*Solea spp.*), purse seines for mullets (*Mugil* and *Lisa* spp.) and anchovy (*E. e. ponticus*), trammel and trap nets. Nevertheless, only bottom-set gillnets pose a primary threat, especially, during the turbot fishing season, between April and June (BLASDOL, 1999).

Small-scale coastal fishery affects Black Sea bottenose dolphins also indirectly by depleting their prey populations. Declining trends have been observed in the abundance of indigenous mullets (*M. cephalus* and *Lisa* spp.) (Zaitsev and Mamaev, 1997). At the same time, the suspected deficiency of cetacean forage resources (Bushuyev, 2000) might be compensated at least in part by the introduced far-east mullet, *L. haematocheila,* which became abundant in the northern Black Sea since 1990s (Zaitsev and Mamaev, 1997) and possibly caused the relocation of bottlenose groups with marked enhancement of their density in coastal waters off the Crimea coasts (see Section 10.4.3).

According to annual compilations of cetacean strandings in Crimea (Krivokhizhin and Birkun, 1999), there was a prominent peak of *T. t. ponticus* strandings in 1990 (20 dead animals, representing 44% of all bottlenose dolphin strandings reported from 1989-1996). The initial cause and magnitude of that spike in bottlenose dolphin mortality remains unclear, although severe purulent pneumonia was revealed in many cases. The multi-microbial pollution originated from untreated sewage contaminating coastal waters constitutes a permanent risk of opportunistic bacterial infections in both the bottlenose dolphin and harbour porpoise populations. Besides, there are certain evidences that bottlenose dolphins as well as other Black Sea cetaceans are exposed to morbillivirus infection (Birkun, 2002e). Another ongoing threat (as a potential source of exotic infections and genetic "pollution") is represented by poorly managed intentional releases and spontaneous escapes of captive bottlenose dolphins and other marine mammals from coastal dolphinaria/oceanaria. The releases of two Black Sea bottlenose dolphins returned to the Black Sea after their long-term residence in the Red Sea environment happened in 1996 and 2004 (Veit *et al.,* 1997; ACCOBAMS/SC, 2005).

The further information on major threats impacting *T. t. ponticus* is shown in Table 10.6.

10.4.7. Population trend

The population size of Black Sea bottlenose dolphins was reduced due to the direct kills by some tens of thousands when the total ban on dolphin fishery has been attained in the Black Sea region in 1983 (see Section 10.4.7). It could be suspected that the population had a tendency to increase during the subsequent period (1983-2006) but still did not recover adequately because of several mass mortality events occurred not long ago, and some persistent anthropogenic influences which show growing trend at present and, most likely, will represent major threats provoking the population decline in the future.

10.5. Conservation tools and strategies

Commercial dolphin fishery was banned in 1966 in the former USSR (present Georgia, Russia and Ukraine), Bulgaria and Romania, and in 1983 in Turkey. Since then a number of substantial improvements of national and international legislation were undertaken in order to protect the Black Sea ecosystem, biodiversity and the cetacean populations, in particular.

10.5.1. National instruments

On national level, Black Sea cetaceans are protected by environmental laws, governmental decrees and national Red Data Books. The bottlenose dolphin is listed in the Red Data Books in Bulgaria, Georgia, Russia and Ukraine, the harbour porpoise - in Bulgaria, Russia and Ukraine, and the common dolphin - in Ukraine only. All these national Red Data Books do not use the IUCN scale of categories and criteria, but implies that the species should be monitored and managed by appropriate state/national programs in Russia and Ukraine. Such a program exists in Ukraine since 1999 ("Delfin"-program adopted by the Ministry of Environment). National action plans for the conservation of Black Sea cetaceans were produced in Ukraine (2001) and Romania (2003) but they still have no legal effect.

1. Dunaysky (Ukrainian Danube Delta) Biosphere Reserve; 2. Odessa Center of the Southern Research Institute of Marine Fisheries and Oceanography; 3. Odessa Branch of the Institute of Biology of Southern Seas; 4. Chornomorsky (Black Sea) Biosphere Reserve; 5. Lebedyni Ostrovy (Swan Isles) Branch of the Crimea Nature Reserve; 6. "TDC Nazaret" Ltd.; 10. Brema Laboratory; 10. "Biological Station" PE; 10. NGO "Oasis"; 10. "Gamma" PE; 11. "Livadia Dolphinarium" JE; 12. Cape Martyan Nature Reserve; 13. Karadag Nature Reserve; 14. Opuk Nature Reserve; 15. Southern Research Institute of Marine Fisheries and Oceanography; 16. Kazantip Nature Reserve; 110. Azov and Sivash National Nature Park; 110. "Group for Scientific and Industrial Investigation" PE; 110. "Meotida" Landscape Park.

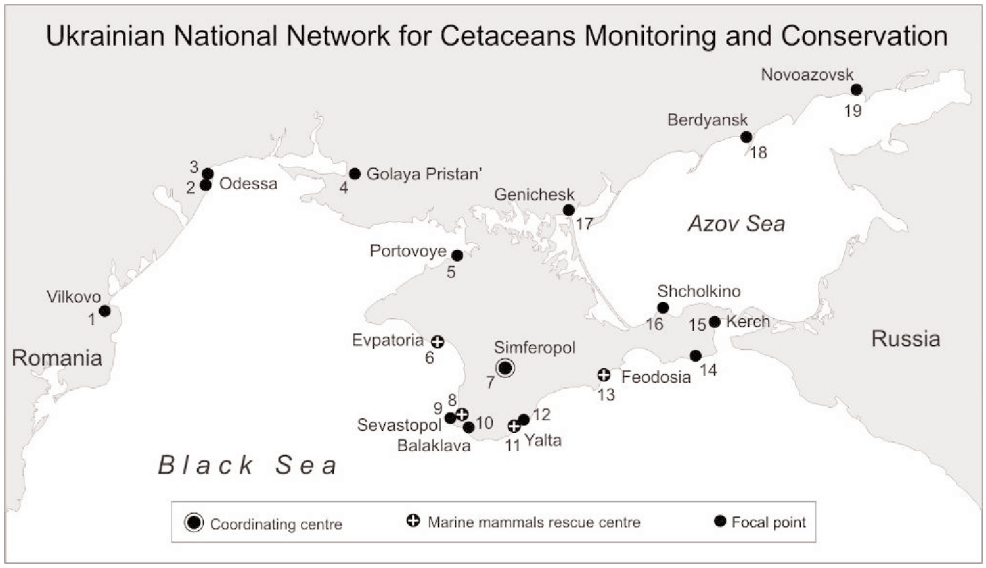

Fig. 10.1. Operational units of the Ukrainian National Network for Cetaceans Monitoring and Conservation (Birkun, 2006b).

Coastal and marine protected areas (PAs) are generally recognized as a primary tool for conservation of the marine environment and biodiversity (Hoyt, 2005). At present, over 60 protected areas and sites are established along the coastline of the Black Sea by the riparian states, and additional 40 areas were suggested for further development (Notarbartolo di Sciara and Birkun, 2002). Some of them contain marine mammal

(cetacean and monk seal) habitats within their boundaries, and could thus serve for the monitoring and conservation of marine mammals if appropriate management objectives are set and the personnel is specifically trained. In this context, the most promising PAs are represented by existing biosphere reserves, nature reserves and national parks which have relatively well-developed infrastructure and research capabilities. The Romanian Danube Delta Biosphere Reserve and Vama-Veche - 2 Mai Marine Reserve are already involved in cetacean monitoring and conservation in Romania.

In 2003-2005, nine coastal protected areas joined the Ukrainian National Network for Cetaceans Conservation, informal fellowship consisting of 19 institutions (operational units) situated in 17 localities along the seaboard of Ukraine (Fig. 10.1). Those protected areas are (from west to east): the Dunaisky [Danube] Biosphere Reserve, Chornomorsky [Black Sea] Biosphere Reserve, Lebedyni Ostrovy [Swan Islands] Branch of the Crimean Nature Reserve, Cape Martyan Nature Reserve, Karadag Nature Reserve, Opuk Nature Reserve, Kazantip Nature Reserve, Azov and Sivash National Nature Park, and Meotida Landscape Park (the latter three PAs are situated in coastal zone of the Azov Sea, while the other six PAs relate to the Black Sea coasts and waters). The inventory of cetacean habitats has been completed and common methodology for cetacean monitoring was introduced in these Ukrainian PAs in 2005. Other Black Sea countries so far do not follow this initiative.

10.5.2. International and regional instruments

The riparian states assumed international obligations to protect Black Sea cetaceans as the contracting parties of the ACCOBAMS, the Convention on Biological Diversity (CBD), the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the Convention on the Conservation of European Wildlife and Natural Habitats (Berne Convention), the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, Appendix II). The harbour porpoise (*P. phocoena*) and bottlenose dolphin (*T. truncatus*) are mentioned in Annex II and the common dolphin (*D. delphis*) is listed in Annex IV of the EC Directive No.92/43/EEC on the conservation of natural habitats of wild fauna and flora. All these instruments should contribute to Black Sea cetacean conservation, especially, the ACCOBAMS and Bucharest Convention.

In 1996, the Ministers of Environment of Black Sea countries adopted some cetacean conservation and research measures in frames of the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (paragraph 62). In 1999, all three species were included as "Data Deficient" (DD) in the regional Black Sea Red Data Book. However, in 2002 they were re-listed as "Endangered" (EN) in the Provisional List of Species of the Black Sea Importance, an annex to the Black Sea Biodiversity and Landscape Conservation Protocol of the Bucharest Convention.

The Berne Convention's Recommendation No.86 (2001) and Resolution 1.12, adopted by the 1st Meeting of the Parties of ACCOBAMS (Monaco, 2002), are intended to strengthen prohibition measures for deliberate catch, keeping and trade of Black Sea bottlenose dolphins. At the 12th Conference of the Parties to CITES (Santiago,

2002), a quota of zero for mercantile export of live bottlenose dolphins wild-captured in the Black Sea has been secured. This measure prohibits transboundary transport of captive Black Sea bottlenose dolphins for "primarily commercial purposes".

The ACCOBAMS Implementation Priorities for 2002-2006 (Notarbartolo di Sciara, 2002) envisage the development of a pilot conservation and management project in the well defined area between Cape Sarych and Cape Khersones, southern Crimea (Ukraine; see Sections 6.4.3 and 6.4.4), for the purpose to establish a marine protected area specialized in conservation of bottlenose dolphins and harbour porpoises. The 1st Meeting of the ACCOBAMS Scientific Committee (Tunis, 2002) recommended that more areas be investigated for identification of critical habitats. Particular concern was expressed by the same meeting in view of large and potentially unsustainable bycatches of harbour porpoises in bottom-set gillnet fisheries throughout the Black Sea shelf area. It was concluded (Recommendation 1.2) that the conservation status of these animals would be greatly improved if existing fisheries regulations restricting fishing effort and the use of certain gear types is enforced.

The Sub-Committee on Small Cetaceans of the IWC Scientific Committee (Berlin, 2003) reviewed the status of Black Sea cetaceans in details and concluded that these populations of harbour porpoises, common dolphins and bottlenose dolphins, which are almost completely isolated from their conspecifics in the northeastern Atlantic and Mediterranean Sea, should be considered as the separate and discrete units for conservation purposes (IWC, 2004). At the same time, it turned out impossible to evaluate fully the status of Black Sea cetaceans due to a lack of basic information. In this respect, the Sub-Committee strongly recommended to improve the conservation-related cetacean research in the region by means of developing the region-wide (a) line-transect surveys, (b) photo-identification programme, (c) genetic analyses of population structure, (d) studies on cetacean life history, (e) comprehensive assessments of man-made threats including the incidental captures in fishing activities, disturbance caused by marine traffic, and past cetacean losses due to the directed catches.

A tentative list of cetacean research and conservation projects implemented in the Black Sea region in 2002-2006 is shown in Appendix A.

The 4th Meeting of the ACCOBAMS Scientific Committee (Monaco, 2006) devoted special consideration to the ACCOBAMS Work Programme on Marine PAs. In particular, it was reminded that the 1st Meeting of the Parties to ACCOBAMS (Monaco, 2002) proposed for the development a pilot PA within inshore waters between Cape Sarych and Cape Khersones in the southern Crimea. In addition to this area the Scientific Committee recommended that the Parties give priority to assessing the value of creating marine PAs for the following additional three areas in the Black Sea and adjacent waters:

- maritime area from Cape Anaklia to Sarp (Georgia) - this represents winter habitat for harbour porpoises and common dolphins; in particular, there is a local problem with pelagic trawling for anchovy, which causes a dolphin bycatch;
- the Kerch Strait (Ukraine and Russia) - used by semi-resident Black Sea bottlenose dolphins and as a migration corridor for several thousand harbour porpoises moving to and from the Azov Sea; there is intensive marine traffic and coastal fisheries with bycatch in gillnets and live captures of bottlenose dolphins; and

the Turkish Strait System (Turkey) - used by all Black Sea cetacean species, including harbour porpoises which are present also in the Northern Aegean Sea.

10.5.3. The IUCN status

In 1996, Black Sea population of the harbour porpoise was included as "Vulnerable" (VU) in the IUCN Red List of Threatened Animals. The conservation status of Black Sea common dolphins and bottlenose dolphins is not evaluated by IUCN up to now, although global status, assigned to *D. delphis* and *T. truncatus,* is "Least Concern" (LC) and "Data Deficient" (DD), correspondingly.[2] At the same time, all three Black Sea cetacean populations are supported by the IUCN 2002-2010 Conservation Action Plan for the World's Cetaceans (Reeves *et al.,* 2003).

The 3rd Meeting of the ACCOBAMS Scientific Committee (Cairo, 2005) encouraged the initiative proposed by the Cetacean Specialist Group of the IUCN Species Survival Commission (IUCN/SSC/CSG) concerning the development of the IUCN Red List of Mediterranean and Black Sea cetaceans. As a result, the IUCN/ACCOBAMS Workshop on the Red List Assessment of Cetaceans in the ACCOBAMS Area (Monaco, March 2006) assessed the conservation status of Black Sea populations of the harbour porpoise, common dolphin and bottlenose dolphin as "Endangered" (EN) and confirmed their belonging to the Black Sea subspecies *P. p. relicta* Abel, 1905; *D. d. ponticus* Barabasch-Nikiforov, 1935; and *T. t. ponticus* Barabasch, 1940 (Reeves and Notarbartolo di Sciara, 2006). According to the IUCN Red List procedure, these assessments should be further reviewed by independent evaluators from IUCN/SSC/CSG and then submitted to IUCN/SSC for final consideration. Therefore, it may be expected that the new IUCN status of Black Sea cetaceans will be established in 2010. As interim measure, the results of the IUCN/ACCOBAMS Red List assessment of cetaceans in the Mediterranean and Black Seas (2006) were adopted by special resolution of the 3rd Meeting of Parties to ACCOBAMS (Dubrovnik, Croatia, 2007).

10.5.4. Conservation plan for Black Sea cetaceans

The development of regional activities on cetacean research, monitoring and conservation demands to be well-designed and coordinated. The regional Conservation Plan for Black Sea Cetaceans (Birkun *et al.,* 2006a) has been drafted in accordance with the ACCOBAMS International Implementation Priorities for 2002-2006 (Notarbartolo di Sciara, 2002). This plan was considered and supported by participants of the Round Table on Conservation of Black Sea Cetaceans conducted within the 1st Scientific Conference of the Black Sea Commission (Istanbul, May 2006). The contracting parties to the ACCOBAMS had approved this plan at their 3rd Meeting (Dubrovnik, Croatia, 2007).

---

2 Since 2003, the neighbouring population of common dolphins in the Mediterranean Sea is included as "Endangered" (EN) in the IUCN Red List of Threatened Animals.

The Conservation Plan for Black Sea Cetaceans

- is prepared based on a strategy designed by ACCOBAMS and reflected in its Annex 2, the Conservation Plan;
- is intended to complement the existing ACCOBAMS Implementation Priorities for 2002-2006, and Priority #6 in the first place, addressing cetacean conservation, management and research in the Black Sea. It is fully corresponds to the ACCOBAMS Working Programme 2005-2007, Resolutions of the 1st and 2nd Meetings of the Paties to ACCOBAMS, Recommendations and decisions of the 1st, 2nd and 3rd Meetings of the ACCOBAMS Scientific Committee;
- is aimed to facilitate the co-operation among Black Sea riparian states and enhance their abilities essential for the conservation of cetaceans and their habitats;
- envisages common mechanisms aimed to promote cetacean conservation and research actions, as well as capacity building, education and public awareness in the Black Sea subregion under the co-ordination role of ACCOBAMS institutions including the Meeting of the Parties, Permanent Secretariat, Bureau, Scientific Committee and, last but not least, Black Sea Co-ordination Unit represented by the Permanent Secretariat of the Commission on the Protection of the Black Sea Against Pollution (the Black Sea Commission);
- expects that it will be adopted and promoted by all Black Sea countries, including those which are still not the Parties of ACCOBAMS, regardless of existing national differences in the available expertise, level of organization, scientific backgrounds and logistical constraints among areas;
- expects also that its implementation will derive adequate support from national, regional, European and global agencies, intended for nature protection and sustainable development, and thus, will be provided with various sources to fund collaborative projects focused on the Black Sea cetaceans conservation.

The principal goals of this plan are to provide a framework and priority actions whereby the Black Sea Community (scientists, fishermen, industry, NGOs, local and national governments, and appropriate intergovernmental organizations) can in the short-term (2006-2010) begin to practically improve the conservation status of Black Sea cetaceans, and in particular obtain the necessary scientific information to allow a full long-term conservation plan to be developed at the end of the period and effective management decisions to be made.

The principal objectives of the Conservation Plan for Black Sea Cetaceans wholly correspond with appropriate items of the ACCOBAMS Conservation Plan:

- consolidation of international and national legal system (Actions 1-4);
- assessment and management of human-cetacean interactions (Actions 5-10);
- habitat protection (Actions 11 and 12);
- research and monitoring (Actions 13-15);
- capacity building, collection and dissemination of information, training and education (Actions 16 and 17); and
- responses to emergency situations (Action 18).

All 18 actions proposed are important for the conservation of Black Sea cetaceans (Appendix B). The order of the actions follows above objectives (*i.e.* corresponds to a format of the ACCOBAMS Conservation Plan) and their numbering does not indicate priorities. These actions consist of 57 smaller actions or sub-actions (activities) which were prioritized according their significance (primary and secondary) in the relation to each other - some actions are clearly more urgent or definitely propaedeutic to others (Appendix C). Besides, some actions are already on the way of their implementation and that is also underlined in the descriptions. They are interactive between the various categories of actions and the actions within categories. In particular, the Research and Monitoring section is absolutely crucial to provide the necessary background to almost all of the other groups of actions. In its turn, the **Basic Cetacean Surveys** action is the most important within the Research and Monitoring category.

The implementation of the Conservation Plan for Black Sea Cetaceans is estimated for a five-year period since the plan is approved by the Black Sea states. This term seems to be realistic under the stipulation that proper planning, coordination and monitoring of the actions proposed is established and adequate methodological, financial and logistical support is provided. This, hopefully, can be ensured under auspices and supervision of the ACCOBAMS, Black Sea Commission and their institutions. Establishing a coordinator position could be helpful for the success of this plan. It may be expected that the plan will serve as a suitable tool for transboundary conservation and management of Black Sea cetacean populations, with an ultimate aim to ensure their survival and welfare in the nearest and remote future.

10.6. Conclusions

This chapter has briefly described the conservation status of Black Sea cetaceans with clear emphasis on specific activities which were launched, declared or drafted on the national, regional and international levels during last decade. Most these activities require more efficient management procedures established on regular basis within a framework of existing legal and institutional arrangements including such important multilateral instruments like the ACCOBAMS and the Bucharest Convention on the Protection of the Black Sea against Pollution, with particular regard to the observance of the Black Sea Biodiversity and Landscape Conservation Protocol.

To further improve the transboundary management of cetaceans-related protection issues, the Conservation Plan for Black Sea Cetaceans was prepared in 2006 by international team of experts acted under the auspices of the ACCOBAMS' and Black Sea Commission's permanent secretariats. This plan reveals major gaps in the knowledge concerning the populations of Black Sea dolphins and porpoises (*e.g.,* a lack of solid data on the abundance, population structure and threats), sets up relevant regional strategies, and recommends concrete research and conservation actions to fill up the gaps. It is anticipated that correct and concerted implementation of the plan by Black Sea riparian countries improves the conservation status of Black Sea cetaceans to substantial extent during next five years under the stipulation that adequate methodological, financial and logistical support is provided.

Four Black Sea states (Bulgaria, Georgia, Romania and Ukraine), being the contracting parties to ACCOBAMS, are already on the way to put into practice the Conservation

Plan owing to the fact that it was approved recently by the 3rd Meeting of the Parties to ACCOBAMS (Dubrovnik, Croatia, 2007). Two other Black Sea countries (the Russian Federation and Turkey) have the opportunity to join to implementation of the plan by force of signing the Strategic Action Programme on the Protection and Rehabilitation of the Black Sea. This new instrument of Black Sea regional importance, drafted by the Black Sea Commission, envisages the *ad hoc* management target on the adoption of the Conservation Plan for Black Sea Cetaceans by the six Black Sea countries without exception.

References

ACCOBAMS/SC. (2005) Report of the 3rd Meeting of the Scientific Committee (Cairo, 15-17 May 2005). ACCOBAMS, 28pp. (unpublished).

Amaha, A. (1994) Geographic variation of the common dolphin, Delphinus delphis (Odontoceti, Delphinidae). PhD thesis, Tokyo University of Fisheries, 211pp.

Amaha, A., Yel, M., Özdamar, E., Miyazaki, N. (1996) On the cranial morphology of Delphinus in the Black Sea. In: B. Öztürk (Ed.), Proceedings of the First International Symposium on the Marine Mammals of the Black Sea , pp. 73-74, Istanbul, Turkey, 27-30 Jun 1994. ACAR Matbaacilik A.Ş., Istanbul, 120pp.

Barabasch, I.I. (1935) Delphinus delphis ponticus subsp. n. Bull. Moskovskogo Obshchestva Ispytateley Prirody (Biol. Div.), 44 (5), 246-2410 (in Russian).

Barabasch-Nikiforov, I.I. (1960) Measurements and coloration of bottlenose dolphins (Tursiops truncatus Montagu) as the criterion for their subspecies differentiation. Nauch. Dokl. Vys. Shkoly, Biol. Sci., N1, 35-42, (in Russian).

Beaubrun, P.C. (1995) Atlas Préliminaire de Distribution des Cétacés de Méditerranée. CIESM & Musée Océanographique, Monaco, 87pp.

Bel'kovich, V.M. (1996) The population structure of three species of Black Sea dolphins as an adequate basis of their abundance estimation. In: B. Öztürk (Ed.), Proceedings of the First International Symposium on the Marine Mammals of the Black Sea, 27-30 Jun 1994, Istanbul, Turkey. ACAR Matbaacilik A.Ş., Istanbul, 120pp.

Bel'kovich, V.M. (2001). Orientation of Dolphins. Mechanisms and Models. Publ. House of the Bakulev Scientific Centre, Moscow, 240pp (in Russian).

Berkes, F. (1971) Turkish dolphin fisheries. Oryx, 14(2),163-1610.

Birkun A., Jr. (2002a) Direct killing and live capture: Black Sea. In: G. Notarbartolo di Sciara (Ed.), Cetaceans of the Mediterranean and Black Seas: State of knowledge and conservation strategies, pp.31-38, ACCOBAMS Secretariat, Monaco, 219pp.

Birkun, A., Jr. (2002b) Habitat loss and degradation: Black Sea. In: G. Notarbartolo di Sciara (Ed.), Cetaceans of the Mediterranean and Black Seas: State of knowledge and conservation strategies, pp. 60-77, ACCOBAMS Secretariat, Monaco, 219pp.

Birkun, A., Jr. (2002c) Interaction between cetaceans and fisheries: Black Sea. In: G. Notarbartolo di Sciara (Ed.), Cetaceans of the Mediterranean and Black Seas: State of knowledge and conservation strategies, pp. 98-107, ACCOBAMS Secretariat, Monaco, 219pp.

Birkun, A., Jr. (2002d) Disturbance: Black Sea. In: G. Notarbartolo di Sciara (Ed.), Cetaceans of the Mediterranean and Black Seas: State of knowledge and conservation strategies, pp. 161-166, ACCOBAMS Secretariat, Monaco, 219pp.

Birkun, A., Jr. (2002e) Natural mortality: Black Sea. In: G. Notarbartolo di Sciara (Ed.), Cetaceans of the Mediterranean and Black Seas: State of knowledge and conservation strategies, pp. 181-193, ACCOBAMS Secretariat, Monaco, 219pp.

Birkun, A., Jr. (2005) Bottom-set gillnet fisheries and harbour porpoises in the Black Sea: High-tech against cetaceans. FINS (the Newsletter of ACCOBAMS), 2(1), 10.

Birkun, A., Jr. (2006a) Cetaceans (Cetacea). In: Y.P. Zaitsev et al. (Eds.), The North-Western Black Sea: Biology and Ecology. Naukova Dumka, Kiev, 703pp (in Russian).

Birkun, A., Jr. (2006b) Consolidation of national network for ceaceans monitoring and conservation in Ukraine. FINS (the Newsletter of ACCOBAMS), 2(2), 14-110.

Birkun, A., Jr., Cañadas, A., Donovan, G., Holcer, D., Lauriano, G., Notarbartolo di Sciara, G., Panigada, S., Radu, G., van Klaveren, M.-C. (2006a) Conservation Plan for Black Sea Cetaceans. ACCOBAMS, Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area. 49pp. (unpublished).

Birkun A., Jr., Glazov D., Krivokhizhin S., Mukhametov L. (2002) Distribution and abundance of cetaceans in the Sea of Azov and Kerch Strait: Results of aerial survey (July 2001). P.73 In: Abstr. 16th Annual Conf. of the European Cetacean Society (Liege, 7-11 April 2002), 86pp.

Birkun, A., Jr., Glazov, D., Krivokhizhin, S., Nazarenko, E., Mukhametov, L. (2003) Species composition and abundance estimates of cetaceans in the Kerch Strait and adjacent areas of the Black and Azov Seas: The second series of aerial surveys (August 2002). In: Abstr. 17th Annual Conf. of the European Cetacean Society, pp.271-272, Las Palmas de Gran Canaria, 9-13 March 2003, 285pp.

Birkun, A.A., Jr., Krivokhizhin, S.V. (1996) Mammals of the Black Sea. Tavria, Simferopol, 96pp (in Russian).

Birkun, A., Jr., Krivokhizhin, S. (1991) Sudden ice formation - a cause of harbour porpoise (Phocoena phocoena) mass mortalities in the Sea of Azov. In: P.G.H. Evans, E.C.M. Parsons, and S.L. Clark (Eds.), European research on cetaceans - 11. Proc. 11th Annual Conf. European Cetacean Society, Stralsund, Germany, 10-12 March 1997, Pp. 275-277, ECS, Kiel, 314pp.

Birkun, A.A., Jr., Krivokhizhin, S.V., Glazov, D.M., Shpak, O.V., Zanin, A.V., Mukhametov, L.M. (2004a) Abundance estimates of cetaceans in coastal waters of the northern Black Sea: Results of boat surveys in August-October 2003. In: Marine Mammals of the Holarctic: Collection of Scientific Papers after the 3rd Internat. Conf., pp.64-68, Koktebel, Ukraine, 11-17 October 2004, Moscow, 609pp.

Birkun, A.A., Jr., Krivokhizhin, S.V., Gridin, V.Y., Zhbanov, A.V., Zanin, A.V., Masberg, I.V. (2004b) Strandings of neonate Black Sea harbour porpoises (Phocoena phocoena) as a probable consequence of the nursing females' death in fishing gear. In: Marine Mammals of the Holarctic: Collection of Scientific Papers after the 3rd Internat. Conf., pp. 59-64, Koktebel, Ukraine, 11-17 October 2004, Moscow, 609pp.

Birkun, A., Jr., Krivokhizhin, S., Komakhidze, A., Mukhametov, L., Shpak, O., Goradze, I., Komakhidze, G., Kryukova A. (2006b) Wintering concentration of Black Sea cetaceans off the Crimean and Caucasian coasts. P.203 In: Abstr. 20th Annual Conf. of the European Cetacean Society (Gdynia, 2-7 April 2006). ECS, Gdynia, 244pp.

Birkun, A., Krivokhizhin, S., Kosova, K. (2004c) Bottlenose dolphin (Tursiops truncatus) became prevalent cetacean species in Black Sea coastal waters off the Crimea. P. 409 In: P.G.H. Evans and E. O'Boyle (Eds.), European research on cetaceans - 15 (Proc. 15th Annual Conf. European Cetacean Society, Rome, Italy, 6-10 May 2001). ECS, Kiel, 478pp.

Birkun, A., Jr., Krivokhizhin, S., Pavlov, V. (1997) New data on the existence of bottlenose dolphins in the Sea of Azov. In: P.G.H. Evans (Ed.), European Research on Cetaceans - 10. Proc. 10th Annual Conf. European Cetacean Society, pp.200-203, Lisbon, Portugal, 11-13 Mar 1996. ECS, Kiel, 334pp.

Birkun, A., Jr., Kuiken, T., Krivokhizhin, S., Haines, D.M., Osterhaus, A.D.M.E., van de Bildt, M.W., Joiris, C.R., Siebert, U. (1991) Epizootic of morbilliviral disease in common dolphins (Delphinus delphis ponticus) from the Black Sea. Vet. Rec., 144(4), 85-92.

Birkun A., Jr., Nikitina V., Krivokhizhin S., Demchenko V., Davidyuk, E. (1993) Organochlorine pesticides in the blubber of Black Sea cetaceans. Veterinaria (Moscow), N6, 50-52 (in Russian).

BLASDOL. (1991) Estimation of human impact on small cetaceans of the Black Sea and elaboration of appropriate conservation measures: Final report for EC Inco-Copernicus (contract No. ERBIC15CT960104). C.R. Joiris (Coord.), Free University of Brussels, Belgium; BREMA Laboratory, Ukraine; Justus Liebig University of Giessen, Germany; Institute of Fisheries, Bulgaria; and Institute of Marine Ecology and Fisheries, Georgia. Brussels, 113pp.

Buckland, S.T., Anderson, D.R., Burham, K.P., Laake, J.L. (1993) Distance sampling: Estimating abundance of biological populations. Chapman and Hall, New York-London, 446pp.

Buckland, S.T., Smith, T.D., Cattanach, K.L. (1992) Status of small cetacean populations in the Black Sea: Review of current information and suggestions for future research. Rep. int. Whal. Commn, 42, 513-516.

Bushuyev, S.G. (2000) Depletion of forage reserve as a factor limiting population size of Black Sea dolphins. In: Ecological Safety of Coastal and Shelf Areas and a Composite Utilization of Shelf Resources. Proc. Marine Hydrophysical Institute, Sevastopol, pp.437-452, (in Russian).

Bushuyev, S.G., Savusin, V.P. (2004) Observations of dolphins from fishing boats in the course of sprat trawling in the northwestern Black Sea. In: Marine Mammals of the Holarctic: Collection of Scientific Papers after the 3rd Internat. Conf., pp. 113-116, Koktebel, Ukraine, 11-17 October 2004. Moscow, 609pp.

Çelikkale, M.S., Karaçam, H., Düzgünes, E., Ünsal, S. and Durukanoglu, H.F. (1981) Size and distribution of dolphin populations in the Black Sea. Doga Turk. Zool. Derg., 13(3), 189-96 (in Turkish).

Danilevsky, N.N., Tyutyunnikov, V.P. (1961) Some data on the current state of dolphins stock in the Black Sea. Rybnoye Khozyaystvo, N11, 25-210 (in Russian).

Das, K., Holsbeek, L., Browning, J., Siebert, U., Birkun, A., Jr., Bouquegneau, J.-M. (2004) Trace metal and stable isotope measurements (13C and 15N) in the harbour porpoise Phocoena phocoena relicta from the Black Sea. Environmental Pollution, 131, 197-204.

Fontaine, M.C., Tolley, K.A., Ridoux, V., Jauniaux, T., Sequeira, M., Addink, M., Smeenk, C., Siebert, U., Birkun, A., López, A., Bouquegneau, J.M., Michaux, J.R. (2005) Phylogeography of harbour porpoise (Phocoena phocoena) in the southeastern North Atlantic and in the Black Sea explored by the analyses of nuclear and mitochondrial DNA. P.26 In: Abstr. 19th Annual Conf. of the European Cetacean Society (La Rochelle, 2-7 April 2005), 130pp.

Frantzis, A., Alexiadou, P., Paximadis, G., Politi, E., Gannier, A., Corsini-Foka, M. (2003) Current knowledge of the cetacean fauna of the Greek seas. J. Cetacean Res. Manage., 5(3), 219-232.

Frantzis, A., Gordon, J., Hassidis, G., Komnenou, A. (2001) The enigma of harbor porpoise presence in the Mediterranean Sea. Mar. Mammal Sci., 17(4), 937-943.

Geptner, V.G., Chapsky, K.K., Arsenyev, V.A., Sokolov, V.E. (1976) Mammals of the Soviet Union. Volume 2, Part 3: Pinnipeds and Toothed Whales. Vysshaya Shkola, Moscow, 718pp (in Russian).

Glazov, D.M, Zhulidov, A.V. (2001) Heavy metals, methyl-mercury and selenium in organs and tissues of two species of Black Sea dolphins (Tursiops truncatus, Phocoena phocoena). In: Abstr. 14th Bien. Conf. on Biology of Marine Mammals, pp. 83-84, Vancouver, Canada, 28 November - 3 December 2001.

Güçlüsoy, H., Kıraç, C.O., Veryeri, N.O., Savaş, Y. (2004) Status of the Mediterranean monk seal, Monachus monachus (Hermann, 1779), in the coastal waters of Turkey. E.U. Journal of Fisheries and Aquatic Sciences, 21(3-4), 201-210.

Hoyt, E. (2005) Marine Protected Areas for Whales, Dolphins and Porpoises: A World Handbook for Cetacean Habitat Conservation. Earthscan, London and Sterling, 492pp.

IWC. (1983) Report of the Sub-Committee on Small Cetaceans. Rep. Int. Whal. Commn., 33,152-170.

IWC. (1992) Report of the Sub-Committee on Small Cetaceans. Rep. Int. Whal. Commn., 42,178-234.

IWC. (2004) Report of the Sub-Committee on Small Cetaceans. J. Cetacean Res. Manage. 6(Suppl.), 315-334.

Joiris, C.R., Holsbeek, L., Bolba, D., Gascard, C., Stanev, T., Komakhidze, A., Baumgärtner, W., Birkun, A. (2001) Total and organic mercury in the Black Sea harbour porpoise Phocoena phocoena relicta. Mar. Pollut. Bull., 42(10), 905-911.

Kıraç, C., Savaş, Y. (1996) Status of the monk seal (Monachus monachus) in the neighbourhood of Ereğli, Black Sea coast of Turkey. Zoology in the Middle East (Mammalia), 12, 5-12.

Kleinenberg, S.E. (1936) The data on studying the nutrition of dolphins of the Black Sea. Bull. Moskovskogo Obshchestva Ispytateley Prirody (Biol. Div.), 45(5), 338-3410 (in Russian).

Kleinenberg, S.E. (19569 Mammals of the Black and Azov Seas: Research Experience for Biology and Hunting. USSR Acad. Science Publ. House, Moscow, 288pp (in Russian).

Kleinenberg, S.E., Klevezal' G.A. (1962) On the method of determining the age of toothed whales. Doklady AN SSSR, 145(2): 460-462 (in Russian).

Klinowska, M. (1991) Dolphins, Porpoises and Whales of the World. The IUCN Red Data Book. IUCN, Gland and Cambridge, 429pp.

Krivokhizhin, S.V., Birkun, A.A., Jr. (1991) Strandings of cetaceans along the coasts of Crimean peninsula in 1989-1996. In: P.G.H. Evans and E.C.M. Parsons (Eds.), European Research on Cetaceans - 12. Proc. 12th Annual Conf. European Cetacean Society, pp.59-62, Monaco, 20-24 Jan 1998. ECS, Valencia, 436pp.

Krivokhizhin, S.V., Birkun, A.A., Jr., Nessonova, J.V. (2000) Prey species of Black Sea cetaceans. P. 229 In: P.G.H. Evans, R. Pitt-Aiken and E. Rogan (Eds.), European research on cetaceans - 14 (Proc. 14th Annual Conf. European Cetacean Society, Cork, Ireland, 2-5 April 2000). ECS, Rome, 400pp.

Krivokhizhin, S., Birkun, A., Jr., Shpak, O., Mukhametov, L. (2006) "Offshore" harbour porpoises in the central Black Sea. P.210 In: Abstr. 20th Annual Conf. of the European Cetacean Society (Gdynia, 2-7 April 2006). ECS, Gdynia, 244pp.

Madhusree, B., Tanabe, S., Öztürk, A.A., Tatsukawa, R., Miyazaki, N., Özdamar, E., Aral, O., Samsun, O., Öztürk, B. (1991) Contamination by butyltin compounds in harbour porpoise (Phocoena phocoena) from the Black Sea. Fresenius J. Anal. Chem., 359: 244-2410.

Malm, E.N. (933)Dolphins of the Black Sea. Priroda (Nature), N2:31-310 (in Russian).

Malm, E.N. (131) ketches on biology of Black Sea dolphins. Priroda (Nature), No5: 55-71 (in Russian).

Meyer, A. (1794) Description of the Ochakov Lands. St. Peterburg. [Cited after: Kleinenberg, 1956] (in Russian).

Mikhalev, Y.A. (1996) Experience of the abundance estimation of the Black Sea dolphins based on the aerial survey. In: B. Öztürk (Ed.), Proceedings of the First International Symposium on the Marine Mammals of the Black Sea, pp. 77-78, Istanbul, Turkey, 27-30 June 1994, Istanbul, 120pp.

Mikhalev, Y.A. (2004a) The Black Sea bottlenose dolphin (Tursiops truncatus Montagu, 1821) distribution pattern according to aerial survey data. In: Marine Mammals of the Holarctic: Collection of Scientific Papers after the 3rd Internat. Conf., Pp. 397-402, Koktebel, Ukraine, 11-17 October 2004. Moscow, 609pp.

Mikhalev, Y.A. (2004b) Distribution peculiarities of harbour porpoises (Phocoena phocoena relicta Abel, 1905) in the Black Sea. In: Marine Mammals of the Holarctic: Collection of Scientific Papers after the 3rd Internat. Conf., pp. 403-407, Koktebel, Ukraine, 11-17 October 2004. Moscow, 609pp.

Mikhalev, Y.A., Savusin, V.P., Bushuyev, S.G. (2004) Associated connection between the accumulations of fishes and dolphins in the Black Sea according to the data of aerial surveys. In: Marine Mammals of the Holarctic: Collection of Scientific Papers after the 3rd Internat. Conf., pp. 393-397, Koktebel, Ukraine, 11-17 October 2004. Moscow, 609pp.

Mikhalev, Y.A., Savusin, V.P., Zelyonaya, F.E. (1971) On the numbers of Black Sea dolphins. In: Marine Mammals (Proc. 7th All-Union Conf. on Research, Conservation and Rational Use of Marine Mammals, pp. 226-227, Moscow, 1978 (in Russian).

Müller, G., Wünschmann, A., Baumgärtner, W., Birkun, A., Komakhidze, A., Stanev, T., Joiris, C.R. (2002) Immunohistological and serological investigations of morbillivirus infection in Black Sea harbour porpoises (Phocoena phocoena). Vet. Microbiol., 87(2): 183-190.

Natoli, A. (2004) Molecular ecology of bottlenose (Tursiops sp.) and common (Delphinus sp.) dolphins. PhD thesis, University of Durham, UK.

Natoli, A., Birkun, A., Aguilar, A., Lopez, A., Hoezel, A.R. (2005) Habitat structure and dispersal of male and female bottlenose dolphins (Tursiops truncatus). Proc. R. Soc. B, 272: 1217-1226.

Notarbartolo di Sciara, G. (2002) International Implementation Priorities for 2002-2006. In: Proc. 1st Session of the Meeting of the Parties to ACCOBAMS, pp.51-62, Monaco, 28 February - 2 March 2002. ACCOBAMS Permanent Secretariat, Monaco, 124pp.

Notarbartolo di Sciara, G., Birkun, A., Jr. (2002) Conservation needs and strategies. In: G. Notarbartolo di Sciara (Ed.), Cetaceans of the Mediterranean and Black Seas: State of knowledge and conservation strategies, pp. 197-214, ACCOBAMS Secretariat, Monaco, 219pp.

Ozharovskaya, L.V. (1991) Reproduction of the Black Sea bottlenose dolphin. In: V.E. Sokolov and E.V. Romanenko (Eds.), The Black Sea Bottlenose Dolphin Tursiops truncatus ponticus: Morphology, Physiology, Acoustics, Hydrodynamics, pp.114-45, Nauka, Moscow, 672pp (in Russian).

Öztürk, B. (1992) The Mediterranean Monk Seal Monachus monachus. Anahtar Kitaplar Yayınevi, Istanbul, 215pp (in Turkish).

Öztürk, B., (1996) Past, present and future of the Mediterranean monk seal, Monachus monachus (Hermann, 1779) in the Black Sea. In: B. Öztürk (Ed.), Proceedings of the First International Symposium on the Marine Mammals of the Black Sea, pp. 96-101, Istanbul, Turkey, 27-30 June 1994. ACAR Matbaacilik A.Ş., Istanbul, 120pp.

Öztürk, B. (Comp.) (1991) Black Sea Biological Diversity: Turkey. UN Publ., New York, 144pp.

Öztürk, B., Öztürk, A.A. (1991) Preliminary study on dolphin occurrence in Turkish straits system. In: P.G.H. Evans, E.C.M. Parsons and S.L. Clark (Eds.), European research on cetaceans - 11. Proc. 11th Annual Conf. European Cetacean Society, pp. 79-82, Stralsund, Germany, 10-12 March 1997. ECS, Kiel, 314pp.

Perrin, W.F., Reilly, S.B. (1984) Reproductive parameters of dolphins and small whales of the family Delphinidae. Rep. Int. Whal. Commn., Sp. Issue 6: 97-133.

Prodanov, K., Mikhailov, K., Daskalov, G., Maxim, C., Chashchin, A., Arkhipov, A., Shlyakhov, V., Ozdamar, E. (1991) Environmental management of fish resources in the Black Sea and their rational exploitation. General Fisheries Council for the Mediterranean, Studies and Reviews, No. 68, FAO, Rome, 178pp.

Read, A.J. (1991) Harbour porpoise Phocoena phocoena (Linnaeus, 1758). In: S.H. Ridgway and R. Harrison (Eds.), Handbook of marine mammals. Vol. 6, 323-355,Academic Press, San Diego.

Reeves, R.R., Notarbartolo di Sciara, G. (2006) Report of the Red List Workshop on Black Sea and Mediterranean Sea Cetaceans (Monaco, 5-7 March 2006) (in press).

Reeves, R.R., Smith, B.D., Crespo, E., Notarbartolo di Sciara, G. (2003) Dolphins, Whales, and Porpoises: 2000-2010 Conservation Action Plan for the World's Cetaceans. IUCN, Gland, Switzerland, 139pp.

Rosel, P.E., Dizon, A.E., Haygood, M.G. (1995) Variability of the mitochondrial control region in populations of the harbour porpoise, Phocoena phocoena, on interoceanic and regional scales. Can. J. Fish. Aquat. Sci., 52(6): 1210-12110.

Rosel, P.E., Frantzis, A., Lockyer, C., Komnenou, A. (2003) Source of Aegean Sea harbour porpoises. Mar. Ecol. Prog. Ser., 247: 257-261.

Sal'nikov, N.E. (1961) Cetaceans (?etacea). In: K.A. Vinogradov (Ed.), Biology of the Northwest Part of the Black Sea, pp.235-240, Naukova Dumka, Kiev, 268pp (in Russian).

Silantyev, A.A. (1903) Black Sea Coast of the Caucasus in Agricultural and Commercial Respects. Issue 1. Dolphins Fishery off the Caucasian Coasts. Department of Agriculture, St. Peterburg, 61pp (in Russian).

Smith, T.D. (1982) Current understanding of the status of the porpoise populations in the Black Sea. Mammals in the Seas, Vol. 4, FAO Fisheries Series, 5(4): 121-130.

Sokolov, V.E. (1991) Overview of research on the Black Sea bottlenose dolphin. In: V.E. Sokolov and E.V. Romanenko (Eds.), The Black Sea Bottlenose Dolphin Tursiops truncatus ponticus: Morphology, Physiology, Acoustics, Hydrodynamics, pp.9-18, Nauka, Moscow, 672pp (in Russian).

Sokolov, V.E., Yaskin, V.A., Yukhov, V.L. (1990) Distribution and numbers of Black Sea dolphins. In: Proc. 5th Congr. of All-Union Teriological Soc., (Moscow, 1990), Vol. 3, 178-179 (in Russian).

Tanabe, S., Madhusree, B., Öztürk, A.A., Tatsukawa, R., Miyazaki, N., Özdamar, E., Aral, O., Samsun, O., Öztürk, B. (1997a) Persistent organochlorine residues in harbour porpoise (Phocoena phocoena) from the Black Sea. Mar. Pollut. Bull., 34(5): 338-3410.

Tanabe, S., Madhusree, B., Öztürk, A.A., Tatsukawa, R., Miyazaki, N., Özdamar, E., Aral, O., Samsun, O., Öztürk, B. (1997b) Isomer-specific analysis of polychlorinated biphenyls in harbour porpoise (Phocoena phocoena) from the Black Sea. Mar. Pollut. Bull., 34(9): 712-720.

Tarasevich, M.N. (1951) Nutrition of the common dolphin in the Black Sea during warm period. VNIRO Collected Articles, No3. [Cited after: Geptner et al., 1976] (in Russian).

Tomilin, A.G. (1951) Mammals of the USSR and Adjacent Countries. Vol. IV. Cetaceans. USSR Acad. Science Publ. House, Moscow, 717pp (in Russian).

Tonay, M.A., Öz, M.I. (1991) Stomach contents of harbour porpoises entangled in the fishing nets in the western Black Sea. In: Proc. Annual Conf. on Underwater Science and Technology (SBT'99 9, Turkey, 1999, pp. 92-98, (in Turkish).

Tzalkin, V.I. (1931) On the distribution of the common dolphin (D. delphis L.) in the Black Sea. Doklady AN SSSR (Reports of the USSR Academy of Science), 16(2): 133-135. (in Russian).

Tzalkin, V.I. (1931) Morphological characteristics, systematical status and zoogeographic significance of the harbour porpoise from the Azov and Black Seas. Zoologichesky Zhurnal, 17(4):706-733 (in Russian).

Tzalkin, V.I. (1940a) The data on biology of the Azov and Black Sea harbour porpoise (Phocaena phocaena relicta Abel). Zoologichesky Zhurnal, 19(1): 160-171 (in Russian).

Tzalkin, V.I. (1940b) Certain observations on biology of Azov and Black Sea dolphins. Bull. Moskovskogo Obshchestva Ispytateley Prirody (Biol. Div.), 49(1): 61-70 (in Russian).

Veit, F., Bojanowski, E., Todt, D., Zilber, R., Supin, A.Y., Mukhametov, L.M. (1991) Back to the Black: Release of a male bottlenose dolphin into the Black Sea after six years in a semi-free enclosure on the Red Sea. In: P.G.H. Evans, E.C.M. Parsons and S.L. Clark (Eds.), European Research on Cetaceans - 11. Proc. 11th Annual Conf. European Cetacean Society, pp.72-75. Stralsund, Germany, 10-12 March 1997. ECS, Kiel, 314pp.

Yaskin, V.A., Yukhov, V.L. (1991) The numbers and distribution of Black Sea bottlenose dolphins. In: V.E. Sokolov and E.V. Romanenko (Eds.), The Black Sea Bottlenose Dolphin Tursiops truncatus ponticus: Morphology, Physiology, Acoustics, Hydrodynamics, pp. 19-26, Nauka, Moscow, 672pp (in Russian).

Yukhov, V.L., Petukhov, A.G., Korkhov, A.I. (1986) Estimation of the abundance of Black Sea dolphins. Biologia Morya (Biology of the Sea), N6:64-610 (in Russian).

Zaitsev, Y., Mamaev, V. (1991) Marine Biological Diversity in the Black Sea: A Study of Change and Decline. United Nations Publ., New-York, 208 p.

Zatevakhin, I.I., Bel'kovich, V.M. (1996) The structure of the society of bottlenose dolphins of the Tarkhankut peninsula. In: B. Öztürk (Ed.), Proceedings of the First International Symposium on the Marine Mammals of the Black Sea, pp.72, Istanbul, Turkey, 27-30 Jun 1994. Istanbul, 120pp.

Zemsky, V.A. (1996) History of the Russian fishery of dolphins in the Black Sea. In: B. Öztürk (Ed.), Proceedings of the First International Symposium on the Marine Mammals of the Black Sea, pp.46-48, Istanbul, Turkey, 27-30 June 1994. ACAR Matbaacilik A.Ş., Istanbul, 120pp.

Zemsky, V.A., Yablokov, A.V. (1974) Catch statistics, short history of exploitation and present status of Delphinus delphis, Tursiops truncatus and Phocoena phocoena in the Black Sea. FAO/ACMRR Group II Meeting (La Jolla, USA, 16-19 December 1974).

Appendix A. Examples of cetacean research and conservation projects implemented in the Black Sea region in 2002-2006

Programme / Initiative	Project (title)	Implementing organizations	Year
Programme for Research, Conservation and Restoration of Marine Mammals in the Black and Azov Seas ('Delfin'-program approved by the Ministry of Ecology and Natural Resources of Ukraine, in August 1999)	Pathological conditions of Black Sea common dolphins	Brema Laboratory (Ukraine)	2001-2002
	Infectious diseases in captive Black Sea bottlenose dolphins	Brema Laboratory (Ukraine)	2001-2002
	Workshop on conservation problems of Black Sea cetacean populations (Koktebel, 23-24 October 2002)	Brema Laboratory in co-operation with Crimean dolphinaria (Ukraine)	2002
	Preparation of three issues of the 'Black Sea Cetaceans' Information Base (CD-ROM)	Brema Laboratory (Ukraine)	2002, 2003, 2004
	Bacteriological aspect of Black Sea bottlenose dolphins adaptation to captivity	Brema Laboratory (Ukraine)	2002
	Feeding objects of Black Sea cetaceans and state of their forage reserves	Brema Laboratory (Ukraine)	2002
	Development of national network for the monitoring of Black Sea cetacean strandings and bycatches, formation of a system aimed to render assistance to sick and traumatized cetaceans in Ukraine, conversion of dolphinaria into centres for rescue and rehabilitation of marine mammals (MORECET)	Brema Laboratory, Biological Station PE, Livadia Dolphinarium JE, Karadag Nature Reserve and Nazareth Ltd (Ukraine)	2002-2006
	Pathological conditions of wild Black Sea harbour porpoises	Brema Laboratory (Ukraine)	2003
	Preparation of draft regulations on conservation-related activities of dolphinaria	Brema Laboratory (Ukraine)	2003
	Assessment of the state of Black/Azov Sea marine mammal populations listed in the Red Data Book	Brema Laboratory in co-operation with the Ukrainian Danube Delta Biosphere Reserve, Odessa Center of the Southern Research Institute of Marine Fisheries and Oceanography, Odessa Branch of the Institute of Biology of Southern Seas, Chornomorsky [Black Sea] Biosphere Reserve, Lebedyni Ostrovy [Swan Islands] Branch of the Crimean Nature Reserve, Cape Martyan Nature Reserve, Karadag Nature Reserve, Opuk Nature Reserve and Kazantip Nature Reserve (Ukraine).	2003

Programme / Initiative	Project (title)	Implementing organizations	Year
	Workshop on conservation problems of Black Sea cetacean populations (Kiev, 25 May 2004)	Ministry of Environment of Ukraine in co-operation with members of national network for monitoring of cetaceans (Ukraine)	2004
EU LIFE-NATURE Program	Conservation of the dolphins from the Romanian Black Sea waters	Grigore Antipa National Institute for Marine Research and Development, Mare Nostrum NGO, Museum Complex for Nature Sciences in Constantsa (Romania)	2001-2004
Joint initiative supported by the ACCOBAMS Secretariat	Genetic study of Black Sea bottlenose dolphins	University of Durham (UK) in co-operation with Brema Laboratory (Ukraine)	2002
Joint initiatives supported by the Ministry of Environmental Protection of Ukraine and Russian Academy of Science	Aerial survey of distribution, abundance and species composition of cetaceans in the Azov Sea (Azovka-2001).	Brema Laboratory (Ukraine) and Institute of Ecology and Evolution (Russia)	2001-2002
	Aerial survey of distribution, abundance and species composition of cetaceans in the Russian and Ukrainian waters of the Black and Azov Seas (Azovka-2002)	Brema Laboratory (Ukraine) and Institute of Ecology and Evolution (Russia)	2002-2003
	Study of accumulations, migrations and habitats of the Black Sea bottlenose dolphin in coastal waters of Russia and Ukraine (Afalina-2003)	Institute of Ecology and Evolution (Russia), Brema Laboratory and Karadag Nature Reserve (Ukraine)	2003-2004
	Distribution, abundance and photo-identification of cetaceans in the northwestern shelf waters of the Black Sea (Afalina-2004)	Institute of Ecology and Evolution (Russia), Brema Laboratory and Karadag Nature Reserve (Ukraine)	2004-2005
	Distribution and abundance of cetaceans in offshore waters of the central Black Sea (Belobochka-2005)	Brema Laboratory (Ukraine) and Institute of Ecology and Evolution (Russia)	2005
Joint Georgian, Ukrainian and Russian initiative	Assessment of cetacean distribution and abundance in coastal waters of the southeastern Black Sea (Afalina-2005)	Brema Laboratory (Ukraine), Marine Ecology and Fisheries Research Institute (Georgia) and Institute of Ecology and Evolution (Russia)	2005
EUROPHLUKES	Photo-identification of Black Sea cetaceans (Black Sea Fins)	Brema Laboratory (Ukraine) and Institute of Ecology and Evolution (Russia) with initiating support derived from the Permanent Secretariat of ACCOBAMS, and the training provided by Tethys Research Institute (Italy)	2003-2004
Small Environmental Projects Scheme (SEPS II) supported by the UK's Department for Environment, Food and Rural Affairs and managed by the British Council-Ukraine	Improvement of the Ukrainian National Network for Cetaceans Monitoring and Conservation (NNCC-project)	Brema Laboratory in partnership with the Ukrainian Danube Delta Biosphere Reserve, Odessa Center of the Southern Research Institute of Marine Fisheries and Oceanography, Odessa Branch of the Institute of Biology of Southern Seas, Chornomorsky [Black Sea] Biosphere Reserve, 'Oasis' NGO, Cape Martyan Nature Reserve, and Karadag Nature Reserve (Ukraine)	2004-2005

Appendix B. Conservation Plan for Black Sea Cetaceans: aims of actions proposed

Actions		Aims
1	Broadening the ACCOBAMS scope	Achieve that all six Black Sea riparian states are the Contracting Parties to ACCOBAMS; disseminate the ACCOBAMS process in the countries which have indirect outlet to the Black Sea through the rivers and exert their influence on the Black Sea environment and biota (including cetaceans) by means of fluvial discharges and marine-riverine traffic.
2	Proper conservation status of cetacean populations	Ensure that Black Sea cetacean species - the harbour porpoise, the short-beaked common dolphin and the common bottlenose dolphin - are properly classified in the international documents aimed to protect the Black Sea environment, ecosystems, living resources and biodiversity.
3	Cetacean conservation approach in fishery regulations	Ensure that Black Sea intergovernmental agreements and national regulations, purposed to manage Black Sea living resources and their exploitation, include items concerned in the conservation of cetaceans
4	Improvement and harmonization of national legislation	Ensure that in the Black Sea states their laws intended to regulate conservation activities, sustainable use and management of marine environment and resources are brought in accordance with international legislation standards related to cetacean conservation.
5	Retrospective analysis of human-induced cetacean mortality	Investigate the feasibility of obtaining meaningful estimates of human-induced cetacean mortality over the 20th century with the view of historical reconstruction of the 'initial' population sizes and, thereby, more clear evaluation of present status and trends of Black Sea cetacean populations.
6	Strategy for reducing cetacean bycatches	Develop a system of concordant measures able to decrease cetacean mortality in fishing gear at least to sustainable levels, with ultimate long-term goal of reducing it to zero if possible.
7	Mitigation of conflicts between cetaceans and fishery	Address the problem of adverse cetacean/fisheries interactions (other than bycatches) and develop measures for this problem solution.
8	Elimination of live capture of Black Sea cetaceans	Restrain intentional removal of live cetaceans from the wild.
9	Mitigation of disturbance caused by shipping	Address the problem of adverse impact of heavy marine traffic on Black Sea cetacean populations and develop appropriate conservation/management measures.
10	Management of threats from gas-and-oil producing industry	Address the problem of potential threats to cetaceans from gas and oil industry operating at sea, and develop pertinent management measures.
11	Network of existing protected areas eligible for cetaceans	Develop regional network of already operating protected areas containing cetacean habitats within their boundaries, taking into account the ACCOBAMS 2010 targets and the ACCOBAMS Criteria for Protected Areas of Importance for Cetacean Conservation.
12	Special marine protected areas for cetacean conservation	Set up particular cetacean protection modes in well- defined key areas containing cetacean habitats which are vitally important, first of all, for harbour porpoises and bottlenose dolphins, taking into account the ACCOBAMS 2010 targets and the ACCOBAMS Criteria for Protected Areas of Importance for Cetacean Conservation.
13	Basic cetacean surveys	Obtain and periodically refresh reliable basin-wide information on cetacean abundance and distribution.
14	Cetacean photo-identification programme	Consolidation of cetacean photo-identification studies in order to provide information on population structure, seasonal movements and ranging patterns of Black Sea cetaceans, mostly, bottlenose dolphins and common dolphins.
15	Regional cetacean stranding net work	Basin-wide systematic study of cetacean strandings in order to monitor mortality levels in cetacean populations, and to provide samples for research of cetacean genetics, life history, ecology, pathology, parasitology, ecotoxicology, etc.
16	Strategies for capacity building and raising awareness	Develop long-term capacity building and public awareness strategies in order to provide explicit improvement of cetacean research, conservation and management in the Black Sea region on basis of consolidated educational activities.
17	Access to information and cetacean libraries	Provide unimpeded access to the results of cetacean research and conservation activities implemented in the Black Sea region and beyond; accumulate, systematize, store and make available relevant published information by means of proper data carriers.
18	Measures for responding to emergency situations	Develop regional strategy, guidelines and operational network able to provide urgent and competent assistance to Black Sea cetaceans involved in emergencies.

Appendix C. Conservation Plan for Black Sea Cetaceans: actions and activities of high priority
URG **- activities addressed as a matter of urgency** (Istanbul Round Table, May 2006)

Actions		**Activities (sub-actions)**
1	Broadening the ACCOBAMS scope	(a) promotion of accession of the Russian Federation and Turkey to ACCOBAMS
2	Proper conservation status of cetacean populations	(a) proper listing Black Sea cetaceans in the IUCN Red List of Threatened Animals (b) providing correct references to the IUCN status of Black Sea cetaceans in relevant international instruments
3	Cetacean conservation approach in fishery regulations	(a) adopting the Black Sea legally binding document for fisheries and conservation of marine living resources
4	Improvement and harmonization of national legislation	(a) improvement of national legislation in respect of international requirements on the conservation of cetaceans
6	Strategy for reducing cetacean bycatches	(a) establishment of a regional bycatch network URG (b) estimation of bycatch levels and temporal and geographical distribution of bycatches (c) evaluation of sustainable bycatch levels for each cetacean species (d) investigation of effects causing by mitigation measures includig pingers and acoustically reflective nets (f) developing management objectives for reducing bycatches in the Black Sea region
8	Elimination of live capture of Black Sea cetaceans	(a) improvement of control assigned to eliminate live capture of cetaceans (b) preparation and adoption of national legal acts banning any intentonal capture of Black Sea cetaceans
11	Network of existing protected areas eligible for cetaceans	(a) assessment of existing protected areas with regard to their relevance to cetacean conservation (b) developing the regional network of eligible protected areas URG (c) preparation of the network's cetaceans-oriented strategy, action plan and guidelines (d) protected areas involved in the network should restrain human activities potentially harmful for cetaceans
12	Special marine protected areas for cetacean conservation	(a) developing management plans and creating ad hoc marine protection areas in the defined localities
13	Basic cetacean surveys	(a) carrying out region-wide survey and assessment of cetacean abundance, distribution and hot spots URG (b) carrying out cetacean survey in the Turkish Straits System
15	Regional cetacean stranding net work	(a) developing the existing national CSNs with their functional fusion into the basin-wide network URG (b) developing a Black Sea regional database of cetacean strandings (c) establishing cetacean tissue bank(s) accumulating samples from stranded and bycaught cetaceans (d) multidisciplinary study of samples collected from stranded and bycaught animals
18	Measures for responding to emergency situations	(a) assessment of emergency situations demanding special response (e.g. rescue-and-release operations) (b) developing guidelines on how to respond to emergency situations affecting Black Sea cetaceans (c) developing regional strategy (contingency plan) and national teams for responding to emergency situations