

Towards a Conservation Plan for common bottlenose dolphins in the Mediterranean Sea

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INTRODUCTION

A Conservation Plan delineates reasonable actions necessary to protect a depleted species. This draft Conservation Plan for common bottlenose dolphins (*Tursiops truncatus*; hereafter "bottlenose dolphins") is intended as a first step towards the design of a comprehensive Plan for the protection of the species.

No information has been included here on the level of effort that should be invested in any of the aspects of the programme, or on the related costs, as this is an exercise that should be done in the context of the final Conservation Plan.

Emphasis has been placed on those approaches that carry no risk to the animals and that can be predicted to yield useful results with some certainty. In addition, there is more focus on those actions that can effectively be developed in the region by taking advantage of the existing expertise.

Most of the actions listed here are likely to benefit not only bottlenose dolphins, but also other cetacean species living in Mediterranean coastal waters, particularly the endangered short-beaked common dolphins (*Delphinus delphis*). It is recommended that those actions which can benefit both bottlenose and common dolphins be developed and implemented together.

This draft Conservation Plan may be subject to modifications as dictated by input from ACCOBAMS Scientific Committee members and other experts, new findings, changes in species status and completion of implementation tasks.

A NOTE ON IMPERFECT KNOWLEDGE

No comprehensive effort has ever been made to summarize the presently-available information on the ecology, status and conservation of Mediterranean bottlenose dolphins at a basin-wide scale. As a consequence, prioritizing action aimed at the protection of this population is a difficult task.

Most actions listed here are based on the threats highlighted by Notarbartolo di Sciara *et al.* (2002). These threats - including intentional and direct takes, prey depletion, contamination by xenobiotic compounds, accidental takes in fishery activities and disturbance - are based on both real and perceived impact on the Mediterranean population. It should be considered as a possibility that threats being more visible or easy to record are given more consideration than those having a higher impact but being subtle and difficult to record or relate to dolphin status. This draft Conservation Plan attempts to compensate for this bias by including actions aimed at the assessment of some potentially important but scarcely visible threats.

A major hindrance to determining the status of coastal dolphins in the Mediterranean is the fragmentary character of the literature, which is composed almost exclusively of so-called "grey literature", including unpublished reports, academic theses or dissertations, conference proceedings and other non-refereed publications. Although some of these studies are of high scientific quality and have been long running, only a small proportion of the relevant available data has been published in peer-reviewed scientific

journals. This situation makes it difficult to evaluate what is known even for many of the areas where focused research on the species has been carried out.

It is recommended that ACCOBAMS stimulates a comprehensive effort by a group of experts, aimed at reviewing the existing information (currently composed largely of grey literature) and at prioritizing research and conservation actions based on the best available knowledge. Such a review effort should include a list of science-based recommendations, and should indicate where the available data are sufficient to adopt management strategies without delay, or where information gaps should be filled by focused research. Whenever the available data are insufficient it is recommended that management be based on the precautionary principle and that imperfect information does not represent an excuse to delay action indefinitely.

A NOTE ON MARINE PROTECTED AREAS

The establishment of MPAs is one of the provisions of the ACCOBAMS Agreement. As far as bottlenose dolphins are concerned, the aim is to ensure that the proposed MPAs make conservation sense. In a marine environment such as the Mediterranean, where human impact is so pervasive, even though it is illegal to deliberately kill cetaceans, MPAs are needed to give the dolphins a greater protection and relief from human encroachment. At least in these areas, set aside for cetacean conservation, cetacean status considerations must have precedence over human activities.

Effective MPAs for cetacean conservation should be designed based on an understanding of cetacean movements and extent of critical habitat for the population. Bottlenose dolphin communities in the Mediterranean are good conservation targets for MPAs, as they are known to show very high levels of site fidelity (although some individuals may travel over long distances, e.g. see Dhermain *et al.*, 1999). This means that a properly designed network of MPAs may represent a solid strategy to protect these coastal and largely "resident" animals, as long as the creation of a few small MPAs is no excuse for forgetting other management goals within the wider region.

MPAs can provide an ideal framework to conduct robust scientific investigations and ecosystem studies, and combine them with socio-economic analyses and other management-oriented assessments. In MPAs for cetaceans dangerous fishing practices such as driftnets should be forbidden, and fishermen should not be allowed to use acoustics to exclude dolphins from their habitat. Due consideration should be given to the maintenance of prey mass and quality needed to sustain a population of cetaceans as large as we can possibly infer from our knowledge or hypothesis of pre-decline levels. Finally, disturbance should be monitored and maintained to the minimum.

Although the creation of MPA networks has been listed among the actions presented in this draft Conservation Plan, this clearly represents a management decision which stands on a higher level, because MPAs targeted to bottlenose dolphin conservation can (and should) incorporate in their management plans many of the actions proposed here. This does not mean that comprehensive sets of conservation actions can only be implemented within MPAs. Indeed, limiting management efforts within a few existing or planned MPAs would represent a conservation failure.

MANAGEMENT AND RESEARCH OBJECTIVES

The following management priorities are relevant to the conservation of bottlenose dolphins in the Mediterranean.

- Maintain the present levels of abundance and facilitate recovery by mitigating threats and preserving bottlenose dolphin habitats
- Attempt to restore population sizes to pristine, pre-decline levels, comparing present abundance with past abundance, based on a qualitative evaluation of the available information in the historical literature
- Ensure that sufficient gene flow is maintained across the Mediterranean basin, after an assessment is made of the degree of dispersal and isolation of the bottlenose dolphin communities living in the basin

- Identify areas where conflict with fisheries or other human-related impacts are particularly acute, and design local and basin-wide mitigation strategies aimed at reducing human-induced mortality and controlling excessive fishing that may directly or indirectly deplete dolphin prey
- Implement with urgency research and monitoring programmes providing scientific information which is essential to inform management, such as:
 - Investigate the present distribution and movements (e.g. inshore/offshore) of Mediterranean bottlenose dolphins, provide a rough estimate of the present abundance at the regional scale, and obtain precise estimates in key Mediterranean habitats
 - Investigate and rank the current threats in order of detrimental impact, both at a regional and local level
 - Support capacity building initiatives and facilitate access to information, particularly in the southern and eastern portions of the Mediterranean basin, to encourage the development of coastal dolphin studies in those areas.

PROPOSED ACTIONS

The 21 actions sketched below are divided into four broad categories: Management, Capacity building, Education & Awareness, Research & Monitoring. All categories are equally important and they will have to be addressed simultaneously.

Although this draft Conservation Plan has been presented as a series of separate actions, there is a clear need for integrating all this into a comprehensive management plan. In some cases, sets of different actions can be particularly effective if conducted in the context of a single effort. For instance, educating fishermen, promoting alternatives to fishing and reducing bycatch and intentional killings may be all sides of the same die. This would also include the monitoring of bycatch events to assess if the action brings positive results.

Many more actions could be listed, which may contribute directly or indirectly to Mediterranean bottlenose dolphin conservation. Here, only those being both feasible and expected to bring timely positive results have been chosen.

It is recognized that some of the actions outlined below are already underway. They were included here to highlight their importance and their need for continued support.

1. MANAGEMENT

ACTION 1.1.

INVESTIGATE OPERATIONAL INTERACTIONS WITH FISHERIES AND PROMOTE MEASURES TO REDUCE CONFLICT

Rationale/Background: Operational interactions between coastal dolphins and fisheries are known to give rise to acute conflict in some Mediterranean areas, where competition for resources (either real or perceived), depredation of fishing gear and/or fishing gear damage often result in dolphin killings (Reeves *et al.*, 2001; Bearzi, 2002; Notarbartolo di Sciarra & Bearzi, 2002).

Recommended action: A workshop has been organized by ICRAM in 2001 specifically to address this problem, which has produced a series of recommendations (Reeves *et al.*, 2001; see Annex 2). Efforts by ACCOBAMS should be aimed at implementing those recommendations through the co-ordination of an expert group committed with the development of appropriate strategies. Data on operational interactions collected by means of fishermen interviews should be designed in a way that allows biased perceptions and/or harsh feelings to be taken into account (Bearzi, 2002). The "commensal" relationship between the

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biologist and the fishermen represents yet another important bias in fishery research. For instance, it has been suggested that direct observations of depredation by marine mammals should not be conducted from fishing platforms, but only from independent platforms (Smith 1995). Research focusing on the animals should be conducted parallel to research focusing on the fisheries. Moreover, research should not only focus on the immediate area and season of harvesting, as this represents an especially constraining practice when considering the food web interactions with marine mammals, with their frequently large annual movements and behavioural flexibility. Finally, ecosystem components other than the abundance of commercially important prey should be considered, as improving our understanding of the dynamics of food web interactions is far more important than investigating consumption rates (Smith 1995).

ACTION 1.2.

INVESTIGATE THE IMPACT OF BYCATCH AND ENACT MITIGATION STRATEGIES

Rationale/Background: Fishery bycatch is considered as a major threat to many cetacean populations and it is known to represent a source of mortality for bottlenose dolphins in several portions of the Mediterranean basin (IWC, 1994; Bearzi, 2002). So far, little has been accomplished to mitigate this problem.

Recommended action: Efforts by ACCOBAMS should be (and currently are) aimed at identifying areas or fisheries that are immediate problems in terms of depleting bottlenose dolphin groups, as compared with areas/fisheries where the incidence of entanglement of this species is known/likely to be low enough (or conversely, the dolphin abundance is high enough) as to make bycatch a relatively unimportant threat. Bycatch rates and dynamics should be assessed as precisely as possible in problem areas, in order to develop area-specific mitigation strategies. An effort is underway by ACCOBAMS to secure funds from the EC to achieve the tasks described here.

ACTION 1.3.

DESIGN A NETWORK OF MARINE PROTECTED AREAS TO PROTECT KEY COASTAL DOLPHINS HABITATS AND FACILITATE THE RECOVERY OF DOLPHIN PREY

Rationale/Background: MPAs represent effective means of mitigating some of the threats affecting coastal dolphins. Success depends on factors including appropriate management and the capacity to match critical habitat preferences with the boundaries of the MPA. MPAs may restore ecosystem functioning and benefit marine food webs by providing shelter to threatened marine species, thus contributing to the recovery of depleted dolphin prey (Agardy, 1997; Roberts *et al.*, 2001). MPAs are also amenable to the promotion of respectful dolphin-watching, which may allow ex-fishermen or part-time fishermen to increase their income with dolphins instead of fishing, and most importantly begin to involve them in the conservation process.

Recommended action: Protection to critical bottlenose dolphin habitats should be ensured by means of a network of MPAs designed to increase or safeguard habitat quality, reduce the chances of unintentional harm (e.g. bycatch), provide shelter and better habitat conditions for dolphin prey, reduce noise levels and direct disturbance, etc. As noted above, MPAs may incorporate in their management plans several of the actions proposed here.

ACTION 1.4.

PROMOTE ALTERNATIVES TO FISHING AND MEASURES TO REDUCE OVERFISHING

Rationale/Background: Overfishing is having a major impact on the Mediterranean ecosystems (e.g. see Briand, 2000) and the resulting food web changes are likely to represent one of the most important threats to coastal dolphins (Bearzi, 2002; Bearzi *et al.*, 2003; Bearzi & Notarbartolo di Sciara, 2003).

Recommended action: Manage fishing effort in key bottlenose dolphin habitats. Support the ongoing efforts by the EU to promote measures aimed at the conversion of the European Mediterranean fishing fleet and at reducing its impact on marine food webs; promote and support the extension of similar fishery policies to non-European riparian States. Responsible whale watching may be promoted in some areas - particularly in MPAs (see above) - as an economically-sound alternative to fishing. Support efforts

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to control or reduce the issuing of new fishing licences. Promote the adoption and implementation of the Pew Marine Conservation Fellows' Action Statement for Fisheries Conservation (see Annex 3).

ACTION 1.5.

MITIGATE THE IMPACT OF DOLPHIN WATCHING AND DISTURBANCE FROM PLEASURE BOATING

Rationale/Background: The impact of dolphin watching - either commercial or amateur - on bottlenose dolphins is controversial and only in a few cases clear detrimental effects have been recorded (IFAW, Tethys Research Institute & Europe Conservation, 1995). Still, intensive and unregulated dolphin watching activities may result in disruption of natural behaviour.

Recommended action: Identify critical habitats where bottlenose dolphins are likely to be negatively affected by intensive and unregulated dolphin watching activities. Promote public awareness and the adoption of voluntary codes of conduct to mitigate the impact of irresponsible dolphin watching and disturbance from pleasure boating (also see Action 3.1.). Provide information to the relevant authorities to promote mitigation measures. Implement the measures resulting from the discussion of ACCOBAMS Document SC2/Inf.1 (ACCOBAMS, 2003).

2. CAPACITY BUILDING¹

ACTION 2.1.

PROFESSIONAL TRAINING IN THE FIELD

Rationale/Background: Involving inexperienced dolphin researchers in professionally-run field research projects is a powerful way of promoting appropriate methods for data collection and developing collaboration networks. A hands-on approach is the most likely to produce lasting benefits, as information gathered through direct personal experience acquired in the field is unlikely to be forgotten or overlooked.

Recommended action: Involve students and researchers from the ACCOBAMS region in field training courses focusing on coastal dolphins, run by professional organizations working in the Mediterranean. Similar actions have been conducted by ACCOBAMS in 2002 and 2003, which have brought positive results. Training should be directed primarily at students and researchers from countries where access to information is difficult, and opportunities to get involved in dolphin research projects are scarce.

ACTION 2.2.

PROFESSIONAL TRAINING IN CETACEAN RESEARCH AND CONSERVATION

Rationale/Background: Opportunities to get professional training in dolphin research techniques and learn about cetacean conservation strategies are still scarce in the Mediterranean region. University courses on cetaceans are extremely rare, and good training opportunities are available only in a few countries. Consequently, many young scientists cannot rely on appropriate training for their professional growth, which prevents the development of cetacean research and conservation initiatives in large portions of the Agreement Area.

Recommended action: Promote and support University courses and other capacity building courses on cetacean conservation strategies and research techniques in the ACCOBAMS region.

¹ Rather than being exclusively targeted to bottlenose dolphins, the actions outlined here are expected to benefit the larger field of cetacean research. As such, they should be considered and treated as far-reaching conservation actions which can ultimately benefit several cetacean species.

ACTION 2.3.

FACILITATION OF ADVANCED DATA ANALYSIS AND PUBLICATION

Rationale/Background: Some researchers and postgraduate students have accumulated sizable datasets containing various field and laboratory data. Those data are often in need of accurate treatment and would benefit from analysis including modern approaches in applied statistics and mathematical modelling. However, expertise to perform such analyses is mostly very limited and concentrated in a few high-profile laboratories and Universities. As a consequence, the publication of results is often delayed indefinitely. In addition, language problems and/or limited scientific writing skills in English may contribute to hampering data publishing for many researchers working in portions of the ACCOBAMS region. This sometimes results in important datasets being accumulated but never becoming available to the larger scientific community. For researchers from several Mediterranean countries it is currently difficult to acquire the necessary expertise, owing to funding limitations and social, political or other constraints. This action aims at providing worthy Mediterranean researchers and students with follow-up and expert supervision to facilitate scientific data analysis and promote data publication.

Recommended action: Identify and promote ways of allowing selected individual scientists to get specific training and expert supervision for advanced analysis and statistical data treatment. The comprehensive analysis of valuable existing datasets assembled by several independent research groups over the last decade should be promoted and supported to improve our current understanding of bottlenose dolphins and other cetacean species. ACCOBAMS should ensure that dolphin data that are relevant for conservation purposes be given appropriate consideration, and that the process of data analysis and publishing be facilitated through appropriate mechanisms.

ACTION 2.4.

SUPPORT LITERATURE COLLECTIONS AND FACILITATE ACCESS TO SCIENTIFIC LITERATURE

Rationale/Background: As emphasised by the ACCOBAMS Implementation Priority Action #16, "one of the greatest hindrances to the region-wide development of a cetacean science tradition - a fundamental prerequisite to conservation and, ultimately, to the fulfilment of the purposes of the Agreement - is the diffused current unavailability of up-to-date specialised literature in most Range States' scientific and academic environments" (see Annex 1). Gaining access to scientific literature on cetaceans is still exceedingly difficult in most Mediterranean countries. Lack of access to appropriate documentation hinders learning and makes publication in refereed journals more difficult.

Recommended action: Facilitate access to the relevant literature throughout the ACCOBAMS region. First, existing collections of cetacean literature with focus on the Mediterranean should be supported. Second, exchange of literature should be facilitated by all means by providing specialized libraries with the necessary support to operate as a source of continuously updated information for researchers working in the Agreement Area. The systematic collection of scientific articles should be promoted and public access to library files ensured (e.g. by making available online as pdf files large collections of articles and by enabling keyword-based searches). This action may ultimately result in the creation of significant cetacean libraries throughout the Agreement range, which may serve as sources for local scientists and interested students.

3. EDUCATION & AWARENESS

ACTION 3.1.

PRODUCE EDUCATIONAL MATERIALS TO PROMOTE COASTAL DOLPHIN CONSERVATION

Rationale/Background: Even if appropriate legislation exists to protect marine mammals, in some Mediterranean areas it may be difficult to mitigate threats due to the present lack of education and public awareness. Long-term education campaigns on the need to protect cetaceans have brought positive results even in the absence of legislation or implementation. Such a "bottom-up" approach is highly desirable whenever legal ("top-down") initiatives do not suffice or wherever environmental public awareness is poor.

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Recommended action: Production of selected science-based, effective educational material to promote the conservation of coastal dolphins, either locally or at the Mediterranean level. Educational materials should be primarily aimed at complementing and supporting ACCOBAMS strategies and priority actions, and should have clear conservation (rather than self-promotion) goals.

ACTION 3.2.

WEB SITE ON MEDITERRANEAN BOTTLENOSE DOLPHINS

Rationale/Background: Internet access is now widespread in the Mediterranean region. This provides ACCOBAMS with an appropriate tool to facilitate access to information regarding ongoing initiatives aimed at bottlenose dolphin conservation. A dedicated web site would allow the dissemination of literature, scientific information and recommendations to the concerned public.

Recommended action: Design and management of a dedicated web site on Mediterranean bottlenose dolphins, with a focus on their conservation problems in the region. The site may include the final bottlenose dolphin Conservation Plan, a download section, feature articles, selected links, contact data and other information. This initiative is similar to the one developed for short-beaked common dolphins (see http://www.accobams.org/Delphinus_delphis/index.htm).

4. RESEARCH & MONITORING

ACTION 4.1.

LINKING CAUSES AND EFFECTS IN SELECTED STUDY AREAS: INVESTIGATE DOLPHIN-FISHERIES INTERACTIONS IN THE MEDITERRANEAN FROM AN ECOLOGICAL PERSPECTIVE

Rationale/Background: Elucidation of ecosystem dynamics, and specifically the possible role of prey depletion and regime shifts as factors contributing to the decline of coastal dolphins in the Mediterranean, is an important but challenging area of research. Investigations of the spatial and temporal variability in Mediterranean fish stocks, when correlated with dolphin abundance and movements, could be informative, as could output obtained from ecosystem models (e.g. Christensen & Pauly, 1992) and analyses of food-web dynamics. Longitudinal research in "natural laboratories" (*sensu* Wells, 1991) may allow to identify threats and assess their impact based on an understanding of ecosystem functioning and needs by the animals. The depletion of dolphin prey caused by overfishing, either directly or through the "fishing down" effect (Pauly *et al.*, 1998, 2002), is a major source of concern. The impact on cetaceans may be hidden and difficult to monitor owing to complex ecosystem dynamics (Bearzi, 2002). The understanding of predator-prey interactions and ecosystem functioning represents an essential conservation means, which may allow to evaluate the potential effects of food web interactions between marine mammals and man. Ecosystem modelling has been proposed in recent years as a viable tool for understanding the complex ecological interactions between cetaceans, fisheries and other ecosystem components (e.g., Smith, 1995; Earle, 1996). If given proper development and implementation, software tools such as "Ecopath-Ecosim" (Christensen & Pauly, 1992) may greatly benefit our understanding of ecosystem dynamics and the future management of coastal dolphin populations.

Recommended action: Promote and support focused investigations by expert research groups aimed at linking causes and effects in study areas representing ideal natural laboratories, to investigate ecosystem and dolphin population dynamics and assess the impact of fishing and habitat degradation. Priority should be given to research in study areas which represent good candidates to allow specific investigations on cause-effect relationships, and provide means of evaluating the effectiveness of measures to protect the animals. Promote the development and application of ecosystem modelling as a tool to explore the dynamics of selected ecosystems and assess the impact of the local fishing pressure on coastal dolphins. Studies should consider both the direct and indirect impacts of fishing (e.g. food-web changes, mechanical destruction of sea floor) on bottlenose dolphin communities. Important information on cetacean diet and nutritional conditions may be obtained from lipid and isotope studies performed on biopsy samples. For further recommendations see Bearzi & Notarbartolo di Sciarra (2003).

ACTION 4.2.

DESIGN AND CONDUCT SURVEYS AIMED AT ASSESSING AND COMPARING BOTTLENOSE DOLPHIN ABUNDANCE

Rationale/Background: At present, almost no information is available on bottlenose dolphin abundance and population parameters in the Mediterranean basin, and reliable abundance estimates have been obtained only in tiny portions of the basin. The present lack of quantitative information prevents to evaluate population status and trends, thus hampering conservation efforts. Field surveys are clearly needed to determine the current distribution and abundance of bottlenose dolphins in the Mediterranean, particularly off the entire North African coastline and in eastern Mediterranean areas where little quantitative information exists.

Recommended action: Surveys should be designed to identify hotspots of occurrence that can be accorded priority for intensive research and management. Standard methods such as vessel-based and/or aerial line transect surveys should be used so that results can be compared over time and from one region to another. Aerial surveys should be preferred to ship surveys whenever dolphin density is known (or expected) to be low. Line transect surveys should be designed to obtain low CV estimates in key bottlenose dolphin habitats, in a way that trends in abundance can be monitored. Abundance estimates in key areas should be repeated on a seasonal and/or annual basis to obtain information on yearly and seasonal habitat use, as well as on population dynamics and trends. In large areas where no information is available, surveys with comparatively looser transect grids may be conducted to obtain less precise abundance estimates, which would be still useful to gain insight into bottlenose dolphin numbers and habitat use.

ACTION 4.3.

ASSESS STOCK DISCRETENESS AND LEVELS OF GENE FLOW IN THE BASIN

Rationale/Background: The risks of local or regional extinction from stochastic processes can be reduced by preserving as much genetic diversity as possible (Shaffer, 1987; Lande, 1988). However, information on the genetic characteristics of Mediterranean bottlenose dolphins is still limited. From preliminary genetic studies carried out by Ada Natoli and colleagues at the University of Durham, U.K., bottlenose dolphins in the Mediterranean appear fragmented into small isolated populations, especially in enclosed waters such as the Adriatic Sea. Limited gene flow is observed between the eastern and western parts of the basin, but further investigations are needed to determine the degree of population differentiation and gene flow on a smaller geographic scale (A. Natoli, pers. comm.)

Recommended action: A better understanding is needed of the genetic characteristics of Mediterranean bottlenose dolphins. Promote the collection and analysis of tissue samples in those areas that have not been investigated so far, particularly in the southern Adriatic Sea, Tyrrhenian Sea, Sicily Channel, North African coasts, eastern Mediterranean, and in the areas adjacent to the Gibraltar Strait and to the Turkish Straits System. Increase the number of samples from those areas where only a few samples are available at the moment (Ionian Sea, northern Adriatic Sea). The collection of a minimum of 30 samples per sub-area is deemed appropriate to conduct genetic analyses aimed at investigating stock structure (A. Natoli, pers. comm.). Samples should be collected for genetic and other analyses from stranded and bycaught animals, or from free-ranging animals with minimal intrusiveness (e.g. by means of "scrub" sampling, a minimally intrusive technique to collect sloughing skin, Harlin *et al.*, 1999). Biopsy samples should be collected, stored and analyzed in the context of a pan-Mediterranean effort. International agreements and initiatives aimed to facilitate the import and export of samples should be considered.

ACTION 4.4.

PROMOTE THE MONITORING OF CETACEAN STRANDINGS AND THE COLLECTION OF BIOLOGICAL MATERIAL FROM STRANDED ANIMALS THROUGH CO-ORDINATED NETWORKS

Rationale/Background: The collection of information on stranded cetaceans obtained through co-ordinated stranding networks, together with inspections of dolphin carcasses and analyses of tissue samples allow to obtain essential information on cetacean species composition, pathologies, contaminant levels and the likely threats affecting the animals at sea. For instance, high levels of PCBs in Mediterranean dolphins, compared to levels in dolphins from other areas (Fossi *et al.*, 2003; Aguilar *et*

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al., 2002), represent a major concern, as toxic contaminants such as PCBs, that accumulate in dolphin tissues through food-chain biomagnification, are known to cause immune-suppression and reproductive impairment in mammals. Stranding networks are relatively well developed in some Mediterranean countries, but they are less developed or lacking in other countries. Therefore, the present situation makes it difficult to compare stranding data recorded across the region, or to evaluate information from cetacean tissue samples collected at a basin scale.

Recommended action: Cross-country collaboration should be facilitated and capacity building actions supported to encourage the development of stranding networks in countries where monitoring of cetacean strandings is lacking. In addition, the improvement of existing networks should be promoted. This will require effective communication and exchange of information at the regional level. Rigorous investigations should be conducted to assess the scale of bycatch and intentional killings, as well as ship collisions and other causes of mortality, based on evidence provided by stranding data. Pollutant levels in stranded/bycaught bottlenose dolphins should be monitored throughout the region. Analyses should be conducted to identify regional differences in exposure and relate contaminant levels to bottlenose dolphin status.

ACTION 4.5.

ASSESS THE IMPACT OF ACOUSTIC DETERRENT DEVICES (ADDs)²

Rationale/Background: Acoustic deterrent devices (ADDs) are becoming increasingly popular in many Mediterranean areas as a means to deter coastal dolphins (mostly bottlenose dolphins but also short-beaked common dolphins) from approaching and depredating fishing gear or catches (Reeves *et al.*, 2001). The short- and long-term impact of exposure to ADD sound, possibly resulting in permanent habitat loss, has never been investigated.

Recommended action: Identify problem areas and monitor changes in behaviour and habitat use by bottlenose dolphins, which may result from the presence of ADDs. Assess to what extent the widespread adoption of ADDs may result in temporary or permanent habitat loss for the dolphins, and investigate the occurrence of other detrimental impact on the animals. Conclusions and recommendations in the ICRAM workshop report on interactions between dolphins and fisheries in the Mediterranean (Reeves *et al.*, 2001, see Annex 2) should be taken into account.

ACTION 4.6.

ASSESS THE IMPACT OF HIGH INTENSITY NOISE, INCLUDING AIRGUNS, MILITARY SONARS, ILLEGAL FISHING WITH DYNAMITE AND MILITARY ARTILLERY EXERCISES IN BOTTLENOSE DOLPHIN CRITICAL HABITATS

Rationale/Background: Growing evidence exists that impulsive sounds can threaten cetaceans (e.g. Richardson *et al.*, 1995; Frantzis, 1998; Gisiner, 1998; Jasny, 1999; Jepson *et al.*, 2003). So far, little specific research has been conducted to monitor the potential impact of high-intensity noise on Mediterranean bottlenose dolphins, although their coastal distribution often overlaps with high-intensity noise sources.

Recommended action: Identify problem areas and assess the impact on coastal dolphins of high intensity noise. Determine whether impulsive noise affects bottlenose dolphin distribution and habitat use, and investigate other possible detrimental effects on the animals. The occurrence of impact on the animals which may be relatively subtle/hidden and therefore difficult to measure (e.g. behavioural disruption, stress etc.) should be evaluated carefully (Richardson & Würsig, 1995).

² See recommendations in the IUCN Project #49, pag. 78 in Reeves *et al.*, 2003 ("Develop and test approaches to reduce conflict between bottlenose dolphins and small-scale fisheries in the Mediterranean Sea").

ACTION 4.7.

PROMOTE COLLABORATIVE PHOTO-IDENTIFICATION STUDIES

Rationale/Background: Individual photo-identification from natural marks has been performed successfully on bottlenose dolphins since the 1970s (Würsig & Würsig, 1977). If studies are conducted over many years photo-identification datasets form the basis for longitudinal studies of birth and death, as well as range and habitat use. Collaborative photo-identification studies represent an effective way of investigating cetacean movements across areas. Recently, the EC funded Europhlukes programme (<http://www.europhlukes.net>) has been providing the necessary framework for the development of collaborations among researchers involved in cetacean photo-identification projects across Europe. However, this effort should be extended to non-European countries in the ACCOBAMS region.

Recommended action: Promote collaborative photo-identification studies aimed at investigating bottlenose dolphin population parameters, habitat use, the relationship between coastal and pelagic groups, and long-range movement patterns. In European countries much of this is expected to result from the Europhlukes project itself, as long as appropriate encouragement is given to cross-country collaborative projects. In non-European Mediterranean countries ACCOBAMS should promote the adoption of photo-identification methods through appropriate capacity building initiatives similar to those that are currently targeting the Black Sea (Bearzi, 2003; and see http://www.accobams.org/index_science.htm).

ACTION 4.8.

DEFINE THE STATE OF THE ART OF BOTTLENOSE DOLPHIN RESEARCH IN THE MEDITERRANEAN

Rationale/Background: In recent years Mediterranean field studies focusing on coastal bottlenose dolphin communities have proliferated, particularly off the northern coasts of the basin. Many research groups have assembled sizable datasets. However, only a portion of the resulting information has been made accessible to the scientific community at large, and peer-reviewed publications remain scarce. This is even more true for research conducted off portions of the eastern and southern Mediterranean coasts, where the results may be published in languages other than English or French and therefore be poorly accessible to many. In addition, several research groups still have to publish in a comprehensive way the results of their work. Consequently, it is difficult to assess what is being done in the Mediterranean and what reliable results can be used to assess the ecology and status of bottlenose dolphins living in the region. For large portions of the Mediterranean information seems to be extremely limited or entirely lacking, although some data may exist which are currently out of reach for most investigators.

Recommended action: Identification of areas where bottlenose dolphin studies are underway, and creation of a directory of Mediterranean scientists and organizations focusing on this species. This information can be partly derived from the ACCOBAMS online database (see http://www.accobams.org/index_science.htm) and from reports by Regional Coordinators. Still, a more focused effort will be needed to make the directory detailed, uniform and comprehensive, and to collect additional data on bottlenose dolphins from the concerned groups. The resulting information may be mapped in order to highlight the present distribution of research effort, and provide insight into the distribution of the species. This is expected to result in a better understanding of the effort needed to fill in the present information gaps. In addition, this action may contribute to the understanding of the main perceived threats affecting the dolphins.

ACTION 4.9.

WORKSHOP ON MEDITERRANEAN BOTTLENOSE DOLPHINS

Rationale/Background: Facilitating exchange of information among scientists and groups working on Mediterranean coastal dolphins is of foremost importance. First, the existing knowledge and expertise may provide insight into management priorities (e.g. help identifying problem areas and assessing the relative importance of threats affecting the species in different portions of the basin). Second, chances to exchange views on dolphins living in different sub-regions can encourage the development of collaborative projects.

Recommended action: As a first step, key actors should be identified and information on their ongoing activities be made available to the wider scientific community (see Action 4.8.). Consequently, a workshop on Mediterranean bottlenose dolphins may be organized to facilitate exchange of information among researchers working in the region. Such a workshop should encourage individual researchers with significant expertise to join working groups, which may focus on items such as bottlenose dolphin distribution, past and present abundance, ongoing threats and perceived conservation priorities. This effort may result in a volume that incorporates work presented at the workshop, as well as reports from working groups. A considerable organization and editing/review work will be necessary to meet the purposes of this action. Success will depend upon wide participation by representative researchers from all Mediterranean countries. Financial support should be provided to facilitate participation by scientists operating in economically depressed regions. Efforts by selected workshop participants should be co-ordinated according to a strict agenda, to ensure that this activity will produce useful output.

ACTION 4.10.

INVESTIGATE THE "SHIFTING BASELINES" EFFECT AND STIMULATE A REVIEW ARTICLE ON MEDITERRANEAN BOTTLENOSE DOLPHIN CONSERVATION

Rationale/Background: How many bottlenose dolphins were there in the Mediterranean in the past? Was the species more abundant 50 years ago? How can we relate the current abundance estimates to historical times for which no quantitative data exist? Have our baselines shifted (*sensu* Pauly, 1995) owing to lack of historical information? Although quantitative information in the old literature may be poor and/or unreliable, review work based on bibliographic searches in old literature archives may greatly enhance our capability to frame the present dolphin status into a context, as shown by a few recent exercises focusing on Mediterranean common dolphins (Bearzi *et al.*, 2003) and northern Adriatic bottlenose dolphins (Bearzi *et al.*, 2004). Review articles describing the past and present status and trends of a cetacean species at the regional level can be extremely useful in providing the background needed for the development of conservation strategies. Unfortunately, the present highly dispersed information on bottlenose dolphins does not allow one to draw satisfactory conclusions on their status, and on the factors that have determined such a status.

Recommended action: Review the past status of bottlenose dolphins based on bibliographic searches aimed to determine the real and perceived abundance of the species in the Mediterranean prior to human exploitation and habitat degradation. Searches should be conducted by a team of experienced scientists in libraries holding significant collections of historical literature on cetaceans and related issues (e.g. cetacean stranding records, culling, bounties for dolphin killings, landings in fish markets, bycatch data, museum collections etc.) Such work may shed light on historical bottlenose dolphin abundance and provide insight into the threats that may have affected the species in the past. The preparation of a review paper on the status and conservation of Mediterranean bottlenose dolphins, similar to the articles published on Mediterranean fin whales (*Balaenoptera physalus*; Notarbartolo di Sciara *et al.*, 2003) and short-beaked common dolphins (Bearzi *et al.*, 2003) should be stimulated. Relevant information may result in part from the bottlenose dolphin workshop described above (see Action 4.9.) and, indirectly, from Action 4.8.

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ANNEX 1 - RELATED ACCOBAMS IMPLEMENTATION PRIORITIES

Action # 2

Investigation of competitive interactions between coastal dolphins and artisanal fisheries

A workshop sponsored by Italy in Rome in May 2001 investigated and evaluated efforts by fishermen and others to deter dolphins from nets. It was concluded that although the problem of dolphin depredation has become a major issue in the eyes of Mediterranean fishermen, and therefore deserves to be addressed in a responsible manner by government agencies and conservation groups, there is a danger that the *ad hoc* and even experimental use of noise-making deterrence devices could have unintended adverse effects on other species, as well as prove ineffective for reducing fishery-dolphin conflicts. The workshop produced a series of recommendations for research and development, and concluded that high-intensity acoustic devices that are typically used to keep pinnipeds away from aquaculture facilities are inappropriate for use in alleviating conflicts between dolphins and fisheries in the Mediterranean. This project would consist in the implementation of the recommendations made by the Rome workshop. In particular, in addition to obtaining detailed quantitative information on the characteristics of common bottlenose and short-beaked common dolphin populations in the Mediterranean (see Actions 7 and 8), data should be collected on the spatial, seasonal, and operational features of small-scale coastal trammel and gillnet fisheries in the region. Identification of a small number of exemplary «problem areas» where overlap occurs (i.e., high dolphin densities matched with high levels of fishing activity) should be followed by rigorous site-specific pilot studies to characterise and quantify the costs of dolphin depredation. Where serious problems are found to exist, rigorous tests of potential solutions should be conducted after extensive consultations with fishermen as well as technical experts. It is important that due consideration be given to the real or potential adverse side effects of any mitigation approach. Non-acoustic means of reducing conflicts, such as changes in methods of gear deployment, the use of quieter engines, the introduction of compensation or insurance mechanisms and the development of parallel dolphin watching activities, all hold promise and deserve to be evaluated.

Action # 4

Development and implementation of pilot conservation and management actions in well-defined key areas containing critical habitat for populations belonging to priority species (*Delphinus delphis*, *Phocoena phocoena*, *Physeter macrocephalus*, *Tursiops truncatus*)

In spite of the recent growth of scientific knowledge and attention on cetacean ecology in the Agreement area, and of the awareness of the survival threats these mammals are subject to, evidence is accumulating that some populations are declining in numbers and becoming increasingly fragmented within their shrinking range. Particular concern exists for short-beaked common dolphins in the Mediterranean, as well as for harbour porpoises, common bottlenose dolphins, and sperm whales. In some well-known instances, relic population units of these species are presently seen to be undergoing dramatic reductions in their numbers, and are thought likely to disappear soon if prompt measures are not taken. This action proposes to select four areas, each of them containing critical habitat for one of the four priority species, in which pilot conservation and management projects be developed and implemented immediately. Areas should be selected on the basis of sufficient available knowledge and characteristics of the area allowing the creation of a model, which can then be applied to other similar situations in the Agreement area. The following areas show particular promise as possible candidates: (a) the coastal waters surrounding the island of Kalamos, western Greece (short-beaked common dolphins); (b) the coastal area of southern Crimea, Ukraine, comprised between Cape Sarych and Cape Kherones (harbour porpoises and Black Sea common bottlenose dolphins); (c) the offshore waters of southern Crete, Greece (sperm whales); and (d) the waters of the Losinj-Cres Archipelago, Croatia (Mediterranean common bottlenose dolphins). Conservation measures should involve the establishment of *ad hoc* protected areas encompassing critical habitat for the target species and the adoption of experimental management plans with the involvement of local people and user groups; measures should include intensive monitoring of the cetacean population, targeted research, regulation of impacting human activities, education efforts directed at the local fishing communities and recreational users, and promotion of more compatible, alternative activities (e.g., whale watching) and resource uses.

Action # 8

Conservation plan for common bottlenose dolphins (*Tursiops truncatus*) in the Mediterranean Sea

In the Mediterranean Sea, common bottlenose dolphins occur in scattered inshore communities of perhaps 50-150 individuals, and the gaps between them appear to be constantly increasing. Conservation threats are roughly similar to those facing short-beaked common dolphins and other small cetaceans of the region, except that common bottlenose dolphins in the Mediterranean Sea may be particularly vulnerable to human activities due to their near-shore occurrence and the fragmented character of their population structure. Incidental kills in trammel and gillnets occur frequently in some areas, probably at unsustainable rates. Overfishing of demersal fish may have affected the prey base for common bottlenose dolphins in some areas. Direct kills resulting from competitive interactions between common bottlenose dolphins and artisanal coastal fisheries are also a source of increasing concern. A series of population assessments across the Mediterranean subregion should be organised, where common bottlenose dolphins are known to occur, combined with larger-scale but less intensive surveys to identify previously unknown «hotspots» of occurrence. A comprehensive map of common bottlenose dolphin presence along the Mediterranean continental shelf should be created, with the identification of concentration zones (where critical habitat is likely to occur) and gaps. Photo-identification data should also be collected during the surveys, to help the creation of a pan-Mediterranean catalogue. Surveys should be designed to obtain data suitable for subsequent assessment of the species distribution and relative sighting frequency over time (e.g., consistent surveys conducted at 3-year intervals). Existing information and data recorded by research groups (either published or unpublished) should be inventoried in a comprehensive database, and made available to the wider community. Collection and analysis of time series data indicative of population trends should be favoured. Finally, efforts should be directed to monitor incidental catches and direct kills, and to investigate the possible role of contaminants and of nutritional stress from reduced availability of suitable prey. For the first phase of the project it is proposed that a steering committee be established with the task of completing the preparation of the plan, including the elaboration of the organisation, logistic, scientific, technical and financial aspects. It is envisaged that the complete proposal will be presented for approval to MOP2.

Action # 11

Development of photo-identification databases and programmes encompassing the entire ACCOBAMS Area

Studying free-ranging cetacean populations using photo-identification techniques has become a common, powerful research practice during the past decade in many areas of the world, including portions of the Agreement area. Such studies have proven, among other things, to hold considerable conservation value. Recently, a three-year programme, «Europhlukes», was funded by the European Commission with the goals of developing an European cetacean photo-id system as a support tool for marine research and conservation, to initiate a European network which will link providers with end-users of the European cetacean photo-id system, and to ensure future growth and maintenance of the system and its databases. Although a budget for this action could not be secured for the 2002-2004 period, it is highly recommended that an operational link be established between ACCOBAMS and the «Europhlukes» project management, to explore possibilities for future co-operative effort, for the extension of the programme to non-European partners within the Agreement Range States, and to help ensuring the indefinite continuation of this worthy initiative after the European project is terminated.

Action # 12

Establishment and implementation of a long-term training programme on cetacean research, monitoring and conservation/management techniques and procedures

Cetacean research and monitoring techniques have made considerable progress in recent decades, and provide significant support to the conservation and management effort. While such techniques are currently consistently applied, and even developed, in portions of the Agreement area, they are largely ignored elsewhere. Diffusing research and monitoring abilities throughout the region thus seems like a timely challenge and one of the highest priorities as far as cetacean conservation is concerned. The problem to be addressed is twofold: (a) transmitting knowledge through appropriate, effective and long-lasting training procedures, and (b) ensuring that such hard-gained knowledge is put to good, long-term use once the trainees endeavour to apply it at home. Accordingly, this activity will firstly consist in the

organisation of field-based training courses in areas providing ideal research facilities and opportunities, to teach standard research techniques and provide selected participants with a hands-on experience. Secondly, follow-up support to the selected trainees in their countries, to assist with the development and implementation of research and conservation projects, will have to be provided through a co-operative effort between the Agreement Secretariat, or the appropriate Co-ordinating Unit, and the concerned Contracting Party.

Action # 16

Development of a network of specialised bibliographic collections and databases

One of the greatest hindrances to the region-wide development of a cetacean science tradition - a fundamental prerequisite to conservation and, ultimately, to the fulfilment of the purposes of the Agreement - is the diffused current unavailability of up-to-date specialised literature in most Range States' scientific and academic environment. This action proposes the establishment of a working group, which should include specialised librarian expertise, to examine the current availability of pertinent bibliographic material across the Agreement area, to strengthen existing facilities, and to identify locations where additional specialised libraries should be established. Support should be provided to existing libraries containing significant cetological bibliographic collections, to ensure continued updating and expansion, to facilitate access to information to the local scientific community, and to provide a framework for capacity building that will encourage documented cetacean research in the Agreement area. Modern document transfer and exchange technology should be adopted and promoted, and library databases should be managed within the context of a network that facilitates cross-library research and exchange of materials.

ANNEX 2 - ICRAM WORKSHOP CONCLUSIONS AND RECOMMENDATIONS

Reeves R.R., Read A.J. & Notarbartolo di Sciara G. 2001. Report of the workshop on interactions between dolphins and fisheries in the Mediterranean: evaluation of mitigation alternatives. ICRAM, Rome. 44 pp.

In addition to the **conclusions** highlighted elsewhere in the report, the workshop **concluded** that:

- Acoustic devices have the potential to damage the hearing of dolphins and other animals and to cause other impacts, such as habitat exclusion. However, the effects of acoustic exposure are highly species-specific and depend on each species' frequency sensitivity, and on the received level of the sound. Available data suggest that ultrasonic, low- intensity devices are most likely to be effective for deterring odontocetes while having the least probability of causing harm to other species.
- To evaluate the effectiveness of any mitigation strategy, it is necessary to have clearly stated management goals. At present, these do not exist in relation to fishery-dolphin conflicts in the Mediterranean.
- Very little quantitative information exists on: the nature and extent of interactions between dolphins and small-scale commercial fisheries in the Mediterranean, the costs of such interactions to the fisheries, or the effects of such interactions on dolphin populations.
- Given (a) what is currently known about the physiology and behaviour of bottlenose dolphins, (b) the potential for excluding dolphins from habitat (and consequent implications for the health of local dolphin populations) and (c) the potential for negative effects on monk seals, high- intensity acoustic devices such as those currently marketed as AHDs and used to deter pinnipeds from aquaculture operations are *inappropriate* for use in alleviating conflict between dolphins and fisheries (or aquaculture operations) in the Mediterranean. This conclusion applies irrespective of the potentially high, or even prohibitive, costs of deploying these devices in the Mediterranean context. The workshop **underlined** that the use of AHDs in the Mediterranean may contravene current national and international regulations.
- In the absence of conclusive evidence that low- intensity acoustic devices (pingers) can be effective in reducing the frequency of interactions between dolphins and fisheries, further research on this topic would be useful.
- Non-acoustic means of reducing conflicts between dolphins and fisheries hold considerable promise and deserve detailed evaluation.

In addition to the **recommendations** highlighted elsewhere in the report, the workshop **recommended** that:

- Government agencies and international bodies begin developing and articulating management goals for mitigation of fishery-dolphin conflicts so that it will be possible to make meaningful evaluations of effectiveness.
- Site-specific studies be carried out (simultaneously) focusing on the characteristics of particular fisheries and on the ecology and behaviour of 'local' dolphin population(s). More information is needed on which animals are engaged in depredation, e.g. individuals or entire groups; older or younger animals, or both; males or females, or both. Photo- identification studies are essential for obtaining this kind of information and for investigating site fidelity. Use of 'signature whistles' to identify individuals involved in fishery depredation in the Mediterranean is unlikely to be practical, at least in the short term.
- Any long-term monitoring program include efforts to investigate and document dolphin mortality, to determine whether fishermen are taking retaliatory measures against dolphins.

Bearzi, G. 2003. Towards a Conservation Plan for common bottlenose dolphins in the Mediterranean Sea. Document presented at the 2nd Meeting of the ACCOBAMS Scientific Committee. Istanbul, Turkey, 20-22 November, 2003.

The urgent need to restore depleted marine populations and maintain sustainable fisheries was endorsed by the World Summit for Sustainable Development in August 2002. These renewed commitments complement numerous prior international agreements, including the FAO Code of Conduct for Responsible Fishing and the FAO statement on a precautionary approach to fisheries management. All of these accords provide the context for the actions we stress below.

Two core problems face fishery management around the world: (1) a wide array of institutions and policies that provide perverse incentives to overfish and (2) the lack of alternatives for people plagued by poverty. National governments will need to address these core problems, employing a precautionary approach and a fully participatory process while implementing the following seventeen priority actions.

Engaging institutions and stakeholders

1. Secure the participation in policy-making and management of all interested parties, including fishers, managers, traders, consumers, scientists, and public interest groups.
2. Establish institutions and forms of governance that provide effective incentives for fishery participants to conserve fishery resources.
3. Ensure that all fishing activities within national waters are conducted under an allocation system that provides tenure to identifiable groups of domestic fishers, in a fair manner.
4. Empower consumers to use marine resources sustainably by strengthening and implementing verifiable third-party certification systems for sustainably produced marine products.

Managing and evaluating fisheries

5. Eliminate subsidies that contribute to the expansion of fishing effort beyond sustainable levels.
6. Assist in the development of environmentally sustainable and socially acceptable alternative and supplementary income opportunities for fishers, such that fishing effort in unsustainable fisheries is reduced.
7. Maximize any fishery's economic and social benefits to society within limits of environmental sustainability.
8. Manage offshore fishing rights to provide equitable benefits within the country.
9. Set performance objectives and publish regular evaluations of progress towards achieving actions listed in this statement.

Conserving ecosystems

10. Ensure development and use of fishing gear and practices that prevent harm to habitats and non-target species.
11. Develop and enforce laws banning fisheries practices and gears that are deleterious to habitats and non-target fauna and flora.
12. Establish national and regional networks of no-take marine protected areas (MPAs) to sustain and enhance fisheries and protect habitats, as a contribution towards global networks of MPAs.
13. Monitor for early detection of ecosystem degradation, then plan and implement responses to halt this degradation.

Addressing technological interventions

14. Design and enforce standards for sustainable aquaculture that ensure economic viability (independent of perverse incentives) and prevent ecological harm.
15. Establish and enforce standards to prevent the escape of genetically modified organisms (GMOs) from production operations and subsequent introduction to coastal and offshore environments.
16. Exercise the greatest caution and scientific judgement before contemplating any intentional production or release of GMOs in the marine environment. Almost all such practices will be counterproductive to broader conservation efforts.
17. Advance and expand our understanding of the state of the oceans and ocean resources, creating and employing new technologies where necessary and environmentally acceptable.

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