



**JOINT ACCOBAMS/PELAGOS WORKSHOPS ON FIN WHALE AND COLLISIONS
Monaco, 12-15 November 2005**

Report of the
Joint ACCOBAMS/Pelagos Workshop on Fin Whales
in the Mediterranean Sea
(12-13 November 2005)

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TABLE OF CONTENTS

1.	INTRODUCTION	3
1.1	Structure of the Workshop.....	3
1.2	Process to get the final report	4
2.	FRAMEWORK FOR FIN WHALE CONSERVATION IN THE ACCOBAMS AREA	
3.	GENERAL PRINCIPLES	4
4.	GENERAL RESEARCH RECOMMENDATIONS	5
4.1	Long-term monitoring	5
4.2	Co-ordinated research	7
4.3	Co-ordinated actions and specific management objectives	8
5.	SPECIFIC PRIMARY RESEARCH RECOMMENDATIONS	8
5.1	Specific recommendations	8
6.	CONCLUSIONS	10
	ANNEX A	11
	ANNEX B	13
	ANNEX C	14
	ANNEX D	19
	ANNEX E	25
	ANNEX F	30
	ANNEX G	34
	ANNEX H	40



1. INTRODUCTION

The meeting was held at the Oceanographic Museum of Monaco, Monaco from 12-13 November 2005. It was followed by the collision workshop (14-15 November 2005). The Mediterranean Fin whale workshop was organised according to the decision of the ACCOBAMS parties on the advice of its scientific committee (Rec. 2.5, Report of the Scientific Committee of ACCOBAMS, 20-22 November 2003) with the aim of identifying key research priorities and draft prioritised recommendations to best ensure the long term study and conservation of Mediterranean fin whales (*Balaenoptera physalus*). The ultimate goal of this workshop was to provide a rationale background for the Mediterranean Fin whale conservation action plan. This workshop was coordinated by Simone Panigada (Tethys Research Institute) with the assistance of Christophe Guinet (CEBC-CNRS). The Workshop thanked the ACCOBAMS Secretariat and the Oceanographic Museum for the quality of facilities provided and the Italian Ministry of Environment for their support. The workshop was opened by Marie-Christine Van Klaveren, executive secretary of ACCOBAMS, who welcome the participants and reminded them of the background to the workshop. She referred to the expectation of the ACCOBAMS parties for scientific recommendations to ensure the conservation of fin whales within the ACCOBAMS agreement area and in the PELAGOS Sanctuary. The Workshop was also addressed by representatives of the PELAGOS: Patrick Van Klaveren (Monaco representative); Francesco Valentini (Representative of the Italian Environment Ministry); Nicolas Vasseli (French representative for the PELAGOS agreement).

The workshop was attended by 34 persons from 7 different countries (see Annex A).

1.1 Rationale and objectives

The aims of this workshop were to:

- (1) provide a review of the existing knowledge regarding abundance, distribution, diet, habitat modelling and conservation issues regarding Mediterranean fin whales (exclusive of the ship strike issue as that was to be specifically addressed during the subsequent Workshop);
- (2) identify major research gaps in our knowledge about Mediterranean fin whales;
- (3) examine and assess the feasibility of these recommendations as well as their potential cost;
- (4) prioritise scientific recommendations aimed at ensuring the long term conservation of the species within the Mediterranean context; and
- (5) provide a rational background for a Mediterranean fin whales conservation action plan.

1.1 Structure of the Workshop

A brief overview of the existing knowledge available for Mediterranean fin whales was provided by 12 talks focussing on distribution, estimation of absolute and relative abundance, and ecology and conservation issues. These presentations were followed by the constitution of three working groups focussing on;

- (1) Abundance and distribution (convenors: G. Donovan and C. Guinet)
- (2) Ecology, Behaviour and habitat modelling (convenors: S. Panigada and M. Weinrich)
- (3) Anthropogenic threats to fin whales (convenor: G. Notarbartolo di Sciara)

The Working Groups were asked to review existing knowledge, to identify knowledge gaps and the research needed to fill these and the feasibility of their success and finally to propose prioritised research recommendations.

Each Working Group then reported to all participants the draft of their main conclusion and research or recommendation priorities. Their (edited) reports are given as Annexes D-F.



1.2 Process to get the final report

When reports of the Working Groups were completed (*and due to the heterogeneity in the format of the conclusion and recommendation provided by each working groups*), the Workshop participants acknowledged that the drafting of the detailed research recommendations and priorities could not be achieved within constraints of the Workshop itself. Greg Donovan graciously offered to develop the full report based on the draft reports of the various Working Groups. In particular, he agreed to consolidate the recommendations therein and present an overall framework for the development of a Conservation Plan for fin whales.

2. FRAMEWORK FOR FIN WHALE CONSERVATION IN THE ACCOBAMS AREA

The primary objective of the workshop can be said to be to begin to develop a conservation plan for fin whales in the ACCOBAMS area. In effect this requires:

- (1) an assessment of the status of the fin whale population or populations in the area;
- (2) an evaluation of the actual and potential anthropogenic threats;
- (3) the development and implementation of appropriate mitigation measures to threats determined to be significant at the population level; and
- (4) the development of long-term monitoring programmes to determine whether identified management objectives are being met.

A framework for a process to develop a full Conservation Plan can be seen in Fig. 1 (adapted from Donovan, Cañadas and Hammond, In Prep).

It was **agreed** to review the reports of the Working Groups in the light of this framework and to begin to develop an integrated list of prioritised recommendations to further the development of a conservation plan, recognising that there was inevitably overlap in the research priorities identified by the various groups. It was also noted that the choice of priority research recommendations did not imply that the other recommendations were not important but rather that their value was not of immediate importance to the *development* of a Conservation Plan.

3. GENERAL PRINCIPLES

The Workshop agreed that in accord with the left hand side of Fig. 1 (understanding the whales themselves), the highest priority must be given to research that would (1) allow an assessment of the present status of fin whales in the area; and (2) allow changes in the status of the fin whales to be detected in the future.

With respect to the right hand side of the Fig. 1 (understanding the threats to the whales), the highest priority must be given to research that enables anthropogenic threats to fin whales to be evaluated and effective mitigation measures to be developed for those threats that are thought to be important at the population level.



4. GENERAL RESEARCH RECOMMENDATIONS

The three Working Groups considered a great many recommendations, some of which were general and others specific (see Annexes D-F). There was insufficient time in the full Workshop to discuss all of the recommendations in detail. The Workshop **agreed** that a full discussion of these should occur within the ACCOBAMS Scientific Committee. However, it draws attention to the following general recommendations that it believes are of immediate value.

4.1. Long-term monitoring

The Workshop **stresses** the absolute importance of long-term monitoring of cetaceans, key identified biotic, abiotic and anthropogenic features of the environment, if management measures are to be effective and seen to be effective. It also **stresses** that this may require a change in emphasis and operations of both management and research agencies where there is often reluctance to invest in long-term programmes. It may also require a change in the way many institutes evaluate scientists. At present, this is often on the basis of the number of publications. It is a feature of long-term monitoring programmes that they do not result in several publications per year despite the fundamental importance of the work. This may discourage high calibre scientists from committing to such programmes to the detriment of cetacean conservation.

The Workshop therefore **strongly recommends** that PELAGOS, ACCOBAMS and its Parties commit to supporting the development and maintenance of long-term monitoring programmes included in this report, including the maintenance of appropriate databases (e.g. the photo-identification catalogue) and research programmes.

Towards a Conservation Plan for Fin Whales

General ecological and behavioural research can contribute to improved ability to address issues related to both 'animals' and 'threats' in the medium-long term

ANIMALS

Features

Decide what aspects of the animals can be used to assess 'status' in the past, now and in the future – taking practicality of measurement into account
e.g. population structure, abundance, distribution

Baseline

Establish baseline values and natural variation for chosen attributes *or* a programme to establish them if any are not known

'Sub-objectives' or 'Targets'

Explore conservation sub-objectives for chosen attributes – then choose final set, taking ability to detect change into account, and if appropriate assigning priorities and short-medium- and long term targets
e.g. maintain or increase current numbers, maintain present distribution

CONSERVATION PLAN

Monitoring and feedback

Establish a monitoring programme to determine whether short- medium- and long-term objectives are being met both in terms of **animals and reduction of threats**. If not requires major re-evaluation of plan (including geographical extent)

Identify potential threats

Identify (and categorise if possible) actual and potential anthropogenic threats to animals
e.g. direct threats (such as bycatches, ship strikes);
indirect threats (such as habitat degradation)

Prioritise

Evaluate, and if possible, determine likely quantitative effects of threats *on populations*
–if a potential threat has significant implications *for population(s)*, establish programme to determine whether an actual or potential threat

Mitigation measures

Examine actual and potential mitigation measures to the prioritised threats. Where practical measures exist, implement them *with suitable oversight* and consultation with stakeholders and include short-, medium- and long-term targets

Where no measures exist for actual threats, establish a programme to develop them involving stakeholders.

All aspects of mitigation measures must be considered, including scientific, practicality, legal framework, education and awareness.

There must be an appropriate administrative and scientific framework to ensure the effective working of the plan (including effective implementation of mitigation measures) and to ensure that the results of monitoring programmes are examined and the plan updated as necessary



A thorough understanding of the Mediterranean fin whale population requires knowledge of more than just the whales, but also the environment on which they depend. Therefore baseline datasets of 'explanatory variables' must be maintained and be easily accessible to researchers. This is especially important in the case of spatial modelling and the determination of possible temporal and geographical hotspots for specific potential threats. The Workshop **agreed** that the ACCOBAMS Secretariat, in conjunction with its Scientific Committee, should play an important role in developing this in the short-medium term by liaising with the appropriate authorities, industries, research institutes and organisations. In particular, it draws attention to the need for:

- (1) detailed bathymetric data (see recommendation H9, Annex E);
- (2) pollutant information (see recommendation AT3, Annex F);
- (3) data on ambient noise levels (see recommendation AT5, AT6, Annex G);
- (4) data on noise from transient activities e.g. military sonar, seismic activities (see recommendation AT7, Annex G);
- (5) data on fin whale prey distribution, abundance and health (see recommendation AT10).

4.2 Co-ordinated research

The Workshop noted that there are numerous examples of how co-operative studies dramatically increase the value of research results. These include:

- (1) combination of photo-identification data into a centralised catalogue with a common data collection and matching protocol;
- (2) development and co-ordination of appropriate biopsy sampling programmes, including coordinated analyses of molecular genetics (both for stock structure and DNA profiling), pollutant analyses, stable isotopes, etc., including identification of appropriate laboratories to ensure that the results are comparable;
- (3) the development of models to try to explain and predict fin whale distribution and abundance, and to refine estimates of abundance. Although such models have great potential, they are extremely "data hungry," and models developed on limited data sets may be misleading.

The Workshop participants **stressed the need for a co-ordinated approach** to fin whale research and the evaluation of results in the ACCOBAMS area; this is the only way to develop, implement and review an effective conservation plan for the species. It is essential that a supranational view is taken with respect to the conservation of species whose range includes waters of several countries as well as the high seas.

It is important for effective conservation efforts that research programmes are focussed within the framework given in Fig.1 and that the work of various research groups is carried out in an efficient and effective manner. In this context it is necessary to ensure that for certain techniques with the potential to disturb the animals (e.g. biopsy sampling), maximal use is made of each sample and that duplication of effort is avoided. The Workshop **recommends** that the ACCOBAMS Scientific Committee provides this overview and guidance role in conjunction with the Secretariat, in particular by developing:

- (1) a protocol for maximising the use of biopsy samples (see recommendation H6B, Annex E);
- (2) a database of research activities in the ACCOBAMS area relating to biopsy sampling, photo-identification and telemetry of fin whales (see recommendation AT2, Annex F).



4.3 Co-ordinated actions and specific management objectives

The northwestern Mediterranean represents an important area for fin whales. The Workshop recognised the existing and developing co-operation between ACCOBAMS and the PELAGOS Sanctuary and **recommends** that this be expanded to include co-operative science-based management actions based on the work and recommendations *inter alia* of the ACCOBAMS Scientific Committee. A number of management related recommendations can be found in Annex F (e.g. AT8, AT9, AT15, AT 16-20).

In particular, the Workshop noted that there do not appear to be clear overall management objectives for fin whales. Without these, it is difficult to quantify how successful conservation measures developed to address particular anthropogenic threats are or will be. The Workshop **recommends** that ACCOBAMS and PELAGOS work towards developing specific management objectives for fin whales, both within the Sanctuary and throughout their range.

5. SPECIFIC PRIMARY RESEARCH RECOMMENDATIONS

All of the recommendations made by the individual Working Groups can be found in their Annexes (D-F). The recommendations summarised below represent specific recommendations arising out of an integrated view of those, classified into the highest priority in accordance with Item 3 above. The development of additional specific and detailed recommendations should be considered by the ACCOBAMS Scientific Committee at its next meeting. The Workshop **recommends** that at that meeting, attention be specifically given to developing focussed recommendations on the following topics:

- (1) obtaining information on distribution and abundance of fin whales outside the summer period (see recommendations DM2, DM6, Annex D; recommendations H1, H4, Annex E); and
- (2) developing a multidisciplinary research programme for Lampedusa, a known winter feeding ground for fin whales (see recommendation H2A, Annex E);

The specific high priority recommendations developed for this Workshop are summarised briefly here but are presented in detail in Annex G, where to the extent possible, the following information is given:

- (1) objectives, including relevance to the framework in Fig. 1;
- (2) timetable of actions and responsible persons;
- (3) approximate financial implications;
- (4) potential and actual supporting institutions.

5.1 Specific recommendations

Recommendation 1: Abundance and trends: (a) obtain baseline information on the distribution and abundance of fin whales in the ACCOBAMS area and (b) develop a subsequent programme to monitor trends in abundance.

This has already been accorded the highest general priority by the ACCOBAMS Scientific Committee. The information from the baseline study and the long-term monitoring programmes are absolutely essential to determine whether ACCOBAMS is meeting its conservation objectives, and therefore whether existing management measures are sufficient. The final expected results can be summarised as:



- (a) *First phase*: baseline abundance estimate(s) and distributional information for fin whales in the Mediterranean Sea and contiguous Atlantic waters for the summer 2007 (or 2008);
- (b) *Second phase*: a smaller-scale monitoring programme to identify long-term trends in abundance and distribution.

This effort is fundamental to the left side of Fig. 1 and is essential in prioritising potential threats in terms of their potential population level impacts.

Recommendation 2: Develop a central photo-identification database for use (as part of a co-ordinated programme) as a long-term management and conservation tool.

The principal aim of this programme is to develop and create a long-term future for a centralised photo-identification database that includes all of the photo-identification efforts from the ACCOBAMS area. Although the focus of this Workshop is the fin whale, it will be most efficient if this database can include all cetacean species. Such a database, as part of a co-ordinated programme, will provide an invaluable conservation and management tool for the fin whale and other species in the Mediterranean basin. It will provide an extremely valuable tool to address many of the issues identified in Annexes D-F. It is relevant primarily to the left side of Fig. 1, but has implications for the right hand side (e.g. with respect to examining threats such as ship strikes, bycatches and health). Reference should be made to the work already undertaken by the Europhlukes programme in this regard.

Recommendation 3: Examine and elucidate Mediterranean fin whale population structure.

The objectives of this recommendation are:

- (a) to examine whether the fin whales found in the Mediterranean represent one homogeneous population, or two or more sub-populations; and, if the latter
- (b) to quantify the level of exchange between them and identify whether they are isolated temporally or geographically.

This is essential to understanding and interpreting abundance data and evaluating the success of mitigation measures. It will also provide samples and information relevant to many of the recommendations found in Annexes D-F. As with Recommendation 1 above, it is fundamental to the left side of Fig. 1 and is essential in prioritising potential threats in terms of their potential population level impacts.

Recommendation 4: Compare individual identification techniques (photo-id and genetic profiles) and implications for management.

- (a) Quantify the levels of fin whale photo-id mis-identification, if they exist (false positives and false negatives) by comparing photographic and DNA profile IDs.
- (b) Identify and quantify potential biases in estimates of population parameters when applying mark-recapture models using these approaches.

Again, the use of photo-identification techniques is central to many of the recommendations found in Annexes D-F. It is essential to investigate and quantify any possible biases in the technique, as has already been achieved for North Atlantic humpback whales. It is thus of direct importance to the left side of Fig. 1.



6. CONCLUSIONS

The Workshop can be considered a success in summarising what we do and do not know about fin whales in the Mediterranean, and in developing a framework and programme for achieving an effective Conservation Plan for fin whales in the ACCOBAMS area. In hindsight, it is clear that more time for discussion was needed. However, it should be recognised that the Workshop is simply the first phase in a long process. It is important that Workshop participants, and particularly the ACCOBAMS Scientific Committee and the ACCOBAMS and PELAGOS Secretariats ensure that momentum is maintained.

Finally, the Workshop wished to thank the organisers and convenors of the Workshop (especially the Secretariats) for the superb facilities and assistance provided.



Annex A

List of Participants

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Annex B

Agenda

- 1. Convenor's opening remarks**
- 2. Election of Chair**
- 3. Adoption of the Agenda**
- 4. Introduction of participants**
- 5. Update on current knowledge in the ACCOBAMS area**
- 6. Presence and distribution**
 - 6.1 Habitat use
 - 6.2 Movements within and out of the Basin
 - 6.3 Diving/feeding behavior
 - 6.4 Abundance estimates
 - 6.5 Photo-identification
 - 6.6 Genetics – stock identity
 - 6.7 Toxicology
 - 6.8 Acoustics
 - 6.9 Ship collisions
- 7. Proposed research priorities**
 - 7.1 Basin wide survey
 - 7.2 Enforce biopsy sampling campaigns (genetic and toxicology)
 - 7.3 Photo-id projects in targeted areas
 - 7.4 Unify existing data-base
 - 7.5 Describe the presence of critical habitats
 - 7.6 Use of pop-ups in targeted locations
 - 7.7 Select specific areas where concentrate research effort
 - 7.8 Identify future key research areas (the Strait of Gibraltar being only one of them, Lampedusa and the Strait of Sicily being another one for instance)
 - 7.9 Describe feeding ecology in targeted areas
 - 7.10 Whale watching impact assessment
 - 7.11 Anthropogenic noise impact assessment
 - 7.12 Involvement of ACCOBAMS Range States
- 8. The Year of the Mediterranean Fin Whale (YoMeF)**
- 9. Discussion and summary**



Annex C

Abstracts of papers submitted

DISTRIBUTION OF THE FORAGING HABITAT OF FIN WHALES: A MODELLING APPROACH

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The analysis of a 10-year summer data set of fin whales sightings show the recurrent occurrence of fin whales (*Balaenoptera physalus*) in the North-western Mediterranean Sea. Fin whales tended to be concentrated in the Eastern part of the Gulf of Lion and in the central part of the Ligurian sea, where they feed exclusively on Krill (*Meganichthyphanes norvegica*). MN larvae hatch in late winter (February-march) and juvenile krill reach the minimum size (1.5 cm) to be consumed by fin whales by early summer. Fin whales abundance and distribution varied from year to year. The coupling of a circulation model and a simple model of trophic transfer allowed us to simulate the spatio-temporal distribution of the fin whales MN forage for the whole basin from 1998 to 2002. The dynamic model simulate 1/16 current fields for several depth range over a 5- day period while the trophic transfer model is initialised by the chlorophyll a field provided by SeaWiFS at a similar spatial scale. The simulations show that the Lion-Ligure cyclonic circulation cell confine the trophic food web and the phytoplankton production zone - associated with dense water formation areas - is also the location where the simulated NM concentrate few month latter. The climatology of the predicted forage calculated over the study period match spatially and temporally the observed summer climatology of fin whales distribution. However the inter-annual variation in observed distribution doesn't match whale the inter-annual variation in the distribution of the simulated forage.

FIN WHALES' DIET IN THE MEDITERRANEAN: THE POINT

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The fin whales' diet in the Mediterranean is mainly known, for the moment, by means of scat or stomach contents analyses. A set of 29 new samples collected in the northern part of the Western Mediterranean basin, between 1994 and 2002 during summer (from June to October), reveals the presence of a single prey: the Euphausiid *Meganichthyphanes norvegica*, according to previous works done in the Ligurian basin. This set also shows a) a temporal evolution in the size structures of eaten individuals, and significant inter-annual variations; b) no latitudinal differences, but some significant differences inside a nycthemeral cycle. Always in summer, some authors suggest that crustaceans or small pelagic fishes could complete this diet.

As for winter, an Italian team reported to have recently found huge densities of the Euphausiid *Nyctiphanes couchii* in waters, near Lampedusa, where fin whales were engaged in feeding activities.

So, our knowledge of the fin whales diet in the Mediterranean is very slight, and it's time to gather all the teams working on this topic or holding samples not yet analyzed, and to establish concerted research programs.

MARK-RECAPTURE TECHNIQUES APPLIED TO THE FIN WHALE IN THE WESTERN LIGURIAN SEA: ABSOLUTE ABUNDANCE AND SURVIVAL RATE ESTIMATES AS CONSERVATION TOOLS

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Several Research Institutes have been collecting photographic material of fin whales in the Mediterranean Sea over the last few years. Here we propose the creation of a common catalogue with the aim of addressing different issues concerning this population.

Main data supplier will be Tethys Research Institute, with about 400 identified whales in the western Ligurian Sea. The Groupe de Recherche sur les Cétacés will provide approximately 140 individuals from the western and central Mediterranean. The Ecole Pratique des Hautes Etudes holds a catalogue of 80 fin whales photo-identified in north western Mediterranean Sea. Other individuals have been identified by the Centre d'Etudes Biologiques de Chizé in the Ligurian Sea.



A preliminary analysis of fin whale photo-identification data collected by Tethys Research Institute from 1990 to 2002 concerned 360 fin whales positively identified, 19% of which were re-sighted, from 2 to 6 successive times. Recaptures (n=98) occurred in the same year (32%) and in different seasons (68%) with a maximum interval of 10 years. Mark-recapture methods were also employed to estimate absolute abundance of fin whales present in the study area during summer months. The estimate of 548 individuals (SE = 92.5; CI 95% = 407- 777; CV = 0.168) shows the feasibility of this method for the species.

In order to give a better understanding of the multiple aspects regarding the ecology of the fin whale in the study area this program proposes to: merge and analyze photo-identification data from different catalogues; continue mark-recapture modeling for the population; achieve absolute abundance estimates; determine possible trends and dynamics; investigate habitat use characteristics and site fidelity; monitor single individuals and assess movements within the feeding area.

The primary benefit of this activity will be its contribution to conservation plans for fin whales in the ACCOBAMS area.

A WINTER FEEDING GROUND FOR FIN WHALES IN THE MEDITERRANEAN SEA

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The knowledge on the ecology of the Mediterranean Fin whale (*Balaenoptera physalus*) was limited, until now, to the north-western part of the basin. In this area the presence of Fin whales is well known during summer, when animals feed on large biomasses of the Euphausiids species *Meganyctiphanes norvegica*. Although both published and anecdotal information report their presence in the South Central Mediterranean during winter, there is no information on habitat use. In February 2004, a 14-day boat survey was carried out in the waters surrounding the island of Lampedusa, where fin whales occur at this time of the year. A total of 20 fin whale groups (average group size 2 animals) were encountered. Sightings occurred at various times of the day in relatively shallow waters (average=62.3 m). On four occasions the sightings occurred within 1 km from shore.

Only adults were sighted. In two different days we estimated a minimum number of Fin whales present in the northern area of the island in 9 individuals.

In each encounter the animals were engaged in surface feeding activity. In order to identify their prey and to obtain information on their feeding behavior, underwater high resolution video images were collected by a professional scuba diver, working in close proximity of the animals during the feeding activity. A Plankton Hamburg Net was deployed to collect plankton samples. Oceanography was assessed by using CTD profiles and rosette. From plankton samples and underwater video, the prey species was identified as the Euphausiid, *Nyctiphanes couchi* (Bell, 1853). The information obtained suggests that this area represent a winter feeding ground for fin whales. The results represent significant new information on fin whale ecology in the Mediterranean, with associated conservation and management implications.

EVALUATION OF THE RISKS OF COLLISION BETWEEN FINWHALES AND MARITIME TRAFFIC IN THE NORTH-WESTERN MEDITERRANEAN SEA IN SUMMER, AND MITIGATION SOLUTIONS

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Ship strikes have been identified as a major threat for fin whales within the Mediterranean sea. But the real impact remains unknown. This study was realised for the north-Western Mediterranean Sea and for the summer period. We evaluated the risks of collision from the shipping intensity levels on one hand, and the relative abundances of fin whales on the other hand, in a 0.1°x0.1° grid using G.I.S. The collision's risks appear very high in the centre of the Ligurian Sea, halfway between the continent and Corsica. These risks are due to an important frequentation of the area by the animals and a strong intensity of traffic of ferries and High Speed Ships (500 to 800 passages during the summer). The risks are also high offshore Provence, from the latitude of Marseilles to that of the islands of Hyères. There too fin whales are highly present, and many ships bound for Corsica (ferries and trading vessels) and for Spain (trading vessels). On the other hand the risks are weak in the Gulf of Lions. In term of frequency of collision, we estimate that 3 fin whales on average are in front of the stem of a ship each day during the summer within the Sanctuary PELAGOS.

In order to reduce these risks, we propose various levels of solution. Two solutions are easy and fast to implement by the maritime companies and inexpensive. Two other solutions appear heavier and longer to implement, and the cost still remains to be estimated.

Before implementing heavy measurements, we must make a similar study on the risks of collision for the sperm whale, which is the second most impacted species. We also estimate that like what occurs in terrestrial environment, all new establishment of regular human activity (new line of ferry for example) must be the subject of a preliminary impact study.



NEW-TOOL TO INVESTIGATE TOXICOLOGICAL HAZARD DUE TO ENDOCRINE DISRUPTOR ORGANOCHLORINES AND EMERGING CONTAMINANTS IN MEDITERRANEAN CETACEANS

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Mediterranean cetaceans accumulate high concentrations of organochlorine contaminants (OCs) and are therefore exposed to high toxicological risk. Some OCs are known to be endocrine disrupting compounds (EDCs). The possibility that certain Mediterranean cetaceans are subject to toxicological risk due to organochlorines and emerging contaminants, such as polybrominated diphenyl ethers (PBDEs) with endocrine disrupting capacity, was investigated using non-lethal “diagnostic” and “prognostic” methods. Benzo(a)pyrene monooxygenase (CYP1A1) activity in skin biopsies was used as a “diagnostic” indicator of exposure to organochlorines in *Balaenoptera physalus*, *Stenella coeruleoalba*, *Delphinus delphis* and *Tursiops truncatus*. Marked differences in levels of OCs and CYP1A1 activity were found between fin whales and odontocetes. As a new “prognostic” tool we explored interspecies (*Balaenoptera physalus*, *Stenella coeruleoalba* and *Tursiops truncatus*) and gender susceptibility to OC-EDCs and PBDEs using qualitative and semi-quantitative evaluation of target proteins, such as CYP450 1A1 and CYP450 2B in cultured cetacean fibroblasts, by western blot, immunofluorescence technique and PCR real time. The main results of the fibroblasts experiments were: 1) the detection of the presence of cytochromes 1A1-1A2 and 2B4 in cetacean fibroblast cell cultures; 2) the increase of fluorescence (cytochromes 2B) in relation to the treatment doses of contaminants; 3) the fin whales and odontocetes showed differences in induction (cytochromes 2B) in relation to OCs treatment.

SUMMER AND WINTER FIN WHALE DISTRIBUTION WITHIN THE WESTERN MEDITERRANEAN SEA

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Fin whale (*Balaenoptera physalus*) is the largest marine predator currently observed in the Mediterranean Sea. The population was found to be genetically distinct from the fin whales found in the north Atlantic. Each summer, an estimated 1000 to 2000 individuals concentrate in the Northern part of the occidental basin (Ligurian sea and Gulf of Lion) where they mainly feed on the zooplankton (*Meganyctiphanes norvegica*). Analysis of the climatology summer sighting distribution reveals that fin whales concentrate mainly over two areas: central part of the Ligurian and Provençal sector where dense water formation take place in winter and high primary production occur in early spring. Winter distribution was investigated through satellite tracking and inferred by the investigation of the stable isotopes ratios of carbon ($^{13}\text{C}/^{12}\text{C}$) measured along 13 baleen plates collected on stranded animals on the French-Spanish Mediterranean (n=11) and Atlantic coasts (n=2). The comparison of $^{13}\text{C}/^{12}\text{C}$ isotopic patterns of baleen plates and the whale's krill prey sampled in the Mediterranean sea and Atlantic suggests that whales sampled in the Mediterranean sea exhibited two different migratory behavior 8 fin whales appeared to be resident to the Mediterranean while 3 individuals exhibiting large variation of their $^{13}\text{C}/^{12}\text{C}$ ration consistent with regular migrations to the Atlantic. Finally, in August 2003, 11 fin whales, 8 of them providing suitable data were tracked up to 310 days and reveal that most of fin whales resided in the north western Mediterranean Sea while one individual migrated through the strait of Gibraltar to the Atlantic.

PASSIVE TRACKING TECHNIQUE EMPLOYED ON FIN WHALES TO EVALUATE THE ADEQUACY OF GUIDELINES USED DURING WHALE WATCHING IN THE LIGURIAN SEA SANCTUARY

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A study dedicated to describe and measure short-term responses of fin whales (*Balaenoptera physalus*) to close approaches by a fast-moving inflatable craft was already conducted in the western portion of the Ligurian Sea from 1994 through 1999. For this purpose a non-invasive technique of passive tracking was developed based on the simultaneous determination of: position of the observation vessel (GPS), laser -measured distance between the target animal and the vessel, azimuth of the target animal. Tracking was also associated to the timing of surfacing intervals and data were processed in real time by a dedicated software (HighWhale). Two different swimming-surfacing patterns, supposed to be related to feeding and travelling respectively, were described. Supposed feeding whales reacted to disturbance by changing their swimming pattern to travelling. Two different avoidance strategies were performed simultaneously by the whales: travelling at increased velocity and reduction of time spent at surface. Recently this technique has been used to test the reaction of whales approached by the same kind of inflatable, but manoeuvred in line with the guidelines for commercial cetacean-watching activities recommended by ACCOBAMS. Five samples, collected in 2001 and 2005, yielded workable data and preliminarily indicate a weak reaction of the whales, if any, as compared to baseline data. Thus, passive tracking appear potentially useful for further testing the whale's reaction in relation to the "conduct" of the boat, and to different kinds of crafts. The final goal is to provide *ad hoc* scientific support to the future management of whalewatching in the Sanctuary, and to set the basis for adapting regulations to the ecology of the targeted population.



PREDICTION OF FIN WHALES SUMMER GROUPING: AN OPERATIONAL AND REAL TIME TOOL

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A previous study in the Mediterranean Sea marine mammal Sanctuary and the adjacent waters showed relationship between the summer fin whale distribution and several combined environmental parameters. The method is characterized by the fact that it takes into account the seasonal changes of water masses. The time integration is made possible by the use of satellite imagery to gain knowledge of the environment. Multiple cross-correlation coefficients were calculated between these environmental parameters and the fin whale summer distribution, expressed into sightings per unit of effort, from 1998 to 2002. A predictive model, the Potential Grouping Index, was developed from this statistical approach to locate and to count areas potentially favourable to the whale presence.

In 2003, a real time system was designed to test the possibility to predict the fin whale summer distribution through an a priori data analysis, and, consequently, to direct a boat towards the predicted fin whale grouping areas. The potential grouping indices are computed before the boat departure, for the whole north-western Mediterranean basin divided in small spatial cells on a grid; the indices are refreshed every four days by a land-based operator, thanks to real time satellite remote-sensing of sea parameters, and a new prediction map is sent to the boat via satellite communication.

Only few days were allotted to this specific topic, nevertheless encouraging results indicated this tool might be interesting for future population studies (photo-Id, distribution surveys), managing activities (maritime freight, fishing, tourism including whale-watching) in the Mediterranean basin and especially in the marine mammal sanctuary. An alarm map could be elaborated on the roads of navigation. This tool must be tested but appears already operational, automatizable and inexpensive.

PRELIMINARY RESULTS ON FIN WHALE DISTRIBUTION IN LIGURIAN SEA

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Studies of cetacean distribution in Pelagos Sanctuary are necessary to protect them efficiently. This work presents the analyses of sighting and effort data collected during two years of campaigns (2004 and 2005) led in the Pelagos Sanctuary area, with the research vessel *Menkab* of the Biology Department of the University of Genoa. Because of the heterogeneity of the data obtained, fin whale distribution is examined with respect to depth, gradient of depth and sea surface temperature. Results indicate significant influence of those three parameters on whales' distribution. By using an empirical model, including the ecosystem dynamic, such results could serve to delimit areas predicted to be important habitats and could serve to design the "whale bulletin", a possible issue to protect cetacean population inside the Sanctuary.

MORTALITY OF MEDITERRANEAN FIN WHALES FROM SHIP COLLISIONS: AN ASSESSMENT OF POPULATION RISK

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The fin whale (*Balaenoptera physalus*) is the cetacean most often recorded as struck by vessels all over the world's oceans. This paper reviews and analyzes ship collision records for the relatively isolated population of fin whales in the Mediterranean Sea from 1897 to 2001, focusing on the period 1972-2001. We collected records both from dead and photo-identified free-ranging individuals. Out of 287 carcasses, 46 individuals (16.0%) were certainly killed by boats; this percentage rose to 19.9% if records including animals presumably killed by vessels or unidentified large specimens were considered. The mean annual collision rate increased from 1 to 1.7 whales per year from the 1970s to the 1990s. 82.2% of the strike events were reported in or adjacent to the waters of the Pelagos Sanctuary for Marine Mammals, a Marine Protected Area characterized by high levels of nautical traffic and frequent whale aggregations. Among 383 photo-identified whales from the same area, 9 (2.4%) had marks that were attributed to a ship impact. The reported rates are unusually high for baleen whales. While the estimated rate of fatal strikes would not threaten the population itself, the high likelihood of unreported fatal strikes combined with other anthropogenic threats suggests an urgent need for a comprehensive, basin-wide conservation strategy for this population, including ship strike mitigation requirements. Mitigation measures might include real-time monitoring of whale presence and distribution to re-locate ferry routes to areas of lower cetacean density, and reducing ship speed in high cetacean density areas. Future research to describe the whales' behavior in relation to approaching vessels including controlled-exposure-experiments combined with passive tracking and multi-sensor recording devices would be helpful to further understand and avoid these interactions.



FIN WHALES (*BALAENOPTERA PHYSALUS*) SUMMERING IN THE LIGURIAN SEA: DISTRIBUTION, ENCOUNTER RATE, MEAN GROUP SIZE AND RELATION TO PHYSIOGRAPHIC VARIABLES

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This paper investigates the distribution of Mediterranean fin whales (*Balaenoptera physalus*) between 1990-99 in the recently-established Pelagos Sanctuary for the Conservation of Mediterranean Marine Mammals. During the study period, 870 days were spent at sea, surveying a total of 73,046km, totalling 540 sightings of fin whales. Mean yearly whale encounter rates showed no significant differences in the first five years, but then steadily decreased between 1995-99. The highest encounter rates and largest mean aggregation size (mean=2.12; SD=1.32; SE=1.15) were in summer 1995 and the mean aggregation size throughout the study period was 1.75 (mode=1; SD=1.11; SE=0.05). Differences in mean aggregation size were significant between years, but not months. This is likely to be related to prey availability and to patchiness of plankton distribution. Generalised Linear Models were used to relate fin whale distribution to physiographic variables (mean, range and standard deviation of depth and slope, and distance from the nearest coast). Water depth was the most significant variable in describing fin whale distribution, with more than 90% of sightings occurring in waters deeper than 2,000m. This study demonstrates the deep water preference of fin whales in this area, emphasises the crucial role that this part of the western Ligurian Sea plays in the ecology of Mediterranean fin whales and provides recommendations for conservation and management measures in the area.

PRELIMINARY RESULTS ON FIN WHALE PHOTO-IDENTIFICATION DURING SURVEYS OF CETACEAN DISTRIBUTION IN LIGURIAN SEA

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All over the year, campaigns were led by the Biology Department of the University of Genoa on its research vessel, *Menkab*. Results on cetacean distribution have been collected during 2004-2005, in the *Pelagos* sanctuary area. A total of 26 fin whale groups have been sighted and recorded by photo-id. This work presents the characteristics of the Biology Department catalogue constructed for this species. Interesting evidences are presented proving vessel contacts with animals. This new photo-id material should be a helpful tool for regular monitoring of fin whale population pooled with other existing photo-id data bases.

CASE OF TWO FIN WHALE STRANDING EVENTS AT GENOA, IN 2005

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Two fin whales stranded on March 2004, the 24th and on September 2005, the 14th, at Genoa. The events are described with a special interest on photo evidences of collision in the two cases. The fact that both animals, estimated to have less than one year old, is discussed. Histological analyses of tissue samples were conducted. Some results as heavy metal concentration are presented.

Annex D

Report of the Working Group on distribution, abundance and population structure

1. OBJECTIVE OF WORKING GROUP

The aim of the Working Group was to review existing information in fin whales in the Mediterranean and develop a list of prioritised recommendations. It was greatly assisted in this review by the report of the Workshop to develop a basin wide survey (Cañadas, Donovan and Fortuna, 2005) and the reader is referred to that report for detailed information on items 2 and 3.

2. REVIEW OF PRESENT KNOWLEDGE

2.1 Population structure

Animals from the Mediterranean have been shown to be genetically different from the eastern North Atlantic, but the limited sample sizes and limited geographical spread of studies from within the Mediterranean preclude conclusions being reached on within basin stock structure.

2.2 Distribution and movements (inter- and intra-annual)

There is good information for a few areas, such as the Ligurian Sea, but poor information for most of the Mediterranean (see Fig. 1). Although there is information on year-round presence in some areas, there are insufficient data to determine whether or not there are significant seasonal changes in density even in those areas.

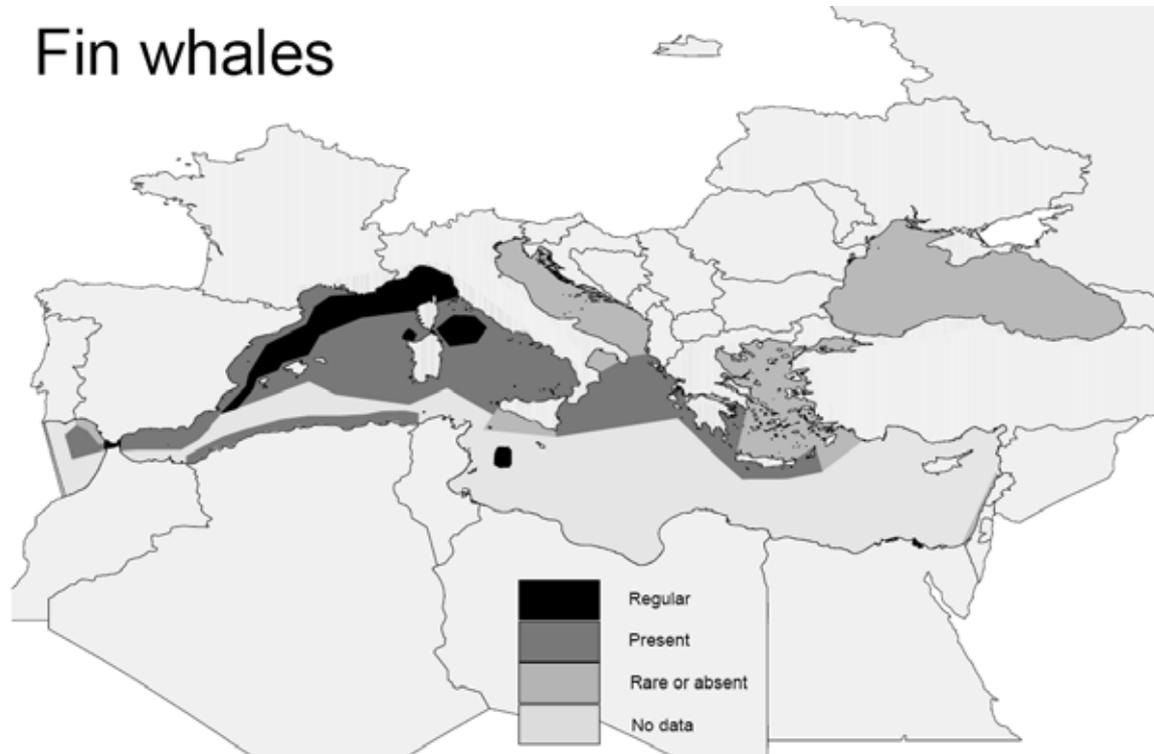


Fig. 1 Schematic summary of information available on distribution of fin whales (from Cañadas, Donovan and Fortuna, 2005)



2.3 Absolute and relative abundance

The primary absolute abundance estimates are for the Provençal and Ligurian Sea area in 1991/92 (Forcada *et al.*, 1995; 1996). There are density and encounter rate data for some smaller areas, mainly from non-systematic surveys.

2.4 Population dynamics (biological parameters)

Information on biological parameters (e.g. survivorship, reproduction) can be useful in terms of population modelling and in identifying potential effects of anthropogenic threats. However, it is difficult to estimate such parameters with sufficient precision to be able to detect changes over time. There is very limited information available for the Mediterranean at present, although some information exists from the North Atlantic (see the 2006 report of the IWC Scientific Committee for a review¹). Probably the best source of such data is long-term series of photo-identification data.

3. IDENTIFY INFORMATION GAPS

3.1 Population structure

Clearly, there is a strong need for genetic samples from throughout the basin if stock structure is to be investigated. There are few genetic samples from outside the northwestern region. Stock structure can best be investigated by using data from a suite of techniques, not simply genetics, and additional complementary methods should be investigated, including individual recognition data, telemetry data, pollutant profiles and stable isotopes.

3.2 Distribution and movements (inter- and intra-annual)

As shown in Fig.1, there are relatively few data outside the northwestern region and there are relatively few information anywhere outside the summer months.

3.3 Absolute and relative abundance

There are no good recent abundance estimates for anywhere in the Mediterranean. The only existing estimates are from 1991/92 (see Item 2.3)

3.4 Population dynamics (biological parameters)

There is little or no published information on biological parameters.

4. METHODS TO ADDRESS INFORMATION GAPS

4.1 Population structure

The Working Group considered two possible projects on this topic. They are summarised in Table 1 below.

	Recommendation	Objective	Feasibility	Time-frame	Costs	Links	Priority 1=high
PS1	Collect (including looking for existing samples) and analyse genetic samples (strandings and biopsy sampling) from throughout the known range of fin whales and at various times of the year and using a variety of markers to update the work of Bérubé <i>et al.</i> 1998. Requires co-ordination wrt genetic and statistical analysis	To investigate whether there is population structure within the Mediterranean, particular wrt animals outside the northwestern Mediterranean (e.g Straits of Gibraltar and Lampedusa)	Yes	Depends whether dedicated or opportunistic	Depends on sample size	Fundamental to understanding abundance and trends	1
PS2	Collect and review information from other techniques that may provide insights into population structure e.g. stable isotopes,	To supplement genetic studies	Yes	Some e.g. pollutants can be through biopsy.	Depends on sample	To PS1	2

¹ Available from the IWC Secretariat: http://www.iwcoffice.org/commission/sci_com/screport.htm



	Recommendation	Objective	Feasibility	Time-frame	Costs	Links	Priority 1=high
	pollutant profiles, individual recognition data. Requires co-ordination wrt laboratory and statistical analysis for some data types, central catalogue for photo-identification data.			Others (baleen plate stable isotopes) must be opportunistic	size		

4.2 Distribution and movements (including long-term monitoring and trends)

The Working Group considered nine possible projects under this topic. They are summarised in Table 2 below.

	Recommendation	Objective	Feasibility	Time-frame	Costs	Links with other reccs	Priority 1=high
DM1	Undertake synoptic basin wide systematic survey. Major ACCOBAMS initiative already underway.	To provide broad synoptic overview of distribution during the summer in a particular year, and to provide information for areas where no little or no information exists at present	Yes	Summer 2007 or 2008	See Valsain report	Fundamental baseline information relevant to many reccs	1
DM2	Platform of opportunity (e.g. ferries, merchant ships), effort-based observations of fin whales in areas where little or no information exists, preferably over wide temporal scale (inter- and intra annual). Requires co-ordination with e.g. ship owners associations. Possible co-operation with other vessels (e.g. Greenpeace; IFAW)	To provide information on distribution of fin whales in areas and/or times of the year for which little or no information exists. To provide information on variability in distribution over time	Yes	Before or during Summer 2006	Observers	Great help in DM1, may help with A4, A5	1
DM3	Co-ordinate and expand studies that utilise spatial modelling, recognising that such approaches can incorporate both systematic and non-systematic survey data but are data intense. Workshop to develop guidelines and examine case studies	To provide explanatory and predictive models of distribution of whales at various spatial scales and provide information on potential critical habitat.	Yes	Long-term	Co-ordinating workshops	Part of DM1, A4, A5,	2
DM4	Collection and analysis of photo-identification data. Requires co-ordination and a central catalogue (c.f. continuation of Europhlukes). Secure long-term future. Collection of photographs can be by dedicated programmes or platforms of opportunity (e.g. whalewatching vessels).	To provide information on intra- and inter-annual on distribution and movements.	Yes	Long-term	Central catalogue, maintenance	PS2, A6, PD1, DM5	1
DM5	Collection and analysis of genetic samples for individual identification (DNA 'fingerprinting'). Requires co-ordination for linking with photo-identification catalogue and for central analysis of data. Collection of samples	To provide information on intra- and inter-annual on distribution and movements.	Yes	Short-term confirmation, ideally also long-term	Co-ordination workshop(s), central analyses	DM4, poss A6 etc	1



	should be undertaken by experienced personnel.						
DM6	Collection and analysis of acoustic data (preferably including location data from arrays) e.g. by using existing arrays (e.g. military) and by placing pop-ups in strategic places. Requires co-ordination with military and for efficient placement of pop-ups.	To provide information on intra- and inter-annual distribution and perhaps inferences on movements	TBA	Short-term, ideally long-term	Hardware, analysis	May help with planning for A1	2
DM7	General research programme to develop automatic recognition of fin whale sounds and triangulation on locations.	To make acoustic data analysis more efficient.	TBA	Unsure	Development costs	DM6, A6	2
DM8	Targeted telemetry studies taking into account need for suitable sample sizes (e.g. wrt Straits of Gibraltar at various times of year, Lampedusa)	To provide information on movements of individual animals in response to specific questions	Difficult	Unsure	Expensive but depends on sample size	PS2	2-3
DM9	Collection of information on other factors (e.g. stable isotopes, pollutant profiles, fatty acids) that may provide information on movements.	To provide general supplementary information and inferences on distribution and movements	Yes	Long-term	Secondary benefit	PS2	2

4.3 Absolute and relative abundance (including long-term monitoring and trends)

The Working Group considered seven possible projects under this topic. They are given in Table 3 below.

	Recommendation	Objective	Feasibility	Time-frame	Costs	Links	Priority 1=high
A1	Undertake synoptic basin wide systematic survey. Major ACCOBAMS initiative already underway.	To provide baseline abundance estimates for the whole ACCOBAMS area	Yes	Summer 2007 or 2008	See Valsain	Many	1
A2	Undertake dedicated smaller-scale surveys in areas where there is little or no information to obtain information on e.g. encounter rates	To allow improved design of the synoptic basin wide survey	Yes	Before or during Summer 2006		A1	1
A3	Platform of opportunity (e.g. ferries, merchant ships), effort-based observations of fin whales in areas where little or no information exists, preferably over wide temporal scale (inter- and intra annual). Requires co-ordination with e.g. ship owners associations.	To allow improved design of the synoptic basin wide survey	Yes	Before or during Summer 2006		A1	1
A4	Hold joint workshop with SCANSII and IWC Scientific Committee (and other Life projects) looking at general theoretical and practical aspects of smaller-scale monitoring for trends	To provide the theoretical background for developing a series of monitoring programmes throughout the area	Yes	Short-term (e.g. 2006)	Workshops	A1	1
A5	Hold ACCOBAMS long-term monitoring workshop to review results of workshop in A4 & results	To develop specific monitoring programmes in the ACCOBAMS area	Yes	After basin wide survey	Workshops	A1	1



	of basin wide and other surveys.						
A6	Expand dedicated photo-identification effort. Requires co-ordination and a central catalogue (c.f. continuation of Europhlukes). Secure long-term future.	To obtain updated unbiased abundance estimates from mark-recapture analysis.	Yes	Long-term	?	A1, A3-6, P1	1
A7	Co-ordinate and expand studies that utilise spatial modelling, recognising that such approaches can incorporate both systematic and non-systematic survey data but are data intense.	To provide abundance estimates and trends (including using data sets not normally suitable for obtaining such estimates)	Yes	Long-term	?	A1, A3-6	2

4.4 Population dynamics (biological parameters)

The Working Group only considered one possible project under this item. This is given in Table 4 below.

	Recommendation	Objective	Feasibility	Time-frame	Costs	Links	Priority 1=high
P1	Continue and expand photo-identification effort and securing long-term future for central catalogue to ultimately provide information on biological parameters such as survivorship, calving rate, age at attainment of sexual maturity etc	To provide information on biological parameters such as survivorship, calving rate, age at attainment of sexual maturity etc	Yes	Long-term	?	A6	2-3

5. RECOMMENDATIONS

5.1 General principles and recommendations (including importance of long-term studies and co-ordinated research effort)

The Working Group **strongly supports** both phases of the basin wide survey initiative (Cañadas, Donovan and Fortuna, 2004) i.e. (1) obtaining 'baseline' information on distribution and abundance *for all species* (although recognising that the focus of this workshop is fin whales) in the ACCOBAMS agreement area from a large-scale synoptic survey; and (2) developing a smaller-scale long term monitoring programme to identify trends in abundance and/or changes in distribution. In accord with the views of the ACCOBAMS Scientific Committee and the MoP, it **agrees** that this should be seen as the highest priority research action.

The Working Group **stresses** the importance of long-term studies both of cetaceans as well as key biotic and abiotic features of the environment. It recognised that this may require a change in emphasis of both management and research agencies. In the present climate there is often reluctance to invest in long-term programmes. It may also require a change in the way many institutes evaluate scientists. At present, this is often on the basis of the number of publications. It is a feature of long-term monitoring programmes that they do not result in several publications per year despite the fundamental importance of the work. This may discourage high calibre scientists from committing to such programmes to the detriment of cetacean conservation.

It therefore **strongly recommends** that ACCOBAMS and its Parties commit to supporting the development and maintenance of long-term monitoring programmes included in this report, including the maintenance of appropriate databases (e.g. the photo-identification catalogue) and research programmes.

Finally the Working Group **stresses the need for a co-ordinated approach** to fin whale research and evaluation of results in the ACCOBAMS area; this is the only way to try to conserve the species. There are numerous examples of how combining data exponentially increases the value of the results. These include:

- (4) combination of photo-identification data into a centralised catalogue with a centralised data collection and matching protocol;
- (5) structured effort to develop and co-ordinate appropriate biopsy sampling programmes with respect to genetic analyses (both for stock structure and DNA profiling), pollution analyses etc. including the need to identify appropriate laboratories for analyses;



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- (6) development of models to try to explain and predict fin whale distribution and abundance, as well as to refine estimates of abundance – these are data hungry but potentially very powerful.

5.2 Specific recommendations

The Working Group agreed to four high priority research tasks:

- Recommendation 1: Abundance: (a) obtain baseline information on the distribution and abundance of fin whales in the ACCOBAMS area and (b) develop a subsequent programme to monitor trends in abundance
- Recommendation 2: Develop a central photo-identification database for use (as part of a co-ordinated programme) as a long-term management and conservation tool
- Recommendation 3: Examine and elucidate Mediterranean fin whale population structure
- Recommendation 4: Comparison of individual identification techniques (photo-id and genetic profiles) and implications for management.

The detailed Recommendations, including rationale and timetable, are given in Annex G.



Annex E

Report of the Working Working Group on Ecology and Behaviour

1. HABITAT USE, INCLUDING OCEANOGRAPHY AND REMOTE SENSING

1.1 Spatial modelling

The Working Group started by discussing the predictive habitat use models and remote sensing data that were presented to the workshop. The working group was encouraged by the advances that had been made using this approach. However, while in some cases the model predictions appeared to be reasonable, the working group cautioned that some of them were based on very limited sightings data. It is well recognised that reliable spatial modelling requires high quality, detailed datasets to avoid spurious correlations. In addition, development and validation of such models requires an iterative process of data gathering and refinement. Field data should be collected to test and ground truth the data and/or model predictions, both on whale distribution and associated oceanographic features. This can then also be used to further inform the predictors and/or models to be more accurate. The Working Group **agreed** that spatial modelling is extremely promising and that work should proceed in this manner.

The number and nature of the variables used in habitat models was noted. There is a need to identify those that are most important to whales, noting that some observed correlations may merely reflect association with other primary factors or small sample sizes. As noted above, robust models require large data sets (both of sightings and potential explanatory variables). It was **agreed** that this would be facilitated by the merging of existing data sets. The poor knowledge of the distribution of whales outside a few surveyed areas was noted (and see Annex B). The productivity models in the Western Basin were particularly noted, and the need for more sighting information from that area was discussed. Beaubrun referred to a series of data off the Gulf of Lyon and the French coast that contain survey track lines, efforts, and sightings for the past 14 years that could be made available for analysis.

The data presented by Moulins, who showed how quickly sea surface temperature (SST) variability can change the habitat on a daily basis, was discussed. It was noted that further information on the precision of the oceanographic data available from remote sensing is needed; the data that she used had each pixel averaged from SST's sensed at approximately 2 nautical miles. The suggestion was made that groups should measure SST at each whale sighting to see if this scale was appropriate. It was noted that the most important variable may be the temperature front the whale was associated with, and a fixed position SST may not accurately measure that.

The Working Group **agreed** that there was value in obtaining periodic looks at the spatial distribution of fin whales over a large horizontal scale on a single day. This might be achieved by having all research groups conduct coordinated survey efforts on a single day, or by undertaking periodic larger scale aerial surveys. In general, it was believed that a comparison of distribution across wide areas was required, in addition to within localized areas, in order to understand the basin-wide scale effects that are influencing fin whale distribution.

It was suggested that the lack of an accurate bathymetric data series for the Mediterranean represented a serious limitation of the ability to model fin whale habitat use, and even the smaller scale circulation patterns of the basin. The fact that some analyses suggested that fin whale distribution was highly tied to slope and bathymetry illustrates this. Differing data sets were discussed, and it was unclear whether there were different extrapolations of the same data set, or if they were based on different sets of measurements. The Working Group **agreed** that a more accurate and realistic picture of the bathymetry of the study area is required and it **recommends** that the ACCOBAMS Secretariat establishes contact with (a) the Hydrographic Institute of Genova to request access to their digitised bathymetry data, (b) the NATO Undersea Research Center (NURC) to explore the possibility of having access to their data and (c) IFREMER to request access to their data (although it is recognised that they have no data above 44 degrees. In general, the desired resolution is one measured point every km or less.

1.2 Aggregations of whales

The Working Group also discussed the general lack of aggregations of whales that had been seen. Wurtz has seen up to 50 whales aggregated within approximately 3 n.miles approximately 25 miles west of Cape Corso in August of 2001; Beaubrun noted an aggregation of over 20 individuals in October (1995 or 1996) in the Gulf of Lyon. It was noted that such aggregations represent a unique opportunity to understand the ecology of the whales and every effort should be made to maximize the data collected at such opportunities.



1.3 Prey, feeding and diving behaviour

The Working Group agreed that the available evidence suggests that *Meganyctiphanes norvegica* is the primary, if not the exclusive, prey of fin whales in the Ligurian Sea and the Western Basin. The limited information from Lampedusa suggests that a different prey source may be important there (*Nyctiphanes couchi*). However, the Working Group recognises that available data are limited. To improve the sample size and geographical spread of the data, the Working Group **recommends** that all research groups in the region should be requested to sample faeces under an agreed upon protocol whenever possible. It noted that such samples could also be used to assess the reproductive condition of females using hormonal levels, as has been done with North Atlantic right whales.

The Working Group also **recommended** that biopsy samples should be used to conduct stable isotope and fatty acid analysis, and that a protocol be developed to maximize the information derived from each biopsy sample. Additional samples used to understand diet should include stomach contents of stranded animals, stable isotopes in baleen from fin whales, and any other appropriate materials. In all cases, the Working Group **agreed** that funding for analysis of these samples should be made available.

The Working Group discussed how best to understand the nature (size, density, behaviour) of the prey schools on which fin whales feed. The small size of euphausiids, the depths at which they are found, and their schooling behaviour can all greatly affect the ability of an echo-sounder to accurately portray the prey school. Multi-beam sonar and/or direct sampling methods, in conjunction with data on underwater whale behaviour, would be a more accurate way of obtaining the necessary data. These techniques have been used successfully by Baumgartner and Mate (2003) and Croll *et al.* (1998) to study other foraging baleen whale species. The Working Group recognised that such methods require large vessels and are expensive. However, it **agreed** that conducting such an in-depth study of the relationship of whales to their prey in the Ligurian Sea and the Western Mediterranean Basin would greatly add to our understanding of whales in the area.

While there is some limited data on feeding and diving behaviour in the Ligurian Sea (Panigada *et al.*, 1999; 2003), there are virtually no data anywhere else in the Mediterranean. The initial work done in Lampedusa (Canese *et al.*, 2006) suggests this may be an important feeding area, and the Working Group **recommends** that this work be continued and expanded in future years. The proximity of the whales to shore in shallow water habitats may make measurements of prey and foraging studies easier than in other deep water basins, but it is unclear how representative such studies might be. Future work should better determine the number of whales using the area, the period of use and residency patterns, and the extent of feeding behaviour in the area.

The Working Group **recommends** that more tagging data is needed to better understand diving and foraging behaviour in the Ligurian Sea area, given the limited sample size that exists. Nothing is known about the diving and foraging behaviour in the Western Basin near the Gulf of Lyon, and the Working Group **recommends** that this area is also covered. While information from the Alborán Sea is desirable, it was noted that the whales there move quickly and it may be a difficult area in which to work.

1.4 Reproduction

The question of breeding and mating habitats for the population was discussed. In general, there are few records of young calves, and mating or calving habitats are unknown. Winter acoustic recordings of male vocalizations, discussed above, might lend insight into mating habitats, but not calving or nursery areas. Some juvenile animals have been found in the stranding data from the Italian coast, but the lack of comprehensive stranding networks in other areas makes comparing this data impossible. What are likely to be young-of-the-year fin whale calves have been seen on some occasions during the summer work in the Ligurian Sea; Tethys has seen them approximately 30 times over 10 years. The Working Group **agreed** that more information about the distribution and ecology of calves and juvenile animals would be desirable, and that all Working Groups should pool their mother-calf sightings to see if patterns emerge.

1.5 Seasonality

The seasonality of habitat use was also discussed. While the winter sightings of feeding whales off Lampedusa are very interesting, in order to place them in an ecological context it is necessary to know the summer distribution of those whales (e.g. are they found in the Ligurian Sea or the Western Basin). Although Lampedusa



is far from the presently identified summer habitats, fin whales (and other *Balaenopterids*) elsewhere have been known to cover great distances (up to 1,000 km) in short (<1 week) time periods e.g., blue and fin whales in other areas (Watkins *et al.* 1984; Mate *et al.* 1999). Photo-identification can be a valuable technique for understanding movements and migrations between the different areas.

In general, knowledge of the distribution, movements and ecology of fin whales in the Mediterranean in any season but summer is poor, and increasing the knowledge base for the remainder of the year is a priority. However, bad weather in the other seasons will make such information difficult to acquire. Use of aerial surveys (that can cover large areas on good weather days), or larger oceanographic vessels (that can remain out during poor weather) should be considered.

Reference was made to limited preliminary winter work that had been carried out in the Ligurian Sea, that had revealed whales to be present in the same areas as during the summer. However, it was noted that the relative abundance may be very different to that in the summer.

Acoustic monitoring of fin whales also holds promise. There is a general paucity of low frequency acoustic data throughout the Basin with the exception of three years of data from autonomous bottom-mounted recording devices ('pop-ups') from the Ligurian Sea, much of which still needs to be analysed (data held by Fabrizio Borsani, ICRAM). While the recordings were made year round, there is limited knowledge of the seasonal call rate of fin whales. It is known that low frequency calls, presumably from males (Clark *et al.* 2002), were obtained from the pop-ups, but it is not known if fin whale feeding sounds were also obtained. The Working Group **recommends** that analysis of these data should be undertaken as quickly as possible to determine what can be learned about winter presence in the Ligurian Sea.

Acoustic monitoring is also encouraged for the Western Basin near the Gulf of Lyon, where there is limited information on whale usage during the winter. Other potential opportunities for acoustic monitoring include the possibility of a remote monitoring system on a bottom-mounted buoy designed for other purposes between Sardinia and the Balearic islands. The Working Group **recommends** that such opportunities be used whenever possible, since data collection is inexpensive but **stresses** that in all such cases sufficient funds be allocated to allow prompt analysis of the data.

1.6 Critical habitat

The term 'Critical Habitat' has not yet been defined in an ACCOBAMS context; nor has it been formally defined within the Pelagos Sanctuary. There was some general discussion of the concept within the Working Group. Critical habitats can be considered as specified 'small' areas important for a single species of concern, in which certain management measures might be required for the population's welfare and/or continued survival.

In general, the Working Group agreed that identification of critical habitats should: be demonstrably important for a key part of the animal's life history (e.g. feeding or breeding); require both an oceanographic basis to predict whale use (e.g. identifiable features which lead to high prey densities) and a time series of data which shows consistent use of whales. Some suggested that the definition of a (Specially protected Area of Mediterranean Importance) SPAMI (SPA Protocol, 1995) could be helpful (excluding those criteria that refer specifically to biodiversity). There was no agreement on whether anthropogenic threats should be used to help determine critical habitats, or whether they should be managed within critical habitats once these are determined by the other criteria. The question of how to manage potential threats arising outside the critical habitat that affect the habitat (e.g. water quality) was also briefly discussed. It was noted that in the USA, critical habitats for North Atlantic right whales are considered those areas that if heavily disturbed, would be difficult for the population to compensate for the loss by using other areas.

In the Mediterranean, it appears that fin whales use large areas that fluctuate greatly over time and between years. Some commented that it may only be possible, therefore, to designate a very large 'critical habitat' and there is a trade-off between the size of a designated critical habitat and the degree of protection that can be offered in such an area. However, others noted that a sufficiently comprehensive and long time series of data is collected for an area, and analyzed e.g. for sighting density and encounter rates (e.g. the analysis presented in Panigada *et al.*, 2005) may result in appropriate smaller key areas being identified.

Given the above discussion, it is clearly premature to identify 'critical habitat' for Mediterranean fin whales. However, some participants mentioned areas that they believed warranted particular attention in the future. These included: an area west of Corsica (approximately 50 x 50 n.miles) that captured a portion of the Ligurian gyre; the Western Basin off the Gulf of Lyon; Lampedusa; and the Gibraltar Strait.



2. RECOMMENDATIONS

Based on the discussions above, the Working Group identified the priority projects given in Table 1 below (note that this has been updated for consistency with Annex D after completion of the meeting). Note that these recommendations have been classified as ‘General’, ‘Specific’ or ‘Could be made specific’.

No.	Recommendation	Objective	Feasibility	Time-frame	Costs	Links	Priority 1=high
H1	Improve knowledge of distribution, movements and ecology outside the summer period	May inform interpretation of abundance estimates and trends. Will provide information relevant to identifying and mitigating threats.	Yes	Medium-long	n/a	DM1,2; A1-3	1
H2A	Expand the temporal and geographical scope of studies at Lampedusa	Information from outside known primary area – may inform and refine spatial modelling exercises to identify other suitable habitat. Relevant to distribution and identification/mitigation of threats.	Yes	Short-medium	?	PS1-2, DM3-6,8	1
H2B	Modelling exercises should be based on as much data as available and follow an iterative approach of hypothesis development, testing and refinement	This work can inform both interpretation of abundance estimates and trends, and identification of critical habitats in relation to anthropogenic threats:	Yes	Medium-long	n/a	DM3	2
H3	In-depth study of fin whale feeding in the NW Mediterranean, using large oceanographic vessel to study prey and whales	May improve spatial models and may provide information relevant to threats.	?	Medium	Expensive	DM3	3
H4	Analysis of existing winter pop-up data should be completed as soon as possible	To obtain information on winter distribution in the Sanctuary. Will be relevant to anthropogenic threats	Yes	Short	Cheap	DM2; DM6	1
H5	Expand tagging (TDR, D-tag etc) efforts to better understand diving behaviour in Ligurian Sea and elsewhere	To obtain better understanding of diving behaviour. May be relevant to improved spatial modelling and mitigating anthropogenic threats	?	Medium-long	Expensive	DM8	2-3
H6A	Examine fatty acid profiles and stable isotopes from biopsy samples	To obtain better information on diet. May also provide inferences on stock structure and distribution.	Yes	Medium - long	Depends if dedicated or part of other programme	DM9	
H6B	Develop protocol for maximising use of biopsy samples	To maximise efficiency and to minimise potential adverse effects on animals	Yes	Short	Cheap	PS1, PS2,	1
H6C	Examine stomach contents from stranded animals	To obtain better information on diet	?	Long	?	H6C	3



H6D	Examine baleen plates for stable isotopes	To obtain information on possible changes in diet over time. May provide inferences for stock structure and distribution	Yes	Medium-long	Cost of analysis	PS2	2
H6E	Utilise opportunistic acoustic possibilities, ensuring finances are available for analysis of resultant data	To provide some information on distribution throughout the year. May be relevant to threats. GENERAL	Yes	Medium - long	Cost of analyses	DM6	2
H6F	Obtain periodic 'looks' at the spatial distribution of fin whales over a wide area on a single day	To get an insight into the reasons for the spatial distribution of animals at a finer scale. May be relevant to threats	?	?	Depends – could be expensive	?	3
H7	Encourage all groups to collect faecal samples under an agreed protocol	To obtain more information on diet. May improve spatial models. May be relevant to threats	Yes	Medium-long	?	H6	3
H8	Encourage all groups to pool their mother-calf sightings data	To obtain better information on reproduction and distribution of breeding areas. May provide inferences for stock structure. May be relevant to threats.	Yes	short	Cheap	PS1 and PS2	2
H9	Identify and make available datasets on potential explanatory variables at appropriate spatial scales. ACCOBAMS to facilitate access to detailed bathymetry data (Hydrographic Institute of Genova, NATO, IFREMER).	To improve spatial models. PART SPECIFIC	Yes	Short for specific	Cheap	H1	2



Annex F

Report of the Working Group on human impacts

1. POLLUTANTS

There are reasons for concern on the effect of toxic pollutants on fin whales in the Mediterranean, a sea which is less than 1% of the global marine surface but has over 20% of the world hydrocarbon-related maritime traffic. Due to the high concentration of human activities and to low water turnover, in the Mediterranean the levels of the main chemicals known to have noxious effects on cetaceans are one order of magnitude greater than in the world's oceans. Organochlorine levels are decreasing worldwide as well as in the Mediterranean, but their levels are still high; in addition, certain organochlorines such as flame retardants, now known to be very damaging to cetaceans, are increasing in the Mediterranean. A greater attention needs to be dedicated to the effects of endocrine disruption by these chemicals on fin whales.

The Working Group considered a number of possible projects under this item, as shown in Table 1 below.

No	Recommendation	Objective	Feasibility	Time-frame	Costs	Links	Priority
AT1	Improve ways of collecting and sharing samples between countries	Generic recommendation to facilitate research on evaluating the potential threat				Many	
AT1A	ACCOBAMS to continue to promote strandings networks and tissue banks	General	Yes	Long-term	Cheap	Many	2
AT1B	Standardise and update protocols on necropsy and strandings protocols (with ECS) including special protocol to examine gonads for endocrine disruption	General	Yes	Long-term	Cheap	Many	2
AT1C	ACCOBAMS to distribute sampling packages and protocols	General	Yes	Short-Long-term	Cheap		2
AT2	Determine potential impacts on species	May be important but extremely difficult cf POLLUTION 2000+	Maybe	Medium – long-term	Expensive		2
AT2A	Collect as many samples as possible (including biopsy) to examine geographic variability	GENERAL: but must be focussed	?	Long-term	Expensive		3
AT2B	Examine biomarkers of exposure and effect for three different regions	OK if using existing data, compatibility	Yes	Medium	Depends if new analyses needed		3
AT2C	Conduct <i>in vitro</i> studies	Interesting new technique needs exploring	Yes	Medium	Expensive		2
AT2D	Examine heavy metal concentrations in sloughed skin	Not focussed	?	Medium-long	Expensive		3
AT2E	Test feasibility of obtaining pollutant information from faecal samples	Interesting new technique needs exploring	Yes	Medium	Expensive		2
AT3	Develop 'pollutant map' of the ACCOBAMS area	To compare with cetacean distribution maps?	Yes	Medium	Cooperate with other bodies		3
AT4	Assess origin of pollutants (e.g. dredging muds)	Possible mitigation measures	?	Medium	Expensive unless already		3



					being done for other reasons		
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2. ACOUSTIC DISTURBANCE

The Working Group noted that a Resolution on anthropogenic noise (Resolution 2.16) was adopted by the Parties to ACCOBAMS at their second meeting (Palma de Majorca, November 2004), and that most of the prescriptions contained in that resolution were relevant to fin whales. Acoustic disturbance was subdivided into two categories: **ambient noise** (i.e. background noise) and **transient sound** of an impulsive nature (e.g., sound produced by seismic surveys, military sonar, military ordnance, dredging operations, coastal construction, oil platforms). Different approaches are obviously needed to address these two categories.

Ambient noise, which is mostly generated by shipping, was recognised as a particularly difficult issue to address, given that the subject is not well understood in the Mediterranean. Worldwide, there has been a trend for increasing levels of ambient noise in the marine environment, and this may well be the case for the Mediterranean given the increase in shipping during the recent decades. An increase in low-frequency ambient noise is presumed to impact cetaceans, particularly on species such as fin whales known to communicate over long distances through low-frequency vocalisations (e.g., by masking vocalisations, thus reducing the range at which communication is effective). However, data is lacking on the distribution of ambient noise in the Mediterranean, as well as on its actual impact on fin whale populations. A large amount of data on ambient noise is presumed to exist but cannot be accessed, being primarily held by the military.

With respect to transient sound, the Working Group **agreed** that there needs to have improved communication between ACCOBAMS and the agencies/industries responsible for the production of such sound in the marine environment, in particular to promote awareness of potential problems to cetaceans, as well as to allow inference and the gathering of knowledge on impacts.

The Working Group considered a number of possible projects under this item, as shown in Table 2 below.

No.	Recommendation	Objective	Feasibility	Timeframe	Costs	Links	Priority
AT5	Form a Working Group to collect and assess acoustic information to allow a description of ambient noise levels in the area with the ACCOBAMS and PELAGOS Secretariats facilitating contact with relevant groups e.g. the military and ICRAM	To try to establish a baseline?	Yes	Medium-term	Working Group costs if meeting		2
AT6	Develop a time series of noise maps and overlay these with maps of cetacean distribution	To try to identify potential hot spots	Maybe	Medium	Contract study?		2
AT7	Obtain information on past, present and future seismic and other transitory noise activities	To allow mitigation measures to be developed for intense activity	Yes, if industry and military cooperate	Short	Unknown		1-2
AT8	ACCOBAMS and PELAGOS Secretariats to liaise with government agencies to try to ensure that appropriate mitigation measures are in place for any transient noise activities	Mitigation	Yes	Short-medium	Liaison is not expensive but measures may be		1-2
AT9	Consideration be given to increased regulations in MPAs	GENERAL	Yes	Medium-long	Lawyers can be expensive		1-2



3. HABITAT DEGRADATION

The Working Group recognised that other types of impact may exist in addition to pollution, noise, and maritime traffic effects, which may combine to degrade fin whale (and other cetaceans) habitat. These include effects of **global climate change** and the presence in the marine environment of **litter** and **debris** (mostly plastic). The Working Group also noted the IWC workshop on cetacean habitat degradation (IWC, 2006) provides considerable insight that may inform attempts to address this issue for fin whales. However, it did not have time to review the report at the present workshop.

The Working Group recognised the complexity of determining the potential impacts of global climate change (e.g. see the report of the IWC Workshop on that subject – 1997, *Rep. int. Whal. Commn* 47: 293-313). A number of possible effects on fin whale conservation in the Mediterranean were briefly referred to in discussion, including changes in marine productivity regimes due to changes in circulation patterns as a result of the warming of waters, and increased acidification of waters due to increases in dissolved CO₂. Isaac offered to send a paper on this subject to the ACCOBAMS Scientific Committee. It was noted that the policies of some Mediterranean coastal states were relevant to the issue of climate changes (e.g. adherence to and implementation of the Kyoto Protocol); one specific example cited was that of the Government of France (“*Bilan Carbon*”).

The Working Group remarked that no information was available on the presence of marine litter and plastic debris in the bodies of Mediterranean fin whales, recognising that it is not possible to draw any general conclusions given the small number of necropsies performed on specimens stranded in the region.

The Working Group considered a number of possible projects under this item, as shown in Table 3 below.

No.	Recommendation	Objective	Feasibility	Timeframe	Costs	Links	Priority
AT10	Monitor the population and health status of fin whale prey and its possible response to climate change (e.g. wrt temperature, circulation, chemical composition of sea water)	General – needs wide variety of expertise	?	Medium-long-term	Expensive		2
AT11	Evaluate the feasibility of using photographic and molecular methods to examine health status in individual fin whales	To obtain an index of the population’s health	Yes	Medium	Photographic cheap – molecular expensive	DM4	2
AT12	Necropsy examinations should be made to determine whether plastic debris ingestion occurs	To see if this is a problem for fin whales	Yes	Medium-long	Cheap	AT1A	3

4. FISHERIES

The Working Group noted that cetaceans, including fin whales, are bycaught in a number of Mediterranean fishing operations (e.g. see the reports of the ACCOBAMS Scientific Committee). The continued use of **driftnets**, in spite of this gear being made illegal by EU, ICCAT and GFCM regulations, was considered as the most relevant source of fisheries-related mortality of fin whales in the region, although examples were given of fin whales having been deliberately encircled in tuna **purse seines** off southern France.

The Working Group considered a number of possible projects under this item, as shown in Table 4 below.

No.	Recommendation	Objective	Feasible	Time-frame	Costs	Links	Priority
AT13	Bycatches of fin whales should be recorded and the impact at the population level be assessed	General	Yes	Short-long	Expensive		1
AT14	Current basin wide survey activities should be strongly encouraged	To provide essential baseline information	Yes	Short-long	Expensive	DM1, A1	1
AT15	ACCOBAMS and PELAGOS should remind parties and range states that existing laws, particularly with respect to the driftnet ban, should be enforced	To reduce entanglement	Yes	Short-long	Cheap		1



5. VESSEL/WHALEWATCH INTERACTION

The Working Group briefly considered the growth of **commercial whalewatching operations** in the ACCOBAMS area. The primary whalewatching activities for fin whales occur in the waters of the Pelagos Sanctuary, although some fin whales are targeted by whalewatching operations in the Strait of Gibraltar and adjacent Alborán Sea waters, and other areas (e.g. Lampedusa) may become important in the future. ACCOBAMS has introduced whale watch guidelines that could be adopted for the implementation of whalewatching regulations (available from the Internet). Published data suggest the susceptibility of deep diving, feeding fin whales to disturbance in the Ligurian Sea (Jahoda *et al.*, 2003). This raises some concern about potential population level effects and emphasises the importance of controlling disturbance by whale watching operations and other traffic from a precautionary perspective.

Note that issues regarding ship collisions were referred to the ship strikes workshop.

The Working Group considered a number of possible projects under this item, as shown in Table 5 below.

No	Recommendation	Objective	Feasible	Time-frame	Costs	Links	Priority
AT16	ACCOBAMS Parties should initiate a licensing system for commercial whalewatching	To examine levels of potential disturbance on whales and promote good practice	Yes	Short	?		2
AT17	ACCOBAMS should develop a labelling system to be trialled as a monitored pilot survey in a specific area	To promote good practice and reduce disturbance on whales	Yes	Short	Moderate		2
AT18	ACCOBAMS (and PELAGOS) should be encouraged to complete and expand a database of whalewatching operators and to use this to examine status and trends in fin whalewatching vessels	To examine status and trends in fin whalewatching vessels	Yes	Short-long	Cheap		2
AT19	ACCOBAMS and PELAGOS should strongly discourage swim-with-fin-whale activities	To prevent disturbance, possibility of disease etc	Yes	Short	Cheap		2
AT20	Whalewatching operators should be encouraged to use vessels with lower noise output and protection around the propellers	To reduce disturbance	Yes	Short-long	Cheap to encourage – maybe expensive for operators		2

6. CUMULATIVE IMPACTS OF RESEARCH

It was recognised that if **research activities** at sea involving some levels of intrusiveness (e.g., photo-id, biopsy, tagging) were to proliferate excessively, potentially damaging disturbance to whales might occur (particularly keeping in mind the deep diving habits of Ligurian Sea fin whales). The Working Group noted that guidelines for the implementation of research regulations are in the process of being developed by ACCOBAMS.

No.	Recommendation	Objective	Feasible	Time-frame	Costs	Links	Priority
AT21	ACCOBAMS should develop a form to record information on disturbing and/or invasive research activities within the ACCOBAMS area (e.g. photo-identification, biopsy sampling, telemetry etc)	To identify duplicate disturbing/invasive research effort and minimise this, to increase efficiency	Yes	Short-long	Cheap	Many	1



Annex G

Specific primary recommendations

Recommendation 1:- (a) obtain baseline information on the distribution and abundance of fin whales in the ACCOBAMS area and (b) develop a subsequent programme to monitor trends in abundance

(N.B. this is relevant to Recommendations DM1-3, A1-4, A5, A7, AT14)

OBJECTIVES AND EXPECTED RESULTS IN THE SHORT- MEDIUM- AND LONG TERM

The objectives for this recommendation are the same as for the major basin wide survey and monitoring programme already recommended by the ACCOBAMS Scientific Committee and the MoP, with the focus on fin whales. The information from the baseline study and the long-term monitoring programmes are absolutely essential if to show whether or not ACCOBAMS is meeting its conservation objectives and whether management measures in place are sufficient. The final expected results can be summarised as:

- (c) *First phase:* baseline abundance estimate(s) and distributional information for fin whales in the Mediterranean Sea and contiguous Atlantic waters for the summer 2007 or, more probably, 2008 – the dates in the table below assume a 2008 survey;
- (d) *Second phase:* a smaller-scale monitoring programme to identify trends in abundance and changes in distribution in the long term.

TIMETABLE OF ACTIONS AND RESPONSIBLE PERSONS

	Date	Action	Responsible persons
1	Immediate	Contact e.g. ship owner associations, navies, research institutions to see if it is possible to put cetacean observers on vessels that will be operating in waters for which there is little or no information on fin whale occurrence and/or expected sighting rates	ACCOBAMS Secretariat in co-operation with the co-ordinators of the basin wide survey (Cañadas and Fortuna)
2	Immediate	Contact potential NGOs etc to see if they are prepared to operate in waters for which there is little or no information on fin whale occurrence and/or expected sighting rates	ACCOBAMS Secretariat in co-operation with the co-ordinators of the basin wide survey (Cañadas and Fortuna)
3	Immediate	Begin seeking funding (incl. in kind) for basin wide survey, including international and national groups; identify national partners/institutes; begin to examine legal issues wrt EEZs	ACCOBAMS Secretariat in co-operation with the co-ordinators of the basin wide survey (Cañadas and Fortuna)
4	Before spring 2007	Hold second planning workshop to forward plans for the basin wide survey as described in the Valsain report. Begin identifying suitable vessels, planes, legal permissions, etc.	Cañadas, Fortuna, Birkun
5	As soon as possible and certainly by the beginning of February 2007	Place experienced observers on appropriate vessels identified in (1) above. Develop protocol for the observers to ensure maximum value from their participation.	Cañadas and Fortuna in consultation with expert advisory group (e.g. Borchers, Hammond, Donovan)
6	Before end of 2007	Review any abundance/distribution related survey plans submitted to ACCOBAMS for financial or 'moral' support, including anything arising from (2) above	Cañadas and Fortuna in consultation with expert advisory group (e.g. Borchers, Hammond, Donovan)
7	Before end 2007	Arrange for analysis of data arising out of (4) and	Cañadas, Fortuna, Birkun



		(5) above	
8	Before end of 2007	Arrange for scientific workshop to look at theoretical and practical aspects of long-term smaller scale monitoring. This will include practical suggestions for programmes in a variety of areas and will include <i>inter alia</i> individual recognition studies (e.g. photo-id).	Cañadas, Fortuna, Birkun, Donovan (IWC), Hammond (SCANS II)
9	Early 2008	Hold final workshop for the basin wide survey, including examination of data from (6). Include finalising cruise plans, mechanism for observer choice and placement etc.	Cañadas, Fortuna, Birkun
10	Summer 2008	Undertake basin wide survey	Cañadas, Fortuna, Birkun
11	Spring 2009	Workshop to review results of basin wide survey	Cañadas, Fortuna, Birkun
12	Autumn 2009	Workshop to develop specific final long-term monitoring plans for the ACCOBAMS area	Cañadas, Fortuna, Birkun
13	Post-2009	Implement long-term monitoring programmes developed under item 11	National governments (perhaps in co-operation), co-ordination by ACCOBAMS secretariat, periodic review by ACCOBAMS Scientific Committee

COSTS (VERY ROUGH!)

The Valsain report (Cañadas, Donovan and Fortuna, 2005) presents a number of options for coverage for the basin wide survey. These can be refined in the light of the information received from effort in areas for which little information was available (see 4 and 5 above). The costs for placing cetacean observers on boats will depend on the number of vessels chosen/available and the associated costs of travel, subsistence and salary. Costs for Workshops will be for invited participants (travel and subsistence) and possibly venue – typically €10-15,000 depending on number of participants. It is anticipated that the expert advisory group can work via correspondence and will not charge for their time. It is not yet possible to estimate costs for long-term monitoring programmes.

SUPPORTING INSTITUTIONS ETC.

ACCOBAMS Scientific Committee, ACCOBAMS Parties, IWC Scientific Committee



Recommendation 2: Central photo-identification database for use (as part of a co-ordinated programme) as a long-term management and conservation tool

(NB this is relevant to recommendations PS2, DM4; DM5; A4; A5; A6; P1)

1 OBJECTIVES AND EXPECTED RESULTS IN SHORT, MEDIUM AND LONG TERM

The principal aim of this programme is to develop and create a long-term future for a centralised photo-identification database that includes all of the photo-identification efforts from at least the ACCOBAMS area. Although the focus of this Workshop is the fin whale, it will be most efficient if this database can include all cetacean species. Such a database, as part of a co-ordinated programme, will provide an invaluable conservation and management tool for the fin whale and other species in the Mediterranean basin.

The value of any photo-identification dataset is increased immeasurably with the co-operation of all researchers working on such studies in a region, particularly when undertaken using agreed protocols and with an agreed central matching system. Such data can provide information on [fin] whale population structure, distribution and movements, absolute abundance, population trends and dynamics. It is essential that such a database is constructed and maintained with a view to the analyses proposed and is compatible with available estimation software. Co-operation needs to include the necessary safeguards for owners of the data. In addition, the value of such a project increases dramatically as more data are accumulated.

Considerable work on all aspects of a multispecies database was undertaken in the EU-funded ‘Europhlukes’ project. This work should form the basis of the proposal. It is also valuable that Tethys has one year of funding available to progress the fin whale component of this database.

TIMETABLE OF ACTIONS AND RESPONSIBLE PERSONS

	Date	Action	Responsible persons
1	Immediate	Identify a responsible body (eg. ACCOBAMS and/or PELAGOS, ECS) to agree to ensure the long term maintenance and expansion of the database	ACCOBAMS and PELAGOS secretariats, ECS
2	Immediate	Identify and contact all the possible contributors to at least the fin whale component in order to identify area coverage and numbers of photographs in addition to that identified and included in Europhlukes	Tethys
3	As soon as possible (before the end of summer 2006)	Organise a follow-up international workshop to the Europhlukes Project, to examine the effective use of photo-identification in the ACCOBAMS area (and perhaps beyond) and in particular to: <ul style="list-style-type: none"> - agree the final database structure and procedures for incorporating and accessing data (including aspects of ownership and authorship); - develop guidelines for future data collection; - review progress in automatic matching; - define the logistics for the maintenance and future development of the database and a comprehensive photo-identification programme, based on identified management needs - define the responsibilities and tasks of an overall database manager 	Tethys combined with ACCOBAMS and Pelagos Secretariat/ Scientific Committee, ECS
8	End of 2006	Undertake first analysis of the fin whale component of the database regarding distribution, seasonal movements, and population parameters, where appropriate and present these to the ACCOBAMS Scientific Committee for review.	At least Tethys, Grec, Ephe, Cebe, Genova University.
9	Early	Appoint data base manager	responsible body (eg ACCOBAMS and Pelagos



	2007		secretariats, ECS)
10	Post 2007	Long- term maintenance and use of database as a management tool in relation to needs identified by <i>inter alia</i> the ACCOBAMS Scientific Committee	Database manager, responsible body

COSTS

The costs of maintaining and improving the database are largely related to maintaining one full time database manager (salary, overheads, necessary travel).

SUPPORTING INSTITUTIONS ETC.

ACCOBAMS, PELAGOS, ECS, ?EU and other funding agencies



Recommendation 3:- Mediterranean Fin whale population structure

(NB this is related to recommendations PS1, A9, DM1, DM4, DM9, A6, DM8)

OBJECTIVE

The objectives of this recommendation are:

- (c) to examine whether the fin whales found in the Mediterranean represent one homogeneous population or two or more sub-population.
- (d) if the latter, quantify the level of exchange between them and identify whether they are isolated temporally or geographically.

Results are expected to be obtained in the medium to long term (5-10 years)

RECOMMENDED METHODS

The primary research tool will involve analysis of a number of genetic markers (via tissues obtained via biopsy sampling or strandings). This will best be achieved by the sample analysis being undertaken by a single laboratory and using a number of recently developed statistical and modelling techniques. In addition, it has been shown that the best information on stock structure is obtained by combining and comparing the results from a number of techniques that provide inferences on geographical or ecological clustering of fin whales within the Mediterranean Sea. This information can often be obtained via other high priority action (e.g. spatial analysis, photo-id) or collected opportunistically as a “by-product” of other actions (e.g. pollutant content, stable isotope, fatty acid signatures) obtained through biopsies or collection of tissue on stranded individuals.

TIME TABLE

This depends on the priority given to the work (e.g. directed studies or opportunistic).

Date	action	Responsible person
Immediate (1 year)	Identify potential genetic research groups willing to commit themselves to this issue on the medium to long term scale and select an appropriate group or groups.	ACCOBAMS Secretariat and Scientific Committee (call for proposals)
Short term (2-year)	Look for any existing fin whale samples, in particular for areas outside the N-Western Med and compare these with existing information for any evidence of sub-populations	Identified research groups and ACCOBAMS scientific committee
Medium term (3 & 4 year)	On the basis of information gathered from the basin wide survey in 2007, design and conduct dedicated large-scale photo-id and biopsy sampling in 2008 and 2009 (Mediterranean fin whale years?). These data will be used for a number of projects including examination of potential population structure.	ACCOBAMS scientific committee in relation with the research group in charge

COSTS

Depends, may be high if samples are obtained through dedicated surveys or less if using plate-form of opportunity (NGO vessels) willing to invest time on research actions recommended by ACCOBAMS and PELAGOS.

POSSIBLE SUPPORTING BODIES

ACCOBAMS, PELAGOS, IWC Scientific Committee



Recommendation 4: Comparison of individual identification techniques (photo-id and genetic profile)

(NB related to recommendations A9, PS1, DM4 and A6)

OBJECTIVES

- (a) Quantify the levels of fin whale photo-id mis-identification, if they exist (false positives and false negatives) by comparing photographic and DNA profile IDs.
- (b) Identify and quantify potential biases in estimates of population parameters when applying mark-recapture models using these approaches.

Results are expected to be obtained at a medium time scale (5 years)

RECOMMENDED METHODS:

Such work requires simultaneously obtained photo-identification and biopsy samples. Such material is more likely to be collected effectively during the two proposed Mediterranean fin whales “years” (2008 and 2009)

TIME TABLE

Date	Action	Responsible person
Immediate (1 – 2 years)	Identify potential genetics research groups willing to commit on the medium to long term scale.	ACCOBAMS (call for proposition)
Medium term (3 & 4 years)	Possibly 2008 and 2009 (Mediterranean fin whale years?) conduct dedicated fin whale photo-identification and biopsy sampling study, building on the results of the basin wide survey	ACCOBAMS scientific committee
Medium term 5-6 years	Evaluate the most effective and efficient individual identification method(s) to be used to provide unbiased estimates of relevant population parameters.	ACCOBAMS scientific committee

COST

To be estimated : could be high if samples are obtained through dedicated surveys or less if using platform of opportunity (NGO vessels) willing to invest time on research actions recommended by ACCOBAMS and Pelagos. However, a dedicated designed study is most likely to achieve the best results

POSSIBLE SUPPORTING BODIES.

ACCOBAMS, PELAGOS.



Annex H

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