Taller PHVA de la Foca Monje del Mediterráneo en el Atlántico Oriental

Atelier PHVA du Phoque Moine de la Méditerranée dans l'Atlantique Oriental

PHVA Workshop for the Mediterranean Monk Seal in the Eastern Atlantic

CENEAM Valsaín (Segovia – Spain)
November 10-13, 2001

FINAL REPORT

***Edited by*:**
Luis Mariano González, Borja Heredia, Antonio Araujo,
Ian Robinson, Jean Worms, Philip Miller, and Ulysses Seal

***A Collaborative Workshop Between*:**
Ministerio de Medio Ambiente, Spain;
Convention on the Conservation of Migratory Species;
IUCN / SSC Conservation Breeding Specialist Group; and
The Workshop Participants

***With Primary Financial Support from*:**
Sea World, Inc.
Ministerio de Medio Ambiente, Spain
Fundación CBD-Habitat, Spain

A contribution of the IUCN/SSC Conservation Breeding Specialist Group, in collaboration with Ministerio de Medio Ambiente, Spain; The Convention on the Conservation of Migratory Species; and Fundación CBD-Habitat, Spain.

This workshop was made possible through the generous financial support of Sea World, Inc.; Ministerio de Medio Ambiente, Spain; and Fundación CBD-Habitat, Spain.

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Section 1
Workshop Introduction

MINISTERIO
DE MEDIO AMBIENTE

DIRECCIÓN GENERAL
DE CONSERVACIÓN
DE LA NATURALEZA

Inés
González Doncel

DIRECTORA GENERAL

Mr. Arnulf Müller-Helmbrecht
Secretaría UNEP/CMS
Martin-Luther King-Str.8
53175 Bonn
Alemania

Madrid, June 2001

Reference: Eastern Atlantic Monk Seal PHVA workshop (10-13 November 2001, Spain)

Dear sir,

The Ministry of the Environment of Spain in coordination with the Conservation Breeding Specialist Group (CBSG) of the World Conservation Union (IUCN), is organising a Population and Habitat Viability Assessment (PHVA) workshop of the Eastern Atlantic Monk Seal, which will be conducted from the 10th until the 13th November 2001, in the National Centre of Environmental Education (CENEAM) in Valsaín (Segovia-Spain).

The objective of this workshop is to bring together the international scientific community for the examination, discussion and evaluation of the draft of the Monk Seal Recovery Plan, which has been prepared by the Working-Group of the Bonn Convention (CMS), with representatives of the authorities of Portugal, Morocco, Mauritania and Spain.

Considering the importance that this Plan, will have for the future of the species, we hope to count with your participation in this workshop, which will also bring together the regional authorities of the involved countries and experts in the species and its habitat.

Please confirm your participation as soon as possible. Afterwards we will send you the documentation and details of the workshop.

Looking forward to hearing from you, sincerely yours

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PHVA Workshop for the Mediterranean Monk Seal in the Eastern Atlantic Workshop Opening Presentation

Within the international framework, the Mediterranean monk seal populations in the Mediterranean have been, for over ten years, the target of several projects and initiatives co-ordinated via the *Action Plan for the Mediterranean of the Barcelona Convention.* The Atlantic population became the target of a similar effort within the framework of the CMS only a short time ago. At the 8th meeting of the CMS/SC (Wageningen 1998), it was agreed that the initial aim would be to draw up an action plan for the species in the eastern Atlantic, which will promote and guide the implementation of the actions agreed on by the countries in the seal's distribution range in the eastern Atlantic, i.e. Morocco, Spain, Mauritania and Portugal, and be complementary to that implemented in the Mediterranean under the Barcelona Convention.

The Plan seeks to contribute a mean to combine the programmes of the various states and private and local organisations into effective, efficient and concentrated efforts that should lead to the recovery of the depleted seal populations. Due to its supranational character, the participation of the range countries' main institutions which carry out activities or have po wers in this matter has been sought. A Technical Working Group was set up consisting of representatives from the relevant authorities with powers in that field in the four range countries named above, and an advisor (Fundación CBD-Hábitat) was given the task of drafting and producing the Plan's technical document.

A joint meeting of all representatives was held in Las Palmas de Gran Canaria (Spain) on 10 and 11 April 2000. The technical document which forms the draft of the Plan was agreed upon at this meeting. The Plan seeks to promote the implementation by the states involved of a series of measures to maintain or re-establish favourable conservation status, the seal's natural habitat and the seal populations in the region. The threats that have been identified to date and which are reflected in the document range from massive die-offs and abnormally low pup survival rates to deaths due to incidental capture in fishing gear and the repercussions of overfishing on feeding resources. The main action proposed is the creation of a Network of Special Areas of Conservation for the Monk Seal. In this context, each contracting state shall contribute to the setting up of this network by proposing the aforementioned type of zones for inclusion.

In order to expose and consult to the scientific community, experts, authorities and people interested in the conservation of the species about the Monk Seal Recovery Plan in the Atlantic, and to improve its technical aspects , it was decided to convenne a Population and Habitat Viability Analysis (PHVA). This workshop was celebrated in November 2001 and this document is its final product.

The Final recomendations from the PHVA included in the present document, will be carefully studied and taken into account to improve the Plan. The improved version of the Plan will serve as a technical support document for the management and conservation authorities of the monk seal in the region.

Luis Mariano González Garcia
Dirección General de Conservación de la Naturaleza
Madrid, Spain

PHVA Workshop for the Mediterranean Monk Seal in the Eastern Atlantic
Workshop Executive Summary

Introduction

The Mediterranean monk seal (*Monachus monachus* Hermann, 1779) is one of the most threatened mammals in the world. Having disappeared from most of its distribution range, in the few surviving isolated groups, the low numbers are a cause for concern even according to the most optimistic estimates. According to the IUCN, there may be no more than 500 seals surviving in the Mediterranean and along the Eastern Atlantic coastline. The recent alarming decline in the latter population has given rise to such serious international concern regarding the future of the Mediterranean monk sea that the world's principal nature conservation bodies are urging prompt and effective conservation action.

The monk seal populations in the Mediterranean have been the subject of attention since 1986. This attention has focused on implementing an international strategy, the «Monk Seal Management Plan», within the framework of the Action Plan for the Mediterranean of the Barcelona Convention (1976). There is, however, no regional strategy or international plan for the Eastern Atlantic.

Two breeding colonies of Mediterranean monk seal survive in the Eastern Atlantic: one on the Desertas Islands (Madeira) and the other on the Cap Blanc Peninsula (Morocco-Mauritania). The fact that they are probably genetically isolated and consist of no more than 200 seals and that each colony is concentrated along just a few kilometres of coastline, breeding in restricted habitats, means that experts regard the status of the Mediterranean monk seal as very critical.

The meager results yielded by conservation efforts to date are largely due to a lack of co-ordination. The most encouraging results in the Atlantic have been obtained through the setting up of the Desertas Islands Nature Reserve (Madeira). This measure, together with the considerable increase in recent years in information on the biology and problems facing the species in the Cap Blanc colony, are giving rise to renewed optimism as regards monk seal conservation.

This document contains an Action Plan based on a new spirit of collaboration. The Plan reflects international concern about the critical status of the Mediterranean monk seal. There is a need for the four countries in its distribution range in the Atlantic (Morocco, Spain, Mauritania and Portugal), which are all parties to the Bonn Convention and responsible for its conservation, to undertake concerted and effective actions to reverse its decline.

Taken from:
"Recovery Plan for the Mediterranean Monk Seal in the Eastern Atlantic"
Bonn Convention (UNEP / CMS)
Draft, 2001

The Workshop

The Conservation Breeding Specialist Group (CBSG), part of the IUCN / World Conservation Union's Species Survival Commission, was invited by officials of Conservación de la Naturaleza del Ministerio de Medio Ambiente to conduct a Population and Habitat Viability Assessment (PHVA) workshop in order to develop more effective conservation strategies for populations of the Mediterranean monk seal in the eastern Atlantic. Specifically, the inviting organizations were interested in using the PHVA workshop process as a way to critically review and provide quantitative analysis on the recommendations made in the "Recovery Plan for the Mediterranean Monk Seal in the Eastern Atlantic" developed through the Bonn Convention (UNEP / CMS) earlier in 2001. Consequently, the draft Recovery Plan became a very important central focus throughout the workshop deliberations. It is important to recognize, however, that the workshop was not designed to facilitate a unanimous approval of this draft Recovery Plan by all participants. The draft Plan includes a number of controversial issues that will require sustained and focused discussion before a satisfactory resolution can be achieved.

The PHVA workshop was conducted 10-13 November 2001 at the CENEAM facility in Valsaín (Segovia-Spain), which is relatively isolated geographically and, consequently, provided an environment conducive to the workshop process and continued interaction at meals and in the evening. Housing and meals were provided on site. There were 62 registered participants from 9 countries including groups from Mauritania, Morocco, Portugal and Spain. The CBSG workshop designers and facilitators were Yolanda Matamoros (CBSG leader for Mesoamerica, Costa Rica), Phil Miller (Program Officer CBSG, USA), and Ulie Seal (CBSG Chairman, USA). Dr. Susie Ellis, Program Officer of CBSG, and Dr. U. S. Seal, Chairman of CBSG had conducted a planning meeting for the workshop with officials of Conservacion de la Naturaleza del Ministerio de Medio Ambiente in Madrid in February 2001. Continuing work on arrangements for the workshop was conducted by email.

At the beginning of each PHVA workshop, the participants derive a shared vision that guides their activities throughout the duration of the meeting: To prevent extinction of the species by maintaining viable populations in the wild. The workshop process then takes a detailed look at the species' life history and population dynamics, current and historical distribution and status, and uses this information to assess the impact of the various threats that are thought to place the species at risk. A crucial outcome of a PHVA workshop is that a substantial amount of information – much of which has not been published or subjected to external review – can be assembled and assessed through expert analysis. This information can be from many sources; those with a wide variety of expertise as well as those having a particular stake in the future of the species are encouraged to contribute their knowledge. In this way, all the data are given equal importance and consideration.

Once assessed for relevance and accuracy, the appropriate data are used to develop a computer simulation model of the growth dynamics of the population(s) under consideration. The general purpose of the model is to determine: i) the risk of population decline or perhaps even extinction under current environmental conditions; ii) those factors most responsible for generating this risk; iii) those aspects of a population's biology and ecology that tend to drive its projected growth. In effect, these modeling techniques provide an objective, neutral platform for assessing information, testing hypotheses, and assisting managers in the conservation decision-making process.

Complimentary to the population modeling effort is a dynamic process of group deliberation that forms the foundation of the workshop activities. Participants work together to identify the key issues from the draft Recovery Plan that affect the conservation of the species and then tackle their implications within topic-based working groups. Each working group produces a report of their deliberations, which are assembled along with other information to produce this report. A successful PHVA workshop depends on determining an outcome where all participants, many coming to the meeting with different interests and needs, gain added benefits through the development of a management strategy for the species in question. Most importantly, working group recommendations are developed by, and therefore become the property of, the local workshop participants.

The opening workshop presentations were made in plenary session with simultaneous translation into Spanish, French, and English. The history of the development of the draft Recovery Plan for the Eastern Atlantic Coast population of the monk seal was summarized noting that the four governments had accepted it with a direct role in the management and conservation of the population. Status reports on the research programs and the populations at Cap Blanc and Madeira and other possible localities were presented for the morning and early afternoon. The program was then managed by the CBSG team with a description of the working group process, the ground rules to observe during the process, and the formation of the working groups. Seven working groups were formed based on the six action themes from the draft Recovery Plan with the addition of a risk assessment and modeling group. The working groups began working that afternoon and continued 3 ½ hours until about 2000 on the first task.

Results of the working group activity were reported in plenary session the next day (Sunday) with extensive discussion and commentary. This served as a basis for proceeding in the development of the problem analysis, setting of goals and then development of actions over the remainder of the workshop. Two plenary sessions to discuss progress and to receive commentary were conducted each day. Each group recorded their discussion and flip chart notes on a computer. These files were collected each day and printed for return to the working groups.

The evening of the third day, copies were distributed to all of the working groups with instructions to prepare in writing any questions they might have for other working groups. Many of these comments were passed directly to the working groups. A plenary session at 1045 on Tuesday gave an opportunity for questions or observations to be made to the whole group. These were recorded and are a part of this report to provide an indication of remaining reservations or uncertainties and to assist clarification. On this final day the working groups reconvened for final editing of their reports. A group of fisheries biologists (one from each of three working groups) prepared a minority report on several issues on Tuesday. It was printed and distributed but did not receive general commentary in plenary. This fisheries report is included in a separate section of the report. One group continued to struggle with an issue on which agreement had not been reached. The final closing plenary was held at 1300 and the meeting closed at 1400. Final versions of the reports were collected and form the body of this report. Some of the recommendations from the working groups are summarized in the following paragraphs. Refer to the more complete group reports for supporting analysis and information.

The draft report from this workshop will be reviewed by a group of editors for accuracy of contents. CBSG will work with the organizers on format, languages, and final preparation of the Report. CBSG prepares the final version and distributes to the organizers and all participants. It then becomes a public document available to any interested person from the CBSG office.

Recommendations

Group A: Establishing mechanisms to co-ordinate and finance the conservation actions set out in the Recovery Plan

- Un réseau informatique pour des échanges d'informations est un instrument de coordination indispensable à la mise en application du Plan d'Action. Le Secrétariat Permanent est chargé de la mise en place de ce réseau.
- La constitution de groupes de travail thématiques doit être encouragée par le comité qui identifie au préalable les thématiques clés.
- Les groupes seront constitués par des experts internationaux compétents dans les domaines identifiés par le comité.
- Les groupes thématiques ont une fonction consultative et sont constitués pour appuyer au besoin le comité.
- L'organisation interne des groupes thématiques est définie par règlement intérieur.
- Le Budget Global doit être présenté sous forme de projet modulaire suivant les thématiques du Plan d'Action pour en faciliter le financement.
- Les besoins en formation doivent être pris en compte dans les projets nationaux et/ou par d'autres mécanismes de financement, dans le cadre de la coopération bilatérale, régionale et internationale.

Group B: Population monitoring and follow-up and to further knowledge about the species, its habitat and the problems affecting it

- Realizar estudio de la población y su habitat, desde Guerguerat hasta Dakhla, prestando especial interés desde Guerguerat (norte de las cuevas de cría) hasta Cabo Barbas.
  Tambien en Madeira excluyendo la Pta. de S. Lourenço.
  La actuación sería localizar lugares donde fuera posible un buen desarrollo de la especie, cuevas, playas…Intentar localizar evidencias de la presencia de estos animales en ambos lugares donde se este realizando el estudio.
- Aprovechar adecuadamente los observadores en los barcos de la flota europea, para recoger información de capturas accidentales, presencia de focas e interacciones de estas con los barcos.
  Coordinación para la recepción de la información de los diferentes observadores.

Obtención de datos recogidos regularmente de encuestas realizadas por el DSPCM, CNROP, INRH, sobre la pesca artesanal.

Group C: Management of the Species and its Habitat (Direct Actions to Reduce Seal Mortality)

- Clarify why survival of pups is so low
- Promote the use of beaches as reproductive sites
- Improve environment in caves not occupied
- Develop protocols for rescue rehabilitation and release using all available knowledge and expertise. Assess present facilities and resources

Group D: Habitat Protection

- Revisión de literatura contemporánea, histórica y gris que contenga referencias sobre la presencia, abundancia y uso de la foca monje en el Atlántico occidental.
- Desarrollo de un protocolo ejecutivo que permita evaluar los hábitats apropiados existentes, existencia de grupos remanentes, e inventario de molestias antrópicas o naturales
- Desarrollo de uno o varios estudios de campo que evalúen e identifiquen los hábitats apropiados existentes, existencia de grupos remanentes, e inventario de molestias antrópicas o naturales
- Redacción de un informe final que evalúe e identifique los hábitats apropiados existentes, existencia de grupos remanentes, e inventario de molestias antrópicas o naturales
- Realizar investigaciones destinadas a conocer los riesgos afrontados por la especie en las cuevas de cría (hábitat de cría). Esto incluye información sobre la mortalidad, supervivencia y reclutamiento de las crías nacidas en la colonia de Cabo Blanco. Esta acción debería ser detallada dentro del grupo B

Group E: Information, awareness raising, and social support

- Concienciación centrada especialmente, a corto plazo, en los pescadores de las piraguas que faenan en la zona de exclusión de pesca
- Concienciación de la propia flota (especialmente patrones y armadores)
- Escuelas y centros de educación primaria y secundaria: Cursillos de formación de profesores y dotación con material educativo (videos, carteles, paneles, "seducción ambiental"...)
- Organismos oficiales: Es fundamental contar con la participación y colaboración de los organismos mauritanos y marroquíes que están relacionados o dependen directamente de la administración pública (Ministerios y centros oficiales)
- Otros colectivos: Pescadores ocasionales, perceberos, militares que acceden por tierra a las playas
- Explicar la existencia de la especie y problemática
- Crear una opinión favorable y recaudar fondos

- Se cuestiona la utilidad de las macro-campañas, ya que una afluencia masiva de turismo sería perjudicial
- Promoción de actuaciones de cooperación encaminadas a un desarrollo sostenible de la comunidad local, dada la precariedad de las condiciones de sus condiciones de vida
- Trabajar en la promoción del desarrollo económico del sector, de manera que los pescadores puedan acceder a la propiedad de las piraguas, y mejorar sus ingresos
- Se considera que es positivo trabajar con incentivos materiales en el caso de la pesca artesanal, no económicos, que faciliten las labores de concienciación social

Group F: Coordinated Emergency Management

- Develop a Primary Response Team designed to deal with emergency situations as they arise.
  Assumptions:
  - Sufficient finances for the primary response team.
  - Monitoring team must interact closely with primary response team.
  - Triggers for alerting primary response team needs to specified (for later) per threat.
  - These are first people on site to presence and extent of threat
  - These are people to notify emergency response team
  - Finances need to be in place to make team work
  - General areas of expertise represented
  - Separate teams for Madeira and Cap Blanc

Group G: Risk Assessment and Population Modeling

- The group recommends the meeting of a working group of specialists as a follow up to this workshop. The working group would further investigate the implications of various potential threats to the species in the Atlantic.
  Particular tasks of this group include a more detailed sensitivity analysis of the threats identified during the workshop, and a population viability analysis. The PHVA should take into account each of the proposed conservation actions included in the action plan, and a new set of fine tuned demographic and genetic parameters.
  The working group should also have population assessment experts (population ecologists, statisticians) to design appropriate monitoring and sampling schemes to effectively evaluate in the near future the consequences of the implementation of conservation actions.

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FINAL REPORT

Section 2
Working Group Reports

Grupo A
Establecimiento de mecanismos para coordinar y financiar las actividades de conservación consideradas en el Plan de Acción

Working Group participants:
Antonio Araujo, Parc National du Banc d'Arguin, Mauritania
Marco Barbieri, UNEP / CMS Secretariat, Germany
Mohamed ould Bouceif, Parc National du Banc d'Arguin, Mauritania
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Nuria el Khadir, Fundación CBD – Habitat, Spain
Ana Maroto, Fundación CBD – Habitat, Spain
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Amina Moummi, Institut National de Recherche Halietique, Morocco
Juan Luis Muriel, Fundación Biodiversidad, Spain

I. Problemas Identificados

A) Coordinación todavía insuficiente entre las partes interesadas

- Referente a los pasos dados para coordinar las Acciones, para los mecanismos, y los efectivos, quedan por concretar – grupos de trabajo, comisiones temáticas.
- La falta de coordinación se nota a varios niveles:
  - Nacional
  - Bilateral
  - Regional

B) Falta de fuentes financieras para realizar las acciones de investigación, conservación y vigilancia necesarias

- Si hay iniciativas en algunos países que se benefician de apoyos financieros, otras sin embargo se quedan bloqueadas por falta de financiación.
- El coste de funcionamiento de las Instituciones de Investigación, y de Conservación va más allá de las capacidades internas de cada país, de allí la necesidad de apoyos financieros a nivel internacional.

C) Necesidad de transparencia en la obtención y la utilización de fondos adquiridos para la conservación de la Foca Monje

- En algunas iniciativas, la gestión de fondos adquiridos para la recuperación de la Foca Monje no es siempre adecuada.
- Las instituciones de Investigación y Conservación no están siempre asociadas.

D) Falta de recursos humanos capaces de ejecutar las acciones de Investigación, Conservación y de Vigilancia necesarias

- En algunos países las competencias técnicas y científicas disponibles no son suficientes para garantizar la realización de las acciones de Investigación , Conservación y Vigilancia de manera duradera.

II. Acciones A Realizar Para La Resolución De Los Problemas Identificados

A) Coordinación

Concretar el compromiso de los países implicados en la recuperación de la foca monje en le Atlántico Oriental no puede hacerse sin que exista un espíritu de cooperación y de coordinación.

A nivel Nacional:

- Creación de una estructura de coordinación quizás dentro de 6 meses de la aprobación del plan
- Designación de un coordinador: punto focal
- Definición de los términos de referencia de esta estructura
- Elaboración de un presupuesto de funcionamiento

A nivel Bilateral:

- Promover, desarrollar encuentros entre las Instituciones de Investigación, de Conservación , con la mediación de coordinadores nacionales
- Estimular, desarrollar encuentros entre gerentes de las ZSCPM (zonas especiales de conservación de la Foca monje) y especialmente entre las zonas concomitantes cuyas problemáticas son similares.

A nivel Regional:

- Un comité de seguimiento de la aplicación del plan de conservación de la Foca Monje compuesto de la manera siguiente:
    - 4 coordinadores nacionales (Portugal, España, Marruecos y Mauritania)
    - 2 representantes de ONG
    - 2 representantes de la Profesión (sector pesquero)
    - 4 científicos (Portugal, España, Marruecos, Mauritania)
    - 1 Veterinario y 1 biólogo de poblaciones seleccionados internacionalmente
    - Otras Instituciones y personalidades útiles invitados
- La constitución de grupos de trabajo temáticos debe estar promovida por el comité que previamente identifica las temáticas más importantes.
- Los grupos serán constituidos por expertos internacionales competentes en los dominios identificados por el comité.

- Los grupos temáticos tienen una función de consulta y son constituidos para apoyar al comité si es necesario.
- La organización interna de grupos temáticos está definida por un reglamento interno.
- **Un Secretariado Ejecutivo** (con la oferta de financiación posible por parte de España y donde los temas de referencia serán elaborados por el CMS), se creará esta base por primera vez en Nouadhibou, por razones de proximidad de poblaciones de foca monje, de amenazas potenciales y de la existencia de estructuras de recuperación y rehabilitación apropiadas. Este Secretariado podrá tener la base posteriormente en otro país de la región.
- Una red informática para intercambio de información y un instrumento de coordinación indispensable a la Aplicación del Plan. La Secretaría Ejecutiva está encargada de la creación de esa red.

B) Recursos Financieros

Para la realización de acciones previstas en el Plan de Acción se necesita unos recursos financieros adecuados. También, y teniendo en cuenta el hecho de que los costes de funcionamiento de las instituciones de investigación, de conservación y de vigilancia van a veces más allá de las capacidades financieras de algunos países, es necesario recurrir a un apoyo financiero internacional.

A nivel Nacional:

- Cada uno de los países interesados está encargado de elaborar un presupuesto donde se exprese las necesidades necesarias para la ejecución de acciones piensa llevar a cabo dentro del ámbito del Plan de Acción propuesto, especialmente en el campo de Investigación, Vigilancia, Conservación y de la Formación.
- Se establecerá una ficha acordada por el comité y utilizada por el país.

A nivel Regional:

En lo que se refiere a los contactos con los financiadores para la obtención de fondos para realizar las acciones del plan, se recomienda una actuación coordinada y se propone dar los pasos siguientes:

- Los presupuestos nacionales son enviados a la Secretaría Ejecutiva, quien se encarga de presentarlos de forma global al comité de seguimiento regional para su aprobación. Es deseable que cada presupuesto nacional este acompañado de una recomendación por parte del país de origen.
- El comité y la Secretaría Ejecutiva son encargados de contactar con los financiadores para la financiación.

Recomendación

- El presupuesto global debe presentarse como un proyecto modular según las temáticas del plan de acción para así facilitar su financiación.

C) Recursos Humanos

La existencia de un personal suficiente y cualificado es una condición esencial para la aplicación efectiva del Plan de Acción, así como la disponibilidad de ese personal sigue siendo una responsabilidad nacional.

Sin embargo la falta de recursos financieros en algunos países puede constituir un obstáculo en cuanto a la disposición de estos recursos humanos.

Por ello los países deben dedicarse a:
- identificar las competencias existentes;
- identificar la falta de personal;
- identificar las necesidades en formación.

Los países deben promover:
- Mejorar las competencias a través del intercambio de experiencias entre varias iniciativas.
- Reforzar la cooperación bilateral con vistas a la mejora de las competencias específicas.

Recomendaciones
- Las necesidades en formación deben de estar consideradas en los proyectos nacionales y/o por otros mecanismos de financiación en el ámbito de la cooperación bilateral, regional e internacional.

D) Transparencia

Este problema esta resuelto por la creación de 3 mecanismos de coordinación propuestos.

Groupe A
Etablissement de mecanismes pour coordonner et financer les activites de conservation envisagées dans le Plan d'Action

Working Group participants:
Antonio Araujo, Parc National du Banc d'Arguin, Mauritania
Marco Barbieri, UNEP / CMS Secretariat, Germany
Mohamed ould Bouceif, Parc National du Banc d'Arguin, Mauritania
Luis Mariano González, Dirección General de Conservación de la Natureleza, Spain
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Amina Moummi, Institut National de Recherche Halietique, Morocco
Juan Luis Muriel, Fundación Biodiversidad, Spain

I. Problèmes identifiés

A) Coordination encore insuffisante entre les parties concernées

- Des démarches entreprises pour coordonner des Actions, mais les mécanismes, effectifs restent à mettre en place- Groupes de travail, commissions thématiques.
- L'insuffisance de coordination se remarque à plusieurs niveaux:
  - National
  - Bilatéral
  - Régional

B) Manque de ressources financières pour exécuter les actions de recherches de conservation et de surveillance nécessaires

- Si des initiatives dans certains pays bénéficient de soutiens financiers, d'autres initiatives demeurent bloquées faute de financement.
- Le coûts de fonctionnement des Institutions de Recherche, de Conservation, de Surveillance et de Formation vont au delà des capacités internes des pays, d'où la nécessité des concours financiers internationaux.

C) Besoin de transparence dans la collecte et l'utilisation des financements acquis pour la conservation du Phoque Moine

- Dans certaines initiatives, la gestion des fonds acquis pour la sauvegarde du Phoque Moine n'est pas toujours appropriée.
- Les institutions de Recherche et Conservation ne sont pas souvent associées.

D) <u>Manque de ressources humaines capables d'exécuter les actions de Recherche de Conservation, de Surveillance nécessaires</u>

- Dans certains pays les compétences techniques et Scientifiques disponibles ne sont pas suffisantes pour assurer la mise en oeuvre des actions de Recherche, Conservation et surveillance de manière durable.

II. Actions à entreprendre pour résoudre les problèmes identifiés

A) Coordination

La concrétisation de l'engagement des pays concernés par la sauvegarde du phoque moine dans l'Atlantique Oriental ne peut se faire que dans un esprit de coopération et de coordination.

Pour ce faire, des organes de coordination et d'exécution doivent être mis en place impliquant des compétences aussi bien nationales qu'internationales.

<u>Au niveau National:</u>

- Création d'un structure de coordination
- Désignation d'un coordinateur, point focal du Plan d'Action
- Définition des termes de référence de cette structure
- Elaboration d'un budget de fonctionnement.

<u>Au niveau Bilatéral:</u>

- Encourager, développer des rencontres entre les Institutions de recherche, de conservation par l'intermédiaire de coordinateurs nationaux
- Encourager, développer des rencontres entre gestionnaires des ZSCPM (zones spéciales de conservation des phoques moine) notamment les zones concomitantes dont les problématiques se ressemblent.

<u>Au niveau Régional:</u>

- Un comité de suivi de l'application du plan de conservation des phoques moine est composé comme suit:
  - 4 coordinateurs nationaux (Portugal, España, Maroc, Mauritanie)
  - 2 représentants d'ONG
  - 2 représentants de la profession (Secteur Pêche)
  - 4 scientifiques (Portugal, España, Maroc, Mauritanie)
  - 1 vétérinaire et 1 dynamicien de populations, selectionnés internationalement
  - Autres Institutions et Personnalités ressources à inviter
- La constitution de groupes de travail thématiques doit être encouragée par le comité qui identifie au préalable les thématiques clés.

- Les groupes seront constitués par des experts internationaux compétents dans les domaines identifiés par le comité.
- Les groupes thématiques ont une fonction consultative et sont constitués pour appuyer au besoin le comité.
- L'organisation interne des groupes thématiques est définie par règlement intérieur.
- **Un Secrétariat Exécutif** (financement possible par l'Espagne et dont les termes de référence seront proposes par la C.M.S.) sera créé et basé, dans un premier temps, à Nouadhibou pour des raisons de proximité des populations de phoques moine, de menaces potentielles et d'existence de structures de recherche et réhabilitation appropriées. Ce Secrétariat pourra être basé ultérieurement dans un autre pays de la région.
- Un réseau informatique pour des échanges d'informations est un instrument de coordination indispensable à la mise en application du Plan d'Action. Le Secrétariat Exécutif est chargé de la mise en place de ce réseau.

B) Ressources Financieres

La mise en œuvre des actions prévues par le plan d'action nécessite des ressources financières adéquates. Aussi et compte tenue du fait que les coûts de fonctionnement des Institutions de Recherche, de Conservation et de Surveillance vont parfois au delà des capacités financières de certains pays, il est nécessaires de faire appel au concours financier international.

<u>Au niveau National:</u>

- Chaque pays concerné est chargé d'élaborer un budget dans lequel il exprime les besoins nécessaires à l'exécution des actions qu'il entend mener dans le cadre du plan d'Action proposé, notamment dans les domaines de la Recherche, de la Surveillance, de la Conservation et de la Formation.
- Une fiche standard sera établie, agréée par le comité et utilisée par le pays

<u>Au niveau Régional:</u>

Dans le cadre des contacts avec les bailleurs de fonds en vue d'obtenir des financements pour la mise en œuvre des actions du plans l'approche coordonnée est recommandée et la démarche suivante proposée :

- Les budgets nationaux sont envoyés au Secrétariat Exécutif qui est chargé de les présenter sous forme globale au comité régional pour approbation. Il est souhaitable que chaque budget national soit accompagné d'une recommandation du pays d'origine.
- Le comité et le Secrétariat Exécutif sont chargés d'approcher les bailleurs de fond pour financement.

Recommandation

- Le Budget Global doit être présenté sous forme de projet modulaire suivant les thématiques du Plan d'Action pour en faciliter le financement.

C) Ressources Humaines

L'existence de personnels suffisants et qualifiés est une condition essentielle pour l'application effective du Plan d'Action et leur mise à disposition demeure une responsabilité nationale.

Toutefois le manque de ressources financières dans certains pays peut constituer un obstacle quant à la mise à disposition de telles ressources humaines.

De ce fait les pays doivent s'investir à :

- Identifier les compétences existantes;
- Identifier le manque en personnel;
- Identifier les besoins en formation.

Les pays doivent encourager :

- L'amélioration des compétences par l'échange d'expériences entre plusieurs initiatives.
- Le renforcement de la coopération bilatérale en vue d'améliorer les compétences spécifiques.

Recommandation

- Les besoins en formation doivent être pris en compte dans les projets nationaux et/ou par d'autres mécanismes de financement, dans le cadre de la coopération bilatérale, régionale et internationale.

D) Transparence

Ce problème sera résolu par la mise en place des mécanismes de coordination proposés.

Grupo B
Investigación y monitoreo de poblaciones y hábitat

Working Group participants:
Daniel Cebrián, National Center for Marine Research, Greece
Jorge Fernández Layna, Fundación CBD – Habitat, Spain
Julio Mas, Centro Oceanográfico de Murcia (IEO), Spain
Azza Mint Jiddou, Centre National Recherche Oceanographique et des Pêches, Mauritania
Rosa Pires, Parque Natural de Madeira, Portugal
Marina Sequeira, Instituto da Conservaçao de Natureza, Portugal

Comienzo del taller. Se acuerda analizar el índice del apartado B) del Plan de acción punto por punto.

3. Control y seguimiento de las poblaciones

3.1 Thijs Kuiken del grupo F, propone que se sustituya: "la excepción de situaciones de peligro para los individuos" por "cuando sea necesario rescatar focas enfermas o heridas para rehabilitación, siguiendo criterios predeterminados".
No hay consenso sobre este punto en el grupo B.

3.2 Es correcto.

3.3. **Se propone que el límite por el Norte se incremente hasta Dakhla** (hay experiencias en Grecia de descubrimientos de colonias en áreas donde no se tenían datos de avistamientos)

3.4. Determinación de parámetros demográficos.
3.4.2. Añadir **"organización social".**

3.5. Seguimiento del estado sanitario.
Por propuesta del grupo F: **se realizarán necropsias en caso de muerte. Los analisis se realizarán el laboratorios de diagnostico y deberían incluir investigaciones de infecciones por morbillivirus.**
Existe consenso en este grupo sobre el cambio propuesto

4. Correcto
5. Correcto
6. Se está de acuerdo con lo reflejado en el Plan de Acción para este punto.

Actuación 3.1.: Se propone que cada participante cuente su forma de trabajar en el seguimiento de las poblaciones.

Madeira (Desertas): Se realiza vigilancia desde el mar y observaciones directas de animales durante 5 horas/día (observatorios). Se utiliza foto-identificación.

Cabo Blanco: Hay cámaras de video instaladas en las cuevas de cría. Se hacen monitoreos periódicos de las playas y se inspeccionan las cuevas hacia el norte. Búsqueda y salvamento de crías desaparecidas. La identificación se realiza fotografiando y dibujando desde los acantilados.

Mejoras de lo discutido anteriormente, tras el primer pleno:

Monitorear

- Dificultad (en Madeira) de monitorear la población para conocer su status. Se realizan 500 horas de seguimiento continuo, se podría hacer un seguimiento simultáneo. Para conseguir la información que falta. Se intentara mejorar el monitoreo para una mejor comparación de datos con otros lugares como Cabo Blanco.
- Dificultad de determinación del status (en el norte de Cabo Blanco) debido a problemas políticos y debido difícil acceso. El resto de monitoreos pueden hacerse sin problemas, se llevan haciendo muchos años a pesar de la geología del terreno.
- En el caso de llegar frescos a las playas una vez muertos se podria hacer algo para poder hacer necropsia y descubrir posibles patologías.
- En Madeira se necesita formar a la gente en cuestión de realización de necropsia, redactando un protocolo de necropsias.
- En laboratorios, seguimiento del protocolo para poder establecer comparaciones de datos encontrados.(obtención de muestras, colección, análisis…)
- Se necesitan diferentes laboratorios de diferentes especialidades.

Pesquerias

- Insuficiente información sobre las interacciones focas-pesqueros (Cabo Blanco).
- Importancia de las estrategias de alimentación- métodos invasivos. Dificultad de mejorar esos métodos para evitar que sean tan perjudiciales. La solución seria no practicar o aplicar otro método.
- Insuficiente información sobre la pesquería industrial (Cabo Blanco).
- Futuro incremento de la pesca artesanal e industrial, que también debe ser añadido por una posible futura sobreexplotación.
- Insuficiente información sobre la evaluación de los daños y las perdidas.

Habitat

- Dificultad de acceso a la población del norte de la Península de Cabo Blanco.
- Dificultad en la formación de personal.
- Presión humana. Debido entre otras cosas al incremento de las poblaciones en estas ciudades dando lugar a un aumento de contaminación que afectaría directamente a los niveles de materia orgánica, al arrojar los residuos al mar.

Genética

- No hay suficientes datos de Madeira
- Traslocacion

Posibles soluciones a los problemas planteados:

Monitoreo

- En cuestiones de formación para la realización de las diferentes actividades, realizar seminarios, mesas de trabajo y cursos de formación.
- Sobre el monitoreo en zonas poco accesibles, la solución podría ser establecer diferentes en el mar, para determinar el status.
- Para poder acceder a lugares difíciles, en cuanto a la situación política, se necesita la cooperación internacional.
- En al caso de cómo poder aprovechar los varamientos producidos, dependiendo de su grado de descomposición, no se sabe realmente si es un problema, se necesita la opinión de un veterinario.

Dentro de este mismo punto, en cuanto al acceso a diferentes laboratorios para poder realizar las necropsias se requiere cooperación internacional y a su vez para su formación se necesitan mesas de trabajo, seminarios y cursos de formación para la obtención de datos fiables.

Pesquerias

- En cuanto a la carencia de suficiente información sobre las interacciones foca-pesquerías, se podrían incrementar las observaciones desde barcos, realizar encuestas… Igual se podría hacer para el caso de las pesquerías industriales, además de una cooperación internacional y un acceso a los libros de abordo.
- Sobre encontrar otros métodos de pesca que no fueran invasivos, hay que seguir investigando.
- En cuanto al posible incremento de ambos tipos de pesquería, en el futuro, se debería evaluar la gestión en el uso de las fuentes de recursos y realizar un control exhaustivo sobre las licencias de pesca. Al no haber la suficiente información sobre daños y perdidas se deberá hacer un mayor seguimiento y observación desde los barcos realizando, además, encuestas y recopilando información recogida en los libros de abordo.

Habitat

- Sobre las dificultades de acceso a algunos puntos, podrían hacerse avistomientos tanto marinos, en barcos, como terrestres.
  Igualmente se incide en la necesidad de realizar cursos de formación para un mejor aprovechamiento, una mayor rapidez a la hora de trabajar y una estricta recogida de datos.
- En cuanto a las soluciones para evitar la presión humana, debe empezar por una evaluación y seguimiento de los niveles de contaminación. A si mismo incrementar sistemas de vigilancia de las reservas existentes.

Genética

- Se necesita un esfuerzo de muestreo tanto para animales muertos como para su rehabilitacion.

Step Actions

Poblaciones

Accion

- Realizar estudio de la poblacion y su habitat, desde Guerguerat hasta Dakhla, prestando especial interés desde Guerguerat (norte de las cuevas de cria) hasta Cabo Barbas. Tambien en Madeira excluyendo la Pta de S.Lourenço.
  La actuacion seria localizar lugares donde fuera posible un buen desarrollo de la especie, cuevas, playas…Intentar localizar evidencias de la presencia de estos animales en ambos lugares donde se este realizando el estudio.

  Responsables de esta actuacion:
  - INRH (Institute National Recherches
  - CNROP(Centre National de Recherches Océanographiques et des Pêches) de Mauritania y la Fundación CBD-HABITAT para la conservacion.
    En Madeira el mismo Parque Natural de Madeira.

  Recursos provendran del personal de estas instituciones

  Linea de tiempo: sobre cuando se haria:
  - En dos temporadas una en verano y otra en invierno, se haran las diferentes prospecciones, durante los dos proximos años.
  - Igualmente en Madeira se haran dos prospecciones en los proximos dos años.

  Resultados: se obtendran resultados directos de las acciones.

  Obstaculos a tener en cuenta:
  - Las condiciones atmosfericas
  - La extension de tierra cubierta de minas

  *Sobre los parametros demograficos, en cuanto a responsabilidad, colaboración de las partes y recursos, se pide ayuda al grupo A

Interacciones entre focas y pesqueros

Acción

- Aprovechar adecuadamente los observadores en los barcos de la flota europea, para recoger información de capturas accidentales, presencia de focas e interacciones de estas con los barcos.
  Coordinación para la recepcióon de la información de los diferentes observadores.

Obtención de datos recogidos regularmente de encuestas realizadas por el DSPCM, CNROP, INRH, sobre la pesca artesanal.

Responsable: sera el estadístico el encargado de recopilar toda esta información (sobre pesquerías) y diseñar el estudio.
Los responsables de suministrar esta información sobre pesquerías seran:

- CNROP, pesquerías, autoridades de los gobiernos implicados, INRH, IEO encargados de suministrar esta información sobre pesquerías.
- Tanto el CNROP como INRH, centralizadores de la información, pudiendose disponer de ella cuando sea necesario.

Línea de tiempo: empezaría a comienzos del 2002 y se mantendrá el programa durante todo el año.

Resultado: sería la estimación de las interacciones entre flotas pesqueras, diferentes artes pesqueras y las focas, por estación del año.
Se obtendrán datos sobre la zona a la que llegan las focas en mar abierto.

Obstáculos: sería conseguir información con datos fiables de la pesquería artesanal, al igual que obtener datos precisos sobre las áreas marítimas de campeo utilizadas por las focas.

Grupo C
Manejo de la especie y el habitat

Participantes del grupo:
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Eugenia Androukakis, Hellenic Society for the Protection of the Monk Seal, Greece
Fernando Aparicio, Fundación CBD – Habitat, Spain
Eduardo Balguerias, Centro Oceanográfico de Tenerife (IEO), Spain
Pablo Fernández de Larrinoa, Fundación CBD – Habitat, Spain
Pedro Lopez, Facultad de Biológicas, Universidad de Las Palmas, Spain
Victor García Matarranz, Dirección General de Conservación de la Naturaleza, Spain
Ian Robinson, Norfolk Wildlife Hospital (RSPCA), England
Dawn Smith, California, United States

I. Identification of threats

Results of brainstorm session:

- Fishing
- Genetics
- Neonatal deaths
- Red tides
- Infections
- Cave collapse
- Habitat destruction
- Human disturbance
- Pollution
- Low reproduction
- Predators

There was no consensus on the importance of the threats but general agreement that the following were important (overlapping) and within the remit of our group. We therefore discussed them in this order.

1. Neonathal deaths
2. Low reproduction rate
3. Fishing could have been, can be and could be in the future a major threat. There are inadequate data to quantify the threats at present

<u>1. Neonatal Deaths</u>
Age of highest risk: 1st 2 weeks of life
Time of the year: Births of pups is highest in sep-oct-nov
Nº of deaths highest in sep-oct-nov.

There was agreement that there were more neonatal deaths during the period of highest pup production, but not that there was a statistically significant higher percentage mortality at any time of year. The influence of weather on mortality rate was not agreed.

There was conflicting data and conflicting interpretation of data on this issue.

Problems:

Environmental factors

Wave action
Sand level
Predators
There are indications that environmental conditions increase the percentage mortality during the winter months, but these indications are not statistically significant and therefore their interpretation remains controversial

Biological factors

Lack of maternal care
Lack of vigor of pups

Pup mortality has been observed in the absence of adverse weather, but when a pup dies or is washed out of the caves during bad weather it can be very difficult or impossible to determine whether the cause was truly environmental or whether biological factors contributed to the loss.

2. Low Reproduction-Low Recruitment

Neonatal mortality as discussed above was a major component of this issue.
Low birth rate. It was agreed further data on this subject was important. Birth rate is very low compared to the potential for the species, but the causes remain unclear.

3. Fisheries

This process can be an important contributor to adult female mortality, which was itself identified by the modeling activity at this workshop as a critical component of monk seal population dynamics.

There is disagreement that local artisanal fishery did not presently constitute a risk to the colony. There was no evidence that local Mauritanian fishermen persecuted seals (as happens in Greece).

Large scale fisheries posed a potential threat both by direct interaction and by degradation of habitat.

II. Actions

<u>Neonatal mortality</u>

1. Clarify why survival of pups is so low
   Research needed:
   - Weather and environmental conditions
   - Behavior
   - Body condition
   - Genetics
   - Infectious diseases

   Review existing data as well as producing new data

   Responsible: Appropiate researchers
   Time of execution: ASAP
   Measurement of results: Scientific publications; report to responsible authorities

2. Promote the use of beaches as reproductive sites
   How: Eliminate disturbance (Human)
   Exclude predators
   Identify sites

   Resources: Authorities to create protection sites; human resources to warden
   Responsible: National authorities, collaborators. Invite experts, researchers and monitoring groups
   Time of execution: Start within two years
   Measurement of results: Once the protected area is established protected area
   A) Seals use protected area
   B) Seals breed in protected area

3. Research needed on why some caves are occupied and some not (were in the past?). Improve environment in caves not occupied, should changes be indicated as desirable by the results of the research.

   Responsible: Appropriate researchers
   Time of execution: One year
   Measurement of results: Start to modify caves (unoccupied) to improve habitat for use

4. Rescue and rehabilitation

   Responsible: Parque Natural do Madeira.
   Cap Blanc – Rescue: monitoring team
   Rehabilitation: Responsible Authorities of Mauritania, invited partners and experts.
   Time of execution: Now (ongoing)
   Measurement of results: Number of pups released; recruitment of pups into a colony

What actions?

Criteria for rescue

- Group A – Evidence of debilitation or disease likely to result on death – passed into rehabilitation.
- Group B – Pup washed out of the caves protected and returned to the caves.
  If a pup can not be returned to the cave, it passes to group A
- Group C – Removal of healthy pups at high risk from environmental conditions – pass into Group B or A as appropriate.

This suggestion is very controversial and should go forward to a specialist group (see later) as a more detailed analysis of the information is needed in order to determine whether this group should be included in the rehabilitation program.

5. Develop protocols for rescue rehabilitation and release using all available knowledge and expertise. Assess present facilities and resources.
   A workshop should be convened on this issue.

   Responsible: An International group recommended to organize this to ensure all available expertise and opinion is represented.
   Time of execution: Six months
   Measurement of results: to hold the workshop, achieve conclusions and produce an agreed protocol.

Fisheries

It is a potential threat.

A. Reinforcement of the existing fishing protected areas
B. Identify and then quantify the impact of seals-fisheries interactions
C. Identify habits and foraging areas of seals

Group D
Habitat Protection and Protected Areas

Participantes del grupo:
Miguel Angel Cedenilla, Fundación CBD – Habitat, Spain
Henrique Costa-Neves, Parque Natural de Madeira, Portugal
Manel Gazo, Facultad de Biología, University of Barcelona, Spain
Rogelio Herrera, Viceconsejería de Medio Ambiente, Gobierno de Canarias, Spain
Ignacio Jiménez, Especies y Espacios Internacional, Spain
Giulia Mo, ICRAM, Italy
Jorge Moreno, O.A. Parques Nacionales, Spain
J. Pete Schroeder, Cyprus Regional Aquatic Marine Center, USA
Jean Worms, Parc National de Banc d'Arguin, Mauritania

GOAL: *To ensure that the Atlantic monk seal population has sufficient available habitat to guarantee its long-term survival and natural expansion with adequate legal protection.*

Objective 1. Habitat protection in presently known monk seal colonies.

Identification of essential strategies for the conservation and legal protection of monk seal habitat in already protected areas with known colonies of monk seals in the region of Cap Blanc and Madeira (Reserva Marina de la Península de Cabo Blanco, Reserva Satélite de Cabo Blanco, R.N. de Ponta São Lourenço, R.N. de las islas Desertas).

Management and research activities for habitat protection in these areas are detailed in tables 1 and 2 .

The following activity: "creation, restoration, improvement of new breeding and resting areas within the Cap Blanc region", was proposed in the group but could not achieve consensus.

Note : Research activities to identify the risks encountered by the species in the breeding caves should continue within a basic monitoring strategy. This includes information on the mortality, survival and recruitment of pups into the Cap Blanc colony. This action should be elaborated within working group B.

Objective 2. Apply the same logic as explained in objective 1 (addressing breeding, mating, foraging, resting habitats etc.) described in tables 1 and 2, in all the areas identified within the Draft Action Plan under the title of " Plan Description, chapter D, Action 10", as well as in sites identified in action 4.3 having remnant populations of monk seals. Such analysis should be applied with priority to areas identified by action 4.3. These areas should be included in a future network of protected areas for monk seals.

This analysis will be carried out with the aid of a special Working Group created for this task.

Time limit: December 2003, when the report will be presented (see action 1.4)

Responsible for the creation of the Working Group: Ministry of the Environment of Spain, Canaries Government, Governments of Madeira and Portugal, Government of Morocco and of Mauritania.

Objective 3. Identification of essential habitat priorities for the species.

Establishment of a working group for the identification and definition of the species´essential habitat requirements for the survival and natural expansion of the species in the Eastern Atlantic.
This activity must be coordinated with group C and E.

Objective 4. To identify past and presently utilized habitat.

The following Action Steps are meant to be enacted in a sequential manner.

4.1. <u>Bibliographic review (contemporary , historic and "grey" literature) containing specific references to the presence, abundance, biological characteristics and hunting of the monk seal in the Atlantic</u>.

Responsible: appropiate research.
Timing for Execution: Deadline March 2002
Mensuration of Results: Compilation of a bibliographic review with annotated bibliographic material
Collaborators: All countries, NGOs, Research groups

4.2. <u>Executive protocol for the assesment of existing appropriate coastal habitat for the species</u>
Development of an executive protocol for the identification of: existing suitable habitat for the species, surviving remnant populations, and an inventory of all anthropogenic or natural disturbances throughout the entire geographical range of the Action Plan.

Responsible: Appropriate research
Timing for Execution: Finalized by September 2002
Mensuration of Results: Production of a final working protocol able to specify timing, costs and methods.
Collaborators: Representative of all countries of the plan´s geographic range, NGOs, research groups
Costs: Full-time salary of 1 person for 8 months + 20% of operational costs.

4.3 Execution of the working protocol developed in point 4.2.
Execution of one or more field studies geared at evaluating and identifying the appropriate habitats available for the species, identification of remnant surviving populations, inventory of anthropic and natural threats.

Responsible: Integrated programs of all four countries within the range
Timing for Execution: Finalized by October 2003
Mensuration of Results: Data collection
Collaborators: All countries, NGOs and research groups
Costs: To be identified in the completion of action 4.2

4.4 Final Report
Writing up of a report identifying the appropriate existing habitats, remnant populations and inventory of anthropic and natural treaths.

Responsible: Representative of all countries of the plan´s geographic range, NGOs, research groups
Timing for Execution: Finalized by December 2003
Mensuration of Results: Written report
Collaborators: All countries, NGOs, Research groups
Costs: full-time salary for one person for 4 months + 20% of operational costs.

Table 1. Habitat needs for monk seals in the Cap Blanc region

	Breeding	Mating	Foraging	Resting	Isolation from human disturbances	Existing protection measures
Reserva Marina de la Península de Cabo Blanco **Reserva Satélite de Cabo Blanco**						
Known risks	Bad sea conditions	None	-Hypothetical overfishing -Lower availability of reported prey (lobster, octopus, etc.) -Hypothetical interaction with fishing gear (artisan and industrial)	None	There is enough isolation around the caves but human disturbance in the area might be increasing	No-fishing zone established and enforced by the Morrocan Royal Navy. Frontier and military post reduce human presence, though it is not formally regulated
Catastrophic risks to habitat	Cave collapse Oil spills					
Actions needed	Non-invasive research on mortality, survival and recruitment Monitor risks of cave collapse (see activities of Group C) Facilitate natural expansion of colonies by coastal management of potential habitats	None	Collect and review information on fishery stock-status Research on fishing pressure in coastal and high-sea Research on feeding ecology and foraging ranges (males, females, adults, subadults, juveniles)	None	Quantify and qualify human disturbance from land Regulation and enforcement to control human activities on land	Enforcement of the no-fishing zone needs to be improved, especially in the vicinity of the caves

Table 2. Habitat needs for monk seals in the Madeira region

	Breeding	Mating	Foraging	Resting	Isolation from human disturbances	Existing protection measures
Reserva Natural de las Islas Desertas **R. N. de Ponta de São Lourenço**						
Known risks	Bad sea conditions	None	None	None	Low disturbance at sea by motorboats	There are two Natural Reserves Patrolling by PNM staff and the Navy
Actions needed	-Maintain present level of law enforcement Increase non-invasive monitoring during breeding season	None	Maintain present level of law enforcement Research on feeding ecology	Maintain present level of law enforcement	Maintain present level of law enforcement Quantify and qualify human disturbance	Maintain present level of law enforcement Include these protected areas within the Nature 2000 network Management plans should be ready in two years

Grupo E
Información, sensibilización y apoyo social

Participantes del grupo:
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Handi M'Barek, Fundación CBD – Habitat, Spain
William Johnson, International Marine Mammal Association, Canada
Nuria Almagro, IPADE, Spain
Gerald Hau, Euronature, Germany
Jordi Sargatal, Fundación Territori I Paisatge, Spain
Sofía Menéndez, Spain

Objetivo General: Mejorar las perspectivas de supervivencia de la foca monje en la Península de Cabo Blanco, y en el Atlántico oriental en general.

Problemas Identificados

1. Insuficiente sensibilización de la población local (pueblos y cuidades de Cabo Blanco hasta Dajla).
2. Falta de implicación de la comunidad local en las actividades de conservación.
3. Situación de pobreza de la población local.
4. Insuficiente conocimiento internacional de la especie, y de su estado de conservación.

Destinatarios

Las zonas-objetivo de la campaña serían principalmente la Península de Cabo Blanco, y la Isla de Madeira.

En el caso de <u>Madeira</u> se apoya la continuación de la campaña realizada hasta ahora por el Parque Natural:

- Educación en escuelas, exposiciones itinerantes, conferencias, visitas a Desertas, participación en los medios de comunicación.
- Se está preparando una campaña para la recogida de datos en los clubes navales y puntos estratégicos donde se reúnen pescadores y navegantes.

Los grupos-objetivos son:

A. Pescadores artesanales que trabajan en la zona de la foca (desde Cabo Blanco hasta Dajla, pero centrándose en la zona de Cabo Blanco).
B. Pescadores industriales de los caladeros cercanos.
C. Población local en general (pueblos y cuidades de Cabo Blanco) y organismos oficiales.
D. Comunidad internacional.

Estrategias

Se distinguen dos apartados básicos:

I. Concienciación
II. Apoyo social

I. Estrategias de Concienciación

Dirigida a cuatro colectivos**:**

A. Pescadores artesanales;
B. Pescadores industriales;
C. Población local en general y organismos oficiales;
D. Comunidad internacional.

A. Pescadores artesanales que trabajan en la zona de la foca

Concienciación centrada especialmente, a corto plazo, en los pescadores de las piraguas que faenan en la zona de exclusión de pesca. Los argumentos básicos serian:

- Importancia intrínseca de la foca
- Existencia de la zona de reserva, y valor de ésta como fuente de recursos pesqueros.

B. Flota industrial

Concienciación de la propia flota (especialmente patrones y armadores). Dada la complejidad de la flota industrial que desarrolla su actividad en la zona (marroquí, mauritana e internacional), se propone centrar las actuaciones sobre los puertos marroquíes y mauritanos más cercanos, como serían el de Agadir, Dajla, y Nouadhibou. Sin embargo no hay que olvidarse de otros puntos que podrían ser interesantes, por su valor estratégico, como los pesqueros de la flota internacional que faena en la zona, y puertos como los de Canarias. Material didáctico: carteles, folletos, emisiones de Onda Pesquera....

Concienciación de las autoridades responsables de la vigilancia, y petición de que asuman con la máxima eficacia sus responsabilidades, mediante entrevistas, videos informativos,...

C. Población local en general y organismos oficiales

1. **Escuelas y centros de educación primaria y secundaria**: Cursillos de formación de profesores y dotación con material educativo (videos, carteles, paneles, "seducción ambiental"...).
2. **Organismos oficiales**. Es fundamental contar con la participación y colaboración de los organismos mauritanos y marroquíes que están relacionados o dependen directamente de la administración pública (Ministerios y centros oficiales). Los centros más importantes serían el CNROP, ENEMP, el Parque Nacional del Banc d´Arguin y el Instituto Oceanográfico de Dajla. Estimular su participación mediante la elaboración de programas conjuntos, y la formación especifica de técnicos en la materia que aseguren una continuidad de las actividades de concienciación y participación directa de la población de los países implicados.

3. **Otros colectivos**.
    - Pescadores ocasionales, perceberos, …
    - Sectores más pobres de la sociedad: niños sin escolarizar, barrios marginales
    - Comerciantes
    - Militares que acceden por tierra a las playas
    - Medios de comunicación: talleres con periodistas de Marruecos y Mauritania sobre la importancia del medio ambiente y la necesidad de preservar la foca
    - Otros

D. Comunidad internacional
- Explicar la existencia de la especie y problemática.
- Crear una opinión favorable y recaudar fondos.
- Se cuestiona la utilidad de las macro-campañas, ya que una afluencia masiva de turismo sería perjudicial.
- Crear un banco de datos e imágenes en internet.

II. <u>Estrategias De Apoyo Social</u>

Dirigida a dos colectivos**:**

A. Pescadores artesanales
B. Población local en general (Cabo Blanco)

- Promoción de actuaciones de cooperación encaminadas a un <u>desarrollo sostenible</u> de la comunidad local, dada la precariedad de las condiciones de sus condiciones de vida. Realización de proyectos de cooperación, en diversos campos: salud, medioambiente, educación, promoción del tejido económico, …
- <u>Establecer líneas de contacto</u> entre las instituciones locales e instituciones e institutos de tecnologías ambientales, ONGs, etc. para la cooperación en infraestructuras (vertederos, red de alcantarillado, depuración, energías renovables, etc.) y proyectos de cooperación al desarrollo.
- Trabajar en la <u>promoción del desarrollo económico</u> del sector, de manera que los pescadores puedan acceder a la propiedad de las piraguas, y mejorar sus ingresos. Para ello seria necesario elaborar un informe económico, que nos permita conocer los ingresos (los gastos, ganancias, alquileres, perdidas ...) de los pescadores de la zona.
- Se considera que es positivo <u>trabajar con incentivos materiales</u> en el caso de la pesca artesanal, no económicos, que faciliten las labores de concienciación social. En este punto se comentan actuaciones que acompañen a las campañas, como puede ser la sustitución de redes dañinas.
- Estudio da la posibilidades de promover <u>la creación de empleos alternativos</u> a la pesce artesanal.

Desarrollo de las actuaciones:

Los organismos oficiales, técnicos locales del área (desde Cabo Blanco hasta Dajla) deberán codirigir las actuaciones de información, sensibilización y apoyo social.

El grupo de comunicación propone incorporar esta cita como entradilla del proyecto.

Hay una verdad elemental
que concierne a todos los proyectos de iniciativa,
y cuya ignorancia hace fracasar
infinidad de ideas y planes espléndidos:

y es que en el momento en que
uno se compromete definitivamente,
entra la providencia ...

Cualquier cosa que quieras,
o sueñes que puedas hacer,
comienza ...

La determinación tiene genio, poder, y magia.
comienza ahora ...

J. W. GOETHE

Recomendaciones Prioritarias

- Las campañas de sensibilización, información y apoyo social deberán ir dirigidas a conseguir la vinculación y participación de las poblaciones locales en las labores de conservación de la foca.

- Estas acciones supondrán una mejora de la calidad de vida de los habitantes locales.

Group F
Emergency Plan Development

Working Group participants:
Abdelaziz Zoubi, Institut National de Recherche Halieutique, Morocco
Albert Osterhaus, Seal Rehabilitation and Research Center, Netherlands
Héctor Mendoza Guzmán, Instituto Tecnológico de Canarias, Spain
José Franco, Instituto Español de Oceanografía, Spain
Joseph Geraci, National Aquarium, USA
Santiago Fraga, Instituto Español de Oceanografía, Spain
Thijs Kuiken, Erasmus Universiteit Rótterdam, Netherlands
M'Hamed Idrissi, Centre Regional de l'INRH Adakhla, Morocco
Mohamed ould Ely Ould Barham, Centre National Recherches Oceanographiques et des Pêches, Mauritania

Goal
Draft a protocol for coordinated response to emergencies:
- Establish a strategy for the development of a common approach for dealing with emergencies
- Identify the composition of the proposed primary response and emergency response teams
- Create schedule for the development and implementation of action plans to deal with most probable causes of emergencies

Definition of emergency
Morbidity-mortality above background level, or an increased risk for this to occur. (Background stranding rates to be determined by Recovery Plan Working Group by age class and sex.)

Envisaged sequence of events leading to action by the Emergency Response Team:
1. On-site monitoring team identifies a possible emergency.
2. Primary Response Team is notified, conducts a preliminary assessment, and determines whether emergency exists.
3. If yes, Primary Response Team notifies Emergency Response Team.
4. Emergency Response Team organizes response.

Primary Response Team

Assumptions:
- Sufficient finances must be in place to allow operation of team (UNEP identified as a possible source).
- Primary Response Team (see List of Actions, B, in Recovery Plan draft) must interact closely with monitoring team.

Membership (Cap Blanc Peninsula):
- Representative from Mauritanian Ministry of Fisheries (suggested number: 1)
- Representative from Moroccan Ministry of Fisheries (suggested number: 1)
- Representatives of integrated Mauritanian and Maroccan monitoring teams (suggested number: 1 from each)

Membership (Madeira):
- Representative responsible Ministry (suggested number: 1)
- Member from monitoring team (e.g., population biologist) (suggested number: 2)
- Member from surveillance team (e.g., fisheries warden, legal) (suggested number: 2)

Emergency Response Team

Assumptions:
- General areas of expertise represented (Biology, Medicine, Environmental monitoring, Logistic support), each by a Group Leader
- Emergency Response Team Coordinator and Group Leaders are appointed, on basis of recognized scientific expertise and for a period of three years, by the Monk Seal Recovery Plan Oversight Committee, in consultation with member countries and other constituent groups.
- Group Leader identifies membership of respective group on basis of recognized expertise.
- Group Leader serves as liaison among group members and with other Group Leaders.
- Finances need to be in place to support Team activities (UNEP?).
- Each group develops a response plan for each type of threat, and determines the criteria for initiating an emergency response, in collaboration with the Primary Response Team.
- The response plans should highlight those emergencies that can be predicted, such as algal blooms, and emphasize monitoring for such events (Early Warning System)
- Responsible for developing and maintaining contact list for emergency communications network.
- Maintains high level of internal communication to review and update action plans

Threat Analysis

Seven threats were identified as constituting an emergency. Each is assigned the four following categories:

A. Effect on population (mortality: low, medium high; age category involved)
B. Expected frequency of emergency (low: 1 per 100 yrs; medium: 1 per 20 yrs; high: 1 per 5 yrs)
C. Monitoring methods needed to determine presence of emergency
D. Response to emergency, including preventative measures where applicable

<u>Unknown cause</u>

A. Ages involved: unknown. Mortality level: unknown.
B. Expected frequency: moderate, decreasing with monitoring effort.

C. Monitoring at all levels required.
D. Response requires full effort of entire emergency response team, with all its resources. It is likely that this scale of response would be in effect in many increased morbidity-mortality events, until cause is determined.

<u>Infectious disease</u>

A. High (60% mortality in harbour seals from morbillivirus. Both adults and juveniles affected.)
B. Low
C. Examination of carcasses should include sampling for infectious agents; clinical signs provide clues; morbidity and mortality patterns in other species (e.g., feral dogs) near seal habitat should be taken into account
D. After diagnosis is made, prevent, treat, monitor further, depending on situation. Consider treatment centre.

<u>Contaminant spill (We consider oil here)</u>

A. Affects all ages, but pups in caves more at risk. Mortality low.
B. Low
C. Strongest indication will come from environmental monitoring (maintain communication with navy and other maritime vessels)
D. Regulate shipping traffic to avoid collisions. Protect critical habitat (including caves). Clean up with minimum disturbance. Consider mobile oil response unit. Handle only critically affected pups.

<u>Algal toxin</u>

A. All ages above nurselings affected (i.e., the ones that eat fish). No to very high mortality.
B. Madeira low, Cap Blanc unknown.
C. Monitoring (RSSL) in place in Cap Blanc. This should be reinforced and adjusted for monk seal habitat. Establish algal toxin monitoring in Madeira, despite lower risk.
D. Depends on toxin. Veterinary input required.

<u>Cave collapse</u>

A. Mortality low to moderate. All ages affected.
B. Frequency moderate
C. There are two methods of monitoring. 1) By seal biology team who regular monitors caves. 2) By geology specialist who measures structural integrity.
D. Clear a path if entrance blocked.

<u>Habitat disturbance</u> (e.g., unusual meteorological event (storm), human disturbance, unusual presence of humans at cave, exploration activities, underwater explosions)

A. All age categories? Level of mortality potentially high.
B. Expected frequency: low.
C. Maintain awareness of plans for human activities in area (e.g. exploration activities, fisheries surveys, oceanographic and biologic sampling)
D. The key lies in prevention. Mitigation possible in some cases. Consider critical habitat, especially during reproductive and nursing period.

Fisheries interaction (legal or illegal)

A. All age categories above nursing. Level of mortality low to moderate.
B. Expected frequency: moderate?
C. Examination of carcasses according to protocol designed to identify this category of mortality. Scientific observers aboard fishing vessels.
D. Alert responsible fisheries management agencies to take mitigation measures.

The following table identifies the proposed composition of the emergency response team according to discipline groups, a schedule for developing an action plan for each group, and general guidance on the nature of the action plans.

Group	**Composition of each discipline group**	**Timing for developing team**	**Time for each subgroup to develop action plan**	**Considerations**
Biology	Seal biologists	1 Mar 2002	Their role is to respond to needs of other groups, both in preparing action plans and at time of actual response.	Critical supportive group for each other category. Will support group and form integral part in response phase and post-response monitoring.
Medicine	Clinical veterinarian Veterinary pathologist Infectious disease specialist Toxicologist (pollutants-phytotoxins) Designated laboratories	1 Mar 2002	First draft plan ready for review by 1 August 2002. Final version by 1 October 2002.	Requires coordinator who will assume administrative responsibility, because it is a large group with many plans. This requires an integrative action plan, with detailed protocols for collection, storage, transportation to designated labs, an analysis in each discipline.
Environmental monitoring	Fisheries biologist Habitat specialist (GIS) Harmful Algal Bloom specialist Contaminant spill specialist Geologist	1 Mar 2002	First draft plan ready for review by 1 August 2002. Final version by 1 October 2002.	Need to develop plan for monitoring (early warning system), and site-specific plan for e.g. oil spill, cave collapse, and fisheries interaction. Encourage development of a field station at northern border of fisheries exclusion area Cap Blanc, which could serve e.g., as data

Group	Composition of each discipline group	Timing for developing team	Time for each subgroup to develop action plan	Considerations
	Meteorologist-physical oceanographer			collecting station for monitoring, office for surveillance. This would contribute to efficiency of surveillance in area. Added advantage would be to start action in proximity to eventual emergency.
Logistic support	May include military (including divers) Field station Transport-equipment Carcass disposal Designated labs Media-public information spokesperson	1 Mar 2002	First draft plan ready for review by 1 August 2002. Final version by 1 October 2002.	Involves list of continuously available logistic equipment available at different sites, confirmed through letters of intent. Strongly encourage the development of a mobile emergency field station, which can be used for different types of emergencies, e.g. with equipment required for large-scale tissue and data collection, storage, communication, and carcass disposal. Reinforce existing rehabilitation centre to provide back-up for emergency. A professional in public relations is an integral part of this group, informed of all aspects of the emergency response team plans and operations, and serves as on-site spokesperson during a response.

Group G
Risk Assessment and Population Modeling

Working Group Participants:
Jaume Forcada, National Marine Fisheries Service / NOAA, United States
Ingrid Mozetich, CBD – Habitat, Spain
Phil Miller, Conservation Breeding Specialist Group, USA

Introduction

Two Mediterranean monk seal populations currently exist in the eastern Atlantic, one in the Desertas Islands (Madeira), and the other on the Cap Blanc peninsula, on the coast of the western Sahara. The colony at Cap Blanc, with an estimated average population of 317 seals in the mid 1990s, was affected by a severe mass mortality event in 1997, which reduced its numbers to 103 individuals (as estimed in 1998, Forcada et al. 1999). The age composition was also changed as a result of the mass mortality, significantly increasing the proportion of young seals. The sub-population in Madeira was composed of about 50 animals in the late 70s and severely reduced in size over the next two decades. The population size is currently estimated to be around 24 seals (Costa-Neves, personal communication). Both populations are presently exposed to a number of potential threats that could compromise their persistence in the Atlantic.

The population modeling group assembled baseline demographic and population data to build risk assessment models and assess the viability of these two populations. The data were used to construct population models and assess current population trends. Sensitivity analysis was employed to assess the impact of measurement uncertainty in demographic rate estimation on population performance. Finally, the group developed a procedure to identify and quantify current threats to populations and habitats, and a survey on potential threats was conducted among the different working groups (see form at the end of this document).

Population Viability Analysis of the Mediterranean Monk Seal in the Eastern Atlantic

Population viability analysis (PVA) can be an extremely useful tool for assessing current and future risk of wildlife population decline and extinction. In addition, the need for and consequences of alternative management strategies can be modeled to suggest which practices may be the most effective in conserving the Mediterranean monk seal in its wild habitat in the eastern Atlantic. *VORTEX*, a simulation software package written for population viability analysis (see final pages of this report), was used here as a mechanism to study the interaction of a number of Mediterranean monk seal life history and population parameters treated stochastically, to explore which demographic parameters may be the most sensitive to alternative management practices, and to test the effects of selected island-specific management scenarios.

The *VORTEX* package is a Monte Carlo simulation of the effects of deterministic forces as well as demographic, environmental, and genetic stochastic events on wild populations. *VORTEX* models population dynamics as discrete sequential events (e.g., births, deaths, sex ratios among offspring, catastrophes, etc.) that occur according to defined probabilities. The probabilities of events are modeled as constants or random variables that follow specified distributions. The package simulates a population by stepping through the series of events that describe the typical life cycles of sexually reproducing, diploid organisms.

VORTEX is not intended to give absolute answers, since it is projecting stochastically the interactions of the many parameters used as input to the model and because of the random processes involved in nature. Interpretation of the output depends upon our knowledge of the biology of the Mediterranean monk seal, the environmental conditions affecting the species, and possible future changes in these conditions. For a more detailed explanation of *VORTEX* and its use in population viability analysis, refer to Miller and Lacy (1999) and Lacy (2000).

Input Parameters for Stochastic Population Viability Models

Species: *Monachus monachus*

Species distribution in the eastern Atlantic: Currently, there are only two known breeding subpopulations in the Atlantic: A colony at Cap Blanc, western Africa, and a colony in the Desertas Islands, Madeira, Portugal.

Breeding System: Polygynous. The degree of polygyny is likely to be very low at Cap Blanc, if it really exists. For the purpose of the simulation exercise we assume that it is polygynous.

Age of First Reproduction: *VORTEX* precisely defines reproduction as the time at which offspring are born, not simply the age of sexual maturity. In addition, the program uses the mean age rather than the earliest recorded age of offspring production. At Cap Blanc, the age of first reproduction (only known for a limited number of animals, Gazo et al. 2000) is assumed to be 4 years on average. The same age is applied for Madeira.

Age of Reproductive Senescence: *VORTEX* generally assumes that animals can reproduce (at the normal rate) throughout their adult life. We assume that monk seals do not experience reproductive senescence; consequently, we assume that individuals reproduce until they die. Field observations suggest that monk seals may live to be 40 years of age.

Offspring Production: Available information on natality rates of the Mediterranean monk seal at Cap Blanc (Gazo et al. 1999, González et al. 2002) are found to be biased by the population modeling working group. Published estimates are expressed as the ratio of observed number of pups to total number of reproductive females in the population. The observed number of pups used is biased because it does not account for those unobserved. The corrected number of reproductive females in Gonzalez et al. is biased because it is produced with a derived estimate of adults in the population from Forcada et al. 1999, subsequently corrected with a biased estimate of sex-ratio which does not account for unobserved individuals. We use a better estimate based on multi-stage capture-recapture modeling of photo-identification data derived by modeling breeding propensity, and observed numbers of breeding and non-breeding females in the colony during the period 1993-1998 and their corresponding recapture probabilities (Forcada et al, unpublished data). The modeling indicates that 51.9% (SD = 12.4%) on average reproduce each year (University of Barcelona, unpublished data). This reproductive rate is largely influenced by the breeding energetics of adult females. In other words, the percentage of adult females that successfully reproduce from year to year will range from about 30% to 70%. Natality rates for the Mediterranean monk seal in Madeira are not currently available. The working group produced an estimate from available information provided by researchers currently working in the area. The estimate is the ratio of the observed average number of pups born in each year (3) to the estimated number of reproductive females in the population. This number is obtained from the observed number of adults corrected by an assumed sex-ratio of 1:1. This gives an estimated number of 0.43. Because of the limited information available, the group could not produce an estimate of standard error, but assumed a variation between 20 and 60%.

Mediterranean monk seal females produce only 1 pup per litter, and the sex ratio of males and females is assumed 1:1, since the estimated value is not significantly different of this ratio. The same values are assumed for the population in Madeira.

Male Breeding Pool: In many species, some adult males may be socially restricted from breeding despite being physiologically capable. This can be modeled in *VORTEX* by specifying a portion of the total pool of adult males that may be considered "available" for breeding each year. The working group assumed that 50% of the males were involved in the reproduction, allowing for a variation between 25 and 75% for the sensitivity analysis.

Age-Specific Mortality: Age specific mortality was obtained from unpublished survival estimates (Forcada et al.) and by modeling the recapture histories of seals from the period 1993-1998. Modeling of several effects, including age, 1997 mass mortality, sampling effort, year and additional covariates allowed for estimates of age specific survival rates. The sampling scheme and subsequent modeling, based on Pollock´s robust design, was also used to test for immigration, emigration and presence of transients in the population. The lack of migratory movements was shown by the best modeling options. Since emigration was insignificant, estimated survival rates were the complement of mortality rates. It also indicated independence between the population of Cap Blanc and Madeira. An analysis of variance components using random effects models was used to separate sampling error from process variation, and process variation was used to derive standard errors (Table below).

	Mortality, % (SD)	
Age Class	Females	Males
0 – 1	59.0 (10.5)	59.0 (10.5)
1 – 2	20.8 (5.7)	20.8 (5.7)
2 – 3	10.0 (0.9)	10.0 (0.9)
3 – 4	10.0 (6.1)	3.4 (0.34)
Adult (4+)	10.0 (6.1)	3.4 (0.34)

Mortality rates for pups and juveniles at Madeira were inferred from the observed number of dead animals. Juvenile and adult mortality rates were assumed to be the same as in Cap Blanc.

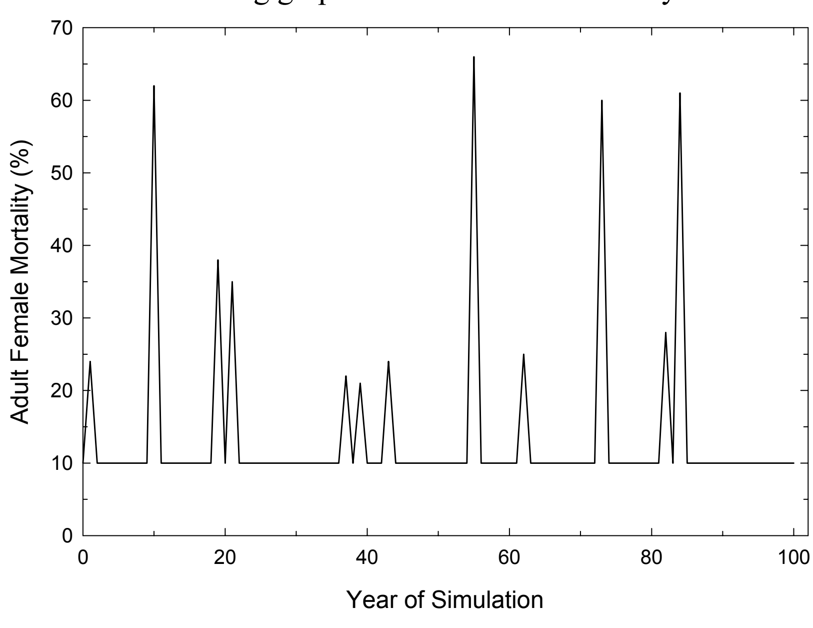
Inbreeding Depression: *VORTEX* includes the ability to model the detrimental effects of inbreeding through reduced survival of pups through their first year. The severity of inbreeding depression is expressed as the number of lethal equivalents per diploid genome in a given population. In the absence of specific data on the impacts of inbreeding on juvenile survival in Mediterranean monk seals, we used the median value of 3.14 lethal equivalents derived from analysis of 45 captive mammal populations in North America by Ralls et al. 1988. In addition, we assume that about 50% of the genes responsible for inbreeding depression are lethal and can be eliminated from the population over time through exposure and selection in homozygotes produced through inbreeding.

<u>Catastrophes</u>: Catastrophes are singular environmental events that are outside the bounds of normal environmental variation affecting reproduction and/or survival. Natural catastrophes can be tornadoes, floods, droughts, disease, or similar events. These events are modeled in *VORTEX* by assigning an annual probability of occurrence and a pair of severity factors describing their impact on mortality (across all age-sex classes) and the proportion of females successfully breeding in a given year. These factors range from 0.0 (maximum or absolute effect) to 1.0 (no effect), and are imposed during the single year of the catastrophe, after which time the demographic rates rebound to their baseline values.

We focused on developing a catastrophe scenario based on the recent mass mortality event that reduced the size of the Cap Blanc population by nearly 70%. Continued analysis of this event leads most researchers to conclude that a severe toxic algal bloom triggered the seal mortality event. These events are beginning to occur across a wider geographic area, and with greater frequency (Joe Geraci, personal communication). For our Mediterranean monk seal analysis we assumed that this type of toxic bloom occurs about every 10 years. In addition, we assumed that the severity of a bloom could be highly variable as it is a function of prevailing environmental conditions and geographic proximity to the affected seal population. Finally, we assumed that the impact of this event is restricted to the adult age class, as adults tend to feed on the affected fish with greater frequency. We assumed that catastrophe mortality could be as high as 70% in adults, with the actual severity drawn from a uniform distribution according to the following Vortex functional form (see Miller and Lacy (1999) for details on the syntax):

```
Mortality = 10+[(60*SRAND(Y+(R*100)))*(SRAND(Y+(R*200))<0.1)]
```

This function generates the following graph of adult female mortality over time:



Note that, in the plot above, both the timing and severity of the event is random. The precise timing and severity of the catastrophe will be different for each scenario that is modeled.

Initial Population Size: Initial population size by age group was obtained from capture-recapture estimates of abundance using photo-identification data for the colony at Cap Blanc in 1996 (Forcada et al 1999). Estimates were rescaled by the proportion of individuals in each age group, and estimated proportions were corrected by unobserved animals using recapture rates estimated by photo-identification and other marking methods (Jaume Forcada, unpublished data).

Photo-identification and count data from Madeira was used to estimate the initial population size by age groups.

Carrying Capacity: The carrying capacity, K, for a given habitat patch defines an upper limit for the population size, above which additional mortality is imposed randomly across deaths of individuals and total population numbers all age classes in order to return the population to the value set for K. Given the low numbers of Mediterranean monk seals in Cap Blanc and Madeira, K was simulated as a population ceiling, of 600 and 75 individuals respectively

Iterations and Years of Projection: All scenarios were simulated 250 times, with population projections extending to 50 years. This time period corresponds to approximately 6 monk seal generations. All simulations were conducted using *VORTEX* version 8.41 (June 2000).

Results of Simulation Modeling

1. Baseline Cap Blanc Population Analysis: Inbreeding and Algal Toxin Catastrophe

Figure 1 shows the 50-year projection of our simulated Cap Blanc population with our best estimates of population variables. In the absence of the catastrophic mortality event and inbreeding effects (the solid line), our baseline model results in a rate of population growth (r) of -0.034. In other words, the simulated population is expected to decline in size at a rate of about 3.5% per year. Recent population trend analysis (Forcada et al. 1999) suggests that the Cap Blanc population was neither increasing nor decreasing in size before the 1997 mortality event; however, the short time period of observation on a small population makes the detection of a significant change in population size difficult at best. Moreover, high variability surrounding population size estimates – as was the case for the 1993 population estimate – further reduces the power to detect a decline. With this in mind, we conclude that the rate of decline observed in our model is within reason for the Cap Blanc population. Even without considering the devastating impacts of a mass mortality event, this population may be impacted by a variety of negative factors – reduced pup survival through cave wash-outs, interactions with local fisheries, reduced availability of suitable breeding sites, etc. – that can collectively act to drive the population into decline.

Additional inspection of Figure 1 and Table 1 indicates that the effects of inbreeding appear to be quite low; moreover, if any effects are seen they are expected to show up only in the long term. Detailed analysis of the model results reveals that the mean level of inbreeding in this population

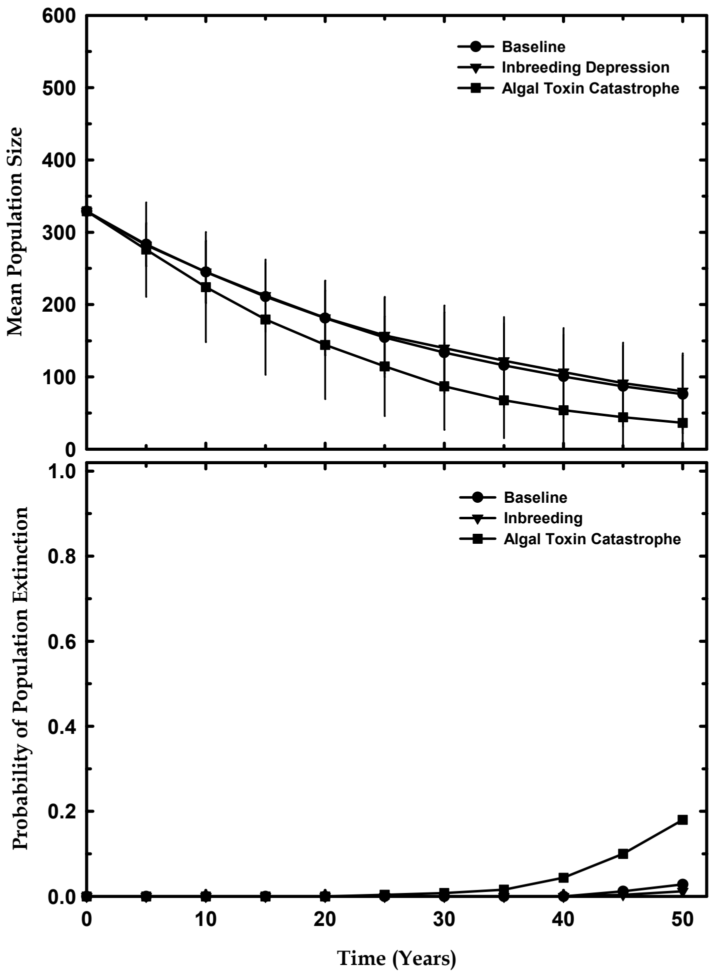


Figure 1. Fifty-year projections of mean population size (±SD) (top panel) and risk of population extinction (bottom panel) for a simulated Cap Blanc population of Mediterranean monk seals with best estimates of demographic parameters based on field data from 1993 – 1997. Inbreeding depression (defined here as an increase in pup mortality) severity is considered to be "typical" for a mammal (Ralls et al. 1988). Catastrophe (annual frequency of occurrence of 10%) results from large bloom of toxic algae that reach adult seals through the food chain. See accompanying text for additional details.

is only 0.007 after 100 years. Such a low degree of inbreeding will not typically generate levels of homozygosity that are necessary to display inbreeding depression (unless the severity of inbreeding depression is extremely high). Workshop participants expressed some concern that this was not realistic, since it is likely that the Cap Blanc population has experienced one or more major contractions in size (also known as "population bottlenecks") during the past decades and would therefore be expected to show low levels of genetic variation and some inbreeding depression. This population does in fact show a low observed natality rate, and the level of genetic variability is amongst the lowest observed in pinnipeds (Pastor et al. 1999). Participants also noted that the apparent lack of proper maternal care and associated low pup viability in some animals at Cap Blanc could result from inbreeding depression.

On the other hand, it is also possible that population bottlenecks and the resulting higher levels of inbreeding would purge lethal genes through a combined process of forced inbreeding and strong selection. As a result, inbreeding depression would be expected to decrease over time as these genes are gradually removed from the population. Unfortunately, virtually nothing is known about the extent of inbreeding in Mediterranean monk seals and the severity of its consequences. While difficult to conduct in the field, additional research on inbreeding in monk seal colonies of the eastern Atlantic would be a valuable tool to assist both population research and conservation.

Finally, we wanted to investigate the impact of a catastrophe similar to the 1997 mass mortality event, likely derived from a toxic algal bloom near the Cap Blanc breeding colony. As seen in Figure 1 and Table 1, the population growth rate is reduced further from a baseline value of –0.034 to –0.056, and the risk of population extinction increases from 1-2% to nearly 20% over the simulation timeframe of 50 years. A catastrophic event like this one can clearly have a major impact on monk seal population dynamics and persistence. It is interesting to note that, despite the significant rate of mean population decline, individual simulations may show periods of stable population numbers and perhaps even marked population growth (see Figure 2). This result lends further support to the notion that, even if the long-term population growth rate is expected to be negative, field researchers may observe shorter periods of population growth that do not necessarily reflect long-term trends.

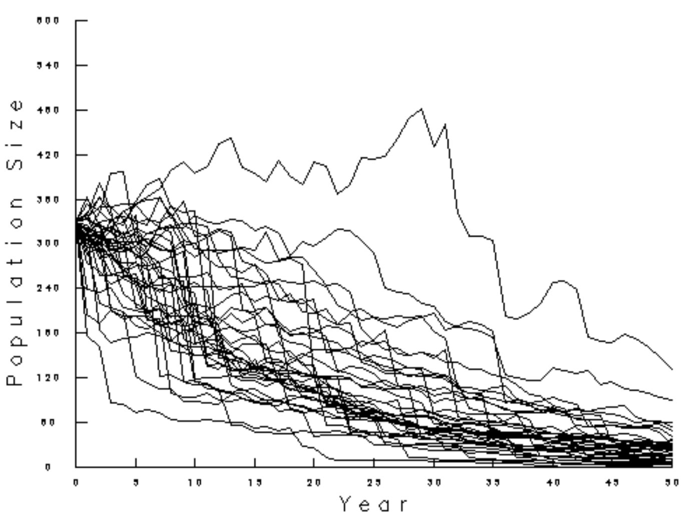


Figure 2. Selected set of the 250 iterations comprising the baseline Cap Blanc monk seal population model, with the addition of a toxic algal bloom catastrophe. Note the infrequent periods of population stability or even growth in the time intervals between catastrophic events despite a long-term average population decline.

Table 1. Stochastic growth rate, probability of extinction, mean size at 50 years for those populations remaining extant at the end of the simulation, mean time to extinction, and final population heterozygosity for the base Cap Blanc population simulations discussed in this section.

Model conditions	r_s (SD)	P(E)	N_{50} (SD)	Mean T(E)	H_{50}
Baseline	-0.034 (0.055)	0.028	76 (54)	45.6	0.972
Baseline / Inbreeding depression	-0.032 (0.055)	0.012	80 (52)	47.3	0.958
Baseline / Catastrophe	-0.056 (0.114)	0.180	36 (36)	43.3	0.938

The carrying capacity used to model population trajectories was assumed to be a population ceiling, similar in value to the upper 95% confidence limit of the highest abundance estimate during the period 1993-1996. There is no available information on the natural carrying capacity of the different Atlantic populations, and for the purpose of simulation, and given the low densities of animals throughout its range, population ceilings are likely to accurately represent recent population growth upper limits. Further investigation would be adequate in a comprehensive PVA analysis.

2. Demographic Sensitivity Analysis

During the development of the baseline input dataset presented above, it quickly became apparent that a number of estimates of Mediterranean monk seal population demographics are estimated with varying levels of uncertainty. This type of measurement uncertainty, which is distinctly different from the annual variability in demographic rates due to extrinsic environmental stochasticity and other factors, impairs our ability to generate precise predictions of population dynamics with any degree of confidence. Nevertheless, an analysis of the sensitivity of our models to this measurement uncertainty can be a valuable aid in identifying priorities for detailed research and/or management projects targeting specific elements of the species' population biology and ecology.

To conduct this demographic sensitivity analysis, we identify a selected set of parameters from the baseline model whose estimate we see as considerably uncertain. We then develop biologically plausible minimum and maximum values for these parameters (see Table below).

		Estimate	
Parameter	Minimum	Baseline	Maximum
Longevity	30	40	50
% Females breeding	30	50	70
% Males breeding	25	50	75
Pup Mortality (%)	50	59	70
Adult Female Mortality (%)	5	10	15
Adult Male Mortality (%)	2	3.4	10

For each of these parameters we construct two simulations, with a given parameter set at its prescribed minimum or maximum value, with all other parameters remaining at their baseline value. With the seven parameters identified above, and recognizing that the aggregate set of baseline values constitute our single baseline model, the table above allows us to construct a total of 12 alternative models whose performance (defined, for example, in terms of average population growth rate) can be compared to that of our starting baseline model.

For all models comprising this analysis, we used an initial population size of 329 individuals, and a carrying capacity of 600.

The result of our sensitivity analysis, expressed as the mean stochastic population growth rate for each of the 13 sensitivity models, is shown graphically in Figure 3 and numerically in Table 2. It is clear from the figure that overall female breeding characteristics are a more important determinant of population dynamics than those corresponding parameters for males. In addition, while not as significantly different, our models show slightly greater sensitivity to uncertainty in juvenile mortality when compared to a similar level of uncertainty in adult mortality. Despite this small difference, it is clear that accurate and realistic models of Mediterranean monk seal population demography will depend upon accurate estimates of female breeding and survival schedules.

Figure 3. Demographic sensitivity analysis of a simulated Mediterranean monk seal population on the Cap Blanc peninsula. Stochastic population growth rate for a set of models in which the specified parameter is varied across a range of biologically plausible values. The baseline model growth rate of -0.034 is given by the central data point for each parameter. The general model of monk seal population dynamics is most sensitive to uncertainty in those parameters giving the widest range in simulated population growth rate. See accompanying text for additional details.

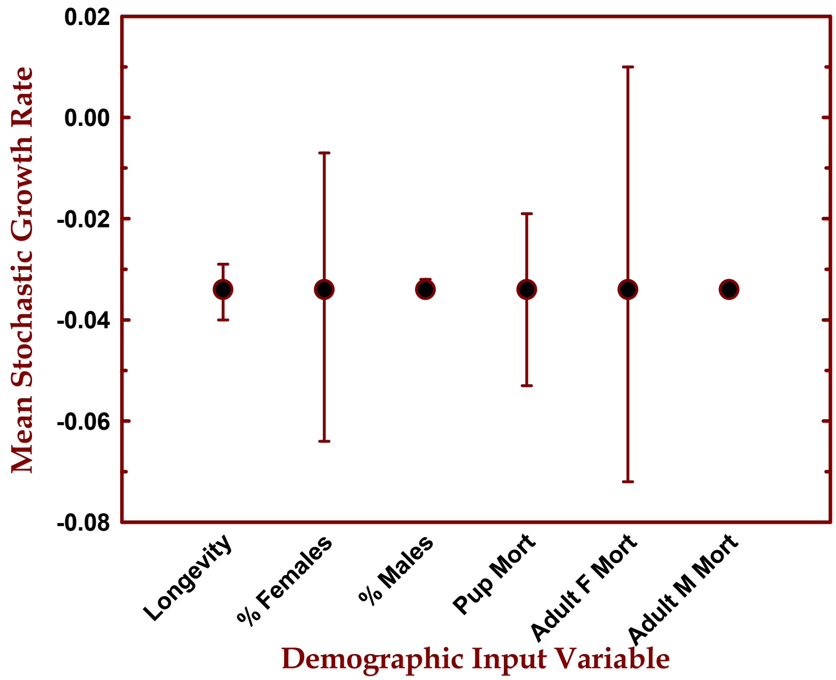
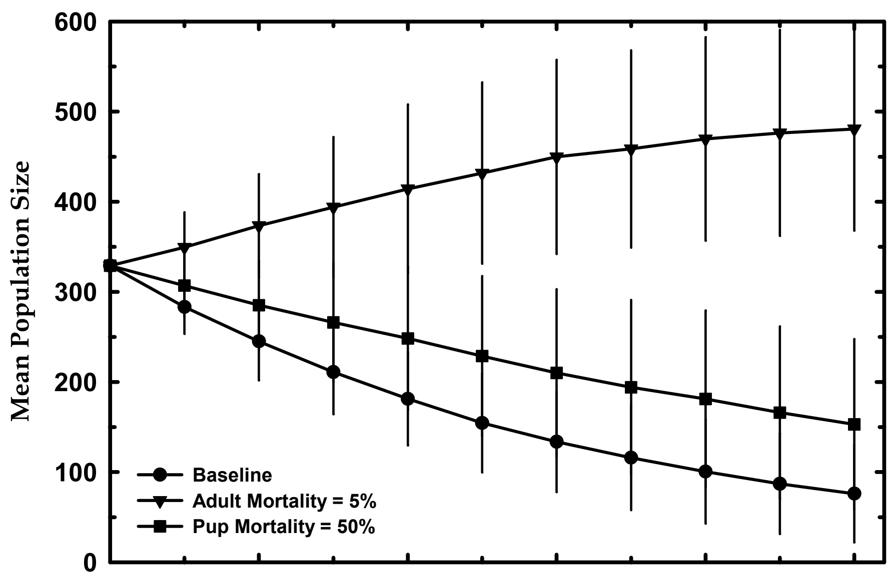


Table 2. Stochastic growth rate, probability of extinction, mean size at 50 years for those populations remaining extant at the end of the simulation, mean time to extinction, and final population heterozygosity for sensitivity analysis based on the Cap Blanc population model discussed in this section. Boxed data indicates those parameters to which our model is most sensitive, with the baseline model showing greatest sensitivity to uncertainty in adult female mortality.

Model conditions	r_s (SD)	P(E)	N_{50} (SD)	Mean T(E)	H_{50}
Baseline	-0.034 (0.055)	0.028	76 (54)	45.6	0.972
Longevity = 30 years	-0.040 (0.065)	0.044	60 (41)	45.8	0.959
Longevity = 50 years	-0.029 (0.049)	0.020	92 (57)	44.4	0.979
% Females Breeding = 30%	-0.064 (0.060)	0.228	18 (11)	43.8	0.930
% Females Breeding = 70%	-0.007 (0.061)	0.000	262 (140)		0.986
% Males Breeding = 25%	-0.032 (0.055)	0.016	82 (50)	47.8	0.973
% Males Breeding = 75%	-0.031 (0.054)	0.012	83 (49)	47.3	0.974
Pup Mortality = 50%	-0.019 (0.056)	0.000	153 (95)		0.982
Pup Mortality = 70%	-0.053 (0.058)	0.088	31 (19)	46.3	0.951
Adult Female Mortality = 5%	0.010 (0.056)	0.000	481 (113)		0.992
Adult Female Mortality = 15%	-0.072 (0.059)	0.576	14 (7)	38.5	0.908
Adult Male Mortality = 2%	-0.034 (0.047)	0.040	75 (46)	44.0	0.974
Adult Male Mortality = 10%	-0.033 (0.084)	0.008	80 (57)	45.5	0.963

Figure 4 shows the consequences of large sensitivity of the population growth rate to comparatively small changes in adult female mortality. Given the current set of parameters used in the simulations, which represent the projected population trends from Cap Blanc before the 1997 mass mortality, only minor increases in adult female mortality are required for a positive population growth. In contrast, a large decrease in pup mortality (30%) will not be sufficient for the long term persistence of the population. While much attention has been given recently to the impact of high mortality among pups at Cap Blanc on general population dynamics, this type of analysis also points out that adult mortality, especially among females, must be carefully evaluated for its effect on overall growth dynamics of the Cap Blanc and other monk seal breeding populations.

Figure 4. Fifty-year projections for a simulated Cap Blanc population of Mediterranean monk seals. Plots show the projection (± SD) using the best estimates of demographic parameters based on field data from 1993 – 1997, as well as other lines in which the pup or adult female mortality are changed from their baseline values to the indicated values. The comparative sensitivity of our baseline model to changes in adult female mortality is evident in this comparison. See text for additional details.



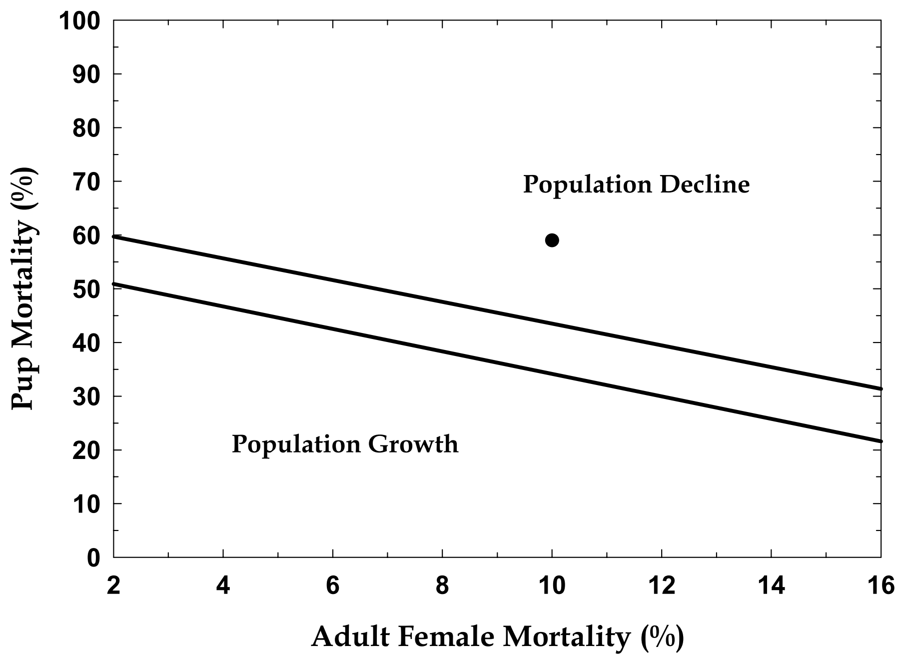
4. Cap Blanc Mortality Analysis

With the results of the sensitivity analysis in hand, our group decided to conduct a more thorough investigation of the relationship between juvenile (pup) mortality, adult mortality, and general population growth dynamics. Specifically, we wanted to identify those combinations of mortality values that would result in positive population growth ($r_s > 0.0$).

To do this, we developed a series of 25 models that spanned the plausible ranges of values for female pup and adult mortality, with the remaining values maintained at their baseline values.

The results were then analyzed using regression analysis to determine the precise combinations of mortality that would yield $r_s = 0.0$. The process was repeated with the inclusion of the toxic algal bloom catastrophe so that we could examine its effect on the identification of the critical mortality values.

Figure 5. Mortality analysis for a simulated Cap Blanc population of Mediterranean monk seals. The lines indicate values of adult female and pup mortality that, in combination and together with the other baseline parameters discussed in the text, give a stochastic population growth rate of 0.0. The lower line separating regions of population growth from decline includes an algal toxin bloom catastrophe, while the upper line does not. The region between the lines indicates the minimum decrease in pup mortality required to allow population recovery between catastrophic events. The recent estimates of pup and adult female mortality in this population are indicated by the circle. See text for additional details.



The results of this analysis are shown in Figure 5. In agreement with the sensitivity analysis in Figure 3, a small increase in adult female mortality must be compensated by a relatively larger decrease in pup mortality in order to maintain a stationary population trajectory. As an example, an increase of just 1% in adult female mortality requires a 2.03% decrease in pup mortality in order to maintain a mean population growth rate of 0.0. Note that, with the inclusion of the algal bloom catastrophe, the r = 0.0 threshold line is depressed relative to the catastrophe-free line. We assumed that this bloom catastrophe affects adults preferentially, so the results of the catastrophe can be see in the context of this mortality analysis as the minimum reduction in pup mortality required to maintain r = 0.0 in the presence of this catastrophe. To illustrate, if we assume a basic adult female mortality rate of 10.0%, the threshold pup mortality rate is 43.5% without the catastrophe but declines to 34.1% in the presence of the catastrophe.

This particular simulation exercise is useful to reply to questions, similar to those asked by workshop participants, related to extent to which the survival of pups must be increased in order to compensate for recent population declines. It is also very useful to investigate these same questions in the context of adult female mortality. Further simulations can consider other combinations of parameters, in agreement with the consequences of the different conservation actions proposed.

Recommended Actions

As an action step, the group recommends the meeting of a working group of specialists as a follow up of this workshop. The working group would further investigate the implications of various potential threats to the species in the Atlantic.

Particular tasks of this group include a more detailed sensitivity analysis of the threats identified during the workshop, and a population viability analysis. The PVA should take into account each of the proposed conservation actions included in the action plan, and a new set of fine tuned demographic and genetic parameters. Most of the required data is pending from analysis, or even in contained in unpublished manuscripts. These and further materials should taken into consideration in a further PVA exercise.

The working group should also have population assessment experts (population ecologists, statisticians) to design appropriate monitoring and sampling schemes to effectively evaluate in the near future the consequences of the implementation of conservation actions.

<u>Action Step Requirements</u>

Responsible:	Spanish Ministry of Environment (?)
Time of execution:	spring 2002 (?)
Cost:	(?)
Collaborators:	(?)

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Appendix A
Mediterranean Monk Seal Threats Form

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY							
INTERACTION WITH FISHERIES							
FOOD DECLINE							
TOXIN POISING							
INFECTIONS DESEASES							
CAVE COLLAPSE							
OIL SPILLS							
STORMS/WEATHER CHANGES							
HABITAT LOSS							
LOW GENETIC VARIABILITY							
PREDATION							
OTHER (List below)							

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	Pup < 2 months	Every year	Natural in cave breeders	Yes	Mainly in Cap Blanc colony	Every winter	Medium to high impact on population recovery
INTERACTION WITH FISHERIES	Weaners, young and adults	There must be some level of interaction	Man made	Yes	No	Difficult to record the whole impact	Medium
FOOD DECLINE	Juveniles	None demonstrated in the Atlantic	?	No	Can be more apparent in the Mediterranean	Difficult to detect	Medium
TOXIN POISING	Mainly adult	Stochastic	Natural	Can be identified but intervention is difficult	Mainly along West African coast	?	High if it appears
INFECTIONS DESEASES	Mainly young animals	?	Natural	Can be identified but intervention is difficult	Could be more severe in concentrated populations	?	High if epidemic
CAVE COLLAPSE	All age groups	Stochastic	Natural	Can be identified but intervention is difficult	Cave breeding populations	?	Low – Medium
OIL SPILLS	All age groups	Stochastic	Man made	Can be identified but intervention is difficult	No	?	High if present
STORMS/WEATHER CHANGES	Pups and juveniles	Stochastic	Both	Can be identified but intervention is difficult	No	?	Low – Medium
HABITAT LOSS	All age groups	Annually	Both	Can be identified but intervention is difficult	No	?	High
LOW GENETIC VARIABILITY	All age groups	?	Natural	No	No	?	Low
PREDATION	Pups and juveniles	?	Natural	Just in case of terrestrial predators	Yes (Cap Blanc?)	?	Low
OTHER (List below)							

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	Pups	Annually	Natural	Yes	Cap Blanc	Frequently	50%
INTERACTION WITH FISHERIES	Adults / juveniles	Annually	Man made	Yes	Everywhere		50%
FOOD DECLINE	All	Annually	Natural	No	No	Difficult	Low
TOXIN POISING	Adults	Stochastic	Natural	10%	Cap Blanc	Easy	100%
INFECTIONS DESEASES	All	?	Natural	10%	Madeira, Cap Blanc	Difficult	10%
CAVE COLLAPSE	Pups	40	Natural	No	Cap Blanc	Easy	40%
OIL SPILLS	All		Man made	10%	All	Easy	5%
STORMS/WEATHER CHANGES	Pups	Annually	Natural	Yes	Cap Blanc	Easy	50%
HABITAT LOSS	All		Man made	Yes	All	Difficult	20%
LOW GENETIC VARIABILITY	All		Natural	Yes	All	Difficult	10%
PREDATION	Pups	5	Natural	no	Cap Blanc	Difficult	1%
OTHER (List below)							

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	Pups	Annually	Both	Yes	Cap Blanc	Very easily	50%
INTERACTION WITH FISHERIES	Adults	Unknown	Man made	Unknown	No	Not easily	Unknown
FOOD DECLINE	> 1 year	Chronic	Man made	Yes	No	Not easily	50%
TOXIN POISING	Mostly adult	5	Natural	Yes	Yes	Easy	Low
INFECTIONS DESEASES	All	Unknown	Natural	Maybe	No	Medium	Low
CAVE COLLAPSE	All	20 – 30	Natural	No	Yes	Easy	Low
OIL SPILLS	All	Always possible	Man made	Yes	No	Easy	Low
STORMS/WEATHER CHANGES	Pups	Annually	Natural	Yes	Yes	Easy	Medium – high
HABITAT LOSS	All	Annually	Man made	Yes	No	Medium	Medium – high
LOW GENETIC VARIABILITY	Adults	Chronic	Both	Identify, Yes, intervene, maybe	No	Medium	Medium
PREDATION	Pups	Unknown	Natural	Yes	Beaches	Not easily	Unknown
OTHER (List below)							

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	2 week pups	Always	?	Can identify, difficult to intervene	Mauritania	Easy	50%
INTERACTION WITH FISHERIES	Adults	Always	Man made	Yes	Offshore of Mauritania	Easy	10%
FOOD DECLINE	All	Always	Man made	Yes	No	Easy	10%
TOXIN POISING	Adults	?	Natural	Can identify, difficult to intervene	No	Easy	10%
INFECTIONS DESEASES	All	?	Natural	Can identify, difficult to intervene	No	Medium	10%
CAVE COLLAPSE	Pups	20	Natural	No	Mauritania	Difficult	0%
OIL SPILLS	All	?	Man made	No	No	Easy	10%
STORMS/WEATHER CHANGES	Pups	Always	Natural	Yes	No	Easy	10%
HABITAT LOSS	All	Always	Man made	Yes	No	Easy	10%
LOW GENETIC VARIABILITY	All	Always	Man made	Yes	No	Easy	50 –100%
PREDATION	Pups	Always	Natural	Yes	Mauritania	Easy	10%
LOW BIRTH RATE	Females	Always	Man made	Can identify, difficult to intervene	Mauritania	Medium	50-100%
POOR MATERNAL CARE	Female / Pups	Always	Man made	Can identify, difficult to intervene	Mauritania	Medium	50-100%

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	Pups	Annually	Natural	Yes, in some cases	Mostly Cap Blanc	If Cap Blank Colony is continuously monitored it is not difficult	Medium
INTERACTION WITH FISHERIES	Juveniles		Man made	Yes, in some cases	No	Needs research	Low
FOOD DECLINE	Juveniles / adults		Man made	Yes, needs political decision, money	No	Difficult. Needs study of fish stocks	Medium – high
TOXIN POISING	Juveniles / adults	20	Natural	It seems no	No, but Cap Blanc colony more susceptible	After it happens, easily detected	Low to high?
INFECTIONS DESEASES	All ages	20 – May	Both	Can be identified, difficult to intervene	No, but Cap Blanc colony more susceptible	After it happens, easily detected	Medium - high
CAVE COLLAPSE	All ages	30	Both	No	Cap Blanc	Not easy	Low – medium
OIL SPILLS	All ages	5	Man made	Yes	No	Easy	Low – high?
STORMS/WEATHER CHANGES	Pups	Annually	Natural	No	No (bigger problem in Cap Blanc)	?	Low – high?
HABITAT LOSS	All ages	5	Both	Yes if man made. Needs protection status	No	Easy in some cases	Low – high?
LOW GENETIC VARIABILITY	Pups	20 – 100	Both	No	No	Not easy	Low – medium
PREDATION	Mainly pups	Annually?	Both	In some cases (terrestrial)	Yes	Easy	Low
AGGRESSIVE CONSPECIFIC	Juveniles, pups	?		Can identify, cannot successfully intervene	?	Easy?	Low

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	Pups	Frequently		Yes	Cap Blanc	Easy, frequently	Medium
INTERACTION WITH FISHERIES	Juveniles / adults	Annually	Man made	Probably		Difficult	Medium – high
FOOD DECLINE	Productividad?	Undetermined	Mostly man made	Yes	Feeding areas unknown		Unknown
TOXIN POISING	All	Undetermined	Natural	Yes	Feeding areas unknown	?	High
INFECTIONS DESEASES	All	Unknown	Natural		Distribution areas	?	Unknown
CAVE COLLAPSE	All	20 – 100 years	Natural	Yes	Cap Blanc	Easy	Low
OIL SPILLS							
STORMS/WEATHER CHANGES	Pups	Frequent	Natural	Yes	Cap Blanc	Easy	Medium
HABITAT LOSS	All		Man made	Yes	All	Easy	High
LOW GENETIC VARIABILITY	All						Low
PREDATION	Unknown						Very low
OTHER (List below)							

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	Pups	Annually	Natural	Yes	Specific	Easy	High
INTERACTION WITH FISHERIES	Juveniles / adults	Annually	Man made	Yes	Regional	Moderate	Medium
FOOD DECLINE	All	Annually	Man made	Yes	Regional	Moderate	Medium
TOXIN POISING	Adults	20 years?	Natural	No	Specific	Sometimes	High
INFECTIONS DESEASES	All	Unknown	Natural	Yes	Regional	Sometimes	High
CAVE COLLAPSE	All	5 years	Natural	Yes	Specific	Easy	Medium
OIL SPILLS	All	20 years?	Man made	Yes	Specific	Easy	Medium
STORMS/WEATHER CHANGES	Pups	Annually	Natural	Yes	Specific	Easy	High
HABITAT LOSS	All	5 years	Man made	Yes	Regional	Frequently	High
LOW GENETIC VARIABILITY	Pups	Annually	Provoked by humans	No	Regional	Moderate	Low
PREDATION	All	Annually	Natural	No	Regional	Moderate	Low
OTHER (List below)							

	TARGETED AGE GROUP	FREQUENCY: 1 YEAR 5 YEARS 20 YEARS 100 YEARS	NATURAL / MAN-MADE	CAN WE IDENTIFY THEM AND SUCCESSFULLY INTERVENE?	REGIONAL SPECIFIC?	HOW EASY/ FREQUENTLY CAN BE DETECTED?	SEVERITY: 10% LOW 50% MEDIUM 100% HIGH
PUP MORTALITY	< 2 weeks	Annually	Natural	? Controversy	Cap Blanc	Easy, continuous	High
INTERACTION WITH FISHERIES	Adult	Annually	Man made	No ?	No	Difficult, continuous	Medium
FOOD DECLINE	All	Annually	Man made		No	Difficult, continuous	Medium
TOXIN POISING	Adult	20 years	Both	No	No	Difficult	Low
INFECTIONS DESEASES	Adult	20 years	Natural	No	No	Difficult	Low
CAVE COLLAPSE	All	20 years	Natural		No	20	Low
OIL SPILLS	Adult	20 years	Man made	Yes	No	Easy	Low
STORMS/WEATHER CHANGES	< Weaning	Annually	Natural	Controversy	Cap Blanc	Continuous	High
HABITAT LOSS	All	Annually	Man made	Yes	No	Continuous	High
LOW GENETIC VARIABILITY	All	Annually	Both	Yes but controversy	No	Continuous	High
PREDATION	< Weaning	Annually	Natural	Yes	No	Rare	Low
OTHER (List below)							

Appendix B
Sample *VORTEX* Input and Output Files

```
CAP_CATS.OUT     ***Output Filename***
Y     ***Graphing Files?***
N     ***Details each Iteration?***
10     ***Simulations***
50     ***Years***
5     ***Reporting Interval***
0     ***Definition of Extinction***
1     ***Populations***
N     ***Inbreeding Depression?***
Y     ***EV concordance between repro and surv?***
0     ***Types Of Catastrophes***
P     ***Monogamous, Polygynous, or Hermaphroditic***
4     ***Female Breeding Age***
4     ***Male Breeding Age***
40     ***Maximum Breeding Age***
50.000000     ***Sex Ratio (percent males)***
1     ***Maximum Litter Size (0 = normal distribution) *****
N     ***Density Dependent Breeding?***
CapBlanc
50.00  **breeding
15.00  **EV-breeding
30.000000  *FMort age 0
10.500000  ***EV
20.800000  *FMort age 1
5.700000  ***EV
10.000000  *FMort age 2
0.900000  ***EV
10.000000  *FMort age 3
6.100000  ***EV
3+[(60*SRAND(Y+(R*100)))*(SRAND(Y+(R*200))<0.1)]  *Adult FMort
6.100000  ***EV
59.000000  *MMort age 0
10.500000  ***EV
20.800000  *MMort age 1
5.700000  ***EV
10.000000  *MMort age 2
0.900000  ***EV
3.400000  *MMort age 3
0.340000  ***EV
3+[(60*(SRAND(Y+(R*100)))*(SRAND(Y+(R*200))<0.1)]  *Adult MMort
0.340000  ***EV
1.000000     ***Probability Of Catastrophe 1***
1.000000  ***Severity--Reproduction***
1.000000  ***Severity--Survival***
1.000000     ***Probability Of Catastrophe 2***
1.000000  ***Severity--Reproduction***
1.000000  ***Severity--Survival***
N     ***All Males Breeders?***
Y     ***Answer--A--Known?***
50.000000     ***Percent Males In Breeding Pool***
Y     ***Start At Stable Age Distribution?***
329     ***Initial Population Size***
600     ***K***
0.000000     ***EV--K***
N     ***Trend In K?***
N      ***Harvest?***
N     ***Supplement?***
N     ***AnotherSimulation?***
```

```
VORTEX 8.41 -- simulation of genetic and demographic stochasticity

CAP_CATS.OUT
Wed Nov 28 14:40:30 2001


  1 population(s) simulated for 50 years, 250 iterations
  Extinction is defined as no animals of one or both sexes.
  No inbreeding depression
  First age of reproduction for females: 4   for males: 4
  Maximum breeding age (senescence): 40
  Sex ratio at birth (percent males): 50.000000


Population: CapBlanc

  Polygynous mating;
   50.00 percent of adult males in the breeding pool.
   50.00 percent of adult females produce litters.
   EV in % adult females breeding = 15.00 SD
   Of those females producing litters, ...
   100.00 percent of females produce litters of size 1

   59.00 percent mortality of females between ages 0 and 1
    EV in % mortality = 10.500000 SD
   20.80 percent mortality of females between ages 1 and 2
    EV in % mortality = 5.700000 SD
   10.00 percent mortality of females between ages 2 and 3
    EV in % mortality = 0.900000 SD
   10.00 percent mortality of females between ages 3 and 4
    EV in % mortality = 6.100000 SD
   % mortality of adult females (4<=age<=40) =
10+[(60*SRAND(Y+(R*100)))*(SRAND(Y+(R*200))<0.1)]
    EV in % mortality = 6.100000 SD
   59.00 percent mortality of males between ages 0 and 1
    EV in % mortality = 10.500000 SD
   20.80 percent mortality of males between ages 1 and 2
    EV in % mortality = 5.700000 SD
   10.00 percent mortality of males between ages 2 and 3
    EV in % mortality = 0.900000 SD
   3.40 percent mortality of males between ages 3 and 4
    EV in % mortality = 0.340000 SD
   % mortality of adult males (4<=age<=40) =
3+[(60*(SRAND(Y+(R*100)))*(SRAND(Y+(R*200))<0.1)]
    EV in % mortality = 0.340000 SD

    EVs may be adjusted to closest values possible for binomial distribution.
    EV in reproduction and mortality will be concordant.

  Initial size of CapBlanc:      329
    (set to reflect stable age distribution)
 Age 1     2     3     4     5     6     7     8     9    10    11    12    13    14
15    16    17    18    19    20    21    22    23    24    25    26    27    28    29
30    31    32    33    34    35    36    37    38    39    40    Total
     9     9     8    10    10     9     9     8     9     7     8     7     7     7
7     6     6     6     5     6     5     5     4     5     4     5     4     4     3
4     4     3     3     3     3     3     3     3     2     3     226  Males
     9     9     8    10     8     7     6     6     5     4     4     3     3     3
2     2     2     1     2     1     1     1     1     1     0     1     0     1     0
0     1     0     0     0     1     0     0     0     0     0     103  Females
```

```
  Carrying capacity = 600
    EV in Carrying capacity = 0.00 SD
Deterministic population growth rate
  (based on females, with assumptions of no limitation of mates, no density
dependence, no functional dependencies, and no inbreeding depression)

     r =  -0.151     lambda = 0.860     R0 =     0.271
   Generation time for:  females = 8.65    males = 12.24

Stable age distribution:  Age class    females    males
                               0        0.052      0.052
                               1        0.025      0.025
                               2        0.023      0.023
                               3        0.024      0.024
                               4        0.025      0.027
                               5        0.022      0.026
                               6        0.020      0.025
                               7        0.017      0.024
                               8        0.015      0.023
                               9        0.013      0.022
                              10        0.012      0.021
                              11        0.010      0.021
                              12        0.009      0.020
                              13        0.008      0.019
                              14        0.007      0.018
                              15        0.006      0.018
                              16        0.005      0.017
                              17        0.005      0.016
                              18        0.004      0.016
                              19        0.004      0.015
                              20        0.003      0.015
                              21        0.003      0.014
                              22        0.003      0.013
                              23        0.002      0.013
                              24        0.002      0.012
                              25        0.002      0.012
                              26        0.002      0.012
                              27        0.001      0.011
                              28        0.001      0.011
                              29        0.001      0.010
                              30        0.001      0.010
                              31        0.001      0.010
                              32        0.001      0.009
                              33        0.001      0.009
                              34        0.001      0.008
                              35        0.000      0.008
                              36        0.000      0.008
                              37        0.000      0.008
                              38        0.000      0.007
                              39        0.000      0.007
                              40        0.000      0.007

Ratio of adult (>= 4) males to adult (>= 4) females: 2.595

Population 1: CapBlanc

Year 5
     N[Extinct] =       0, P[E] =  0.000
     N[Surviving] =   250, P[S] =  1.000
     Mean size (all populations) =  276.10 (   4.13 SE,   65.26 SD)
  Means across extant populations only:
     Population size =           276.10 (   4.13 SE,   65.26 SD)
     Expected heterozygosity =    0.997 (  0.000 SE,   0.001 SD)
```

```
     Observed heterozygosity =    1.000 (  0.000 SE,   0.000 SD)
     Number of extant alleles =  459.42 (   6.16 SE,   97.41 SD)

Year 10
     N[Extinct] =       0, P[E] =  0.000
     N[Surviving] =   250, P[S] =  1.000
     Mean size (all populations) =  224.08 (   4.81 SE,   76.08 SD)
  Means across extant populations only:
     Population size =          224.08 (   4.81 SE,   76.08 SD)
     Expected heterozygosity =    0.996 (  0.000 SE,   0.002 SD)
     Observed heterozygosity =    1.000 (  0.000 SE,   0.001 SD)
     Number of extant alleles =  332.63 (   6.20 SE,   98.06 SD)

Year 15
     N[Extinct] =       0, P[E] =  0.000
     N[Surviving] =   250, P[S] =  1.000
     Mean size (all populations) =  179.47 (   4.84 SE,   76.50 SD)
  Means across extant populations only:
     Population size =          179.47 (   4.84 SE,   76.50 SD)
     Expected heterozygosity =    0.994 (  0.000 SE,   0.002 SD)
     Observed heterozygosity =    0.999 (  0.000 SE,   0.002 SD)
     Number of extant alleles =  246.12 (   5.39 SE,   85.22 SD)

Year 20
     N[Extinct] =       0, P[E] =  0.000
     N[Surviving] =   250, P[S] =  1.000
     Mean size (all populations) =  144.22 (   4.75 SE,   75.13 SD)
  Means across extant populations only:
     Population size =          144.22 (   4.75 SE,   75.13 SD)
     Expected heterozygosity =    0.991 (  0.000 SE,   0.004 SD)
     Observed heterozygosity =    0.999 (  0.000 SE,   0.004 SD)
     Number of extant alleles =  183.76 (   4.76 SE,   75.27 SD)

Year 25
     N[Extinct] =       1, P[E] =  0.004
     N[Surviving] =   249, P[S] =  0.996
     Mean size (all populations) =  114.26 (   4.38 SE,   69.23 SD)
  Means across extant populations only:
     Population size =          114.68 (   4.38 SE,   69.06 SD)
     Expected heterozygosity =    0.987 (  0.001 SE,   0.009 SD)
     Observed heterozygosity =    0.998 (  0.000 SE,   0.007 SD)
     Number of extant alleles =  138.57 (   4.13 SE,   65.12 SD)

Year 30
     N[Extinct] =       2, P[E] =  0.008
     N[Surviving] =   248, P[S] =  0.992
     Mean size (all populations) =   86.45 (   3.82 SE,   60.37 SD)
  Means across extant populations only:
     Population size =           87.08 (   3.82 SE,   60.19 SD)
     Expected heterozygosity =    0.982 (  0.001 SE,   0.013 SD)
     Observed heterozygosity =    0.996 (  0.001 SE,   0.012 SD)
     Number of extant alleles =  101.26 (   3.43 SE,   53.99 SD)

Year 35
     N[Extinct] =       4, P[E] =  0.016
     N[Surviving] =   246, P[S] =  0.984
     Mean size (all populations) =   66.68 (   3.32 SE,   52.53 SD)
  Means across extant populations only:
     Population size =           67.61 (   3.34 SE,   52.43 SD)
     Expected heterozygosity =    0.972 (  0.002 SE,   0.025 SD)
     Observed heterozygosity =    0.995 (  0.001 SE,   0.013 SD)
     Number of extant alleles =   75.02 (   2.87 SE,   45.04 SD)
```

```
Year 40
     N[Extinct] =      11, P[E] =  0.044
     N[Surviving] =   239, P[S] =  0.956
     Mean size (all populations) =   51.81 (   3.01 SE,   47.55 SD)
  Means across extant populations only:
     Population size =           53.85 (   3.08 SE,   47.63 SD)
     Expected heterozygosity =    0.960 (  0.002 SE,   0.035 SD)
     Observed heterozygosity =    0.993 (  0.001 SE,   0.023 SD)
     Number of extant alleles =   56.72 (   2.44 SE,   37.72 SD)

Year 45
     N[Extinct] =      25, P[E] =  0.100
     N[Surviving] =   225, P[S] =  0.900
     Mean size (all populations) =   40.26 (   2.59 SE,   40.95 SD)
  Means across extant populations only:
     Population size =           44.17 (   2.75 SE,   41.32 SD)
     Expected heterozygosity =    0.947 (  0.003 SE,   0.048 SD)
     Observed heterozygosity =    0.992 (  0.001 SE,   0.019 SD)
     Number of extant alleles =   45.28 (   2.14 SE,   32.15 SD)

Year 50
     N[Extinct] =      45, P[E] =  0.180
     N[Surviving] =   205, P[S] =  0.820
     Mean size (all populations) =   30.51 (   2.21 SE,   34.87 SD)
  Means across extant populations only:
     Population size =           36.39 (   2.51 SE,   35.89 SD)
     Expected heterozygosity =    0.938 (  0.004 SE,   0.054 SD)
     Observed heterozygosity =    0.986 (  0.002 SE,   0.031 SD)
     Number of extant alleles =   36.65 (   1.85 SE,   26.50 SD)


In 250 simulations of CapBlanc for 50 years:
  45 went extinct and 205 survived.

This gives a probability of extinction of 0.1800 (0.0243 SE),
  or a probability of success of          0.8200 (0.0243 SE).

45 simulations went extinct at least once.
Of those going extinct,
    mean time to first extinction was 43.27 years (0.93 SE, 6.25 SD).

Means across all populations (extant and extinct) ...
Mean final population was 30.51 (2.21 SE, 34.87 SD)

   Age 1       2       3   Adults    Total
    0.74    0.52    0.52   20.87     22.65  Males
    0.68    0.56    0.57    6.05      7.86  Females

Means across extant populations only ...
Mean final population for successful cases was 36.39 (2.51 SE, 35.89 SD)

   Age 1       2       3   Adults    Total
    0.00    0.00    0.00   25.45     27.62  Males
    0.00    0.00    0.00    7.38      9.59  Females

Across all years, prior to carrying capacity truncation,
  mean growth rate (r) was -0.0565 (0.0013 SE, 0.1438 SD)

Final expected heterozygosity was      0.9378 ( 0.0038 SE,  0.0541 SD)
Final observed heterozygosity was      0.9861 ( 0.0022 SE,  0.0315 SD)
Final number of alleles was             36.65 (   1.85 SE,   26.50 SD)
*************************************************************************
```

Appendix C
Simulation Modeling and Population Viability Analysis

A model is any simplified representation of a real system. We use models in all aspects of our lives, in order to: (1) extract the important trends from complex processes, (2) permit comparison among systems, (3) facilitate analysis of causes of processes acting on the system, and (4) make predictions about the future. A complete description of a natural system, if it were possible, would often decrease our understanding relative to that provided by a good model, because there is "noise" in the system that is extraneous to the processes we wish to understand. For example, the typical representation of the growth of a wildlife population by an annual percent growth rate is a simplified mathematical model of the much more complex changes in population size. Representing population growth as an annual percent change assumes constant exponential growth, ignoring the irregular fluctuations as individuals are born or immigrate, and die or emigrate. For many purposes, such a simplified model of population growth is very useful, because it captures the essential information we might need regarding the average change in population size, and it allows us to make predictions about the future size of the population. A detailed description of the exact changes in numbers of individuals, while a true description of the population, would often be of much less value because the essential pattern would be obscured, and it would be difficult or impossible to make predictions about the future population size.

In considerations of the vulnerability of a population to extinction, as is so often required for conservation planning and management, the simple model of population growth as a constant annual rate of change is inadequate for our needs. The fluctuations in population size that are omitted from the standard ecological models of population change can cause population extinction, and therefore are often the primary focus of concern. In order to understand and predict the vulnerability of a wildlife population to extinction, we need to use a model which incorporates the processes which cause fluctuations in the population, as well as those which control the long-term trends in population size (Shaffer 1981). Many processes can cause fluctuations in population size: variation in the environment (such as weather, food supplies, and predation), genetic changes in the population (such as genetic drift, inbreeding, and response to natural selection), catastrophic effects (such as disease epidemics, floods, and droughts), decimation of the population or its habitats by humans, the chance results of the probabilistic events in the lives of individuals (sex determination, location of mates, breeding success, survival), and interactions among these factors (Gilpin and Soulé 1986).

Models of population dynamics which incorporate causes of fluctuations in population size in order to predict probabilities of extinction, and to help identify the processes which contribute to a population's vulnerability, are used in "Population Viability Analysis" (PVA) (Lacy 1993/4). For the purpose of predicting vulnerability to extinction, any and all population processes that impact population dynamics can be important. Much analysis of conservation issues is conducted by largely intuitive assessments by biologists with experience with the system. Assessments by experts can be quite valuable, and are often contrasted with "models" used to evaluate population vulnerability to extinction. Such a contrast is not valid, however, as *any* synthesis of facts and understanding of processes constitutes a model, even if it is a mental model within the mind of the expert and perhaps only vaguely specified to others (or even to the expert himself or herself).

A number of properties of the problem of assessing vulnerability of a population to extinction make it difficult to rely on mental or intuitive models. Numerous processes impact population dynamics, and many of the factors interact in complex ways. For example, increased fragmentation of habitat can make it more difficult to locate mates, can lead to greater mortality as individuals disperse greater distances across unsuitable habitat, and can lead to increased inbreeding which in turn can further reduce ability to attract mates and to survive. In addition, many of the processes impacting population dynamics are intrinsically probabilistic, with a random component. Sex determination, disease, predation, mate acquisition -- indeed, almost all events in the life of an individual -- are stochastic events, occurring with certain probabilities rather than with absolute certainty at any given time. The consequences of factors influencing population dynamics are often delayed for years or even generations. With a long-lived species, a population might persist for 20 to 40 years beyond the emergence of factors that ultimately cause extinction. Humans can synthesize mentally only a few factors at a time, most people have difficulty assessing probabilities intuitively, and it is difficult to consider delayed effects. Moreover, the data needed for models of population dynamics are often very uncertain. Optimal decision-making when data are uncertain is difficult, as it involves correct assessment of probabilities that the true values fall within certain ranges, adding yet another probabilistic or chance component to the evaluation of the situation.

The difficulty of incorporating multiple, interacting, probabilistic processes into a model that can utilize uncertain data has prevented (to date) development of analytical models (mathematical equations developed from theory) which encompass more than a small subset of the processes known to affect wildlife population dynamics. It is possible that the mental models of some biologists are sufficiently complex to predict accurately population vulnerabilities to extinction under a range of conditions, but it is not possible to assess objectively the precision of such intuitive assessments, and it is difficult to transfer that knowledge to others who need also to evaluate the situation. Computer simulation models have increasingly been used to assist in PVA. Although rarely as elegant as models framed in analytical equations, computer simulation models can be well suited for the complex task of evaluating risks of extinction. Simulation models can include as many factors that influence population dynamics as the modeler and the user of the model want to assess. Interactions between processes can be modeled, if the nature of those interactions can be specified. Probabilistic events can be easily simulated by computer programs, providing output that gives both the mean expected result and the range or distribution of possible outcomes. In theory, simulation programs can be used to build models of population dynamics that include all the knowledge of the system which is available to experts. In practice, the models will be simpler, because some factors are judged unlikely to be important, and because the persons who developed the model did not have access to the full array of expert knowledge.

Although computer simulation models can be complex and confusing, they are precisely defined and all the assumptions and algorithms can be examined. Therefore, the models are objective, testable, and open to challenge and improvement. PVA models allow use of all available data on the biology of the taxon, facilitate testing of the effects of unknown or uncertain data, and expedite the comparison of the likely results of various possible management options.

PVA models also have weaknesses and limitations. A model of the population dynamics does not define the goals for conservation planning. Goals, in terms of population growth, probability of persistence, number of extant populations, genetic diversity, or other measures of population performance must be defined by the management authorities before the results of population modeling can be used. Because the models incorporate many factors, the number of possibilities to test can seem endless, and it can be difficult to determine which of the factors that were analyzed are most important to the population dynamics. PVA models are necessarily incomplete. We can model only those factors which we understand and for which we can specify the parameters. Therefore, it is important to realize that the models probably underestimate the threats facing the population. Finally, the models are used to predict the long-term effects of the processes presently acting on the population. Many aspects of the situation could change radically within the time span that is modeled. Therefore, it is important to reassess the data and model results periodically, with changes made to the conservation programs as needed.

The *VORTEX* Population Viability Analysis Model

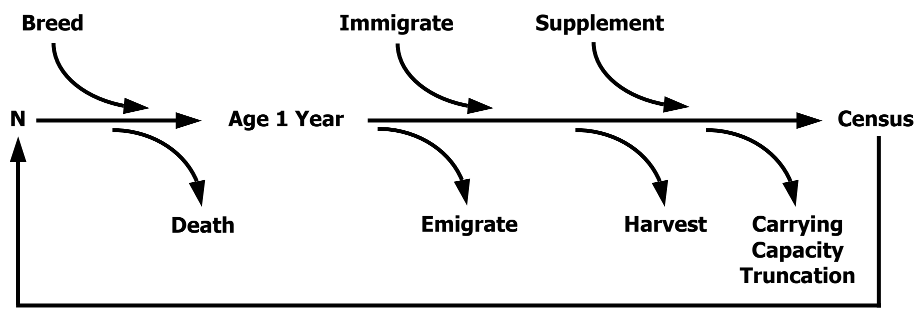
For the analyses presented here, the *VORTEX* computer software (Lacy 1993a) for population viability analysis was used. *VORTEX* models demographic stochasticity (the randomness of reproduction and deaths among individuals in a population), environmental variation in the annual birth and death rates, the impacts of sporadic catastrophes, and the effects of inbreeding in small populations. *VORTEX* also allows analysis of the effects of losses or gains in habitat, harvest or supplementation of populations, and movement of individuals among local populations.

Density dependence in mortality is modeled by specifying a carrying capacity of the habitat. When the population size exceeds the carrying capacity, additional morality is imposed across all age classes to bring the population back down to the carrying capacity. The carrying capacity can be specified to change linearly over time, to model losses or gains in the amount or quality of habitat. Density dependence in reproduction is modeled by specifying the proportion of adult females breeding each year as a function of the population size.

VORTEX models loss of genetic variation in populations, by simulating the transmission of alleles from parents to offspring at a hypothetical genetic locus. Each animal at the start of the simulation is assigned two unique alleles at the locus. During the simulation, *VORTEX* monitors how many of the original alleles remain within the population, and the average heterozygosity and gene diversity (or "expected heterozygosity") relative to the starting levels. *VORTEX* also monitors the inbreeding coefficients of each animal, and can reduce the juvenile survival of inbred animals to model the effects of inbreeding depression.

VORTEX is an *individual-based* model. That is, *VORTEX* creates a representation of each animal in its memory and follows the fate of the animal through each year of its lifetime. *VORTEX* keeps track of the sex, age, and parentage of each animal. Demographic events (birth, sex determination, mating, dispersal, and death) are modeled by determining for each animal in each year of the simulation whether any of the events occur. (See figure below.) Events occur according to the specified age and sex-specific probabilities. Demographic stochasticity is therefore a consequence of the uncertainty regarding whether each demographic event occurs for any given animal.

VORTEX Simulation Model Timeline



Events listed above the timeline increase N, while events listed below the timeline decrease N.

VORTEX requires a lot of population-specific data. For example, the user must specify the amount of annual variation in each demographic rate caused by fluctuations in the environment. In addition, the frequency of each type of catastrophe (drought, flood, epidemic disease) and the effects of the catastrophes on survival and reproduction must be specified. Rates of migration (dispersal) between each pair of local populations must be specified. Because *VORTEX* requires specification of many biological parameters, it is not necessarily a good model for the examination of population dynamics that would result from some generalized life history. It is most usefully applied to the analysis of a specific population in a specific environment.

Further information on *VORTEX* is available in Miller and Lacy (1999) and Lacy (2000).

Dealing with Uncertainty

It is important to recognize that uncertainty regarding the biological parameters of a population and its consequent fate occurs at several levels and for independent reasons. Uncertainty can occur because the parameters have never been measured on the population. Uncertainty can occur because limited field data have yielded estimates with potentially large sampling error. Uncertainty can occur because independent studies have generated discordant estimates. Uncertainty can occur because environmental conditions or population status have been changing over time, and field surveys were conducted during periods which may not be representative of long-term averages. Uncertainty can occur because the environment will change in the future, so that measurements made in the past may not accurately predict future conditions.

Sensitivity testing is necessary to determine the extent to which uncertainty in input parameters results in uncertainty regarding the future fate of the pronghorn population. If alternative plausible parameter values result in divergent predictions for the population, then it is important to try to resolve the uncertainty with better data. Sensitivity of population dynamics to certain parameters also indicates that those parameters describe factors that could be critical determinants of population viability. Such factors are therefore good candidates for efficient management actions designed to ensure the persistence of the population.

The above kinds of uncertainty should be distinguished from several more sources of uncertainty about the future of the population. Even if long-term average demographic rates are known with precision, variation over time caused by fluctuating environmental conditions will cause uncertainty in the fate of the population at any given time in the future. Such environmental variation should be incorporated into the model used to assess population dynamics, and will generate a range of possible outcomes (perhaps represented as a mean and standard deviation) from the model. In addition, most biological processes are inherently stochastic, having a random component. The stochastic or probabilistic nature of survival, sex determination, transmission of genes, acquisition of mates, reproduction, and other processes preclude exact determination of the future state of a population. Such demographic stochasticity should also be incorporated into a population model, because such variability both increases our uncertainty about the future and can also change the expected or mean outcome relative to that which would result if there were no such variation. Finally, there is "uncertainty" which represents the alternative actions or interventions which might be pursued as a management strategy. The likely effectiveness of such management options can be explored by testing alternative scenarios in the model of population dynamics, in much the same way that sensitivity testing is used to explore the effects of uncertain biological parameters.

Results

Results reported for each scenario include:

<u>Deterministic r</u> -- The deterministic population growth rate, a projection of the mean rate of growth of the population expected from the average birth and death rates. Impacts of harvest, inbreeding, and density dependence are not considered in the calculation. When $r = 0$, a population with no growth is expected; $r < 0$ indicates population decline; $r > 0$ indicates long-term population growth. The value of r is approximately the rate of growth or decline per year.

The deterministic growth rate is the average population growth expected if the population is so large as to be unaffected by stochastic, random processes. The deterministic growth rate will correctly predict future population growth if: the population is presently at a stable age distribution; birth and death rates remain constant over time and space (i.e., not only do the probabilities remain constant, but the actual number of births and deaths each year match the expected values); there is no inbreeding depression; there is never a limitation of mates preventing some females from breeding; and there is no density dependence in birth or death rates, such as a Allee effects or a habitat "carrying capacity" limiting population growth. Because some or all of these assumptions are usually violated, the average population growth of real populations (and stochastically simulated ones) will usually be less than the deterministic growth rate.

Stochastic r -- The mean rate of stochastic population growth or decline demonstrated by the simulated populations, averaged across years and iterations, for all those simulated populations that are not extinct. This population growth rate is calculated each year of the simulation, prior to any truncation of the population size due to the population exceeding the carrying capacity. Usually, this stochastic r will be less than the deterministic r predicted from birth and death rates. The stochastic r from the simulations will be close to the deterministic r if the population growth is steady and robust. The stochastic r will be notably less than the deterministic r if the population is subjected to large fluctuations due to environmental variation, catastrophes, or the genetic and demographic instabilities inherent in small populations.

P(E) -- the probability of population extinction, determined by the proportion of, for example, 500 iterations within that given scenario that have gone extinct in the simulations. “Extinction” is defined in the VORTEX model as the lack of either sex.

N -- mean population size, averaged across those simulated populations which are not extinct.

SD(N) -- variation across simulated populations (expressed as the standard deviation) in the size of the population at each time interval. SDs greater than about half the size of mean N often indicate highly unstable population sizes, with some simulated populations very near extinction. When SD(N) is large relative to N, and especially when SD(N) increases over the years of the simulation, then the population is vulnerable to large random fluctuations and may go extinct even if the mean population growth rate is positive. SD(N) will be small and often declining relative to N when the population is either growing steadily toward the carrying capacity or declining rapidly (and deterministically) toward extinction. SD(N) will also decline considerably when the population size approaches and is limited by the carrying capacity.

H -- the gene diversity or expected heterozygosity of the extant populations, expressed as a percent of the initial gene diversity of the population. Fitness of individuals usually declines proportionately with gene diversity (Lacy 1993b), with a 10% decline in gene diversity typically causing about 15% decline in survival of captive mammals (Ralls et al. 1988). Impacts of inbreeding on wild populations are less well known, but may be more severe than those observed in captive populations (Jiménez et al. 1994). Adaptive response to natural selection is also expected to be proportional to gene diversity. Long-term conservation programs often set a goal of retaining 90% of initial gene diversity (Soulé et al. 1986). Reduction to 75% of gene diversity would be equivalent to one generation of full-sibling or parent-offspring inbreeding.

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Fisheries Biology

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An ad hoc group of fisheries biologists from Morocco, Mauritania and Spain met during the Workshop to look at the potential problem of interactions between seals and fisheries in order to propose to the group a plan of action to evaluate its actual nature and magnitude. The ad hoc group drafted the attached plan of action and recommended to held a meeting to develop it into a formal research project. Such a meeting should take place during the first semester of 2002 in a venue to be decided.

The ad hoc group insisted on the necessity of maintaining the current conservation measures adopted by the Moroccan and the Mauritanian governments to protect the Cabo Blanco seal colony and suggested the need for their reinforcement particularly by establishing land based stations that could also be used by scientists.

Proposed Action Plan For Evaluating The Potential Impact Of Fisheries On Seal Population

1. Direct Impact

   a) Monitoring of fishing activity in the distribution area of the Cabo Blanco seal colony

      - European fleet: VMS, logbooks, scientific observers
      - Other fleets: VMS??, logbooks, scientific observers

   b) Monitoring of seal activities

      - Radio and/or satellite tracking for determining foraging range and depth activity range

   c) From a) and b): modeling areas and depths of overlapping between seals and fleets and their seasonal variations

2. Damages Evaluation Of Fishing Activity On Seals

   d) Recording of actual interactions including their nature (wounded, death, etc) by means of scientific observers or reliable skippers

e) Land surveys for location of wounded or dead animals and determination of damage causes

f) Estimation of number of animals dead or wounded by fisheries interactions

3. Indirect Impact (competition for food)

g) Estimation of nutritional needs of seal populations

- Feeding studies (preys and importance in diet)
- Energetic requirements (prey consumption by species and time period (e.g. year)

h) Estimation of prey species abundance within the foraging area of the population by analyses of data from Moroccan and Mauritanian trawl surveys

i) Analyses on the competition between fishing activities and seals. Simplified equation: catches/species/area + consumption/species/foraging area abundance/species/foraging area

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CENEAM Valsaín (Segovia – Spain)
November 10-13, 2001

FINAL REPORT

Section 3
Workshop Participant List

Workshop Participant List

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Section 4
Appendices

Appendix I

Principales retos para la conservación de la foca monje del Mediterráneo en el Atlántico Oriental en los próximos 5 años

- Creación de un Área Protegida Trasacional entre Marruecos y Mauritania
- Lograr diversificar los asentamientos de la foca monje y su reintroducción
- Evitar el descenso de la población de la foca monje
- Conservación de su hábitat que favorezca su reintroducción
- Coordinación técnica y política asociada a medidas de desarrollo social
- Estabilizar poblaciones
- Consenso y coordinación para implementar medidas de conservación
- Área de distribución extensa
- Aumentar poblaciones y su distribución así como solucionar problemas geopolíticos.
- Recuperación progresiva de la especie
- Conseguir que la población de Cabo Blanco aumente así como su distribución
- Parque Trasnacional de Cabo Blanco
- Conservar el hábitat para la supervivencia de la especie
- Conservación de la foca monje
- Supervivencia con problemas complejos, medidas de urgencia, trabajo a largo plazo
- Evitar el problema de la concentración de individuos en Cabo Blanco promoviendo el aumento del área y su distribución sin tener en cuenta las fronteras políticas
- Protección y Conservación de la colonia de Cabo Blanco utilizando los excedentes poblacionales para repoblar otras áreas
- Llegar a Acuerdos entre los diferentes países de la región de Cabo Blanco. Disminuir la mortalidad
- Coordinación y consenso entre técnicos, científicos y políticos, que son parte de la conservación de la especie

Primary Challenges for the Conservation of the Mediterranean Monk Seal in the Eastern Atlantic for the Next 5 Years

- Special nature of Cap Blanc and its geography: How to manage?
- Maintain Cap Blanc population viability
- Manage humain impacts (Fisheries); Develop effective strategies
- Lack of international coordination
- Conflicting national interests
- Effective means of habitat protection
- Geopolitics of Cap Blanc Population management
- Obtain multicultural, multinacional consensus on management options
- Preservation and conservation of habitat; objetive measures of habitat degradation
- Lack of multinational coordination; inability to develop management alternatives
- Difficulty in reaching an agreement on role of rehabilitation
- Achieving both habitat and population management effectiveness
- Increasing habitat degradation
- To try and develop truly effective conservation strategies
- Reach and maintain international consensus
- Need seals to USE a broader range of habitats
- Control fisheries in Newly-developed Cap Blanc reserve
- Political instability of region; increasing conflict with fishers; preparedness for catastrophes
- Providing funding for conservation action developing international body to share conservation resources
- How to coordinate activity between scientists and decisions-makers
- Effective collaboration
- Independent approaches among nations; need an unified approach
- Adequate habitat protection (Fisheries)
- Practical field application of a real action plan
- Practical action plan with coordinated implementation
- Need transparent cooperation and collaboration, with special consideration given to local socio-economic situations
- More effective species and habitat protection
- Must identify and quantify threats

SUMMARY

- Strong commitment to develop and manage viable populations
- Strong sense of urgency-seeking effectiveness with rapidity
- Shared focus on fundamental importance of habitat management –expansion?
- We need an <u>effective</u> Action Plan
- Must cooperate and collaborate-across disciplines and between nations

Appendix II: IUCN Policy Statements

IUCN/SSC Guidelines For Re-Introductions

Prepared by the SSC Re-introduction Specialist Group *
Approved by the 41st Meeting of the IUCN Council, Gland Switzerland, May 1995

INTRODUCTION

These policy guidelines have been drafted by the Re-introduction Specialist Group of the IUCN's Species Survival Commission (1), in response to the increasing occurrence of re-introduction projects worldwide, and consequently, to the growing need for specific policy guidelines to help ensure that the re-introductions achieve their intended conservation benefit, and do not cause adverse side-effects of greater impact. Although IUCN developed a Position Statement on the Translocation of Living Organisms in 1987, more detailed guidelines were felt to be essential in providing more comprehensive coverage of the various factors involved in re-introduction exercises.

These guidelines are intended to act as a guide for procedures useful to re-introduction programmes and do not represent an inflexible code of conduct. Many of the points are more relevant to re-introductions using captive-bred individuals than to translocations of wild species. Others are especially relevant to globally endangered species with limited numbers of founders. Each re-introduction proposal should be rigorously reviewed on its individual merits. It should be noted that re-introduction is always a very lengthy, complex and expensive process.

Re-introductions or translocations of species for short-term, sporting or commercial purposes - where there is no intention to establish a viable population - are a different issue and beyond the scope of these guidelines. These include fishing and hunting activities.

This document has been written to encompass the full range of plant and animal taxa and is therefore general. It will be regularly revised. Handbooks for re-introducing individual groups of animals and plants will be developed in future.

CONTEXT

The increasing number of re-introductions and translocations led to the establishment of the IUCN/SSC Species Survival Commission's Re-introduction Specialist Group. A priority of the Group has been to update IUCN's 1987 Position Statement on the Translocation of Living Organisms, in consultation with IUCN's other commissions.

It is important that the Guidelines are implemented in the context of IUCN's broader policies pertaining to biodiversity conservation and sustainable management of natural resources. The philosophy for environmental conservation and management of IUCN and other conservation bodies is stated in key documents such as "Caring for the Earth" and "Global Biodiversity Strategy" which cover the broad themes of the need for approaches with community involvement and participation in sustainable natural resource conservation, an overall enhanced quality of human life and the need to conserve and, where necessary, restore ecosystems. With regards to the latter, the re-introduction of a species is one specific instance of restoration where, in general, only this species is missing. Full restoration of an array of plant and animal species has rarely been tried to date.

Restoration of single species of plants and animals is becoming more frequent around the world. Some succeed, many fail. As this form of ecological management is increasingly common, it is a priority for the

Species Survival Commission's Re-introduction Specialist Group to develop guidelines so that re-introductions are both justifiable and likely to succeed, and that the conservation world can learn from each initiative, whether successful or not. It is hoped that these Guidelines, based on extensive review of case - histories and wide consultation across a range of disciplines will introduce more rigour into the concepts, design, feasibility and implementation of re-introductions despite the wide diversity of species and conditions involved.

Thus the priority has been to develop guidelines that are of direct, practical assistance to those planning, approving or carrying out re-introductions. The primary audience of these guidelines is, therefore, the practitioners (usually managers or scientists), rather than decision makers in governments. Guidelines directed towards the latter group would inevitably have to go into greater depth on legal and policy issues.

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1. DEFINITION OF TERMS

"Re-introduction": an attempt to establish a species(2) in an area which was once part of its historical range, but from which it has been extirpated or become extinct (3) ("Re-establishment" is a synonym, but implies that the re-introduction has been successful).

"Translocation": deliberate and mediated movement of wild individuals or populations from one part of their range to another.

"Re-inforcement/Supplementation": addition of individuals to an existing population of conspecifics.

"Conservation/Benign Introductions": an attempt to establish a species, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range.

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2. AIMS AND OBJECTIVES OF RE-INTRODUCTION

a. Aims:
The principle aim of any re-introduction should be to establish a viable, free-ranging population in the wild, of a species, subspecies or race, which has become globally or locally extinct, or extirpated, in the wild. It should be re-introduced within the species' former natural habitat and range and should require minimal long-term management.

b. Objectives:
The objectives of a re-introduction may include: to enhance the long-term survival of a species; to re-establish a keystone species (in the ecological or cultural sense) in an ecosystem; to maintain and/or restore natural biodiversity; to provide long-term economic benefits to the local and/or national economy; to promote conservation awareness; or a combination of these.

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3. MULTIDISCIPLINARY APPROACH

A re-introduction requires a multidisciplinary approach involving a team of persons drawn from a variety of backgrounds. As well as government personnel, they may include persons from governmental natural resource management agencies; non-governmental organisations; funding bodies; universities; veterinary institutions; zoos (and private animal breeders) and/or botanic gardens, with a full range of suitable expertise. Team leaders should be responsible for coordination between the various bodies and provision should be made for publicity and public education about the project.

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4. PRE-PROJECT ACTIVITIES

4a. BIOLOGICAL

(i) Feasibility study and background research

- An assessment should be made of the taxonomic status of individuals to be re-introduced. They should preferably be of the same subspecies or race as those which were extirpated, unless adequate numbers are not available. An investigation of historical information about the loss and fate of individuals from the re-introduction area, as well as molecular genetic studies, should be undertaken in case of doubt as to individuals' taxonomic status. A study of genetic variation within and between populations of this and related taxa can also be helpful. Special care is needed when the population has long been extinct.
- Detailed studies should be made of the status and biology of wild populations(if they exist) to determine the species' critical needs. For animals, this would include descriptions of habitat preferences, intraspecific variation and adaptations to local ecological conditions, social behaviour, group composition, home range size, shelter and food requirements, foraging and feeding behaviour, predators and diseases. For migratory species, studies should include the potential migratory areas. For plants, it would include biotic and abiotic habitat requirements, dispersal mechanisms, reproductive biology, symbiotic relationships (e.g. with mycorrhizae, pollinators), insect pests and diseases. Overall, a firm knowledge of the natural history of the species in question is crucial to the entire re-introduction scheme.
- The species, if any, that has filled the void created by the loss of the species concerned, should be determined; an understanding of the effect the re-introduced species will have on the ecosystem is important for ascertaining the success of the re-introduced population.
- The build-up of the released population should be modelled under various sets of conditions, in order to specify the optimal number and composition of individuals to be released per year and the numbers of years necessary to promote establishment of a viable population.
- A Population and Habitat Viability Analysis will aid in identifying significant environmental and population variables and assessing their potential interactions, which would guide long-term population management.

(ii) Previous Re-introductions

- Thorough research into previous re-introductions of the same or similar species and wide-ranging contacts with persons having relevant expertise should be conducted prior to and while developing re-introduction protocol.

(iii) Choice of release site and type

- Site should be within the historic range of the species. For an initial re-inforcement there should be few remnant wild individuals. For a re-introduction, there should be no remnant population to prevent disease spread, social disruption and introduction of alien genes. In some circumstances, a re-introduction or re-inforcement may have to be made into an area which is fenced or otherwise delimited, but it should be within the species' former natural habitat and range.
- A conservation/ benign introduction should be undertaken only as a last resort when no opportunities for re-introduction into the original site or range exist and only when a significant contribution to the conservation of the species will result.
- The re-introduction area should have assured, long-term protection (whether formal or otherwise).

(iv) Evaluation of re-introduction site

- Availability of suitable habitat: re-introductions should only take place where the habitat and landscape requirements of the species are satisfied, and likely to be sustained for the for-seeable future. The possibility of natural habitat change since extirpation must be considered. Likewise, a change in the legal/ political or cultural environment since species extirpation needs to be ascertained and evaluated as a possible constraint. The area should have sufficient carrying capacity to sustain growth of the re-introduced population and support a viable (self-sustaining) population in the long run.
- Identification and elimination, or reduction to a sufficient level, of previous causes of decline: could include disease; over-hunting; over-collection; pollution; poisoning; competition with or predation by introduced species; habitat loss; adverse effects of earlier research or management programmes; competition with domestic livestock, which may be seasonal. Where the release site has undergone substantial degradation caused by human activity, a habitat restoration programme should be initiated before the re-introduction is carried out.

(v) Availability of suitable release stock

- It is desirable that source animals come from wild populations. If there is a choice of wild populations to supply founder stock for translocation, the source population should ideally be closely related genetically to the original native stock and show similar ecological characteristics (morphology, physiology, behaviour, habitat preference) to the original sub-population.
- Removal of individuals for re-introduction must not endanger the captive stock population or the wild source population. Stock must be guaranteed available on a regular and predictable basis, meeting specifications of the project protocol.
- Individuals should only be removed from a wild population after the effects of translocation on the donor population have been assessed, and after it is guaranteed that these effects will not be negative.
- If captive or artificially propagated stock is to be used, it must be from a population which has been soundly managed both demographically and genetically, according to the principles of contemporary conservation biology.
- Re-introductions should not be carried out merely because captive stocks exist, nor solely as a means of disposing of surplus stock.
- Prospective release stock, including stock that is a gift between governments, must be subjected to a thorough veterinary screening process before shipment from original source. Any animals found to be infected or which test positive for non-endemic or contagious pathogens with a potential impact on population levels, must be removed from the consignment, and the uninfected, negative remainder must be placed in strict quarantine for a suitable period before retest. If clear after retesting, the animals may be placed for shipment.
- Since infection with serious disease can be acquired during shipment, especially if this is intercontinental, great care must be taken to minimize this risk.
- Stock must meet all health regulations prescribed by the veterinary authorities of the recipient country and adequate provisions must be made for quarantine if necessary.

(vi) Release of captive stock

- Most species of mammal and birds rely heavily on individual experience and learning as juveniles for their survival; they should be given the opportunity to acquire the necessary information to enable survival in the wild, through training in their captive environment; a captive bred individual's probability of survival should approximate that of a wild counterpart.

- Care should be taken to ensure that potentially dangerous captive bred animals (such as large carnivores or primates) are not so confident in the presence of humans that they might be a danger to local inhabitants and/or their livestock.

4b. SOCIO-ECONOMIC AND LEGAL REQUIREMENTS

- Re-introductions are generally long-term projects that require the commitment of long-term financial and political support.
- Socio-economic studies should be made to assess impacts, costs and benefits of the re-introduction programme to local human populations.
- A thorough assessment of attitudes of local people to the proposed project is necessary to ensure long term protection of the re-introduced population, especially if the cause of species' decline was due to human factors (e.g. over-hunting, over-collection, loss or alteration of habitat). The programme should be fully understood, accepted and supported by local communities.
- Where the security of the re-introduced population is at risk from human activities, measures should be taken to minimise these in the re-introduction area. If these measures are inadequate, the re-introduction should be abandoned or alternative release areas sought.
- The policy of the country to re-introductions and to the species concerned should be assessed. This might include checking existing provincial, national and international legislation and regulations, and provision of new measures and required permits as necessary.
- Re-introduction must take place with the full permission and involvement of all relevant government agencies of the recipient or host country. This is particularly important in re-introductions in border areas, or involving more than one state or when a re-introduced population can expand into other states, provinces or territories.
- If the species poses potential risk to life or property, these risks should be minimised and adequate provision made for compensation where necessary; where all other solutions fail, removal or destruction of the released individual should be considered. In the case of migratory/mobile species, provisions should be made for crossing of international/state boundaries.

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5. PLANNING, PREPARATION AND RELEASE STAGES

- Approval of relevant government agencies and land owners, and coordination with national and international conservation organizations.
- Construction of a multidisciplinary team with access to expert technical advice for all phases of the programme.
- Identification of short- and long-term success indicators and prediction of programme duration, in context of agreed aims and objectives.
- Securing adequate funding for all programme phases.
- Design of pre- and post- release monitoring programme so that each re-introduction is a carefully designed experiment, with the capability to test methodology with scientifically collected data.

Monitoring the health of individuals, as well as the survival, is important; intervention may be necessary if the situation proves unforseeably favourable.

- Appropriate health and genetic screening of release stock, including stock that is a gift between governments. Health screening of closely related species in the re-introduction area.
- If release stock is wild-caught, care must be taken to ensure that: a) the stock is free from infectious or contagious pathogens and parasites before shipment and b) the stock will not be exposed to vectors of disease agents which may be present at the release site (and absent at the source site) and to which it may have no acquired immunity.
- If vaccination prior to release, against local endemic or epidemic diseases of wild stock or domestic livestock at the release site, is deemed appropriate, this must be carried out during the "Preparation Stage" so as to allow sufficient time for the development of the required immunity.
- Appropriate veterinary or horticultural measures as required to ensure health of released stock throughout the programme. This is to include adequate quarantine arrangements, especially where founder stock travels far or crosses international boundaries to the release site.
- Development of transport plans for delivery of stock to the country and site of re-introduction, with special emphasis on ways to minimize stress on the individuals during transport.
- Determination of release strategy (acclimatization of release stock to release area; behavioural training - including hunting and feeding; group composition, number, release patterns and techniques; timing).
- Establishment of policies on interventions (see below).
- Development of conservation education for long-term support; professional training of individuals involved in the long-term programme; public relations through the mass media and in local community; involvement where possible of local people in the programme.
- The welfare of animals for release is of paramount concern through all these stages.

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6. POST-RELEASE ACTIVITIES

- Post release monitoring is required of all (or sample of) individuals. This most vital aspect may be by direct (e.g. tagging, telemetry) or indirect (e.g. spoor, informants) methods as suitable.
- Demographic, ecological and behavioural studies of released stock must be undertaken.
- Study of processes of long-term adaptation by individuals and the population.
- Collection and investigation of mortalities.
- Interventions (e.g. supplemental feeding; veterinary aid; horticultural aid) when necessary.
- Decisions for revision, rescheduling, or discontinuation of programme where necessary.
- Habitat protection or restoration to continue where necessary.
- Continuing public relations activities, including education and mass media coverage.
- Evaluation of cost-effectiveness and success of re- introduction techniques.
- Regular publications in scientific and popular literature.

Footnotes:

1. Guidelines for determining procedures for disposal of species confiscated in trade are being developed separately by IUCN.
2. The taxonomic unit referred to throughout the document is species; it may be a lower taxonomic unit (e.g. subspecies or race) as long as it can be unambiguously defined.
3. A taxon is extinct when there is no reasonable doubt that the last individual has died

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The IUCN/SSC Re-introduction Specialist Group

The IUCN/SSC Re-introduction Specialist Group (RSG) is a disciplinary group (as opposed to most SSC Specialist Groups which deal with single taxonomic groups), covering a wide range of plant and animal species. The RSG has an extensive international network, a re-introduction projects database and re-introduction library. The RSG publishes a bi-annual newsletter RE-INTRODUCTION NEWS.

If you are a re-introduction practitioner or interested in re-introductions please contact:

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IUCN Position Statement on Translocation of Living Organisms:

INTRODUCTIONS, REINTRODUCTIONS AND RE-STOCKING
Prepared by the Species Survival Commission in collaboration with the Commission on Ecology, and the Commission on Environmental Policy, Law and Administration
Approved by the 22nd Meeting of the IUCN Council, Gland, Switzerland, 4 September 1987

FOREWORD

This statement sets out IUCN's position on translocation of living organisms, covering introductions, re-introductions and re-stocking. The implications of these three sorts of translocation are very different so the paper is divided into four parts dealing with Introductions, Re-introductions, Re-stocking and Administrative Implications, respectively.

DEFINITIONS:

Translocation is the movement of living organisms from one area with free release in another. The three main classes of translocation distinguished in this document are defined as follows:

- **Introduction** of an organism is the intentional or accidental dispersal by human agency of a living organism outside its historically known native range.
- **Re-introduction** of an organism is the intentional movement of an organism into a part of its native range from which it has disappeared or become extirpated in historic times as a result of human activities or natural catastrophe.
- **Re-stocking** is the movement of numbers of plants or animals of a species with the intention of building up the number of individuals of that species in an original habitat.

Translocations are powerful tools for the management of the natural and man made environment which, properly used, can bring great benefits to natural biological systems and to man, but like other powerful tools they have the potential to cause enormous damage if misused. This IUCN statement describes the advantageous uses of translocations and the work and precautions needed to avoid the disastrous consequences of poorly planned translocations.

PART I

INTRODUCTIONS

BACKGROUND

Non-native (exotic) species have been introduced into areas where they did not formerly exist for a variety of reasons, such as economic development, improvement of hunting and fishing, ornamentation, or maintenance of the cultures of migrated human communities. The damage done by harmful introductions to natural systems far outweighs the benefit derived from them. The introduction and establishment of alien species in areas where they did not formerly occur, as an accidental or intended result of human activities, has often been directly harmful to the native plants and animals of many parts of the world and to the welfare of mankind.

The establishment of introduced alien species has broken down the genetic isolation of communities of co-evolving species of plants and animals. Such isolation has been essential for the evolution and maintenance of the diversity of plants and animals composing the biological wealth of our planet. Disturbance of this isolation by alien species has interfered with the dynamics of natural systems causing the premature extinction of species. Especially successful and aggressive invasive species of plants and animals increasingly dominate large areas having replaced diverse autochthonous communities. Islands, in the broad sense, including isolated biological systems such as lakes or isolated mountains, are especially vulnerable to introductions because their often simple ecosystems offer refuge for species that are not aggressive competitors. As a result of their isolation they are of special value because of high endemism (relatively large numbers of unique local forms) evolved under the particular conditions of these islands over a long period of time. These endemic species are often rare and highly specialised in their ecological requirements and may be remnants of extensive communities from bygone ages, as exemplified by the Pleistocene refugia of Africa and Amazonia.

The diversity of plants and animals in the natural world is becoming increasingly important to man as their demands on the natural world increase in both quantity and variety, notwithstanding their dependence on crops and domestic animals nurtured within an increasingly uniform artificial and consequently vulnerable agricultural environment.

Introductions, can be beneficial to man. Nevertheless the following sections define areas in which the introduction of alien organisms is not conducive to good management, and describe the sorts of decisions that should be made before introduction of an alien species is made.

To reduce the damaging impact of introductions on the balance of natural systems, governments should provide the legal authority and administrative support that will promote implementation of the following approach.

Intentional Introduction

General

1. Introduction of an alien species should only be considered if clear and well defined benefits to man or natural communities can be foreseen.
2. Introduction of an alien species should only be considered if no native species is considered suitable for the purpose for which the introduction is being made.

Introductions to Natural Habitats

3. No alien species should be deliberately introduced into any natural habitat, island, lake, sea, ocean or centre of endemism, whether within or beyond the limits of national jurisdiction. A natural habitat is defined as a habitat not perceptibly altered by man. Where it would be effective, such areas should be surrounded by a buffer zone sufficiently large to prevent unaided spread of alien species from nearby areas. No alien introduction should be made within the buffer zone if it is likely to spread into neighbouring natural areas.

Introduction into Semi-natural Habitat

4. No alien species should be introduced into a semi-natural habitat unless there are exceptional reasons for doing so , and only when the operation has been comprehensively investigated and carefully planned in advance. A semi-natural habitat is one which has been detectably changed by man's actions or one which is managed by man, but still resembles a natural habitat in the diversity of its species and the complexity of their interrelationships. This excludes arable farm land, planted ley pasture and timber plantations.

Introductions into Man-made Habitat

5. An assessment should be made of the effects on surrounding natural and semi-natural habitats of the introduction of any species, sub-species, or variety of plant to artificial, arable, ley pasture or other predominantly monocultural forest systems. Appropriate action should be taken to minimise negative effects.

Planning a Beneficial introduction

6. Essential features of investigation and planning consist of:
    - an assessment phase culminating in a decision on the desirability of the introduction;

- an experimental, controlled trial;
- the extensive introduction phase with monitoring and follow-up.

THE ASSESSMENT PHASE

Investigation and planning should take the following factors into account:

a) No species should be considered for introduction to a new habitat until the factors which limit its distribution and abundance in its native range have been thoroughly studied and understood by competent ecologists and its probable dispersal pattern appraised.

Special attention should be paid to the following questions:

- What is the probability of the exotic species increasing in numbers so that it causes damage to the environment, especially to the biotic community into which it will be introduced?
- What is the probability that the exotic species will spread and invade habitats besides those into which the introduction is planned? Special attention should be paid to the exotic species' mode of dispersal.
- How will the introduction of the exotic proceed during all phases of the biological and climatic cycles of the area where the introduction is planned? It has been found that fire, drought and flood can greatly alter the rate of propagation and spread of plants.
- What is the capacity of the species to eradicate or reduce native species by interbreeding with them?
- Will an exotic plant interbreed with a native species to produce new species of aggressive polyploid invader? Polyploid plants often have the capacity to produce varied offspring some of which quickly adapt to and dominate, native floras and cultivars alike.
- Is the alien species the host to diseases or parasites communicable to other flora and fauna, man, their crops or domestic animals, in the area of introduction?
- What is the probability that the species to be introduced will threaten the continued existence or stability of populations of native species, whether as a predator, competitor for food, cover, breeding sites or in any other way? If the introduced species is a carnivore, parasite or specialised herbivore, it should not be introduced if its food includes rare native species that could be adversely affected.

b) There are special problems to be considered associated with the introduction of aquatic species. These species have a special potential for invasive spread.

- Many fish change trophic level or diet preference following introduction, making prediction of the results of the re-introduction difficult. Introduction of a fish or other species at one point on a river system or into the sea may lead to the spread of the species throughout the system or area with unpredictable consequences for native animals and plants. Flooding may transport introduced species from one river system to another.
- introduced fish and large aquatic invertebrates have shown a great capacity to disrupt natural systems as their larval, sub-adult and adult forms often use different parts of the same natural system.

c) No introduction should be made for which a control does not exist or is not possible. A risk-and-threat analysis should be undertaken including investigation of the availability of methods for the control of the introduction should it expand in a way not predicted or have unpredicted undesirable effects, and the methods of control should be socially acceptable, efficient, should not damage vegetation and fauna, man, his domestic animals or cultivars.

d)When the questions above have been answered and the problems carefully considered, it should be decided if the species can reasonably be expected to survive in its new habitat, and if so, if it can reasonably be expected to enhance the flora and fauna of the area, or the economic or aesthetic value of the area, and whether these benefits outweigh the possible disadvantages revealed by the investigations.

THE EXPERIMENTAL CONTROLLED TRIAL

Following a decision to introduce a species, a controlled experimental introduction should be made observing the following advice:

- Test plants and animals should be from the same stock as those intended to be extensively introduced.
- They should be free of diseases and parasites communicable to native species, man, his crops and domestic livestock.
- The introduced species' performance on parameters in 'the Assessment Phase' above should be compared with the pre-trial assessment, and the suitability of the species for introduction should be reviewed in light of the comparison.

THE EXTENSIVE INTRODUCTION

If the introduced species behaves as predicted under the experimental conditions, then extensive introductions may commence but should be closely monitored. Arrangements should be made to apply counter measures to restrict, control, or eradicate the species if necessary.

The results of all phases of the introduction operation should be made public and available to scientists and others interested in the problems of introductions.

The persons or organisation introducing the species, not the public, should bear the cost of control of introduced organisms and appropriate legislation should reflect this.

ACCIDENTAL INTRODUCTIONS

1. Accidental introductions of species are difficult to predict and monitor, nevertheless they "should be discouraged where possible. The following actions are particularly important:
    - On island reserves, including isolated habitats such as lakes, mountain tops and isolated forests, and in wilderness areas, special care should be taken to avoid accidental introductions of seeds of alien plants on shoes and clothing and the introduction of animals especially associated with man, such as cats, dogs, rats and mice.
    - Measures, including legal measures, should be taken to discourage the escape of farmed, including captive-bred, alien wild animals and newly-domesticated species which could breed with their wild ancestors if they escaped.
    - In the interest of both agriculture and wildlife, measures should be taken to control contamination of imported agricultural seed with seeds of weeds and invasive plants.
    - Where large civil engineering projects are envisaged, such as canals, which would link different biogeographical zones, the implications of the linkage for mixing the fauna and flora of the two regions should be carefully considered. An example of this is the mixing of species from the Pacific and Caribbean via the Panama Canal, and the mixing of Red Sea and Mediterranean aquatic organisms via the Suez Canal. Work needs to be done to consider what measures can be taken to restrict mixing of species from different zones through such large developments.

2. Where an accidentally introduced alien successfully and conspicuously propagates itself, the balance of its positive and negative economic and ecological effects should be investigated. If the overall effect is negative, measures should be taken to restrict its spread.

WHERE ALIEN SPECIES ARE ALREADY PRESENT

1. In general, introductions of no apparent benefit to man, but which are having a negative effect on the native flora and fauna into which they have been introduced, should be removed or eradicated. The present ubiquity of introduced species will put effective action against the majority of invasives beyond the means of many States but special efforts should be made to eradicate introductions on:
    - islands with a high percentage of endemics in the flora and fauna;
    - areas which are centres of endemism;
    - areas with a high degree of species diversity;
    - areas with a high degree of other ecological diversity;
    - areas in which a threatened endemic is jeopardised by the presence of the alien.
2. Special attention should be paid to feral animals. These can be some of the most aggressive and damaging alien species to the natural environment, but may have value as an economic or genetic resource in their own right, or be of scientific interest. Where a feral population is believed to have a value in its own right, but is associated with changes in the balance of native vegetation and fauna, the conservation of the native flora and fauna should always take precedence. Removal to captivity or domestication is a valid alternative for the conservation of valuable feral animals consistent with the phase of their evolution as domestic animals.

    Special attention should be paid to the eradication of mammalian feral predators from areas where there are populations of breeding birds or other important populations of wild fauna. Predatory mammals are especially difficult, and sometimes impossible to eradicate, for example, feral cats, dogs, mink, and ferrets.
3. In general, because of the complexity and size of the problem, but especially where feral mammals or several plant invaders are involved, expert advice should be sought on eradication.

BIOLOGICAL CONTROL

1. Biological control of introductions has shown itself to be an effective way of controlling and eradicating introduced species of plants and more rarely, of animals. As biological control involves introduction of alien species, the same care and procedures should be used as with other intentional introductions.

MICRO-ORGANISMS

1. There has recently been an increase of interest in the use of micro-organisms for a wide variety of purposes including those genetically altered by man.
    Where such uses involve the movement of micro-organisms to areas where they did not formerly exist, the same care and procedures should be used as set out above for other species.

PART II

THE RE-INTRODUCTION OF SPECIES*

Re-introduction is the release of a species of animal or plant into an area in which it was indigenous before extermination by human activities or natural catastrophe. Re-introduction is a particularly useful tool for restoring a species to an original habitat where it has become extinct due to human persecution, over-collecting, over-harvesting or habitat deterioration, but where these factors can now be controlled. Re-introductions should only take place where the original causes of extinction have been removed. Re-introductions should only take place where the habitat requirements of the species are satisfied. There should be no re-introduction if a species became extinct because of habitat change which remains unremedied, or where significant habitat deterioration has occurred since the extinction.

The species should only be re-introduced if measures have been taken to reconstitute the habitat to a state suitable for the species.

The basic programme for re-introduction should consist of:

- a feasibility study;
- a preparation phase;
- release or introduction phase; and a
- follow-up phase.

THE FEASIBILITY STUDY

An ecological study should assess the previous relationship of the species to the habitat into which the re-introduction is to take place, and the extent that the habitat has changed since the local extinction of the species. If individuals to be re-introduced have been captive-bred or cultivated, changes in the species should also be taken into account and allowances made for new features liable to affect the ability of the animal or plant to re-adapt to its traditional habitat.

The attitudes of local people must be taken into account especially if the reintroduction of a species that was persecuted, over-hunted or over collected , is proposed. If the attitude of local people is unfavorable an education and interpretive programme emphasizing the benefits to them of the re-introduction, or other inducement, should be used to improve their attitude before re-introduction takes place.

The animals or plants involved in the re-introduction must be of the closest available race or type to the original stock and preferably be the same race as that previously occurring in the area.

Before commencing a re-introduction project, sufficient funds must be available to ensure that the project can be completed, including the follow-up phase.

THE PREPARATION AND RELEASE OR INTRODUCTORY PHASES

The successful re-introduction of an animal or plant requires that the biological needs of the species be fulfilled in the area where the release is planned. This requires a detailed knowledge of both the needs of the animal or plant and the ecological dynamics of the area of re-introduction. For this reason the best available scientific advice should be taken at all stages of a species re-introduction.

This need for clear analysis of a number of factors can be clearly seen with reference to introductions of ungulates such as ibex, antelope and deer where re-introduction involves understanding and applying the significance of factors such as the ideal age for re-introducing individuals, ideal sex ratio, season, specifying capture techniques and mode of transport to re-introduction site, freedom of both the species and the area of introduction from disease and parasites, acclimatisation, helping animals to learn to forage in the wild, adjustment of the gut flora to deal with new forage, 'imprinting' on the home range, prevention of wandering of individuals from the site of re-introduction, and on-site breeding in enclosures before release to expand the released population and acclimatise the animals to the site. The re-introduction of other taxa of plants and animals can be expected to be similarly complex.

FOLLOW-UP PHASE

Monitoring of released animals must be an integral part of any re-introduction programme. Where possible there should be long-term research to determine the rate of adaptation and dispersal, the need for further releases and identification of the reasons for success or failure of the programme.

The species impact on the habitat should be monitored and any action needed to improve conditions identified and taken.

Efforts should be made to make available information on both successful and unsuccessful re-introduction programmed through publications, seminars and other communications.

PART III

RESTOCKING

1. Restocking is the release of a plant or animal species into an area in which it is already present. Restocking may be a useful tool where:
   - it is feared that a small reduced population is becoming dangerously inbred; or
   - where a population has dropped below critical levels and recovery by natural growth will be dangerously slow; or
   - where artificial exchange and artificially-high rates of immigration are required to maintain outbreeding between small isolated populations on biogeographical islands.
2. In such cases care should be taken to ensure that the apparent nonviability of the population, results from the genetic institution of the population and not from poor species management which has allowed deterioration in the habitat or over-utilisation of the population. With good management of a population the need for re-stocking should be avoidable but where re-stocking is contemplated the following points should be observed:

   a) Restocking with the aim of conserving a dangerously reduced population should only be attempted when the causes of the reduction have been largely removed and natural increase can be excluded.

   b) Before deciding if restocking is necessary, the capacity of the area it is proposed to restock should be investigated to assess if the level of the population desired is sustainable. If it is, then further work should be undertaken to discover the reasons for the existing low population levels. Action should then be taken to help the resident population expand to the desired level. Only if this fails should restocking be used.
3. Where there are compelling reasons for restocking the following points should be observed.

   a) Attention should be paid to the genetic constitution of stocks used for restocking.

   - In general, genetic manipulation of wild stocks should be kept to a minimum as it may adversely affect the ability of a species or population to survive. Such manipulations modify the effects of natural selection and ultimately the nature of the species and its ability to survive.

- Genetically impoverished or cloned stocks should not be used to re-stock populations as their ability to survive would be limited by their genetic homogeneity.

b) The animals or plants being used for re-stocking must be of the same race as those in the population into which they are released.

c) Where a species has an extensive natural range and restocking has the aim of conserving a dangerously reduced population at the climatic or ecological edge of its range, care should be taken that only individuals from a similar climatic or ecological zone are used since interbreeding with individuals from an area with a milder climate may interfere with resistant and hardy genotypes on the population's edge.

d) Introduction of stock from zoos may be appropriate, but the breeding history and origin of the animals should be known and follow as closely as possible Assessment Phase guidelines a, b, c and d (see pages 5-7). In addition the dangers of introducing new diseases into wild populations must be avoided: this is particularly important with primates that may carry human zoonoses.

e) Restocking as part of a sustainable use of a resource (e.g. release of a proportion of crocodiles hatched from eggs taken from farms) should follow guidelines a and b (above).

f) Where restocking is contemplated as a humanitarian effort to release or rehabilitate captive animals it is safer to make such releases as re-introductions where there is no danger of infecting wild populations of the same species with new diseases and where there are no problems of animals having to be socially accepted by wild individuals of the species.

PART IV

NATIONAL, INTERNATIONAL AND SCIENTIFIC IMPLICATIONS OF TRANSLOCATIONS

NATIONAL ADMINISTRATION

1. Pre-existing governmental administrative structures and frameworks already in use to protect agriculture, primary industries, wilderness and national parks should be used by governments to control both intentional and unintentional importation of organisms, especially through use of plant and animal quarantine regulations.
2. Governments should set up or utilise pre-existing scientific management authorities or experts in the fields of biology, ecology and natural resource management to advise them on policy matters concerning translocations and on individual cases where an introduction, re-introduction or restocking or farming of wild species is proposed.
3. Governments should formulate national policies on:
    - translocation of wild species;
    - capture and transport of wild animals;
    - artificial propagation of threatened species;
    - selection and propagation of wild species for domestication; and
    - prevention and control of invasive alien species.

4. At the national level legislation is required to curtail introductions:

   Deliberate introductions should be subject to a permit system. The system should apply not only to species introduced from abroad but also to native species introduced to a new area in the same country. It should also apply to restocking.

   Accidental introductions

   - for all potentially harmful organisms there should be a prohibition to import them and to trade in them except under a permit and under very stringent conditions. This should apply in particular to the pet trade;
   - where a potentially harmful organism is captive bred for commercial purposes (e.g. mink) there should be established by legislation strict standards for the design and operation of the captive breeding facilities. In particular, procedures should be established for the disposal of the stock of animals in the event of a discontinuation of the captive breeding operation;
   - there should be strict controls on the use of live fish bait to avoid inadvertent introductions of species into water where they do not naturally occur.

   Penalties

5. Deliberate introductions without a permit as well as negligence resulting in the escape or introduction of species harmful to the environment should be considered criminal offences and punished accordingly. The author of a deliberate introduction without a permit or the person responsible for an introduction by negligence should be legally liable for the damage incurred and should in particular bear the costs of eradication measures and of habitat restoration where required.

INTERNATIONAL ADMINISTRATION

Movement of Introduced Species Across International Boundaries

1. Special care should be taken to prevent introduced species from crossing the borders of a neighboring state. When such an occurence is probable, the neighboring state should be promptly warned and consultations should be held in order to take adequate measures.

   The Stockholm Declaration

2. According to Principle 21 of the Stockholm Declaration on the Human Environment, states have the responsibility 'to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states'.

   International Codes of Practice, Treaties and Agreements

3. States should be aware of the following international agreements and documents relevant to translocation of species:
   - ICES, Revised Code of Practice to Reduce the Risks from introduction of Marine Species, 1982.
   - FAO, Report of the Expert Consultation on the Genetic Resources of Fish, Recommendations to Governments No L 1980.
   - EIFAC (European Inland Fisheries Advisory Commission), Report of the Working Party on Stock Enhancement, Hamburg, FRG 1983.
   - The Bonn Convention MSC: Guidelines for Agreements under the Convention.

- The Berne Convention: the Convention on the Conservation of European wildlife and Natural Habitats.
- The ASEAN Agreement on the Conservation of Nature and Natural Resources.
- Law of the Sea Convention, article 196.
- Protocol on Protected Areas and Wild Fauna and Flora in Eastern African Region.

In addition to the international agreements and documents cited, States also should be aware of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). International shipments of endangered or threatened species listed in the Appendices to the Convention are subject to CITES regulation and permit requirements. Enquiries should be addressed to: CITES Secretariat**, Case Postale 456, CH-1219 Chatelaine, Genève, Switzerland; telephone: 41/22/979 9149, fax: 41/22/797 3417.

Regional Development Plans

4. International, regional or country development and conservation organisations, when considering international, regional or country conservation strategies or plans, should include in-depth studies of the impact and influence of introduced alien species and recommend appropriate action to ameliorate or bring to an end their negative effects.

Scientific Work Needed

5. A synthesis of current knowledge on introductions, re-introductions and re-stocking is needed.
6. Research is needed on effective, target specific, humane and socially acceptable methods of eradication and control of invasive alien species.
7. The implementation of effective action on introductions, re-introductions and re-stocking frequently requires judgements on the genetic similarity of different stocks of a species of plant or animal. More research is needed on ways of defining and classifying genetic types.
8. Research is needed on the way in which plants and animals are dispersed through the agency of man (dispersal vector analysis).

A review is needed of the scope, content and effectiveness of existing legislation relating to introductions.

IUCN Responsibilities

International organisations, such as UNEP, UNESCO and FAO, as well as states planning to introduce, re-introduce or restock taxa in their territories, should provide sufficient funds, so that IUCN as an international independent body, can do the work set out below and accept the accompanying responsibilities.

9. IUCN will encourage collection of information on all aspects of introductions, re-introductions and restocking, but especially on the case histories of re-introductions; on habitats especially vulnerable to invasion; and notable aggressive invasive species of plants and animals.

Such information would include information in the following categories:

- a bibliography of the invasive species;
- the taxonomy of the species;
- the synecology of the species; and
- methods of control of the species.

10. The work of the Threatened Plants Unit of IUCN defining areas of high plant endemism, diversity and ecological diversity should be encouraged so that guidance on implementing recommendations in this document may be available.
11. A list of expert advisors on control and eradication of alien species should be available through IUCN.

Note:
* The section on re-introduction of species has been enhanced by the Guidelines For Re-Introductions
** The address of the CITES Secretariat has been updated.

Appendix 3: Synthèse des actions entreprises par le Maroc pour préserver la population de Phoque Moine

Ci-après, une synthèse des actions entreprises par le Maroc, depuis le début des années 90, pour préserver la population de phoque moine (*Monachus monachus*) relevant de sa zone de juridiction. Différentes mesures, essentiellement de conservation et de préservation plus que de suivi ou d'étude (faute de moyens), ont été ainsi prises par le Gouvernement du Maroc. Il s'agit notamment de :

1. L'instauration d'une réserve maritime d'interdiction de l'exercice de tout genre d'activité de pêche (pélagique ou démersales; coquillages ou crustacés) dans la zone comprise entre 20°54'40''N et 21°23'00''N, à 12 milles nautiques de la côte. Il s'agit d'une zone qui est soumise à la surveillance par les unités (patrouilleurs) de la Marine Royale;

2. La prise en compte de cette disposition dans le plan d'aménagement de la pêcherie aux poulpes en vigueur, et ce, à la fois en maintenant cette réserve maritime et en la renforçant par:

    - L'interdiction de tout type de chalutage à l'intérieur de la bande des 8 milles nautiques à partir de la côte, entre Cap Blanc (Lagouira) et Cap Bojdor ;
    - La limitation de l'expansion vers le sud de toutes les activités de la pêche artisanale aux petits métiers (barques) par l'implantation du site de pêche de Lamhiriz (Roc chico), situé au niveau du parallèle 22°10'00''N, bien loin de la zone peuplée par les phoques moines. Il s'agit du dernier des quatre villages de pêcheurs artisans à partir desquels les barques sont autorisées à exercer leurs activités tout au long du littoral de la région Oued Eddahab - Lagouira ;

3. La création, en 1998, d'un centre Régional de Recherche Halieutique de l'INRH à Dakhla (CRRH/INRH – Dakhla) ayant pour principales missions la préservation des ressources halieutiques, de la diversité biologique et de l'équilibre écologique de la Région Oued Eddahab – Lagouira, l'étude et le suivi de l'évolution du milieu marin de cette région, et la surveillance de la qualité et la salubrité de l'environnement marin. La structure architecturale du CRRH/INRH – Dakhla, bâti sur la rive ouest de la baie de Dakhla, a même prévu un bassin pour la réhabilitation et le secours des phoques moines ;

4. La mise en place conjointement par l'Institut National de Recherche Halieutique (INRH) du Maroc et le Centre National de Recherches Océanographiques et des Pêches (CNROP) de Mauritanie d'un programme bilatéral dans lequel un grand intérêt est accordé (i) à la gestion et l'aménagement des ressources halieutiques partagées entre les deux pays, (ii) à la surveillance de la salubrité de l'environnement marin, et (iii) à la diversité biologique, dont fait partie la population de phoque moine de la péninsule de Cap Blanc ;
5. La création, à l'échelle de la région Oued Eddahab – Lagouira, d'un Comité Local pour le Suivi de la Préservation du Phoque Moine, présidé par le Centre Régional de l'INRH à Dakhla.

Actuellement, il existe une prise de conscience de la nécessité que le Maroc doit être doté d'une station de terrain, à proximité de la zone peuplée par les phoques moines de Méditerranée, au niveau précisément de VillaLobos (D'Khila), juste à la limite nord de la réserve maritime instaurée par le Maroc depuis 1993.

Une telle station aura un grand rôle à jouer non seulement de nature scientifique, en matière de suivi directe de la population des phoques moines, de leurs habitats, de l'environnement aquatique fréquenté (hydrodynamique, perturbations phytoplanctoniques, etc.), mais également en terme de contribution au respect des mesures de préservation qui y sont appliquées et d'aide aux efforts de surveillance qui y sont déployés. Elle doit également servir de base pour d'éventuelles interventions en cas d'urgence, notamment en cas de mortalité (individuelle ou massive), d'accidents, d'intempéries, d'éboulement de grottes, etc.

Appendix 4: Tools for the Conservation of Migratory Species Developed Within the CMS[1]

Marco Barbieri
CMS Secretariat

Introduction

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) was concluded in 1979 and came into force on 1 November 1983. At present, 76 States are Parties to the Convention, and another 15 countries are participating in related Agreements under CMS. Parties to CMS work together to conserve migratory species and their habitats by providing strict protection for the endangered migratory species listed in Appendix I of the Convention; by concluding multilateral Agreements for the conservation and management of migratory species listed in Appendix II; and by undertaking co-operative research activities.

Major Components of CMS

<u>Appendix I: Endangered Migratory Species</u>
Appendix I to the Convention lists at present 86 species, including the Mediterranean monk seal. With respect to these species, the Parties are committed to conserve and, where appropriate, restore critical habitats, prevent to the extent posible, or at least minimise, factors affecting their conservation status, including factors impeding their migration, and prohibit any taking, with few exceptions.

Through various resolutions, the Conference of the Parties (COP) can, usually on the basis of proposals from the Scientific Council, encourage the Parties and instruct the Secretariat to develop concerted actions and prepare review reports on priority species included in Appendix I.

<u>Appendix II: Migratory Species Conserved Through Agreements</u>
Appendix II lists migratory species which (1) have an unfavourable conservation status that require international Agreements for their conservation and management, and (2) have a conservation status which would significantly benefit from the international co-operation deriving from an international Agreement. The Mediterranean monk seal is listed also on this appendix. CMS provides for the development of specialized regional Agreements for individual species or, more often, for a Group of species listed at Appendix II. In this respect, CMS is a framework Convention since it provides for separate internationally legally binding instruments between Range Status of certain migratory species or groups of species. Parties to such Agreements do not have to be Parties to the parent Convention.

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[1] Paper presented by the CMS Secretariat for the Population and Habitat Viability Assessment (PHVA) Workshop of the Mediterranean Monk Seal in the Eastern Atlantic (CENEAM Valsaín, Segovia, Spain, 10 – 13 November 2001)

Various forms of multilateral Agreements are developed under CMS, ranging from legally-binding AGREEMENTs open to accesion by all Range Status of those species (whether or not they are Parties to the Convention) to agreements whose provisions are not defined explicitly by the Convention text. These include less formal Memoranda of Understanding for species or populations that periodically cross national jurisdictional boundaries. Guidance on priorities for the development of Agreements is given by the COP through recommendations on cooperative actions for Appendix II species.

- "***AGREEMENTS***" (Art. IV, para 3; Art. V)

The more formal and comprehensive AGREEMENT should, inter alia:
Deal preferably with more than one species;
Cover the whole of the range of the species concerned;
Include all necessary instruments to make the AGREEMENT operational and effective. In substance, AGREEMENTS should provide for:

(i) co-ordinated species conservation and management plans;
(ii) conservation and restoration of habitats;
(iii) control of factors impeding migration;
(iv) co-operative research and monitoring; and
(v) exchange of information and public orientation.

- "***agreements***" (Art. IV, para 4)

The Convention also provides for Agreements for the conservation of any population or geographically separate part of the population of any species of wild animals which periodically cross jurisdictional boundaries. This flexibility provides for the development and conclusion of targeted treaties which can be the most effective instrument for the conservation and management of certain species or groups of species. Under this category of "agreement", the geographic coverage does not have to extend to the whole of the migration range of the species concerned, nor does the species have to be listed in Appendix I of the Convention; the species does not even have to fall within the narrow definition of "migratory".
Agreements of this type have been so far established in the form of Memoranda of Understanding (MOU). The aim of a MOU is to co-ordinate short-term measures to be taken by the Range States at the administrative and scientific levels, in some cases on the basis of already existing commitments. This allows for the conclusion of a MOU between the Ministries of the Range States concerned (which avoids lengthy ratification procedures) with a view to initiating immediate concerted protection measures for seriously endangered species until a more elaborate strategy can be prepared and adopted. A MOU describes the actions to be taken collectively and more specific measures to be implemented in each country. This may at a later stage be converted into a more formal Agreement if the members agree, or incorporated as an Action (or Conservation) Plan in a broader and more comprehensive Agreement.

- "***Action Plans***"

Documents referred to as "action plans" (under the designation of action / conservation / management plans) have been produced under different circumstances within CMS. Most agreements established under Art. IV and V of the Convention have APs attached or contain provisions for their establishment. The status of these APs is different according to the type of Agreement. For legally-binding Agreements, annexed APs are equally binding. However, unlike the text of the Agreement, for which posible amendments need to go through a process of ratification to come into force, amendments to the AP decided by the Conference of the Parties to the Agreement are usually of immediate application. Such APs normally do not enter in the merit of specific actions to be undertaken by individual Parties. APs developed in connection with MOUs reflect the character of urgency for action of this type of tool: they normally include few general provisions while focussing on urgent actions to be carried out by the individual range states / signatories. These APs are developed in parallel with, or following the signature of the MOU, and are adopted and periodically revised by the meetings of the signatory parties. APs however have also been developed in some cases as self-standing documents, normally in response to resolutions and / or recommendations of the COPs. Development of self-standing APs has been used as a mechanism to try to foster rapid action when conditions did not allow for the sufficiently expeditious development of agreements. APs of this type are developed with the assistance of qualified institutions / organizations and the involvement of experts from the range states and other concerned organizations. Cooperation among range states and organizations established within the development and implementation of such APs is, at least in certain cases, expected to prepare the ground for the establishment of more formal agreements.

Appendix 5: Draft Recovery Plan for the Mediterranean Monk Seal in the Eastern Atlantic

<u>EDITOR'S NOTE:</u>

Officials of Conservación de la Naturaleza del Ministerio de Medio Ambiente, the organization that invited CBSG to conduct this PHVA workshop, were interested in using the PHVA process as a way to critically review and provide quantitative analysis on the recommendations made in the "Recovery Plan for the Mediterranean Monk Seal in the Eastern Atlantic" developed through the Bonn Convention (UNEP / CMS) in 2001. Consequently, the draft Recovery Plan became a very important central focus throughout the workshop deliberations. It is important to recognize, however, that the workshop was not designed to facilitate a unanimous approval of this draft Recovery Plan by all participants. The draft Plan includes a number of controversial issues that will require sustained and focused discussion before a satisfactory resolution can be achieved.

Therefore, the inclusion of the draft Recovery Plan within this report does not imply unanimous approval of the contents of the draft Plan by all participants in the PHVA workshop.