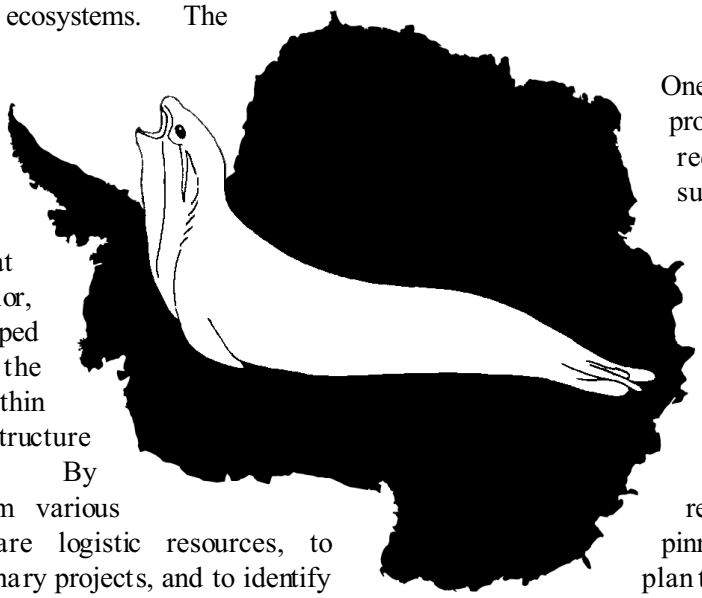
Report of the 1995 APIS Program planning meeting

Executive Summary

Twenty-six scientists from nine nations participated in a planning meeting for the Antarctic Pack Ice Seals (APIS) Program, which was held at the Alaska Fisheries Science Center's National Marine Mammal Laboratory, Seattle, USA, from 7-9 June 1995. This five-year program (1995/96-1999/00) was initiated by the SCAR Group of Specialists on Seals to promote studies on the status of Antarctic pack ice seal populations and the role they play in Antarctic marine ecosystems. The participants identified 41 anticipated APIS research projects involving scientists from 18 nations. Most of these projects (e.g., distribution and abundance, genetics, habitat use and foraging behavior, energetics) are being developed specifically to meet the objectives and to operate within the collaborative research structure of the APIS Program. By encouraging scientists from various national programs to share logistic resources, to collaborate on multi-disciplinary projects, and to identify and utilize centers of specialized analytical expertise, the APIS Program seeks to build a cooperative, multi-national science effort that is not only efficient and cost-effective, but when taken as a whole, will produce scientific opportunities and results that are far greater than the sum of its parts.



The meeting established four scientific task groups to address the technical details of coordinating data collection, processing, and analysis methods among APIS investigators and research platforms:

(i)Estimating seal abundance and distribution from ships, helicopters and fixed-wing aircraft, (ii) Population dynamics, especially to ensure comparability of data from long-term tagging studies, (iii) Seal behavior, in particular the protocols used to collect data with time-depth recorders (TDRs) and satellite-linked instruments, and (iv) Collection of specimen material for genetics, disease, diet and ecotoxicology studies.

One of the chief areas where program-wide coordination is required is in arranging logistic support in the pack ice zone. A principal motivation for developing the APIS Program structure was the desire to overcome the past lack of adequate logistic support for Antarctic pack ice seal research. By funding and scheduling a relatively large number of pinniped research projects that plan to share logistic support within a finite time period (5 years), researchers will have significantly more research platforms available to them for the duration of their projects than would normally be available within a single national program. By cooperating among national programs, overall costs can be kept lower, and opportunities for researchers from all nations can be enhanced.

Estimates were developed of the amount of ship and aircraft support that would be required for the circumpolar survey of seal distribution and abundance planned for 1998/99 (see figure on next page). Assuming that the majority of the survey effort would be conducted from

ship-based helicopters, and allowing for bad weather and transit time between survey lines, a total of approximately 100 helicopter days and 150 ship days would be needed in the pack ice zone. By deploying ship and helicopter resources cooperatively during the one season when the circumpolar survey is planned, it will be possible to obtain high quality abundance estimates within acceptable statistical confidence limits.

To be successful, it is essential that the circumpolar survey be closely coordinated among all national programs deploying ships and aircraft as part of this multi-national effort. Researchers were encouraged to consult as soon as possible with their respective logistics coordinators to ensure that appropriate requests and arrangements for ship time and aircraft support are being incorporated into national programs' long-term planning.

In contrast to most previous research cruises in the pack ice zone, where seal work was often "piggy-backed" onto cruise tracks developed by other disciplines (e.g., oceanography, lower trophic level processes), investigators in the APIS Program intend to set ship track lines focused foremost on answering APIS research questions. However, to gain a fuller ecological perspective, APIS researchers will encourage the full participation of scientists from other disciplines. Important sources of complementary data include physical and biological oceanographers, zooplankton researchers, scientists studying non-pinniped upper trophic level species such as seabirds and whales, and specialists in remote sensing technology (e.g., sea ice). In this regard, liaison with other Antarctic research programs such as SO-GLOBEC and CEMP will be emphasized.

The meeting endorsed the concept of designating APIS Centers of Analytical Expertise, which could serve as focal points for analyses of specimen material. Specific subjects which could be approached in this way are genetics, diet, age estimation, ecotoxicology, health and disease, reproductive status, and vocalizations.

To be effective in coordinating the multinational research undertaken as part of the APIS Program, dedicated funding for program administration will be required. The main purpose of these funds will be to bring program participants together for planning meetings, technical workshops, and collaborative analyses. Although funds to support individual research projects will need to be secured from national programs, this additional support is required to facilitate inter-project and overall program coordination. All program participants were urged to seek sources of financial support that could be used by the program to continue its coordinating role. In addition, the Steering Committee was tasked with soliciting financial support from groups such as foundations, funding organizations, and corporations.

Two APIS meetings are scheduled for 1996: a) a program planning meeting, and b) a workshop on survey methods for estimating pack ice seal abundance and distribution. These have both been provisionally scheduled for the period just prior to the SCAR meetings, to be held in Cambridge, U.K., in July 1996.

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APIS

ANTARCTIC PACK ICE SEALS

An international research program coordinated by the SCAR Group of Specialists on Seals

APIS Report No. 1

Report of the 1995 APIS Program planning meeting

National Marine Mammal Laboratory
Alaska Fisheries Science Center
National Marine Fisheries Service/NOAA
Seattle, WA USA

7-9 June 1995

INTRODUCTION AND BACKGROUND

1. A planning meeting for the Antarctic Pack Ice Seals (APIS) Program was held at the Alaska Fisheries Science Center's National Marine Mammal Laboratory, Seattle, USA, from 7-9 June 1995. Dr. W. Aron, Director of the Center, welcomed the meeting participants, who are involved in pinniped research programs from nine countries.

2. The APIS Program has been under development by the Scientific Committee on Antarctic Research's (SCAR) Group of Specialists on Seals since 1990. That group's Convenor, Prof. D.B. Siniff, introduced the program and described the background and events leading to the present meeting. The Group of Specialists on Seals is charged with evaluating the status of Antarctic pinniped stocks, encouraging and coordinating scientific research, and providing advice and recommendations to SCAR and other international organizations under the Antarctic Treaty system.

3. Recognizing the important need for a better understanding of the Antarctic pack ice seals and the role that they play in Antarctic marine ecosystems, the APIS Program was initiated. This five-year program is intended to provide an intellectual and logistic focus for pinniped researchers in the Antarctic pack ice zone. By encouraging scientists from various national programs to share logistic resources, to collaborate on multi-disciplinary projects, and to identify and utilize centers of specialized analytical expertise, the APIS Program seeks to build a cooperative, multi-national scienceeffort that is not only efficient and cost-effective, but when taken as a whole, will produce scientific opportunities and results that are far greater than the sum of its parts.

4. At its 1990 meeting, the Group of Specialists on Seals began outlining the scope of a research initiative on Antarctic pack ice seals. These ideas were further refined at the group's 1992 meeting, and plans were finalized for holding a workshop to identify research priorities and to develop a program plan. That workshop, held at the University of Minnesota in May 1993, produced a research prospectus describing priority questions and the scientific approach for the APIS Program. During May 1994, at a meeting held in Padova, Italy, development of the APIS Program was continued by producing an implementation plan and establishing a Steering Committee comprised of Drs. J.L. Bengtson (Chairman), M.N. Bester, I.L. Boyd, H. Burton, and Y. Naito.

5. With the broad aspects of science and logistics having been addressed in previous meetings, the present planning meeting was convened to further advance the process of coordinating the operational details of the program, which begins its first field season during the 1995/96 austral summer. Dr. Bengtson chaired the meeting, and Dr. Boyd served as coordinating rapporteur. A list of meeting participants is provided in Appendix 1. Regrets had been received from Drs. Bester, P.L. Boveng, and Naito, who are active in the APIS Program but could not attend the

meeting.

6. The provisional agenda was adopted (Appendix 2). A list of documents circulated during the meeting is provided in Appendix 3. Readers of this report should recognize that it reflects preliminary discussions of plans and intended research projects, some of which are in relatively early stages of development. The process of APIS Program development is dynamic, and as this cooperative and collaborative research initiative evolves, its details will undoubtedly shift as new opportunities and realities present themselves.

7. Participants expressed their appreciation for the financial support provided to the meeting by the U.S. Department of State, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), and the U.S. National Science Foundation. Thanks were also expressed to the National Marine Mammal Laboratory for hosting the meeting.

PINNIPED RESEARCH PROJECTS

8. A wide variety of research is being planned for the Antarctic pack ice seals (crabeater seal, *Lobodon carcinophagus*; leopard seal, *Hydrurga leptonyx*; Ross seal, *Ommatophocca rossii*; and Weddell seal, *Leptonychotes weddelli*). These projects address research questions in all nine of the APIS Program research topics (e.g., distribution and abundance, genetics, habitat use and foraging behavior, energetics).

9. Prior to considering the pinniped research projects that are being developed within the APIS Program, the program's overall scientific framework and approach were reviewed. It was agreed that the nine priority questions originally posed in the APIS research prospectus were still very relevant and appropriate. In particular, the comparisons to be drawn between Arctic and Antarctic sea ice ecosystems are likely to be quite interesting given the similarities (e.g., environmentally patchy, areas of high seasonal productivity) and differences (e.g., annual/multi-year ice, broad basins/narrow continental shelf) in these two systems. Similarly, it was noted that information expected to be produced by the APIS Program pertaining to pack ice seals' role in carbon flux in Antarctic marine ecosystems will be an important contribution to the current debate on this issue.

10. To begin coordinating the various science activities that are being developed within national programs, the meeting reviewed the pinniped research projects that researchers anticipate will be undertaken as part of the APIS Program. The following paragraphs outline both the general areas of interest and specific projects that are being planned or proposed at present. Obviously, given the different systems and schedules for evaluating and funding research within different national Antarctic programs, these projects are currently at various stages of development (e.g., solely an idea or interest, a written proposal, or an already-funded project). But these descriptions, and the accompanying collation in Table 1, represent participants' best attempts to indicate the pinniped research projects that are likely to be conducted. A summary of the anticipated pinniped research projects is presented in Table 2 with respect to each of the APIS research topics.

11. **Australia:** The Australian Antarctic Division has already made significant moves to incorporate the APIS Program within its own program objectives. Current and anticipated studies cover many of the research areas within APIS:

i)Surveys. Researchers intend to make a major contribution to circumpolar surveys of pack ice seal abundance and distribution in 1998/99 in the area of Prydz Bay and Casey Station (60°E to 120°E). Preliminary surveys will take place in 1995 and 1996 to develop and refine survey methodologies. A more intensive survey will be carried out in 1997 as part of an integrated study of the physical and biological oceanography of the Prydz Bay region. Ship support and land-based, long-range helicopters will be available mainly in the spring and possibly to a lesser degree in the summer. Small-scale summer surveys will be conducted to allow comparing of the spring surveys carried out by the Australian Antarctic Division with the main census effort of other national programs.

ii)Habitat use, seasonal movement and dive/haulout behavior. Satellite platform terminal transmitters (PTTs) have already been deployed on crabeater seals, and this effort will continue through the period of the APIS Program within the region of interest (defined above).

iii)Genetic identity, diet, toxicology and disease. During the handling of seals, biological samples will be collected routinely for distribution to labs with specific expertise. There is an opportunity to establish a center for the analysis of milk lipid biomarkers at the CSIRO Oceanography Group.

iv)Energetics and physiology. Dr. B. Green (Division of Wildlife Ecology, CSIRO) has data on the body composition of crabeater seals (mainly lactating females) from isotope studies carried out in October-November

1985 at 55°E (Enderby Land).

12. **Belgium/Argentina:** Interests are centered around ecotoxicology studies of organochlorines and heavy metals, especially comparisons between Arctic and Antarctic top predators. Scientists for this research are based at the Free University of Brussels and the Instituto Antartico Argentino. Argentina also has an icebreaker which may be available for carrying out survey work in the Weddell Sea; the APIS Steering Committee was asked to recommend when and where this ship could make its most valuable contribution to coordinated survey efforts.

13. **Brazil:** Researchers at the Universidade Federal do Parana and the Universidade de São Paulo have expressed interest in participating in the APIS Program by investigating aspects of crabeater seal behavior and ecology. For this work, consideration is being given to developing a proposal to conduct pinniped studies aboard the Brazilian National Antarctic Program's ice-strengthened research vessel. If this project is approved and funded, it is likely that the ship's general area of operations would be in the pack ice zone near the Antarctic Peninsula.

14. **Canada:** Canadian scientists have a long history of pack ice seal research in the Arctic, and are interested in extending some of these studies to the Antarctic to draw comparisons between the two regions. Anticipated projects within APIS fall into two categories:

i) Genetic discreteness of subpopulations. Recently-developed techniques to evaluate the genetic relatedness among different subpopulations offer the opportunity to assess the extent to which discrete populations of Antarctic pack ice seals may occur around the continent. Analytical probes, similar to those used for Arctic phocids and polar bears, will be developed from existing specimen material and then applied to circumpolar samples obtained during the APIS field period.

ii) Geographic variation in vocalizations. Part of this work would attempt to compare the underwater vocalizations of leopard, crabeater, and Weddell seals from different sectors of the Antarctic. Geographic variations in vocalizations, especially when considered in the context of complementary genetic data, may provide insight into the ecological and behavioral segregation among different subpopulations of these species.

15. **Chile:** The Instituto Antartico Chileno (INACH) has developed a 5-year research plan (1995-2000) which includes supporting the APIS Program. Areas of research interest are: a) distribution and abundance of pack ice seals, b) ecotoxicology, and c) parasitology, especially helminths. The Chilean Navy has expressed interest in supporting APIS studies with Chile's new icebreaker (AP46 *Oscar Viel*) which is due to enter service in 1995/96. The icebreaker is equipped with two helicopters (B-105 or UH-57) and could accommodate 12-14 scientists. This ship may be available to carry out circumpolar or focused regional cruises involving surveys of pack ice seal abundance during the core period in 1998/99. The main areas of operation in other years will be around the northern Antarctic Peninsula and the South Shetland Islands. This platform is available for cooperative work with scientists from other countries, and INACH would welcome such collaboration. In addition to ship support, Chile might be able to provide helicopter (twin engine Bell and UH-1H) and fixed-wing (twin otter) air support to APIS projects working in the South Shetland Islands.

16. **China:** An opportunity exists to carry out research on the distribution and abundance of pack ice seals from the Chinese icebreaker, RSV *Xuelong* (Snow Dragon), which transits between the South Shetland Islands (Great Wall Station) and Prydz Bay (Zhongshan Station) every 2-3 years. When moving between the stations, there is some flexibility in the cruise track, which might be able to accommodate APIS research needs. It is anticipated that this transit is likely to occur during 1998/99 (APIS core period), and possibly also during one or two other years within the APIS study period. During the 1998/99 season, cruises could take place during August-September and January-February. The icebreaker is capable of carrying helicopters which could be used for conducting aerial surveys. However, at present there are no plans to deploy helicopters because of financial limitations. The Chinese program is open to the idea of placing helicopters aboard the icebreaker to conduct APIS Program ice seal surveys if sufficient support can be found to cover helicopter costs, perhaps through cooperative agreements with other national programs. Plans to coordinate some of the proposed activities with Australia are being developed.

17. **Denmark:** There is no current research program on Antarctic pack ice seals, but Danish scientists have extensive experience working on seals in the Arctic. As APIS is interested in drawing comparisons between the Arctic and Antarctic seal communities, especially in relation to differences in the two regions' seasonal ice regimes, Danish scientists are seeking to develop collaborative links with other studies within the APIS Program.

18. **France:** During 1998/99, French researchers intend to carry out fixed-wing aircraft surveys of pack ice seal

Table 1. List of anticipated pinniped research projects to be conducted as part of the APIS Program by investigators in various national programs, as of June, 1995.

Project number	Principal investigator(s)	Season	Research topic	Location	Regional status	Level of certainty	Intent/collaboration	Logistical requirements
AR-1	Vergani	1995/96-1999/00	Survey	Weddell Sea and other locations	Regional	1	Seeks advice from APIS for best areas of deployment	Ship and helicopter (Irizar)
AU-1	Burton / Southwell	1995/96-1996/97 ES & LS	Survey	Prydz Bay	Regional	5	Space for additional personnel	Ship and helicopter available (Aurora Australis)
AU-2	Burton / Southwell	1998/1999	Survey	Prydz Bay	Circumpolar	5	"	"
AU-3	Burton / Southwell	1995/96-1999/00	Crabeater seal behavior (PTT deployment)	Prydz Bay	Regional	5	"	"
AU-4	Burton / Southwell	1995/96 - 1999/00	Population identity, diet, toxicology and disease	Prydz Bay	Sub-regional	5	Collection of tissue for other projects	Laboratory facilities for analysis of dietary lipids
AU-5	Burton	1995/96-1999/00	Weddel seal population dynamics	Vestfold Hills	Sub-regional	5	Collaboration with US-4	Ship and over-snow vehicles
AU-6	Shaughnessy / Green	1996/97	Crabeater seal body composition	Enderby Land	Sub-regional	3	Analysis of existing data	Laboratory facilities
BE/ARE-1	Joiris/Vergani	1995/96-1999/00	Ecotoxiclogy	Not specific	Regional	4	Collaboration between Belgium and Argentina	Access to field sites
BR-1	Fanta	1996/97-1998/99	Crabeater seal ecology	Ant. Peninsula	Regional	1	Possible collaboration with U.S.	Ice-strengthened vessel
CA-1	Stirling/Strobeck	1995/6-1999/00	Population identity using DNA and vocalizations	Not specific	Circumpolar	3	Analysis if tissues and recordeing collected by other projects	None
CH-1	Torres	1998/99	Survey	Circumpolar	Circumpolar	3	Space for additional personnel/ collaboration with other countries	Ship and helicopter (Oscar Viel)
CH-2	Torres	1995/96-1999/00	Ecotoxicology	N. Ant. Peninsula and S. Shetlands	Regional	3	Space for additional personnel/ collaboration with other countries	Ship and helicopter (Oscar Viel)
CH-3	Torres	1995/96-1999/00	Parasitology	Ant. Peninsula and S. Shetland Islands	Regional	3	Space for additional personnel	Ship and helicopters (Oscar Viel)

Project number	Principal investigator(s)	Season	Research topic	Location	Regional status	Level of certainty	Intent/collaboration	Logistical requirements
PC-1	Dong	1995/96, ES & LS in 1998/99)	Survey	S. Shetland Islands east to Prydz Bay	Circumpolar	2	Collaboration with Australia and other countries	Icebreaker available (*RSV Xuelong*)
PC-2	Dong	1997/98	Aging, growth and genetics	S. Shetland Islands east to Prydz Bay	Sub-regional	3	Possible collaboration with other programs	Subregional access to seals
DK-1	Heidi-Jorgensen		Comparison with Arctic seals	Not specific	Not specific	1	Possible collaboration with UK, Germany, Spain, Belgium & Italy	None
FR-1	Guinet	1998/99	Survey	Adelie Land	Regional / circumpolar	2	Possible collaboration with other programs	Fixed-wing aircraft support
GE-1	Plötz	1997/98-1998/99 ES	Survey	Weddell Sea, Filchner Ice Shelf	Regional / circumpolar	2	Possible collaboration with UK-2, SA-1 & SA-2	Fixed-wing aircraft support
GE-2	Plötz	1997/98	Foraging behavior of Weddell seals	Weddell Sea	Sub-regional	3	Ongoing--collaboration possible	Continued support for German Program
IY-1	Focardi	1996/97 - 1999/00	Ecotoxicology	Ross sea	Regional	1	Seeking collaboration in other regions	None
JA-1	Naito	1996/97	Survey	East Queen Maud Land	Regional	3/4	Space for collaboration	*Shirase* and helicopters
JA-2	Naito	1998/99	Survey	East Queen Maud Land	Regional / Circumpolar	1/2	Space for collaboration	*Shirase* and helicopters
NO-1	Blix	1995/96 - 1998/99	Dispersion and foraging behavior	Queen Maud land	Regional	3		Icebreaker support required
SA-1	Bester	1996/97- 1999/00 LS	Survey	3^0E- 9^0W	Regional	2	Collaboration with GY-1	Ship and helo during relief voyage to SANAE Station
SA-2	Bester	1998/99 or 1999/00 LS	Survey	3^0E- 9^0W	Circumpolar	3	Collaboration with GY-1	Dedicated ship and helicopter

Project number	Principal investigator(s)	Season	Research topic	Location	Regional status	Level of certainty	Intent/collaboration	Logistical requirements
SA-3	Bester	1995/96-1999/00	Ross & crabeater seal behavior and PTTs	Western Queen Maude Land	Regional	2	Collaboration with AU-3.	Ship and helo during relief voyage to SANAE Station
SA-4	Bester/Robinson	1996/97-1999/00	Population identity using DNA	Not specific	Circumpolar	2	Analysis of tissues collected by other projects	None
SP-1	Aguilar	1997/98-1999/00	Ecotoxicology	Ant. Peninsula, and other regions	Regional	2	Requires collaboration in order to be extended to other regions	Access to seals for tissue collection, needs ship/helo time.
UK-1	Boyd	1995/96 LS	Survey (ship & helo)	S. Bellinghausen	Regional	4	Space for additional personnel	Ship and helicopter (HMS Endurance)
UK-2	Boyd	1995/96-1998/99 (LS)	Survey	Marguerite Bay & S. Bellingshausen	Regional	5, 95/96; 3, later	Joint equipment development (see project GY-1)	Fixed wing aircraft
UK-3	Boyd	1998/99	Survey	Bellinghausen or western Weddell	Circumpolar	1	Coordinated with ship-based surveys by other programs	Ship and helicopter (HMS Endurance)
UK-4	Boyd	1997/98-1999/00	Energetics and physiology (measurement of metabolic rates)	Mainly Marguerite Bay, perhaps with US-1	Sub-regional	2	Open to collaboration with other national programs but mainly an internal UK project	Portable physiology lab built into a container for land- or ship-based activities.
UK-5	Boyd	1996/97-1999/00	Lipid analysis of diet preferences	Circumpolar	Sub-regional	2	Will use samples collected during other APIS projects	May need space on ship to carry out specific types of sampling
UR-1	Maltsev	1995/96-1999/00	Parasitology	Not specific	Sub-regional	1	Requires collaboration and funding	Ship support to access animals. Specimen collection.
US-1	Bengtson/ Boveng	1997/98-1999/2000	Physical oceanography and crabeater seals	Not specified	Regional	2	Collaboration with other US projects and national programs	Ice-strengthened ship
US-2	Siniff/Gelatt/ Stewart	1997/98-1999/2000	Juvenile crabeater seal ecology and behavior	Not specified	Sub-regional	2	Collaboration with other US projects and national programs	Ice-strengthened ship and helicopters
US-3	Bengtson/ Boveng/Siniff	1997/98-1999/2000	Crabeater and leopard seal interactions	Antarctic Peninsula	Sub-regional	2	Collaboration with other US projects and national programs	Ice-strengthened ship and coastal access via small boat

Project number	Principal investigator(s)	Season	Research topic	Location	Regional status	Level of certainty	Intent/collaboration	Logistical requirements
US-4	Siniff/Bengtson Boveng/Laake	1997/98-1999/2000	Pack ice seal abundance and distribution	Ross Sea?	Circumpolar	2	Collaboration with US-1, 2, 3. Deployment of PTTs	Icebreaker and helicopters
US-5	Siniff/ Stewart	1995/6-1999/00	Weddell seal ecology and population dynamics	Ross Sea	Regional	3	Current collaboration with Weddell seal work at McMurdo	Support at McMurdo Station
US-6	Yochem/ Stewart	1997/98-1999/00	Health, pathology, and ecotoxicology of seals	Not specific	Circumpolar	2	Analysis of tissue samples collected by other projects	Several sources of analytical expertise have been identified

LS - Late summer; Dec-FebLevels of certainty:1 - ideaAR - ArgentinaCH - ChileJA - JapanUR - Ukraine

ES - Early summer; Sept-Nov2 - proposalAU - AustraliaDK - DenmarkNO - NorwayUS - United States

LW- Late winter; June-Aug3 - optimisticBE/AR - Belgium/ArgentinaFR - FrancePC -People's Republic of China

EW - Early winter; March-May4 - confidentBR - BrazilGE - GermanySP - Spain

5 - fundedCA - CanadaIY - ItalyUK - United Kingdom

distribution and abundance in the region of Adélie Land. French scientists can also gain access to pack ice seals in this region to collect biological samples, such as skin for genetics studies, on behalf of other APIS projects.

19. **Germany:** Two main activities are anticipated for Germany's participation in the APIS Program:

i)Surveys. Plans are being developed to conduct surveys of pack ice seal abundance and distribution in the vicinity of the Filchner Ice Shelf during the 1998/99 summer. These surveys will be conducted using the fixed-wing aircraft (*Polar II*) of the German national program. The aircraft can be equipped with a surveillance camera to photograph seals hauled out on pack ice. The status of this initiative is that a proposal is currently being drafted for aerial survey support in 1997/98 or 1998/99. There may also be a possibility of aircraft support in other seasons during the 5-year APIS Program. The prospects of obtaining ship time aboard R/V *Polar Stern* are uncertain.

ii)Weddell seal behavior. A second APIS initiative will be to continue studies of Weddell seal diving and feeding behavior. Electronic instruments to monitor dive depth, stomach temperature, and mouth activity will be deployed on Weddell seals during the winter/spring in the vicinity of Neumeyer Station.

20. **Italy:** Ecotoxicology and the levels of contaminants present at various trophic levels is a continuing focus of Italian research in the Antarctic. As part of the APIS Program, Italian researchers have expressed an interest in comparing the types and quantities of pollutants carried by Antarctic pack ice seals in various geographic sectors around the continent.

21. **Japan:** The region of APIS research operations for Japanese scientists will be eastern Queen Maud Land where surveys of pack ice seal densities will be carried out during at least two Antarctic summers. This work may occur together with other studies of foraging behavior based around new types of micro-electronic recorders. The Japanese National Institute for Polar Research is seeking collaboration with other national programs, particularly for studies of trophic interactions.

22. **Norway:** Norwegian scientists are currently conducting research on the seasonal movements and foraging behavior of pack ice seals in relation to ice and oceanographic conditions. It is intended that this work will continue through the APIS research period by deploying satellite PTTs on crabeater seals. It is hoped that the Norwegian program will be in a position to provide icebreaker and helicopter support as part of the APIS Program.

23. **South Africa:** Operations by the South African National Antarctic Programme (SANAP) are likely to be concentrated within the region 0°W to 5°W. There are three main research areas in which SANAP expects to contribute to APIS:

i)Surveys. Pack ice seal surveys within the main study area could be conducted on an annual basis as the ship, SA *Agulhas*, traverses the pack ice to relieve SANAE Station. This would take place during December and, during one or more years, it could also be extended to surveys in the area 3°E to 9°W during January and February. A bid is also being made to contribute to the circumpolar census in 1998/99.

ii)Behavior. It is envisaged that the presence of the SA *Agulhas* in the pack ice, either while surveys are being carried out or during related oceanographic cruises, will provide opportunities for the deployment of instruments (in particular satellite PTTs) on pack ice seals.

iii)Genetics. There may be opportunities for establishing a center of analytical expertise for molecular genetics of pack ice seals at the Department of Zoology and Entomology at the University of Pretoria.

24. **Spain:** Spain has no current involvement in Antarctic seal research. However, there is a current proposal for research on pinniped ecotoxicology, focused mainly on organochlorines, for 1997/98 - 1999/00. The study area would be the South Shetland Islands/Antarctic Peninsula although, depending on opportunities, it could be expanded to other areas. Logistic support, principally through international collaboration, is required for this project to provide access to seals in the field to obtain morphometrics and blubber biopsies. The two components of this project are:

i)Pollutants in ice seals. Efforts will be made to compare differences in pollutant profiles between crabeater and leopard seals.

ii)Comparisons with other species. The base-line levels of pollutants as biomarkers in elephant seals and Antarctic fur seals will be determined to allow comparisons with ice-breeding pinnipeds.

Table 2. Project summary of anticipated contributions to the APIS Program, arranged by research topic as defined in the APIS Prospectus, season, and spatial scale.

APIS research topic	Seasons	Spatial scale	APIS research project codes (see Table 1)
Distribution, abundance & species composition	1995/96 - 1998/99	Regional and circumpolar	AR-1, AU-1, AU-2, CH-1, FR-1, GE-1, JA-1, JA-2, NO-1,PC-1, SA-1, SA-2, UK-1, UK-2, UK-3, US-1, US-4
Genetic identity of populations	1995/96-1999/00	Sub-regional	AU-4, CA-1, PC-2, SA-4, US-6
Habitat use and seasonal movements	1995/96-1999/00	Regional	AU-3, BR-1, DK-1, NO-1, SA-3, US-1, US-2, US-3, US-5
Seals as platforms for oceanographic research	1995/96-1999/00	Regional	US-1, (elephant seal research by Australia may help develop appropriate instruments pack ice seals)
Population dynamics	Retrospective and 1995/96-1999/00	Regional	AU-5, US-3, US-5
Diving, feeding behavior and activity patterns	1995/96-1999/00	Regional	AU-3, BR-1, GE-2, SA-3, US-1, US-2, US-3, US-5
Diet	1995/96-1999/00	Sub-regional	AU-4, GE-2, UK-5, US-3, US-6
Toxicology and disease	1995/96-1999/00	Regional	BE/AR-1, AU-4, CH-2, CH-3, IY-1, SP-1, UR-1, US-6
Energetics & physiology	Retrospective and 1997/98 - 1998/99	Sub-regional	AU-6, UK-4

25. **Ukraine:** Dr. V.N. Maltsev, YugNIRO, Kerch, has expressed interest in conducting parasitological research as part of the APIS Program. The comparative study of pack ice seal helminthofauna can assist in determining the extent to which local and regional pinniped populations may be segregated ecologically. The proposed work would build on previous helminthological analyses of samples from five pinniped species collected near the Balleny Islands during the 1986/87 sealing expedition by the former Soviet Union. As the Ukraine program does not operate research vessels in the Antarctic, the proposed studies would require logistic support as part of a collaboration with other national programs.

26. **United Kingdom:** Researchers are likely to conduct pack ice seal studies at both the sub-regional and regional scale throughout the period of the APIS Program. Those studies will be focused in three disciplinary areas, principally along the southwestern coast of the Antarctic Peninsula and the southern and eastern Bellingshausen Sea:

i)Energetics and physiology. At the sub-regional level, this topic reflects areas of interest and expertise available within the U.K. Plans to develop a portable physiological research laboratory for ship and land-based use are in hand. The lab will be used to examine metabolic rates of pack ice seals under different controlled-temperature

conditions and will be linked to studies of metabolic rate in free-ranging seals, probably using heart rate to measure field metabolic rate. The plan is to carry out most of this research from Rothera Research Station but it may also be possible and desirable to extend these studies to other sites by moving the laboratory to various shore and ship platforms. Once developed, this facility would also be available for use by other research groups if required.

ii)Pack ice seal diet. Also at the sub-regional level, a proposal is being considered to develop analytical techniques for examining dietary lipids. The British Antarctic Survey has a lipid chemistry laboratory and the intention is to obtain technical support to use this laboratory for pinniped diet analyses. This could develop as an APIS center of analytical expertise to process specimen material obtained by other APIS researchers.

iii)Abundance and distribution. At the regional level, there is a firm intention to carry out survey work from HMS *Endurance* in the southern Bellingshausen Sea during February/March 1996 and possibly also during 1997 (area of operation presently uncertain). Researchers intend to bid for ship and aircraft support for the 1998/99 season. In parallel with this, aircraft (twin otter) time has been allocated in 1995/96 to evaluate the practicalities of carrying out seal surveys from fixed-wing aircraft. If these tests are successful, it should be possible to obtain 10-30 h of aircraft time per year for the duration of the APIS Program. Most aircraft surveys would be conducted in the area of Marguerite Bay and the eastern Bellingshausen Sea between December and March, although it may also be possible to conduct surveys over the western Weddell Sea.

27. **United States:** Plans are being developed to undertake research projects on several topics as part of the APIS Program. Some of these are extensions of earlier pack ice seal research by U.S. investigators, some utilize new technology that will allow testing hypotheses in ways previously unavailable, and some are new initiatives which will take advantage of the collaborative opportunities made possible by the APIS Program:

i)Influences of physical oceanography on crabeater seal ecology and population dynamics. Analyses of crabeater seal cohort strength over several decades have indicated that survival rates fluctuate in an apparently periodic fashion about every five years. It is likely that physical processes such as water mass movements and sea ice characteristics, as well as their subsequent impacts on primary and secondary production, are closely linked to these fluctuations. This study would assess intra- and inter-annual pinniped habitat selection, dive patterns, foraging behavior, and the characteristics of the marine zones (horizontal and vertical) that seals transit through and occupy. Researchers are developing proposals for a multi-disciplinary approach to address this topic, involving physical oceanographers, as well as utilizing seals as platforms for oceanographic research (i.e., to carry satellite-linked sensors) during periods when research vessels are not available.

ii)Ecology and behavior of juvenile crabeater seals. Young-of-the-year and juvenile crabeater seals are vastly under-represented in age structures calculated from collections of specimen material. This bias suggests that, at least in some areas, juvenile crabeater seals behave differently than older age classes. These differences may include haulout patterns (e.g., young seals remain in the water and are not observed on ice as often) or geographic distribution (e.g., they may segregate by age class). A survey correction factor also needs to be developed which accounts for this large portion of the crabeater seal population that may not be visible during surveys. This project will investigate the status of crabeater seal pups from weaning through their first year or two, which is also the period when crabeater seals are believed to be most vulnerable to leopard seal predation.

iii)Crabeater seal and leopard seal predator-prey interactions. Although crabeater and leopard seals are known to interact closely, the specific nature of these interactions and the relative effects of the two species on each other are not well understood. For example, nearly all crabeater seals bear the scars of predatory chases by leopard seals, but the actual resulting mortality rates and impacts on the crabeater seal population from this pressure are unknown. Therefore, it is not yet possible to assess the degree to which leopard seals are ecologically linked to crabeater seals throughout the year. This work would involve efforts at two scales: a) local studies of individual leopard and crabeater seals to assess and compare their behavior in relation to each other, and b) regional studies using satellite-linked instruments to evaluate broad-scale patterns throughout the year.

iv)Abundance, distribution, and population discreteness. Issues that need to be resolved regarding estimating the abundance of pack ice seals include: a) haul-out correction factors, b) survey stratification schemes for opportunistic sampling and for planned surveys, and c) extrapolating sub-regional surveys of abundance to broader, circumpolar pack ice areas. Prior to the APIS Program's coordinated, circumpolar survey, historic survey data will be analyzed for relevant information on regional stratification, sample size estimation, and

methods for incorporating seal haul-out patterns and sea ice distribution into abundance estimates. In addition to this preparatory work, proposals are being developed for participation in the 1998/99 APIS circumpolar survey aboard U.S. icebreakers, helicopters, and fixed-wing aircraft.

v)Weddell seal population dynamics. Continuation of the long-term project on the population dynamics of Weddell seals at McMurdo Sound is planned, with an additional emphasis during the APIS Program to implement coordination between this study and the Weddell seal project at Davis Station. The McMurdo study will include documentation of movement patterns (satellite PTTs) and diet (lavage) to examine ecosystem feedback mechanisms and their effects in the Weddell seal population. Efforts will be made to interact with Ross Sea oceanographic studies planned for 1996/97 to obtain data on ecosystem interactions. There is also an interest in comparing the long-term Weddell seal database from McMurdo with long-term pinniped studies in other regions (e.g., northern elephant seals in the North Pacific) for evaluating and predicting environmental, biotic, and anthropogenic influences on the demography and ecology of Antarctic pinnipeds.

vi)Immunology, diseases, pathology, and ecotoxicology. In all of the studies described above, researchers plan to sample blood and tissue (including archived samples) to determine population discreteness through DNA analysis, contaminants levels in pack ice seal tissue, and the occurrence and causes of disease. An animal's health and physiological state can also be reflected in measurements of blood parameters. Scientists at several institutions have expressed an interest in collaborating with this work, including: Hubbs-Sea World Research Institute (physiological condition and health), the Wildlife Health Center (immunology, disease, pathology), and the Armed Forces Institute of Pathology (tissue analysis and repository for samples collected).

28. **Other projects:** It was recognized that not all potential APIS pinniped research projects had been represented at the meeting or in the preceding paragraphs of this report. In particular, it was noted that there was a possibility that investigators from Finland, India, Korea, Netherlands, New Zealand, Russia, and Sweden might wish to participate in the APIS Program. It was agreed that Dr. Bengtson should write to relevant scientists in these countries to inquire about their potential interest.

SCIENTIFIC TASK GROUPS

29. Data comparability across the various collaborative components of the APIS Program is considered essential. Projects carried out at regional and circumpolar scales of interest will require coordination of data collection, processing, and analysis methods among investigators and research platforms. Four areas were identified in which standardization of methods needs to be a priority:

i)Estimating seal abundance and distribution from ships, helicopters and fixed-wing aircraft,

ii)Population dynamics, especially to ensure comparability of data from long-term tagging studies,

iii)Seal behavior, in particular the protocols used to collect data with time-depth recorders (TDRs) and satellite-linked instruments, and

iv)Collection of specimen material for genetics, disease, diet and ecotoxicology studies.

30. To address the technical details of these topics, four scientific task groups were established. The four groups and their respective co-convenors are: 1) abundance and distribution (J.L. Laake and C. Southwell), 2) population dynamics (P.L. Boveng and D.B. Siniff), 3) behavior (J. Plötz and B.S. Stewart), and 4) specimen material (A. Aguilar and P.D. Shaughnessy). The meeting's plenary session divided into these task groups to identify the main issues that will require attention in the near future as preparations are made for the APIS Program's field work phase. Brief reports for each task group's discussions are presented in the following sections.

31. It was agreed that these groups should work mostly via correspondence, with occasional workshops or planning sessions held as needed. Participation in the four task groups is open to all interested parties, regardless of whether or not they participated in the task group discussions during the present meeting. Persons interested in participating in a task group should contact one of the co-convenors. In addition to contacts through correspondence, colleagues were encouraged to utilize opportunities to consult with each other whenever possible in association with other meetings that are planned (e.g., Marine Mammal Society, SCAR, CCAMLR).

32. The following terms of reference were developed to guide the work of all four task groups:

i)Identify topics where protocols for collecting, processing, or analyzing data or specimens are desirable,

ii)Recommend existing protocols for APIS standardization and, where necessary, develop new ones (e.g., for data and specimen collection, sampling design),

iii)Facilitate the implementation of the protocols (e.g.,

through training, enhancing communications and information transfer/dissemination),

iv)Develop mechanisms, where appropriate, for coordinating and integrating management and analysis of specimens and data, and

v)Identify logistic needs in terms of space and time.

Abundance and Distribution Task Group

33. Estimating the continent-wide abundance of Antarctic pack ice seals poses some unique and challenging problems. The logistics and costs of properly surveying the remote and vast area of pack ice around Antarctica dictates the need for a multinational effort. The ultimate success of a circumpolar survey depends on developing a sampling design with adequate coverage, flexible but standardized sampling protocols that can provide comparable results from different observation platforms, and coordination of planning and implementation.

34. The haulout behavior of pack ice seals complicates obtaining an accurate assessment of their abundance and distribution. While it is known that these seals exhibit a general diel haulout pattern, uncertainties remain about the magnitude of individual, seasonal, and geographic variations in haulout behavior. The analytical aspects of deriving haulout correction factors need to be developed and coordinated with the Behavior Task Group.

35. The precision of continent-wide estimates of seal abundance can be improved by regional stratification to account for large-scale geographic variation. Past survey data and data collected from recent pilot surveys will be used to develop strata and to allocate sampling effort between strata. In addition, seal movement data collected from satellite-linked time-depth recorders (SLTDRs) may be used to refine strata by identifying the extent to which seals travel within and between residual pack ice areas. Further smaller-scale stratification based on habitat characteristics (e.g., ice coverage, bathymetry) will also be examined using available data.

36. The following issues need to be discussed and resolved as part of the planning process for the multinational circumpolar survey of pack ice seals scheduled for 1998/99: A. Survey methods

1) Design issues

a) Timing - season/day

b) Stratification

c) Sample selection

2) Implementation

a) Sampling method

b) Data requirements

c) Data collection

d) Ancillary data collection

e) Data recording

B. Coordination of multinational sampling

1) Country

2) Sector

3) Year/season

4) Available platforms/technical specifications

C.Integration of haulout behavior into abundance estimates

1) Identify data requirements (e.g., SLTDRs)

2) Method of integration into abundance estimate.

37. It was agreed that as a matter of priority, preliminary variance estimates would be calculated from previous surveys to estimate the total requirements for ship and aircraft time to conduct an adequate circumpolar survey of pack ice seals. A 20% error bound on the continental abundance estimate, corresponding to a coefficient of variation (CV) of 0.10, was set as a minimum goal. Based on historical survey data, approximately 9,000 linear nautical miles of search effort would be needed to achieve this goal. Assuming a 0.5 nautical mile survey strip, approximately 0.33% of the entire Antarctic pack ice zone during January-February would be sampled. Assuming the majority of the survey effort would be conducted from helicopters operating from ships, and allowing for bad weather and transit time between survey lines, a total of approximately 100 helicopter days (using about 2-3 flight hours per day) and 150 ship days would be needed in the pack ice zone itself (i.e., not counting open-water transit to and from the pack ice).

38. By deploying ships collaboratively from various national programs during the 1998/99 austral summer as provisionally outlined in Figure 1, it is logistically feasible to meet or exceed the minimum levels of logistic support required for the circumpolar survey. For example, nine national programs are presently considering contributing ship and aircraft time to the circumpolar survey. While it is unlikely that the level of commitment will be the same in all programs, spreading the logistic requirements among nine or more national programs would result, on average, of about 15-20 days of ship time per program. Given this coverage, the circumpolar survey can be expected to provide results of high quality within

acceptable statistical confidence limits. In addition, if fixed-wing aircraft are available, and if acceptable aerial photography methodologies for surveying Antarctic pack ice seals can be developed, these aircraft could be used to supplement sampling in areas that are difficult to reach from a helicopter or ship.

39. As part of future discussions and planning, attention will also be given to using platforms of opportunity (e.g., tour ships, regularly-scheduled supply ships) for collecting survey data. Such opportunities would be useful both in obtaining abundance data within subregions and for deployment and recovery of instruments monitoring seal behavior.

40. Recognizing that advance planning is essential for obtaining adequate logistical support, the task group considered the geographic areas that might be surveyed by different national programs, so that any potential gaps could be identified. The provisional plan for coordinating each nation's expected coverage of geographic sectors is given in Table 3 and Figure 1. There is some overlap in certain areas and coordination is needed between South Africa/Germany and China/Australia to share platforms, optimize scheduling, and identify priority sampling areas.

Figure 1. Provisional map showing the anticipated sector coverage for deployment of ships and aircraft by national program for the 1998/99 circumpolar survey of Antarctic pack ice seals. The arcs along latitudinal lines indicate the sectors in which various national programs may deploy ships and ship-based helicopters. The shaded areas near the continent are zones in which aerial surveys using fixed-wing aircraft may be feasible.

41. Australia's current survey plans concentrate primarily during the spring whereas most other surveys are planned for summer. Therefore, the combination of both spring and

summer surveys for a continent-wide estimate may create difficulties if there are large-scale movements of seals during the interval between surveys. The Australian program is conducting the following research to address this issue: a) deployments of SLTDRs on seals, and b) sampling a smaller sector during both spring and summer to compare estimates. If the research suggests that the continent-wide estimate would be compromised by using spring surveys, it will be necessary to sample between 60°E to 120°E during summer, which would open considerable gaps in the circumpolar coverage as currently planned (see Figure 1).

42. Most of the national plans propose conducting visual surveys from icebreakers, ice-reinforced ships or helicopters. However, it was also noted that large-format photography from fixed-wing aircraft might be useful in areas of large seal concentrations (e.g., Marguerite Bay and other coastal areas along the Antarctic Peninsula) and therefore warrants further investigation. If such surveys are feasible, it would be possible to greatly expand the spatial and temporal coverage of surveys. For example, the United Kingdom operates Dash-7 aircraft out of Rothera Station, and may be able to survey the northwest Weddell Sea and the southwest Bellingshausen Sea; Germany operates Polar II aircraft out of Filchner Station, and could survey the southern Weddell Sea; Chile operates Twin Otter aircraft out of Presidente Frei Station, and could survey the South Shetland Island and northern Antarctic Peninsula area; and the United States operates Twin Otter aircraft out of McMurdo Station, and could survey the Ross Sea and perhaps the area west of Cape Adare.

43. Dr. Boyd stated that it may be possible for the U.K. to test large-format photography for surveying pack ice seals during the 1995/96 austral summer. These tests will take place out of Rothera Station. Dr. Plötz recalled that the German program had successfully used large-format cameras and fixed-wing aircraft to survey Weddell seals during the 1983/84 season. It was noted that even if species identification was not possible from aerial photography, a generic count of seals hauled out on pack ice would be very useful; the species composition from such counts could be extrapolated from other surveys conducted aboard ships and helicopters.

44. For visual surveys, it was agreed that line transect sampling (e.g., Buckland, S.T., D.R. Anderson, K.P. Burnham, and J.L. Laake. 1993. Distance sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.) was preferable to the strip

Table 3. Provisional plan of geographic coverage and timing for surveys of pack ice seal abundance and distribution as proposed or planned by individual national programs. Implementation of most nations' plans is dependent on securing logistic support and funding. See Figure 1 for a map of the proposed coverage.

Country	Area	Year/Season	Platform
Argentina	80°W - 30°W	97/98 - summer 98/99 - summer	Icebreaker/2 helicopters
Australia	60°E - 120°E	98/99 - spring	Icebreaker/2 helicopters
	60°E - 90°E	97/98 - spring	" "
	60°E - 80°E	98 - summer	" "

Chile	100°W - 60°W	98/99 - summer	Icebreaker/2 helicopters
China	60°W - 100°E	96/97 (?) -summer 98/99 - summer	Icebreaker
Germany	60°W - 20°W	97/98 or 98/99 -summer	Icebreaker/fixed-wing aircraft
South Africa	20°W - 20°E	98/99 - summer	Ice-reinforced ship/2 helicopters, fixed-wing aircraft
United Kingdom	80°W - 55°W	95/96 - summer	Fixed-wing aircraft
United States	150°E - 120°W	98/99 - summer	Icebreaker/2 helicopters, fixed-wing aircraft

transect sampling used in past surveys for the following reasons: a) the variety of platforms and platform characteristics preclude defining a reasonable common strip width within which all seals on the ice could be counted with certainty, b) if such a common strip were defined, it would have to be quite narrow and considerable data would be excluded, and c) definition of a strip for a particular platform would depend on numerous sighting characteristics of the platform and observer abilities, which would require collecting distances to a set of observations, which is the basis of line transect sampling.

45. Recently conducted surveys of pack ice seals from icebreakers, using line transect sampling, illustrate the reasons why line transect sampling is preferable. Surveys were conducted from the bridge of the Australian R/V *Aurora Australis* (Southwell *et al.*) at a height of 16 m, from the conning tower of the USCGC *Polar Star* (Bengtson *et al.*) at a height of 31 m, and from the conning tower of the U.S. R/V *Nathaniel B. Palmer* (Gelatt and Siniff) at a height of 25 m. For the latter two surveys, it would be reasonable to assume that all seals were seen within a 400 m strip (200 m either side) but for the former, seals were less visible because of the lower platform and only a 200 m strip would be reasonable. In either case, using a strip transect would exclude at least 2/3 of the observations outside of the strip. By collecting the perpendicular distances to observed seals during these surveys, it was possible to use all sightings of seals and to "adjust" the counts for the differences in sighting probability between the platforms resulting from factors such as platform height.

46. The task group proposed that a 2-day workshop be held prior to the next meeting of the SCAR Group of Specialists on Seals in Cambridge during July, 1996. It is important that at least one active participant from each national program planning to conduct surveys attends the workshop to achieve a common level of understanding and agreement on survey methods and protocols. A provisional agenda addressing the terms of reference and priorities noted above is provided in Appendix 4.

47. In preparation for the workshop, the following working papers will be developed by individual task group members: a) preliminary survey design and logistic requirements, b) platform technical specifications list, and c) data collection requirements. A packet containing introductory information and these papers will be circulated prior to the workshop. At the workshop itself, each participant will be requested to present information describing their survey platform(s), as outlined in the technical specifications list, and equipment available to collect the required data. This will help identify where resources and further coordination are needed.

Population Dynamics Task Group

48. With the exception of mark-recapture programs on Weddell seals, data that reflect the population dynamics of pack ice seals depend upon activities such as collections (e.g., teeth, blood, and reproductive tissues) for age structure and reproductive information, as well as movement patterns from satellite work. The following paragraphs indicate the types of data that will be important for interpreting population dynamics of the pack ice species.

49. Tissue samples that are taken from seals handled should include blood and teeth for use in studies such as genetic analyses, health correlates with life history parameters, pregnancy rates and age determination. Seals captured for satellite tag deployment will yield data on movement patterns in relation to gender, age, reproductive and molt status. Such information is important for evaluating correlations between environmental measures and age/gender classes, and could establish which biotic and abiotic factors are causally related to seal distribution, abundance, and behavior.

50. Every effort should be made to obtain and archive historical data on the ages and reproductive status of seals that were either collected for scientific purposes or that were harvested commercially (e.g., the 1986/87 sealing expedition by the former Soviet Union). Further, any existing specimen material that could be used (e.g., molecular studies) to evaluate patterns of population discreteness should be identified.

51. Observations of tagged individuals are often recorded during field studies but are less often made available to other researchers. These data, along with unusual or infrequent observations, should be drawn together. As such, the observations could give new insights into certain life history traits of the pack ice seal species. One way to facilitate exchanging this type of information would be to expand the SCAR Group of Specialists on Seals' tagging and marking database so that it also included data on resighted tags and marks.

52. Long-term tagging programs on Weddell seals exist at McMurdo Station, Davis Station, and Signy Island. The Signy Island program has been discontinued but the other two are ongoing. Coordination among these programs needs to be emphasized to allow inter-regional comparisons of population parameter estimates.

53. The Population Dynamics Task Group will continue to discuss these and other issues through correspondence.

Behavior Task Group

54. Behavioral data are a key part of the scientific objectives of APIS, including the need to: a) provide correction factors for survey data to account for diel and seasonal variation in haulout behavior, b) examine the spatial and temporal movements of individuals, c) determine the portions of the water column which are exploited by each species, and d) provide information about behavioral time budgets to be integrated with measurements of energy expenditure to calculate complete energy budgets for representative individuals. This diverse set of requirements means that careful consideration must be given data collection methods to ensure that infrequent opportunities to obtain behavioral data are used to greatest effect. It is important that protocols for data collection are standardized across research projects because, without such coordination, it will probably prove to be very difficult to combine and compare data sets.

55. To adequately describe behavioral aspects of various components of the population, data are needed from sufficient samples of individual seals from specific age classes, gender, reproductive status, and molt stages. This may not be feasible for individual programs to accomplish because of limited funding or logistic constraints. Therefore, the Steering Committee may encourage APIS participants to concentrate the deployment of instruments on specific demographic/age classes while other research teams focus on other classes.

56. In practical terms, the standardization of data collection protocols centers on specific types of instruments normally used to collect these data. Satellite platform terminal transmitters (PTTs) are likely to be the most common type of instrument used during the APIS study period, but retrievable archival recorders (e.g., TDRs) may also be used in local experiments. The capabilities of PTTs are likely to improve significantly during APIS, and it is therefore important to achieve standardization at an early stage so that data sets collected early in the study period are comparable with those collected on superior instruments deployed towards the end of this period.

57. Multi-channel archival recorders (not transmitted via satellite link) collect information such as depth, heart rate, swimming speed and water temperature on a time base and store this information until the recorder is retrieved. Their primary value for APIS is in: a) collection of ecological information (depth of dive/foraging effort,

oceanographic data, correlations of dive performance/effort with water temperature/salinity characteristics), and b) determination of haulout patterns to calibrate seal surveys. There is a need to standardize data collection protocols for these instruments. This need has also been recognized by the CCAMLR Working Group on Ecosystem Monitoring and Management (WG-EMM) which is developing standard methods for data collection and analysis. The Behavior Task Group will be represented at WG-EMM meetings to discuss such standard methods and the most efficient course for APIS would probably be to adopt and adapt the CCAMLR methods as appropriate.

58. In cases where behavioral data are transmitted to a satellite, it is vital that standard protocols for data collection are used. This is because of the significant amount of on-board data processing that occurs, meaning that only data summaries are transmitted to the satellite and received by the researcher. The manner in which data are summarized can have a significant effect on the interpretation and comparability of data sets in two specific ways:

i)Location and diel haulout data. To conserve batteries and increase the effective deployment duration of instruments, it is normally possible to program instruments with a duty cycle. Such duty cycling must balance the importance of transmitting to the satellite while animals are out of the water (when the chances of gaining an uplink are greatest) with the importance of obtaining unbiased information about the timing of haulout and the location of individuals when they are in the water.

ii)User-defined bins (frequency histograms). Specific statistics, such as dive depth and duration, are normally classified into user-defined data bins. Unless these bins are assigned with some insight into the diving behavior of the species being studied, then a biased view of the behavior could be obtained. Furthermore, unless data from different deployments are collected using the same protocols, then the possibilities of combining these data sets *post hoc* are much diminished. The way in which dive statistics are transmitted also varies greatly with the types of satellite PTTs utilized.

59. Behavioral data collection protocols should be standardized as soon as possible. Ideally, simulations of the effects of different ways of summarizing data should be carried out before a final decision is made about adopting standard methods. However, it is important to ensure that these methods are in place as soon as possible and it was agreed that draft methods for data collection from satellite PTTs should be made available by 1 October 1995 so that data collected in 1995/96 would be compatible with future data sets. These draft methods will be agreed by correspondence. All regional programs should be encouraged to adopt the general APIS protocols although the group did recognize that some already-established

Table 4. Partial list of Antarctic pack ice seal tissue specimens currently available as of June 95. [quality codes for the source of material: 1, live; 2, fresh; 3, beginning to decay; 4, advanced decay].

Point of contact	Species	Material	Amount of sample available	Date collected	Location collected	Current (storage) location	Method of collection	Source material quality	Preservation method	Associated biological data collected	Availability/ comments
I.L. Boyd /R.M. Laws British Antarctic Survey Madingley Road Cambridge, U.K. CB3 0ET Tel: +44 1223-36118 ilbo@pcmail.nerc-bas.ac.uk	crabeater	ovaries, teeth	< 750	1965- 75	Margurite Bay/ Ant. Peninsula	B.A.S. Cambridge	shot for dog food	2	formalin (ovaries), glycerin-alcohol (teeth)	sex, age, morphological measurements	restricted at present-- under analysis
	Weddell	teeth	< 100	1965-75	Margurite Bay/ Ant. Peninsula	B.A.S. Cambridge	shot for dog food	2	glycerin -alcohol (teeth)	sex, age, morphological measurements	restricted at present-- under analysis
P.D. Shaughnessy CSIRO Wildlife & Ecology P.O. Box 84 Lyneham 2602 Australia Tel: +61 6-2421760 p.shaughnessy@dwe.csiro.au	crabeater	whole blood	< 1 ml, ~10 animals	Oct-Nov 1985	Enderby Land 50^0 E	CSIRO Canberra	live	1	frozen	sex, ageclass, repro. status, weight	available
	crabeater	plasma, rbc, white cells	< 1 ml, ~ 8 - 10 animals	May 1993	140^0 E	CSIRO Canberra	live	1	frozen	sex, ageclass, repro. status, weight	available
	crabeater	plasma, rbc, white cells	< 1 ml, ~ 8 - 10 animals	Jan 1995	?	CSIRO Canberra	live	1	frozen	sex, ageclass, repro. status, weight	available
	crabeater	liver, heart, kidney, blubber, muscle	~ 10g, 2 animals	May 1993	140^0 E	CSIRO, Canberra	sacrifice	1	frozen	sex, ageclass, repro. status, weight	available
D.B. Siniff Dept of Ecol, Evol, and Beh. University of Minnesota St. Paul, MN 55108 USA Tel: +1 612-625-5732 siniff@ecology.umn.edu	leopard	repro. tracts	~30 animals	1978-79	Antarctic Peninsula	Minnesota, USA	sacrifice	2	formalin	age?	available, but permit required for export

I. Stirling Canadian Wildlife Service 5320-122 St, Edmonton, AB T6J 3S5, Canada Tel: +1 405-435-7349 istirlin@gpu.srv.ualberta.ca	Weddell	ovaries, lower jaws	~ 50-60 animals	1966-69	McMurdo Sound	Edmonton, Canada	sacrifice	2	formalin, transferred to alcohol	yes
J.L. Bengtson Natl Marine Mammal Lab Seattle, WA 98115 USA Tel: +1 206-526-4016 bengtson@afsc.noaa.gov	crabeater	reproductive tissue and teeth	<750	1977-91	Antarctic Peninsula	NMML, Seattle	sacrifice	2	formalin or alcohol	sex, age, morphom measurements
	crabeater	gonads	<750	1977-91	Antarctic Peninsula	NMML, Seattle	sacrifice	2	formalin	sex, age, morphom measurements
	crabeater	blood, urine	<100	1977-95	circumpolar	NMML, Seattle	sacrifice or live	1/2	frozen	sex, age, morphom measurements
	crabeater	blubber, skin, hair	<50	1989-91	Antarctic Peninsula	Swedish Mus. of Nat.History	sacrifice	2	frozen	sex, age, morphom measurements
	Ross	repro./abdominal tissue, teeth	<5	1977-91	Antarctic Peninsula	NMML, Seattle	sacrifice	2	formalin, alcohol, or frozen	sex, age, morphom measurements
	leopard	gonads and teeth	<50	1977-91	Antarctic Peninsula	NMML, Seattle	sacrifice	2	formalin	sex, age, morphom measurements
T. Øritsland Institute of Marine Research P.O. Box 1870-72 Nordnes N-5024 Bergen, Norway Tel: +47 5-23-8500 FAX: +47 5-23-8387	crabeater	reproductive tissues and teeth	<300	1964	west of South Orkney Islands	Bergen, Norway	sacrifice	2	formalin (soft tissues) or dry (teeth)	sex, age, morphom measurements
	leopard	reproductive tissues and teeth	<100	1964	west of South Orkney Islands	Bergen, Norway	sacrifice	2	formalin (soft tissues) or dry (teeth)	sex, age, morphom measurements
	Ross	reproductive tissues and teeth	<20	1964	west of South Orkney Islands	Bergen, Norway	sacrifice	2	formalin (soft tissues) or dry (teeth)	sex, age, morphom measurements

research programs may not wish to alter their protocols because of their need to maintain consistency with previous research efforts.

60. The satellite PTTs currently in most common use for Antarctic pinniped studies are those manufactured by Wildlife Computers because these have been shown to operate well on Antarctic pack ice seals. If any new designs of instruments are developed and deployed during the APIS study period, they should, ideally, have data formats which are comparable with the data formats produced by the Wildlife Computers instruments so that collaborative analyses are possible.

Specimen Material Task Group

61. It was noted that a fair amount of specimen material collected from pack ice seals in the past is currently available from archival collections. This material could be useful both in directly answering some of the APIS research questions (e.g., age structure, reproductive trends) as well as helping to prepare for new studies to be conducted during APIS field work (e.g., developing genetic probes for Antarctic phocids). As an aid to identifying material that may be available for analysis, a summary was drafted during the meeting (Table 4). Colleagues are requested to update this table as possible.

Table 5. Research categories for which it would be desirable to coordinate the collection, processing, and analysis of APIS specimen material and other data.

Type of analysis for which specimen material or recordings are to be collected and for which protocols need to be adopted or agreed	Summary of selected data collection/analysis protocols that are already developed and of possible relevance to the APIS Program
Age estimation (teeth, toenails, jaws)	Chapters 8 (morphometrics, specimen collection, and preservation) and 11 (age determination) in Laws, R.M. (ed.), 1993, Antarctic seals: research methods and techniques, Cambridge University Press.
Reproduction (gonads, blood, urine)	Chapters 8 (morphometrics, specimen collection, and preservation) and 12 (reproduction) in Laws, R.M.(ed.), 1993, Antarctic seals: research methods and techniques, Cambridge University Press.
Genetics (tissue, blood)	Chapter 9 (genetic-based studies for stock separation) in Laws, R.M. (ed.), 1993, Antarctic seals: research methods and techniques, Cambridge University Press; Hoezel, A.R. (ed.), 1991, Genetic ecology of whales and dolphins, Report of the International Whaling Commission, Special Issue 13; Hoezel, A.R. & G.A. Dover, 1989, Molecular techniques for examining genetic variation and stock identity in cetacean species, Report of the International Whaling Commission, Special Issue 11.
Ecotoxicology (tissue) Organochlorines Heavy metals Others	Chapter 10 (collection of material for determination of organochlorines and heavy metals) in Laws, R.M. (ed.), 1993, Antarctic seals: research methods and techniques, Cambridge University Press; Geraci, J.R. & V.J. Lounsbury, 1993, Marine mammals ashore: a field guide for strandings; IWC, 1995, Report of the workshop on chemical pollution and cetaceans, SC/47/Rep2.

Health and disease (tissue, blood) Haematology Immunology Microbiology Pathology Parasitology	Geraci, J.R. & V.J. Lounsbury, 1993, Marine mammals ashore: a field guide for strandings; Tissue bank guidelines, U.S. Armed Forces Institute of Pathology (AFIP).
Diet (stomach, scat, blubber)	Chapter 13 (diet) in Laws, R.M. (ed.), 1993, Antarctic seals: research methods and techniques, Cambridge University Press.
Vocalizations (recordings)	Chapter 6 (vocalizations) in Laws, R.M. (ed.), 1993, Antarctic seals: research methods and techniques, Cambridge University Press.

62. In order for it to be possible to fully interpret data from specimen analyses, it is important to have associated biological data. Investigators were encouraged to try to link the following types of data with specimen material:

i)sex, age, reproductive status, physical and physiological condition, molt stage,

ii)method of specimen collection (animal found dead, sacrificed, fisheries bycatch, from live animal), and

iii)quality of source material (live, fresh, beginning to decay, advanced decay).

63. For each type of study that requires specimen material, the APIS Program needs to identify or develop agreed data collection protocols. During the meeting, the task group was able to list several protocols which are already currently available (Table 5). The task group will evaluate these existing protocols and recommend which should be adopted or adapted by APIS, and for which topics new protocols need to be developed.

64. There are a number of laboratories with analytical expertise relevant to different types of specimen analyses. These laboratories and research groups need to be identified so that their potential interest in becoming involved with the APIS Program can be determined. Furthermore, researchers at these laboratories may wish to contribute ideas on how pinniped specimen material should be collected during the APIS Program (see the section on centers of analytical expertise below).

PROGRAM-WIDE COORDINATION

Logistics

65. One of the chief areas where program-wide coordination will be required is in arranging logistic support for APIS Program activities. A principal motivation for developing the APIS Program structure was the desire to overcome the past lack of adequate logistic support for Antarctic pack ice seal research. By funding and scheduling a relatively large number of pinniped research projects that plan to share logistic support within a finite time period (5 years), researchers will have significantly more research platforms available to them for the duration of their projects than would normally be available within a single national program. By cooperating among national programs, overall costs can be kept lower, and opportunities for researchers from all nations can be enhanced.

66. Throughout most of the APIS Program field work phase (1995/96 through 1999/2000), it is anticipated that there will be many bi- and multi-lateral collaborations to share logistic resources among pinniped researchers (e.g., scientists from two or more countries aboard a ship provided by one national program) and with other research programs (e.g., SO-GLOBEC). For the most part, close program-wide logistic coordination among these collaborations will not be required. But APIS investigators should be encouraged during their planning process to build into their logistic requests extra berths aboard ships and at stations so that they can offer these to other APIS investigators who could benefit from the logistic support in that geographic area, time of year, or that particular field season (e.g., if their national program did not have ship time available for them in that year).

67. To be successful, it is essential that the circumpolar survey planned for the 1998/99 austral summer be closely coordinated among all national programs deploying ships and aircraft as part of this multi-national effort. A preliminary description of the geographic coverage required has already been given in the section on the Abundance and Distribution Task Group (see Figure 1). Researchers are encouraged to consult as soon as possible with their respective logistics coordinators to ensure that appropriate requests and arrangements for ship time and aircraft support are being incorporated into national programs' long-term planning. As these arrangements develop, there must be good communication among APIS investigators and logistics coordinators in various national programs so that plans and scheduling can be adjusted as necessary to ensure that the circumpolar survey has adequate spatial and temporal coverage.

68. When planning the spatial and temporal coverage for surveys of seal abundance and distribution, it was agreed that fixed-wing aircraft may be able to "fill the gaps" in the coverage left by ships and helicopters due to their relatively limited range. The potential utility of conducting pack ice seal surveys from fixed-wing aircraft should be evaluated as a matter of priority in the program's early years to see if they can be used to provide broader coverage and in areas not otherwise accessible by ships and helicopters.

69. IAATO. The APIS Program's attention was drawn to a recent call for proposals from the International Antarctic Association of Tour Operators (IAATO), which was issued during the 1995 Antarctic Treaty consultative meeting in Seoul. Recognizing that research in the Antarctic is expensive and that member companies are committed to supporting science, IAATO has called for proposals by Antarctic national programs, Antarctic organizations, and individual researchers. IAATO members are prepared to provide continuing support to science on a number of levels, to the best of their ability:

i)transporting scientists, support personnel and equipment,

ii)conducting surveys and research following standard protocols,

iii)carrying scientists who engage in research aboard tour ships, and

iv)providing relevant data on individual sites.

Proposals for collaborative projects may be made to individual companies or through the IAATO Secretariat. In some cases, there may be a cost for services provided.

Centers of analytical expertise

70. A major aim of the APIS Program is to promote coordinated research activities and to establish links between research groups, some of which may not have been involved previously in research on Antarctic seals, but which may have specific interests and expertise that could be vital to achieving the scientific objectives of the program. Field research projects on Antarctic pack ice seals are usually costly and, by necessity, involve a limited number of personnel. However, each field project has the capacity to service the needs of several laboratory-based projects so long as the samples or materials are collected in the appropriate manner. Specific subjects which could be approached in this way are genetics, diet, age estimation, ecotoxicology, health and disease, reproductive status, and vocalizations.

71. To begin establishing a network of expertise in these subjects and to provide coordination, a list of potential collaborating laboratories was prepared (Table 6). It was agreed that the Chairman of the Steering Committee would write to each of these laboratories/scientists to inform them of the APIS Program and to invite them to participate by seeking funding in collaboration with one of the APIS projects or by seeking independent funding.

72. While it may be desirable in some circumstances to encourage links between centers of analytical expertise and individual field projects, in many cases more progress could be made by pooling samples (e.g., for genetics) from several field projects and by having these analyzed as a group at one or several laboratories. In these circumstances, a member of the APIS Steering

Committee would act to promote networking between research groups to facilitate the exchange of samples and information. Dr. Boyd agreed to serve as this coordinator.

73. The group agreed to defer, until the responses to the Chairman's letter could be evaluated, any decision about the criteria to be used for assessing the technical qualifications of particular laboratories. In many cases, this will be a decision made by the leaders of specific field research projects, but it may be appropriate for APIS to provide guidance about which criteria have to be met by a laboratory before APIS will recommend that it should be designated to receive and process samples. There may also be cases in which specific laboratories may be asked to archive material for subsequent analyses (e.g., for toxicology studies).

Complementary data

74. In contrast to most previous research cruises in the pack ice zone, where seal work was often "piggy-backed" onto cruise tracks developed by other disciplines (e.g., oceanography, lower trophic level processes), investigators in the APIS Program will set ship track lines designed to answer APIS research questions. To complete the ecological picture of what is occurring in these areas, APIS researchers will invite the participation of scientists in other disciplines.

75. Important sources of complementary data for these purposes include physical oceanographers, who can shed light on the physical forcing within ecosystems; biological oceanographers and zooplankton researchers, who are interested in the biological productivity and prey abundance/ distribution in different areas; scientists studying non-pinniped upper trophic level species such as seabirds and whales; and researchers who are experts in remote sensing technology, such as sea ice, sea surface temperature, and water currents, who can assist in providing a regional and circumpolar perspective to smaller-scale studies.

76. Mr. Burton presented the results of a project that had used seals as platforms for oceanographic research. Information about physical oceanography was obtained from instruments deployed on southern elephant seals at Macquarie Island. These instruments were archival recorders, but the technology could also be incorporated into satellite-linked units. His presentation provided important insights into both the type of technology which could be applied to pack ice seals and into large-scale spatial and temporal oceanographic patterns affecting the ecology of the Southern Ocean.

77. In considering the importance of incorporating complementary data into APIS studies, the group

Table 6. Laboratories and research groups with specialized analytical expertise pertaining to APIS research activities. These groups are sources of potential collaboration, and some may be candidates for becoming APIS Centers of Analytical Expertise. The name of the person at the current meeting who suggested a particular entry is shown in parentheses.

Age estimation J.L. Bengtson, National Marine Mammal Laboratory, Seattle, WA USA G. Klevezal, Koltzon Institute of Evolutionary Biology, Moscow, Russia (B. Stewart)
Reproduction J.L. Bengtson, National Marine Mammal Laboratory, Seattle, WA USA I.L. Boyd/R.M. Laws, British Antarctic Survey, Cambridge, U.K.
Genetics Mark Adams, Evolutionary Biology Unit, S. Australian Mus. North Tce, Adelaide S.A. 5000, Australia (P. Shaughnessy) Bill Amos, Dept. Of Genetics, Cambridge University, Downing Street, Cambridge CB2 3EH UK (I. Boyd) Andrew Dizon, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA, 92038 USA (B. Stewart) T.J. Robinson, Dept. of Zoology and Entomology, University of Pretoria, Pretoria, 0002 South Africa (M. Bester) D.B. Siniff, Dept. of Ecology, Evolution and Behavior, University of Minnesota, St. Paul, MN 55108 USA Helen Stanley, Conservation Genetics Group, Institute of Zoology, Regents Park, London, NW1 4RY U.K. (I. Boyd) Curtis Strobek, Dept. of Biology, University of Alberta, Edmonton, Alberta, T6G 2E9 CANADA (I. Stirling)
Ecotoxicology Asuncion Borrell and Alex Aguilar, Dept. De Biologia Animal Vertebrates, Universitat de Barcelona, Barcelona, SPAIN Silvano Focardi, Dip. Di Biologia Ambientale, University of Siena, via delle Cerchia 3, 3100 Siena, Italy (A. Aguilar) Claude Joiris, Laboratory for Ecotoxicology, Free University of Brussels, Pleinlaan, 2 B-1050 Brussels, Belgium (D. Vergani) National Wildlife Research Center (toxicology), Ottawa, Canada (I. Stirling) Michael Oehme, Lillistrom, Norway (dioxins)

Health and disease

Immunological and Wildlife Health Group, University of California Davis (Immunology), Davis, CA USA (P. Yochem)

V. N. Maltsev, YugNIRO 334500 Kerch, 2 Sverdlov St, Crimea, Ukraine (Parasitology)

Richard Norman, Vet. Clinical Ctr., Univ. of Melb., Princes Highway, Werribee VIC 3030 Austr. (Parasit.) (P. Shaughnessy)

Daniel Torres, Instituto Antartico Chileno, Luis Thayer Ojeda 814, Casilla 16521, Correo 9, Santiago, Chile (Parasitology)

Pamela Yochem, Hubbs-Sea World Research Institute, 2595 Ingraham Street, San Diego, CA 92109 USA

Diet

Peter Nicholls, CSIRO Division of Oceanography, GPO Box 1538, Hobart, Tasmania 7001, Australia (H. Burton)

Taro Ichii, National Institute for Far Seas Fisheries, Shimizu, Japan (J. Bengtson)

Vocalizations

Ted Miller, Biology Department, Memorial University, St. John's, Newfoundland A1B 3X9 Canada (E. Miller)

Tracey Rogers, Department of Veterinary Anatomy, University of Sydney NSW 2006, Australia (P. Shaughnessy)

Ian Stirling, Canadian Wildlife Service, 5320-122 St., Edmonton Alberta T6H 3S5 Canada

Jeanette Thomas, Western Illinois University, 6502 34 Ave, Moline, IL 61265 USA (I. Stirling)

emphasized that accurate data on pack ice distribution and characteristics are essential. Sea ice data are especially important for stratifying survey design and analyses, and it is therefore essential that plans for acquiring such data be in place well before the circumpolar survey in 1998/99. It was agreed that this topic would be addressed as a matter of priority at the next APIS planning meeting.

Data integration

78. Each of the scientific task groups for the APIS program was asked to consider the extent to which some system of data integration or management would be useful for different research topics, and as necessary, provide recommendations on the most practical methods for accomplishing such coordination. It was agreed that at this stage in the APIS Program's development, there was no need to establish a central database. However, because it is expected that data on some topics will be collected and brought together for subsequent analyses (especially for those topics where data from various areas will be compared, such as the circumpolar survey of abundance and distribution), discussions should be started as soon as possible on effective mechanisms for bringing these data together.

79. The potential desirability of linking into or utilizing databases that already exist was also discussed. Several potentially relevant databases include:

i)SCAR Group of Specialists on Seals' pinniped tagging and marking database,

ii)CEMP database on sea ice distribution,

iii)SCAR cartographic and bathymetric database, and

iv)Other databases on sea ice characteristics and distribution (e.g., U.S. Navy/NOAA Joint Ice Center).

Liaison with other groups

80. A recurring theme within the reports of previous APIS planning meetings has been the need for the APIS Program to function as a forum within which scientists working on Antarctic pinnipeds are able to integrate their research with other international research initiatives in the Antarctic. This approach was re-endorsed at the current meeting, which recognized the need to ensure that APIS was represented whenever possible at planning meetings of other relevant research programs. This liaison would ensure appropriate scientific and logistical integration of APIS with these other programs.

81. Both the SO-GLOBEC and Coastal Zone EASIZ programs are potentially important sources of complementary data for the APIS program. Copies of this report will be sent to the Conveners of SO-GLOBEC and EASIZ. At present, APIS is not represented on the Steering Committees for either of these important programs, but it would be helpful for a member of the APIS Steering Committee to attend relevant meetings of the respective Steering Committees of each of these programs to explain the APIS Program's objectives, implementation plans, and progress in program development.

82. CCAMLR. Because the crabeater seal is a species selected for monitoring within the CCAMLR Ecosystem Monitoring Program (CEMP), plans to develop the APIS program have received strong support from CCAMLR. This has resulted in financial support to APIS from CCAMLR to assist with funding planning meetings. The APIS program will contribute valuable biological data that will assist CCAMLR with its mission to manage the marine living resources of the Southern Ocean from an ecosystem perspective. Through Dr. Boyd, the APIS Program has direct representation at the CCAMLR Working Group on Ecosystem Monitoring and Management (WG-EMM), and this report was completed for presentation at the WG-EMM meeting in Siena, Italy, during late July 1995.

83. Whales and seabirds are potentially important competitors for food with Antarctic pack ice seals and it is important that APIS research should be integrated as much as possible with investigations of these species. The APIS research prospectus and implementation plan were circulated at the 1995 meeting of the IWC Scientific Committee, which is the main forum for coordinating research on Southern Ocean cetaceans. In addition, information on APIS activities will be sent to the Convener of the SCAR Bird Biology Subcommittee to solicit interest in collaborative research on seabirds during APIS cruises.

84. COMNAP. To promote close liaison with planning activities at the national program level, COMNAP (Council of Managers of National Antarctic Programs) had been invited to nominate a member of the APIS Steering Committee. Although at the time of the current meeting COMNAP had not yet designated its representative, the meeting reaffirmed that having COMNAP involved in APIS Program planning would do much to enhance effective coordination among national programs. The Chairman was requested to follow-up on this matter by correspondence.

Communication and meetings

85. Promoting effective communication among Antarctic pack ice seal investigators is a fundamental goal of the APIS Program. With the advent of electronic mail and the Internet, communication around the world is becoming increasingly easy. Participants were encouraged to utilize e-mail to keep in touch with each other. The Steering Committee will also consider the feasibility of setting up an APIS Program bulletin board or list server on the Internet.

86. Beginning with this report, the APIS Program has initiated a report series to disseminate information. It is expected that reports of planning meetings, technical workshops, and information on methodological protocols will be included in this series. In addition, the Steering Committee will evaluate the possibility of distributing an APIS newsletter periodically to inform the broad scientific community of developments within the program.

87. Most of the work of the APIS Steering Committee and the four task groups is to be carried out by correspondence. However, it will be necessary to meet for planning and workshops occasionally throughout the APIS field work phase and for subsequent analyses. The APIS workshop and meetings that were held during the past three years were instrumental in developing the program. Now that the program's 5-year field work phase is starting (1995/96), it is likely that planning meetings will continue to be necessary on an approximately annual basis.

88. At present, there are two APIS meetings scheduled for 1996: a) a programmatic planning meeting, and b) a workshop by the Abundance and Distribution Task Group. These have both been provisionally scheduled for the period just prior to the SCAR meetings, to be held in Cambridge, U.K., in July 1996. Dr. Boyd agreed to contact the local committee for the SCAR meetings to

confirm their dates, and then to investigate options for making the necessary arrangements for the APIS meetings.

Funding

89. To be effective in coordinating multinational research undertaken as part of the APIS Program, dedicated funding for program administration will be required. The main purpose of these funds would be to bring program participants together for planning meetings, workshops, and collaborative analyses. Although funds to support individual research projects will need to be secured from national programs, this additional support is required to facilitate the overall coordination of the program.

90. The APIS Program has been assisted greatly over the past several years by receiving financial support from CCAMLR, SCAR, the U.S. National Science Foundation, and the U.S. Department of State. That support made it possible to bring researchers together to begin developing the APIS Program. As such support will be needed in the future, all program participants were urged to seek sources of financial support that could be used by the program to continue its coordinating role. In addition, the Steering Committee was tasked with soliciting financial support from groups such as foundations, funding organizations, and corporations.

Close of the meeting

91. The Chairman thanked all of the participants for their valuable contributions, hard work, and good humor throughout the meeting, which had resulted in very productive sessions. He noted that the participation at this meeting of researchers from so many national programs provided ample evidence that there is broad interest in the APIS Program, and wide agreement that it is addressing important scientific questions. As the program begins its field work phase during the forthcoming austral summer, several research groups have already developed plans to work together collaboratively as part of the APIS Program. This quick start with field work and international collaboration bodes well for the program's future success.

92. In closing the meeting, the Chairman thanked the Alaska Fisheries Science Center and the National Marine Mammal Laboratory for providing such a pleasant and productive venue for the meeting. Special thanks were extended to the staff of the National Marine Mammal Laboratory for their cheerful and effective assistance with all phases of the meeting. On behalf of the meeting participants, Dr. Laws expressed the group's appreciation to Dr. Bengtson for his efforts in making preparations for the planning meeting and for chairing its sessions so effectively.

Appendix 1. List of participants in the APIS Program planning meeting, Seattle, 7-9 June, 1995.

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Appendix 2. Agenda for the 1995 APIS Program planning meeting, 7-9 June 1995, Seattle, USA.

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1. Welcome
   a. Overview of the GSS and the APIS Program
   b. Meeting schedule and logistics
   c. Adoption of the agenda

2. Progress reports
   a. Interactions with international groups and research programs
   b. Developments within national programs

3. Seal data collection techniques (are standard methods needed?)
   a. Studies benefiting from coordination (distribution, abundance, and species composition; habitat use and seasonal movements; diving, feeding behavior, and activity patterns; diet?)
   b. Other studies (genetic identity of populations; seals as platforms for oceanographic research; population dynamics; energetics and physiology; toxicology and disease)

4. Complementary data (requirements and strategies)
   a. Competitors (e.g., seabirds)
   b. Prey (e.g., krill, fish, squid)
   c. Biological oceanography (e.g., primary production)
   d. Physical oceanography (e.g., sea ice, water mass structure)

5. Database requirements
   a. Data management needs within APIS
   b. Advantages/disadvantages of various database types

6. Collaborative opportunities
   a. Sharing logistic platforms
   b. Centers of analytical expertise
   c. Collaborative analyses and modeling

7. Areas of operation
    a. Approach to apportioning effort in the 5 APIS areas
    b. Needs for focusing on special areas

8. Schedule and timing
    a. Requests for ship and aircraft support
    b. Data collection (synoptic and seasonal)
    c. Planning meetings and workshops

9. Communications and reporting
    a. Reporting structure
    b. Newsletter
    c. Electronic bulletin board

10. Funding strategies
    a. National programs
    b. Independent funding

11. Closing of the meeting

Appendix 3. List of documents circulated at the APIS Program planning meeting, 7-9 June 1995, Seattle, USA.

1.Bengtson, J.L., A.S. Blix, I.L. Boyd, M.F. Cameron, M.B. Hanson, and J.L. Laake. [In review.] Antarctic pack ice seal research, February-March 1995. Antarctic Journal of the United States.

2.Bengtson, J.L., A.S. Blix, I.L. Boyd, M.F. Cameron, M.B. Hanson, and J.L. Laake. [Research plan and field protocols.] Ecology, biology, and behavior of Antarctic pack ice seals: research cruise aboard the USCGC *Polar Star*, February-March 1995.

3.Bester, M.N. [Letter.] Written contribution to the 1995 APIS planning meeting: comments received from Marthan Bester (May 1995).

4.Bester, M.N., A.W. Erickson, and J.W.H. Ferguson. [In review.] Seasonal change in the distribution and density of seals in the pack ice off Princess Martha Coast, Antarctica. Antarctic Science.

5.Gambell, R. [Letter.] Response from Dr. Ray Gambell, Secretary to the IWC, confirming that the APIS research prospectus and implementation plan were distributed at the 1995 IWC meeting.

6.Gelatt, T.S. and D.B. Siniff. [In review.] Line transect survey of Antarctic seals in the Amundsen-Bellingshausen Seas, 1994. Marine Mammal Science.

7.Holsbeek, L., C. Joiris, and D. Vergani. [Unpublished manuscript.] Weddell Sea winter distribution of seals; observations during the ANT X/4 expedition: June-July 1992.

8.Joiris, C. 1991. Spring distribution and ecological role of seabirds and marine mammals in the Weddell Sea, Antarctica. Polar Biol., 11:415-424.

9.Joiris, C., L. Holsbeek, and D. Vergani. [Proposal.] Free University Brussels Belgium - Instituto Antartico Argentino, Proposal into the APIS-project.

10.Joiris, C.R. and W. Overloop. 1991. PCBs and organochlorine pesticides in phytoplankton and zooplankton in the Indian sector of the Southern Ocean. Antarctic Science, 3:371-377.

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Appendix 4. Provisional agenda for the 1996 workshop of the Abundance and Distribution Task Group.

I. Background information

a) Introduction

b) Line transect sampling concepts

c) Presentations on pilot survey methods and results

II. Circumpolar survey design

a) Proposed design

b) Review of national program survey plans

III. Survey implementation

a) Data requirements

b) Platform specifications

c) Data collection techniques

d) Data recording

e) Survey protocol definition

IV. Haul-out observations

a) Opportunities for static counts

b) Review of Behavior/Movement task group recommendations

c) Coordination of national plans for tagging

APIS

ANTARCTIC PACK ICE SEALS

An international research program coordinated by the SCAR Group of Specialists on Seals

Participation in the APIS Program is open to everyone who would like to become a collaborating contributor. Pinniped scientists, as well as those who study complementary elements of Antarctic marine ecosystems (see the section on page 18), are encouraged to join in the planning and implementation of this international research initiative.

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Provisional map showing the anticipated sector coverage for deployment of ships and aircraft by national programs during the 1998/99 circumpolar survey of Antarctic pack ice seals.