

## REPORT OF BIOLOGICAL OCEANOGRAPHY COMMITTEE



The Biological Oceanography Committee met on October 22 (13:30-16:20). The Chairman Dr. Patricia A. Wheeler called the meeting to order and welcomed the members of the Committee and observers (see Endnote 1). Dr. Vladimir I. Radchenko served as rapporteur.

Suggestions were made about the agenda and the revised agenda was approved.

Dr. Wheeler distributed copies of a draft strategic plan for the BIO Committee that reviewed past activities and outlined plans for the future. The BIO Committee agreed with the recommendations for further integration of symposia and sessions with other PICES committees and international organizations, increased level of attendance for science committees, working groups, and task teams, and increased support for students to attend PICES meetings.

Dr. Wheeler reviewed the PICES rules for choice of the new BIO Chairman. The formal election was conducted by Dr. W. Doug McKone, PICES Executive Secretary. Dr. Tsutomu Ikeda was nominated and elected by acclamation in accordance with the Rules of Procedure.

The PICES Secretariat would like to expand the information reported through its web page and BIO selected Dr. Linda Jones to serve as the initial contact advisor for the Secretariat.

Dr. Wheeler reported on the plans for an ICES/PICES workshop on Zooplankton Ecology in April/May of 2000. BIO discussed the proposal and recommends Dr. T. Ikeda, BIO Chairman-elect to nominate a Committee Member to serve as the main PICES representative in planning this workshop.

Dr. Wheeler reported on the PICES plan for a 4-day conference on “*El Niño and Beyond: A*

*conference on Pacific climate variability and marine ecosystem impacts from the Tropics to the Arctic*” in March or April 2000. The BIO Committee discussed the proposed conference and voted by acclamation in favor of supporting the proposal.

Dr. Richard D. Brodeur reported on the first meeting of Working Group 14 on Micronekton. Working Group 14's terms of references were expanded to include the ecological role of micronekton in addition to sampling methods. The first report of Working Group 14 is attached (see Endnote 2).

Dr. Allen Macklin gave an update on the Bering Sea Metadata project and invited input of additional data.

Mr. Robin M. Brown described the proposal for a TCODE Workshop on Data Visualization. The BIO Committee discussed the proposal and voted by acclamation in favor of supporting the proposal.

Dr. Paul J. Harrison described the proposal for a CCCC Advisory Panel to help develop the proposal for an Iron Fertilization Experiment in the North Pacific. The BIO Committee discussed the proposal and recommended it for Science Board approval by acclamation with special note to future CCCC Advisory Panel members on the necessity of careful controls and addition of measurements to understand underlying processes.

Nominations were tabulated for the Best Presentation Award. Based on these nominations the BIO Committee selected a short list of seven candidates and voted for Dr. Kazuaki Tadokoro (with T. Sugimoto), “Importance of low saline advected water from the Sea of Okhotsk for spring blooming of phytoplankton in west side of the North Pacific Ocean”, as the 1998 Best BIO Presentation.

Dr. George L. Hunt and Dr. Hidehiro Kato presented a summary of WG 11 progress (see Endnote 3). The final report will be submitted to BIO in spring 1999. BIO will review the final report and recommendations, and forward it with comments to SB prior to PICES VIII. WG 11 proposed several suggestions for establishing a three year Study Group on Marine Mammal and Seabird Ecology. The BIO Committee discussed these proposals and recommended approval by Science Board. On behalf of the BIO Committee, Dr. Wheeler thanked Drs. Hunt and Kato for their efforts.

The BIO Committee discussed potential Topic Sessions for PICES VIII. Past unselected topics and new topics were discussed. A short list of possible topics was generated and the Committee selected "Recent findings of GLOBEC and GLOBEC-like programs in the North Pacific" as the next BIO/CCCC Topic Session. Possible BIO Co-Conveners are Drs. Vladimir I. Radchenko, Mark D. Ohman and David L. Mackas. The topic "Coastal eutrophication, phytoplankton dynamics, and harmful algal blooms" as a special MEQ/BIO session was also approved if scheduling permits. Dr. Kwang-Woo Lee was recommended as a possible Co-Convener. The BIO Committee noted that this MEQ/BIO session might have greater attendance at PICES IX in Japan. Other topics suggested for PICES IX include "Marine Birds and Mammals", "The Importance of Microbial Loop Processes and Cycling of DOC", "Zooplankton Dynamics and Top-down Control" and as a result of the Science Board Symposium, "A Regional Comparison of Annual Production".

Dr. Wheeler announced the schedule for the availability of the drafted minutes from this meeting and requested comments by 13:30, October 23, and written final approval by 18:30, October 23.

## Scientific Program

The following scientific papers were presented from the BIO Committee sponsored part of the program.

*Controlling factors for lower trophic levels (especially phytoplankton stocks).* Co-Convenors: Vera Alexander (U.S.A.), Akira Taniguchi (Japan) & Paul J. Harrison (Canada)

Akihito Shiimoto. Controlling factors for phytoplankton biomass in the subarctic North Pacific

Karl Banse. Phytoplankton fall blooms in the open western and eastern subarctic Pacific: added iron or relaxed grazing?

Paul J. Harrison, P. Boyd & R. Goldblatt. Is there a connection between dust and fish? How is bottom up and top down control turned on and off?

Takashige Sugimoto & K. Tadokoro. Interdecadal variations of plankton biomass in the North Pacific

Kazuaki Tadokoro & T. Sugimoto. Importance of low saline advected water from the Okhotsk Sea for spring blooming of phytoplankton in west side of the North Pacific Ocean

Katsuyuki Sasaki, K. Kawasaki & K. Nakata. The change of chlorophyll *a*, nutrients and photosynthesis from subtropical to transition region in June around Kuroshio Extension

Terry E. Whitley & D.A. Stockwell. Deep phytoplankton uptake and growth on the southeast Bering Sea shelf in 1997 and 1998

Jun Nishioka, S. Takeda & C.S. Wong. Change in the concentrations of iron in different size fractions during a phytoplankton bloom in control ecosystem enclosures

## Endnote 1

### Participants

#### Canada

Paul J. Harrison  
David L. Mackas

#### China

Ming-Yuan Zhu

#### Japan

Takashige Sugimoto  
Atsushi Tsuda

#### Korea

Jae-Hyung Shim

#### Russia

Vladimir I. Radchenko

#### U.S.A.

Linda Jones  
Michael M. Mullin  
Patricia A. Wheeler

## Endnote 2

### Report of Working Group 14

#### Effective sampling of micronekton to estimate ecosystem carrying capacity

The meeting was chaired by Dr. Richard D. Brodeur, since neither of the two Co-Chairmen (Robison/Parin) were able to attend.

Brodeur noted the complete absence of Chinese and Korean members and the representation of Russia by a non-WG 14 member. PICES should act to guarantee participation by these nations in subsequent WG 14 meetings.

Drs. Jeffrey M. Napp and Brodeur two years ago and was approved by PICES BIO Committee in 1997. Original goal of the Micronekton WG proposal was to examine the various collection techniques currently being used to sample micronekton. BIO subsequently expanded this mandate to encompass an overall assessment of our current understanding of micronekton biology and their role in the North Pacific.

#### Introductions

WG 14 members and other attendees introduced themselves and their interests in WG 14. Interests expressed included:

- Micronekton distributions
- Micronekton feeding ecology
- Role of micronekton in exporting Carbon from surface waters
- Position of micronekton in North Pacific food web
- Micronekton as food for other predators (salmon, other fish, mammals, birds)
- Micronekton life histories.

#### Terms of Reference

Dr. Patricia Wheeler (BIO Chairman) reviewed the Terms of Reference for WG 14 as well as general Working Group Guidelines. The guidelines include:

- All WG 14 activities to be coordinated by the two Co-Chairmen.
- Product of WG 14 is to be a report presented to BIO after 3 years.
- May be followed up by special workshops, etc.
- WG 14 will report annually to both BIO and FIS Committees at PICES Annual Meetings.
- Any changes to the Terms of Reference must be approved by BIO and SB.

#### History of WG 14

Dr. Brodeur gave a brief overview of the genesis of WG 14. The idea was originally proposed by

## **Definition of micronekton**

A discussion ensued as to how WG 14 will define micronekton for its purposes. It was pointed out that there are a variety of definitions based variously on size, swimming ability, Reynolds numbers, etc. The basic question revolved around whether to include adult euphausiids and other large zooplankton which border on micronekton since this would significantly increase the scope of the WG. It was decided that since WG 14 will focus primarily on oceanic rather than shelf communities, micronekton will be defined to include: mesopelagic fishes, squids, pelagic shrimps and mysids, plus adult euphausiids. The group decided not to include shelf forage fishes such as capelin, herring, and sand lance as these were already covered by PICES Working Group 3.

## **Past studies of micronekton and availability of existing data**

Dr. Brodeur pointed out that although a substantial micronekton literature does exist, it is often neither widely available nor widely read. Particularly important starting points might include the 1988 two-volume set from the joint NSF-JSPS Honolulu Symposium edited by Nemoto and Percy, plus a special volume of Biological Oceanography devoted to micronekton, also edited by Dr. William G. Percy. A list of other notable papers was provided by Dr. Brodeur to assist those WG members less familiar with the micronekton literature.

## **Sampling problems**

A discussion ensued regarding likely sampling problems that the group might want to address. As a starting point, Dr. Brodeur suggested the WG conduct an e-mail survey of various micronekton researchers in order to establish what gears are currently in use around the world. Such a survey should also include the opportunity for respondents to outline collection problems associated with various gear-types. It

was also noted that the survey should ask why various agencies collect micronekton, since there was a feeling among the members that in many cases micronekton are primarily by-catch, and are rarely targeted explicitly.

Dr. Percy noted that big nets are not great for quantifying micronekton due to problems with unquantified levels of escape and avoidance behavior. Alternatives might include the use of acoustics or devices such as “pop-up nets”.

Dr. Michael M. Mullin pointed out that much of the initial work on micronekton was motivated by US Navy interests in deep scattering layers. This source of funding no longer exists and so it was noted that future efforts to mount targeted sampling programs for micronekton may be harder to fund.

The Japanese are currently collecting acoustic data on micronekton, but since they have yet to establish target strengths, they have been unable to estimate biomass. There was a general consensus that as acoustics will figure prominently in future micronekton studies, target strength research should be encouraged.

Other possible sampling techniques show some promise for studying micronekton, including the use of video cameras and ROV's. These techniques may prove particularly useful for understanding the behaviors of micronektonic species, especially those that spend part of the diel cycle very close to the bottom (e.g., some mysids and euphausiid species) where they are unavailable to traditional sampling gear. It was suggested that combinations of nets, acoustics and cameras may be the optimal solution.

## **Planned micronekton work for the coming year**

- i. There will be a Hokkaido University micronekton sampling program (led by Dr. Yasunori Sakurai) in the Gulf of Alaska and the Bering Sea in the summer of 1999, aboard the *Oshoro Maru*. Data will first be collected via stomach analysis of micronekton predators (e.g. salmon)

collected with gillnets. This will be followed up with midwater trawl surveys specifically targeting micronekton. The trawl to be used will measure 4m x 20m and will primarily target small squid.

- ii. There is currently funded U.S. proposal (led by Sinclair and Percy) to sample micronekton in the Green Belt region of the Bering Sea and the first cruise will take place in April 1999. The Green Belt region is an important area for feeding by marine mammals and birds.
- iii. US GLOBEC Gulf of Alaska Monitoring component currently runs a north-south line that samples for micronekton at least once a year. There may also be micronekton sampling during two cruises in the Bering Sea in April and June of 1999 (led by Coyle).
- iv. GLOBEC Canada is currently beginning to think about plans for their Phase II funding cycle. WG 14 should keep in touch with GLOBEC Canada to see whether field work might include the collection of micronekton samples.
- v. Drs. Brodeur, Peterson, and Wilson are undertaking a sampling program that used Methot nets to sample micronekton off the outer Continental Shelf from California to B.C. with sampling in 1995 and 1998. There is also a proposal to use NOAA vessels returning to Seattle via Kodiak to

collect micronekton during the winter in the Subarctic Gyre.

- vi. Dr. Skip McKinnell (Canada) offered the use of a collection of some 60 dolphin stomachs collected in the central north Pacific Transition Zone during the summer of 1991 as potential sampling devices of micronekton.

#### **WG 14 Plans for the coming year**

- e-mail survey of researchers currently collecting micronekton.
- literature review of micronekton studies and circulation of key papers to all WG members
- Dr. Brodeur proposed a draft Table of Contents for the WG 14 final report to BIO. A discussion arose as to whether the group wanted to aim for a publication quality product that would serve as a “state of our existing knowledge” document about micronekton in the North Pacific. Dr. Brodeur will raise the issue with BIO.
- current plan is for WG 14 to meet again at next year’s PICES Meeting in Vladivostok, Russia, or perhaps in conjunction with the MONITOR Task Team meeting in Hakodate, Japan, prior to PICES. If we cannot ensure sufficient attendance at that meeting we may approach BIO for funds to meet at some more convenient time.
- there will be some need to change the membership of the WG to account for gaps in expertise and/or national representation.

### **Endnote 3**

#### **Report of Working Group 11 Consumption of Marine Resources by Marine Birds and Mammals in the PICES Region**

PICES WG 11 met October 14 to 17, 1998, in Fairbanks, Alaska, U.S.A., to estimate the biomass of prey required to support populations of marine mammals and seabirds in selected regions of the North Pacific Ocean. Since the last meeting of WG 11 in Pusan, Republic of

Korea, we have completed assembling the available data on the sizes of populations of marine mammals and seabirds in 14 subregions of the PICES area, and the types and amounts of prey eaten by marine mammals and seabirds in these regions during the summer where

sufficient data permitted calculation of prey consumption based on estimated energy demand. The process of summarizing this data base is progressing well, and this report includes preliminary examples of the types of overview that we will produce. We expect to circulate our draft Final Report for comment in February 1999, and to submit the Final Report in May 1999.

WG 11 was asked for its assistance in supplying information to TCODE on the availability of time series data for marine mammals and seabirds in the PICES area (see later TCODE section of report).

WG 11 recognizes that PICES will continue to require sound information on marine mammals and seabirds. To the scientists involved in WG 11, it is clear that the PICES community has only begun to examine the ecological roles of the marine mammal and seabird components of North Pacific marine ecosystems. Therefore, WG 11 strongly recommends that PICES establish a Technical Committee on Marine Mammal and Seabird Ecology that would report to the Science Board. An important role of this committee would be to encourage the integration of marine mammal and seabird scientists into the PICES community. The Technical Committee would provide information on marine mammals and seabirds to the PICES Scientific Committees, and would identify important problems, scientific questions, and knowledge gaps that needed to be addressed. (See Recommendation section for details.)

## **Preface**

The third meeting of the PICES WG 11 was held 14 to 17 October, 1998, in Fairbanks, Alaska, U.S.A. The purpose of the meeting was to finalize our estimates of marine mammal and seabird population size, the types of prey consumed, and the amounts of prey required to support marine mammal and seabird populations in the North Pacific Ocean, and to begin the compilation of our Final Report. Marine birds and mammals are important components of the

marine environment for many reasons. As occupants of the highest trophic levels in marine ecosystems, they are important not only as consumers and processors of carbon, but also as key components in the composition and structuring of marine ecosystems. Furthermore, because of their physiology, mobility, and longevity, marine birds and mammals integrate environmental features and conditions over a broad range of temporal and spatial scales and therefore can provide useful insight into the status of marine ecosystems over time. The Terms of Reference given to WG 11 referred explicitly to the need to assess the role of marine birds and mammals in the consumption of marine resources (1996 PICES Annual Report).

This WG was proposed by BIO Committee and BIO believes that this WG activity will contribute to the ecosystem studies contemplated in CCCC. Dr. Linda Jones will be the point of contact for BIO. It is the intent of BIO that this WG encourage communication with CCCC/IP, with overlapping membership where possible.

## **Summary of WG 11 accomplishments**

In the intersession between the Pusan meeting and the Fairbanks meeting, members of the WG assembled 84 working tables of the species-specific summertime marine mammal and seabird abundance, food habits and prey consumption for the 14 subregions (Figure 1) that the WG identified within the PICES area as agreed in Pusan. Except for the checking of a few cells for which questions remain open, these tables are now as complete as we can make them, and they will provide the data on which our Final Report will be based.

The tables vary in completeness because for some species and subregions data were unavailable. For some subregions and species, there is a solid record of the populations present and the relevant food habits, and it has been possible to estimate, by prey type, the amount of prey consumed during the summer season. In other regions or for certain populations, we have been able to estimate the sizes of the populations

present and their energy requirements, though a lack of knowledge of the mix of prey types taken has prevented the WG from developing quantitative estimates of consumption by prey type. In these cases we have provided an upper and lower estimate of the amount of prey consumed by dividing energy demand by the energy density of energy poor and energy rich prey, respectively.

To facilitate the use of the Final Report, and to emphasize patterns of energy consumption and prey use among subregions, we have developed a series of summary tables. In general, there is a greater wealth of information about seabirds than is available for marine mammals, and because the data for the pelagic distribution of seabirds was largely available in a single data base (the CAMRIS data base developed by Glenn Ford for the U.S. Fish and Wildlife Service), somewhat greater progress has been made in synthesizing the seabird data. Because some species of marine mammals move through two or more of the subregions, there are species for which a total population estimate is available, but the proportion in each subregion cannot be determined. Therefore, to show the size of marine mammal populations throughout the entire PICES area, a table summarizing the estimated abundances of marine mammals in the PICES will be constructed.

As an example of the direction that our summary efforts are taking, Table 1 provides an overview of the seabird survey effort in each of the subregions of the PICES area in relation to their surface areas. Based on these surveys and counts of birds at colonies, we developed estimates of the sizes of seabird populations in each of the subregions, their density, biomass per unit area, and energy requirements (Table 2). Although species richness is roughly equivalent across the subregions, there are considerable differences among subregions in the density of seabirds and in their energy requirements. For instance, in both the subarctic and transition zones, energy demand is higher on the western side. In Table 3, we summarize estimates of the minimum and maximum expected prey

consumption by seabirds in each subregion, based on energy demands and assumptions about the maximum and minimum likely energy density of prey used. Again, there are large differences among the subregions in the flux per unit area to seabirds. In the Final Report, we hope to be able to relate these differences to variations in marine productivity or food web structure in the subregions.

The WG has identified regions for which data exist that were unavailable to us. We also identified certain subregions in which ongoing research suggests that changes in populations or food habits have occurred since the compilation of the data base on which its report is based. Additionally, because of the vast region and large number of species covered, we found it necessary to combine species of prey used into broad categories. We thus acknowledge that additional work could greatly enhance our knowledge of prey use or changes in populations or food habits in response to climate change.

In assessing our accomplishments, members of WG 11 expressed frustration at the limited opportunity for interdisciplinary collaborations with other groups within PICES. This problem was not because of a lack of interest on the part of other members of PICES, but rather the coincidence of our WG sessions with those of other groups with which we were to have interacted prevented us from contributing to their sessions. This was particularly unfortunate, as in the Terms of Reference it was specified that it was the intent of BIO that WG 11 be encouraged to develop communication with CCCC/IP by having overlapping membership where possible.

## **TCODE**

WG 11 was asked for its assistance in supplying information to TCODE on the availability of time series data for marine mammals and seabirds in the PICES area. Because the 1998 meeting of WG 11 is the WG's last, it was clear that it would not be practical for it to take on the task of assembling the information requested.

However, individual WG members volunteered to assist TCODE on an *ad hoc* basis with the following suggestions for strengthening the TCODE meta-database:

1. Identifying meta-databases already in existence that may hold information relevant to marine mammals and seabirds in the PICES area (e.g., International Whaling Commission Scientific Committee, NOAA); links should be established to these and other databases, and
2. Compiling a list of marine mammal and bird scientists who may have relevant data sets, and who may be interested in listing these in the TCODE database (it is recommended that the TCODE Chairman contact the identified scientists directly to advise them of TCODE's objectives and to solicit their input.

### **Recommendation for the future inclusion of marine mammal and seabird scientists in PICES**

As WG 11 concludes its work concerning the consumption of prey by marine mammals and birds in the PICES area, we are looking ahead to the continuing needs of PICES for sound information on marine mammals and seabirds. To the scientists involved in WG 11, it is clear that the PICES community has only begun to examine the ecological roles of the marine mammal and seabird components of North Pacific marine ecosystems. The participation of marine mammal and seabird ecologists in PICES would provide an important contribution to the understanding of many other issues, such as ecosystem responses to climate change, being addressed by scientists within the PICES forum.

It is difficult to see how ecosystem-oriented discussions of marine science can be considered complete without including components of marine ecosystems as numerically and ecologically important as marine mammals and seabirds. Yet at present, no efficient mechanism exists to serve as a focal point for bringing the

contributions of marine mammal and seabird scientists into the mainstream of PICES deliberations. That omission represents a loss for marine mammal and seabird scientists whose work would benefit from the existence of an effective international forum for interdisciplinary collaboration in the North Pacific. It also represents a loss for other PICES scientists who do not have the benefit of active involvement with marine mammal and seabird scientists from the North Pacific rim. Therefore, we strongly recommend that there should be a functional presence of marine mammal and seabird science in PICES. The best way to encourage that presence is through the establishment of a group of technical experts that can develop a dynamic marine mammal and seabird voice within PICES, and can foster and maintain effective cross-disciplinary links to other groups within PICES.

We propose that PICES form a Technical Committee on Marine Mammal and Seabird Ecology that will continue on a long-term basis. Extending and expanding the terms of reference of WG 11 would not be desirable; a new marine mammal and seabird group with broader terms of reference should be established. An important function of the Technical Committee will be to encourage a two-way exchange of information between the marine mammal and seabird science communities and the disciplines represented in PICES. Additionally, the Technical Committee will function to support a broader participation of the marine mammal and seabird scientific communities in the activities of PICES.

#### Reporting:

The Technical Committee on Marine Mammal and Seabird Ecology will report to the Science Board.

#### Membership:

The Technical Committee on Marine Mammal and Seabird Ecology will consist of 1 marine mammal and 1 seabird scientist from each PICES country, with an intended minimum membership of at least 4 marine mammal and 4 seabird scientists. This

minimal number is requisite to creating a critical mass.

Terms of Reference:

1. Provide information, when requested, to PICES Scientific Committees, the CCCC Program and other PICES Task Teams on the biology and ecological roles of marine mammals and seabirds;  
For example, summarize the results of ongoing monitoring of marine mammal and seabird populations around the Pacific Rim for indications of environmental change;
2. Identify important problems, scientific questions, and knowledge gaps in assessing

the roles of marine mammals and seabirds in marine ecosystems;

3. Assemble relevant information on the biology of marine mammals and seabirds and disseminate it to the PICES community through reports and symposia; e.g., assemble time series data on seabird and marine mammal populations and examining them for congruence with other indices of change in the biological and physical environment;
4. Develop strategies to capitalize on opportunities for collaborative, interdisciplinary research.

DRAFT

Table 1. Surface areas and marine bird survey effort for subregions of the PICES area.

REGION	CODE	AREA Km <sup>2</sup>	SURVEY EFFORT Km <sup>2</sup>	Coverage (% of subregion)
Eastern Bering Sea Shelf	BSC	1,021,950	35,485	3.47
Western Bering Sea and Basin	BSP	1,357,655	8,755	0.64
Gulf of Alaska	ASK	428,520	15,735	3.60
California Current, North	CAN	166,455	3,446	2.07
Eastern Sub-Arctic	ESA	3,621,580	2,490	0.06
Western Sub-Arctic	WSA	2,168,315	4,340	0.20
Kamchatka and Kurile Islands	KM/KL	111,570	12	0.01
Sea of Okhotsk	OKH	1,599,225	0	0
California Current, South	CAS	128,620		
Eastern Transition Zone	ETZ	7,808,530	6,065	0.08
Western Transition Zone	WTZ	6,337,700	11,805	0.18
Kuroshio/Oyashio Current s Zone	KR/OY	348,455	700	0.20
Sea of Japan	SJP	1,006,455	0	0
East China Sea	ECS	435,235	0	0

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Table 2. Summary of seabird species richness, density and energy demand within subregions of the PICES area.

Subregion	Number of Seabird Species	Total Birds Present	Seabird Density Individuals·km <sup>-2</sup>	Seabird Biomass (kg·Km <sup>-2</sup> )	Seabird Energy Demand (kJ·km <sup>-2</sup> ·d <sup>-1</sup> ) x 10 <sup>3</sup>
BSC	38	34,690,000	33.9	18.6	36.6
BSP	46	22,325,000	16.4	7.0	14.0
ASK	39	16,139,825	37.7	21.5	42.2
CAN	51	8,426,975	50.6	15.1	32.8
ESA	24-36	7,905,000	2.2	0.8	1.5
WSA	30-31	14,945,000	6.9	3.8	4.5
KM/KL	47-54	2,635,000	23.6	15.6	26.8
OKH	41-43	10,005,000	6.3	1.8	4.0
CAS	48	2,720,000	21.1	16.0	28.1
ETZ	35-40	5,850,000	0.7	0.4	0.6
WTZ	35-40	56,620,000	8.9	3.2	6.4
KR/OY	56-63	15,555,000	44.6	11.8	24.7
SJP	30-31	365,000	0.8	0.1	0.1
ECS	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA

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Table 3. Estimated Total Prey Consumption by Marine Birds in subregions of the PICES area. (metric tonnes per 92 day summer)

Subregion	Prey Consumption	
	Assuming all Prey with Energy Density of 7kJ/g	Assuming all Prey with Energy Density of 3kJ/g
BSC	655,753	1,530,091
BPS	333,066	777,155
ASK	316,396	738,259
CAN	98,209	229,155
ESA	91,561	213,641
WSA	240,237	560,554
KM/KL	52,238	121,889
OKH	112,647	262,841
CAS	63,151	147,356
ETZ	83,722	195,352
WTZ	712,341	1,662,130
KR/OY	150,348	350,814
SJP	2705	6,310
ECS	No Data	No Data
Total	2,912,374	6,795,547

## Appendix 1

### Participants

#### Canada

Ken Morgan

#### China

#### Japan

Norihisa Baba

Hidehiro Kato (Co-Chairman)

#### Korea

#### Russia

#### U.S.A

John L. Bengtson

George L. Hunt, Jr. (Co-Chairman)

Chadwick V. Jay

Lloyd F. Lowry

## Endnote 4

### Strategic Work Plan for BIO Committee

Presented by Patricia A. Wheeler

**MISSION:** The mission of the Biological Oceanography Committee is to promote and coordinate biological oceanography and interdisciplinary research in the northern North Pacific. Biological oceanography plays a key intermediary role with respect to the other PICES standing committees. For example, lower trophic levels may be the most directly affected by processes considered by the Physical Oceanography and Climate Committee. Biological Oceanography also plays a central role in defining “normal” conditions against which changes of interest to Marine Environmental Quality can be measured. Finally, Biological Oceanography interacts with the Fisheries Science Committee to provide scientific advice on interactions of harvested species with both lower trophic levels and with other non-harvested “top predators” such as marine mammals and birds.

#### **RESPONSIBILITIES:**

- Develop scientific programs for annual and inter-session meetings;
- Formation of working groups for key areas of interest;
- Participation in CCCC Implementation Panel and Task Teams;
- Develop coordination of activities with other international and national programs.

**DEVELOPMENT:** The developmental phase of BIO activities covers the period from 1992-1995. During this phase the biological oceanography scientific programs for annual meetings were generated. The next phase 1996-1998 evolved into more jointly sponsored sessions with the other scientific committees and the formation of two working groups.

Activities of BIO Committee:

**PICES I** (1992)

**PICES II** (1993) Recommend development of straw man proposal for PICES-GLOBEC

**PICES III** (1994) Symposium “Structure and ecosystem dynamics of the subarctic and transition zone North Pacific – is the east like the west? (Co-Convenors: Brodeur and Taniguchi)

**PICES IV** (1995) Topic Session “Factors affecting the balance between alternative food web structures in coastal and oceanic ecosystems” (Co-Covenors: Omori and Wang)

**PICES V** (1996) Topic Session “Regional and interannual variants in life histories of key species” (Co-Covenors: Mackas and Ikeda)

Recommended increased BIO representation for CCCC-IP, REX Task Team (Hunt) and MODEL Task Team (Jones)

Zhang appointed to SCOR WG 105 as PICES representative and as rapporteur to BIO and FIS for SCOR WG 105

Recommended WG11: Consumption of marine resources by marine birds and mammals in the PICES region”

**PICES VI** (1997) BIO/FIS Topic Session “Micronekton of the North Pacific: Distribution, biology and trophic linkages” (Co-Convenors: Brodeur and Kawaguchi)

BIO/MEQ Topic Session “Harmful algal blooms: Causes and consequences” (Co-Convenors: Forbes and Shim)

Recommended WG14: Effective sampling of micronekton to estimate ecosystem carrying capacity

**PICES VII** (1998) BIO Topic Session “Controlling factors for lower trophic levels (especially phytoplankton stocks)” (Co-Convenors: Alexander, Taniguchi, and Harrison)

POC/BIO Topic Session “Carbon cycle in the North Pacific Ocean” (Co-Convenors: Tsunogai and Wong)

MEQ/BIO Topic Session “Contaminants in higher trophic level biota – linkages between individual and population responses” (Co-Convenors: Addison and Jones)

Recommended PICES/ICES collaboration for GLOBEC zooplankton workshop in 2000

Approved recommendation for Iron Experiment Advisory Panel

## **STRATEGIC PLAN FOR THE FUTURE**

- Increased cooperative activities with other components of PICES;
- Increased interaction with other international organizations;
- Increased targeted activities for recognized scientific issues for which international coordination and support is needed;
- Improved member participation in committees, task teams and working groups;
- Increased inter-session work via e-mail for committees and working groups and shorter annual meetings;
- Increased travel support for student participation at annual meetings.