

# REPORT OF MARINE ENVIRONMENTAL QUALITY COMMITTEE

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The MEQ Scientific Committee met on Wednesday, October 22, 1997, at PICES VI in Pusan, Republic of Korea. The meeting was convened from 1330 to 1730 hours. (See Endnote 1 for participants.)

## Introduction

The meeting was opened by MEQ Chairman Dr. Richard Addison, who welcomed all participants, and asked that each introduce themselves and their affiliations. The Chairman then proposed an agenda (Appendix 1). The proposed agenda was unanimously accepted, and the meeting was called to order.

## Harmful Algal Blooms (HAB): presentation by Mr. J. Roderick Forbes, Co-convenor of HAB Session

Mr. Forbes explained that a large number of international and local organizations outside PICES are actively studying HABs. A good example of this is the Asian Pacific Economic Cooperation (APEC). Although there has been much research on HABs to date, these phenomena continue to steadily increase worldwide. There is still a distinct gap between research, management implications and mitigation.

In September-October of 1998, the International Oceanographic Commission (IOC) and APEC will convene a symposium to deal with this lack of continuity with HAB problems. The meeting, entitled "International Symposium on Management and Mitigation of Harmful Algal Blooms" will be held either in the Philippines, or at the East-West Center at the University of Hawaii Manoa Campus, Honolulu. Mr. Forbes has asked that PICES endorse and support this symposium, and is also specifically requesting that MEQ formally serve as a co-supporter. In addition, Mr. Forbes is asking MEQ/PICES to sponsor three scientists to attend and participate in

the proposed IOC/ APEC meetings, (total estimated cost; US\$14.5k).

MEQ responded that the PICES Science Board is currently developing a more formal and consistent mechanism as to how PICES should respond to such requests from various outside international bodies. Therefore, MEQ agreed to consider the request over the next few weeks, with Dr. Addison rendering our decision to Mr. Forbes at a later date.

(Following discussions at the PICES Science Board, it was decided that PICES would support this meeting in principle, but that funds would not be available from PICES to support the meeting financially.)

**Action: Dr. Addison to contact Mr. Forbes**

## Bering Sea Ecosystem Biophysical Metadatabase Project: presentation by Dr. S. Allen Macklin, Co-Project Manager, NOAA

Dr. Macklin explained NOAA's metadatabase project for the Bering Sea. "Metadata" refers to data about data, rather than to the actual data per se. The mission of the project is to locate and assemble an inventory of the extensive biological and physical data which exists for the Bering Sea ecosystem, develop these into an indexed, annotated catalog (metadatabase), and make the metadatabase available to the public through various mechanisms, including the World Wide Web. The metadatabase references only the existence of data and information products. Thus, researchers do not have to submit their actual data; but should merely describe the content, quality, condition, spatial and temporal characteristics of the data. The data are organized according to Federal Geographic Data Committee (FDGC) standards, and will be made available for public access via search engines on the World Wide Web. Dr. Macklin hoped that MEQ/PICES and their various colleagues will contribute as much as

possible to the Bering Sea metadata base, and stressed that the actual data itself will remain under the control of the researcher or similar source person. The program is especially interested in contaminant-related data, and will be receptive to any other types of information relevant to the Bering Sea.

Dr. Addison led a brief discussion of this issue, and asked (1) whether or not NOAA was aware of the various other databases like this which exist, and (2) whether or not the various databases are compatible. MEQ agreed to study the issue further, and to advise Dr. Macklin of our decision after the PICES meeting.

**Action: Dr. Addison to contact Dr. Macklin**

#### **Brief review of minutes from MEQ meeting, PICES V**

To help familiarize newer attendees with the recent history of MEQ and its activities, Rapporteur Dr. C. Michael Watson briefly recounted highlights of the minutes from the previous year's meeting at Nanaimo, B.C., Canada (PICES V). He recounted the two MEQ research tasks originally planned for the Western Pacific in conjunction with Working Group 8, which were: (1) the proposed practical workshop at Jiaozhou Bay (Qingdao, Shandong Province, People's Republic of China), for harmonization of research and analytical methodologies among the six PICES member countries, and (2) the proposal to holistically examine a pollution gradient outward from the mouth of the Changjiang River in the East China Sea, to establish baseline data prior to the substantive changes in benthic ecology and species diversity which will occur after the construction of the Three Gorges Dam.

Dr. Watson then explained that for the time being, MEQ has discontinued its research plan for the Changjiang estuary, because of its very resource-intensive nature and the highly politicized climate currently surrounding the Three Gorges Project. Thus, the proposal for the Jiaozhou Bay Workshop

is now MEQ/WG 8's sole focal research project for the near term.

Since the Workshop's conception at Nemuro, (PICES III), MEQ had anticipated a three-year time frame for carrying out the actual research on site. After the Nanaimo meetings last October (PICES V), two most likely favorable time periods for conducting the Workshop were proposed: These were to be either May-June, 1997, or September, 1997 just prior to PICES VI in Pusan. But because of funding problems, the need to transport specialized equipment and materials over the great distances involved, and the time constraints necessary to secure official sampling permission, the Workshop plan has had to be delayed until 1998.

He also briefly reviewed other highlights of MEQ's business meeting at PICES V/Nanaimo, in which three MEQ Topics were proposed for the PICES VI symposia in Pusan. These included (1) a Joint MEQ/BIO Session on HAB, (2) a session on the Pollution Impacts of Aquaculture, and (3) a continuing session on our common MEQ theme, "Processes of Contaminant Cycling." MEQ's "Best Paper Award" from PICES V was won by Dr. Y. Gao, of Rutgers University for her paper entitled: "Cycling of contaminants through the atmosphere: long range transport vs. regional deposition".

#### **Discussion and acceptance of minutes from PICES V**

After brief discussion, the informal overview of last year's MEQ Meeting's minutes were accepted as read.

#### **Report of Working Group 8, PICES VI: Dr. John E. Stein (Co-Chairman, WG 8)**

Several days prior to the MEQ meeting, WG 8 met on October 17-18 in Pusan. These WG 8 sessions focused on updating and improving the MEQ Practical Workshop Plan, addressing the various issues and questions outlined below: WG 8 also identified a list of likely participants from each country, and prepared a detailed list of information and equipment necessary for the workshop. Dr.

Stein summarized WG 8's recent workshop-related activities as follows:

- A. Jiaozhou Workshop Bibliography: Realizing that more information was needed prior to arriving at a final study design, during 1996-97 various members of WG 8 and MEQ have been working closely with Prof. Ming-Jiang Zhou in Qingdao, to gather existing baseline scientific information on biota, contaminants and related factors in the Jiaozhou Bay - Laoshan Bay ecosystem. During this period, a significant number of relevant papers were identified and obtained by Prof. M.J. Zhou, Drs. Colin Levings, and John E. Stein. These were then organized into a detailed and extensive bibliography, which was sent to MEQ/WG 8 members earlier this year.
- B. Modifications to the Workshop Plan:
  - (a) Scientific Design: The Scientific Design was made more pragmatic and refined in a manner which should ensure a successful workshop. The overall objective of the Jiaozhou Workshop will remain "harmonization of Techniques" among the participating PICES scientists. The specific focus will be on biological and ecological effects, and on evaluating methods used to compare such effects. Mollusks and benthic fish species will be the primary organisms of interest.
  - (b) Research Time Line: The proposed time line for the MEQ Practical Workshop is now May-June, of 1998. The essential plan is to carry out the work at that time, and to begin to prepare research reports during the ensuing year. An editor will be assigned to the project, specifically for organizing the results for presentation at PICES VIII. It is also hoped that preliminary workshop results will be available to present at PICES VII (Fairbanks).
- C. Funding Needs: Dr. Stein reported that PICES Finance Committee has allocated \$20k as partial support for research and equipment related aspects of the Jiaozhou workshop.

However, PICES expects member countries to fund all travel and per diem for their respective participating scientists. WG 8 is seeking to secure some added travel funding from outside sources, but the likelihood is not favorable at this time. However, Dr. Addison indicated that it is likely PICES will still be able to fund some travel to Qingdao for a very small number of selected Russian and Chinese scientists, if no other monies can be found in the interim.

- D. Administrative Needs for Practical Workshop: Obtaining formal permission from the Chinese Government is an important factor in assuring the viability of the Workshop. MEQ/PICES must be sure to obtain the necessary approval from the Chinese Government. The issue of obtaining this approval was discussed at length, and MEQ and WG 8 agreed that the most effective mechanism is for the PICES Governing Council to send identical letters of application to both the Ministry of Agriculture of China and the State Oceanographic Administration of China.
- E. Possible Alternate Workshop Site: In the event that official permission for the Jiaozhou Workshop might somehow not be granted in time, discussion briefly focused on possible alternate Workshop sites. The most appropriate fallback site was agreed to be the Masan Bay - Chinhae Bay area in the Republic of Korea, where the marine ecosystem, fishery and mariculture resources, and anthropogenic stressors are similar in many ways to Jiaozhou Bay. MEQ colleagues from Korea indicated that obtaining necessary governmental permission for PICES to conduct a workshop in Korea would take about one month.
- F. Summary of Plan for MEQ /WG 8 Practical Workshop: It was unanimously resolved that MEQ will conduct its Practical Workshop in the Western Pacific in 1998, or not at all. The first choice for this workshop will be Jiaozhou Bay. But because of the present uncertainty

about obtaining permission at Jiaozhou Bay, MEQ decided to (a) set a deadline of January 31 for receiving formal permission from the Chinese authorities, and (b) as a fallback position, allocate an alternate site for the workshop, in case we are not able to utilize Jiaozhou /Laoshan Bays at Qingdao. This alternate site would be the Masan Bay-Chinhae Bay region, Republic of Korea.

MEQ/PICES will immediately reapply for formal Workshop permission from China.

- G. Presentation of Workshop Results: Discussion then arose about how MEQ should present preliminary results from the Practical Workshop, during PICES VII (Fairbanks; 1998)). It was agreed that MEQ schedule a presentation at Fairbanks which will outline the research design and nature of the workshop, documenting what took place. Although the format will be left "open", room will be made for a concurrent presentation of available preliminary results from the workshop.

**Action: Profs. M.J. Zhou and J.Y. Zhou to identify contacts in PRC agencies;  
Dr. Addison to draft letter for Dr. Doubleday's signature;  
Dr. Addison to draft letter to Dr. K.W. Lee re: "fallback" workshop in Korea**

#### **Input of long time-series data to PICES Technical Committee for Data Exchange (TCODE)**

As a follow-up to our MEQ discussions about TCODE last year at PICES V, Dr. Addison explained that TCODE Inventory of Long Time series is now implemented on the PICES Web server (<http://pices@ios.bc.ca/data/longterm/ltsintr.htm>). In somewhat the general fashion of the Bering Sea meta-database discussed earlier, TCODE is merely an inventory which identifies data, but does not contain the actual data, per se. TCODE is primarily interested in developing an inventory of long time series data, with special

relevance to various large and comprehensive ongoing marine science research programs. Some of the key on-line deliverables of TCODE would include such services as: (a) sources of real time data, (b) on-line technical manuals for marine sciences, (c) marine science software services, (d) mapping /bathymetric data, and similar research /policy tools.

TCODE's main data categories thus far have focused on biological oceanographic observations, physical /chemical oceanographic observations, fisheries and meteorology. TCODE is requesting whether or not MEQ would recommend that a specific category, "contaminants", also be included, to encompass data on marine environmental quality and pollution. After discussion, MEQ agreed to have Dr. Addison explore the issue further with TCODE, and to render an appropriate response on behalf of MEQ at a later date.

**Action: Dr. Addison to contact Mr. Robin Brown**

#### **Report on MEQ Scientific Sessions, PICES VI - Processes of Contaminant Cycling**

Dr. Dong-Beom Yang summarized the various MEQ Scientific Sessions. The Topic Session, "Processes of Contaminant Cycling" included six scheduled presentations, and the Contributed Papers Session included eight, of which three (all from Russia) were withdrawn. The eleven papers which were presented covered a range of subjects, these included overviews of the extent of metal contamination around the Korean coast (K.W. Lee), general contaminant distribution in the Changjiang estuary (J.Y. Zhou) and radionuclides in the East Sea (Sea of Japan) (D.S. Moon). Prof. Zhou also introduced a newly-published, comprehensive research text he has edited, entitled "Sources, transport and environmental impact of contaminants in the coastal and estuarine areas of China", from which he presented excerpts of selected relevant chapters.

More specific studies of the extent of contamination included investigations of alkyltins

around a salmon farm in Western Canada (L. Harding) and the accumulation of metals and organochlorines around Vladivostok (A.V. Tkalin). Processes of contaminant distribution were covered in papers of organochlorines in the Arctic (R.F. Addison), physical oceanographic conditions in the vicinity of mariculture operations in Japan (S. Toda), biological productivity in Hangzhou Bay as influenced by the Changjiang River discharges (X.R. Ning) and biogeochemical cycling of Phosphorus (M.W. Han). D. Aminin described new approaches to determining the effects of contaminants, and L. Gramm-Osipov described models of the speciation of metals in natural waters. The MEQ Poster Session was also especially enlightening, and much valuable information was presented, especially by our Russian and American colleagues.

In general, the sessions were better attended and the presentations more polished than in previous years, and one paper (Aminin, et al.) described joint research by authors from Korea and Russia. Dr. Aminin was later awarded the prize for the best paper to be presented at the MEQ session.

The Chairman thanked Dr. D.B. Yang on behalf of the MEQ Committee for his work in organising an interesting and informative session.

The joint MEQ-BIO session on harmful algal blooms was scheduled to have sixteen papers, five of these were withdrawn. The session included overviews of the HAB problem from around the Pacific (New Zealand, Philippines and Southeast Asia in general, and Korea, Japan and China). The potential factors which controlled or initiated HAB were discussed, and one paper (S. Hahn) showed that around the coast of Korea HAB have occurred almost since records first began a few years B.C.

### **Proposals for MEQ Scientific Sessions, PICES VII (Fairbanks, U.S.A., 1998)**

Dr. Addison led a discussion to set forth MEQ's proposed topics For PICES VII, which began with a short survey of some of the respective needs and interests of the various participating PICES nations. Various topics proposed and discussed as

possible future sessions for MEQ included: oil pollution and spill response, marine resource subsistence of endemic peoples, human activities which affect HABs, specific mechanisms of toxicity of various algal species, ecological risk assessment, mariculture problems in Asia, speciation of metals as a function of biogeochemical cycling and bioavailability, and similar themes.

MEQ noted that participation in some of our prior scientific sessions have not attracted an equal balance of scientists from all PICES member nations. Part of this problem is due to travel costs over great distances. MEQ strongly recommends that PICES more actively seek to rectify these attendance and participation problems. To best attract and maintain a broader and more representative scientific audience, MEQ should increasingly combine our research perspectives on contaminants with other relevant PICES committee sessions. A good example of this is the current joint MEQ/BIO HAB session at PICES VI.

After appropriate discussion, MEQ recommended the following sessions for PICES VII:

1. A session outlining the research design and preliminary results of MEQ's Practical Workshop (Jiaozhou Bay; see previous WG 8 discussion).
2. Contaminants in high trophic level biota; linkages between individual and population responses. There is now considerable evidence that while we can show an impact of contaminants on individuals, there is little substantive evidence at the population level. Why is this? -- is it just a question of the detection of population effects? Or are compensatory mechanisms operating to "buffer" the population from individual impacts? If so, are these phenotypic or genotypic? Apart from providing a joint focus for MEQ and BIO, this topic seem particularly suited to an Alaskan venue for PICES, because much of the evidence comes from "wildlife" studies, especially on marine

mammals (and often Arctic or sub-Arctic marine mammals) and birds.

3. Science and technology for environmentally sustainable mariculture. This session will explore the following question: How do we measure "ecosystem health", particularly in the context of impacts of mariculture? This session should ideally be organized jointly with other committees, but for logistic reasons -- resulting from the timetable of PICES VI -- it is simply not possible to arrange this. This point is to be discussed at the next Science Board meeting.
4. Marine oil spills: case studies in assessing biological and ecosystem effects.
5. HAB toxins: mechanisms of toxicity, and the processes by which pollution affects the population dynamics of harmful algal species
6. Metal speciation and biogeochemical cycles. (To be considered as a focus for contributed papers.)

### **Future Activities and Focus for MEQ**

The MEQ agreed to play a strong inter-sessional role in drafting three discussion papers, on topics of interest to it and other committees. These "white papers" would provide much of the basis for decisions on MEQ's activities over the next few years.

These three topics will be: (1) "Environmentally Sound Mariculture: Status and Technology Needs", (2) "Harmful Algal Blooms (HABs): Causes, Consequences and Mitigation", and (3) "MEQ /PICES Interactions with GIWA?: A Feasibility Study". Discussion culminating in the first two decision elements centered around draft proposals prepared by Drs. Varanasi and Stein, and focused on the interdisciplinary nature and global importance of both mariculture and HABs. The GIWA (Global International Waters Assessment Project) discussion was led by Dr. Addison. Summaries of these three proposed topics are as follow:

Mariculture: In the North Pacific there is a long history in the use of mariculture to produce seafood and more recently to recover depleted stocks. Reliance on mariculture of fish and invertebrate species to meet some of the demand for seafood in PICES member countries is likely to increase. This and the concomitant concern about impacts on coastal ecosystems from mariculture activities has heightened the need to develop technologies to promote environmentally sound mariculture, better understand environmental impacts of mariculture, and develop effective monitoring and environmental mitigation approaches. It was proposed and agreed upon to commission a report on current mariculture practices: ongoing research and technology development, existing and suspected environmental impacts, current mitigation efforts and technology needs. This report would constitute the initial step in developing a science plan by the MEQ that would serve as the basis of PICES member country scientists to coordinate and develop complementary research programs on development of technology for environmentally sound mariculture.

### **Action: Drs. Varanasi and Stein**

HABs: The world-wide incidence of blooms of toxic algal species may be increasing. How do the processes of eutrophication and HABs affect marine environmental quality? Our knowledge of the biology and toxicology of harmful algal species is rudimentary and our understanding of the natural and anthropogenic forcing factors that induce a HAB event is inadequate. Thus, the ability to effectively predict and possibly mitigate the environmental and economic impacts from toxic algal species is lacking. It was proposed and agreed upon to commission a report to develop a science plan to coordinate efforts to better understand the ecology of harmful algal species in the North Pacific marine environment, and improve the ability to predict harmful algal blooms to minimize impacts on fishery resources. In addition to investigating causes and consequences of HABs the plan would also address improving monitoring approaches and the potential for environmentally sound mitigation measures.

**Action: Drs. Stein and Varanasi**

GIWA: Dr. Addison introduced future MEQ-relevant issues raised by a recent paper by Bewers and Pernetta, which outlines the objectives and intended results of the Global International Waters Assessment Project (GIWA). The GIWA Program is currently being proposed to the Global Environment Facility (GEF), under its International Waters Portfolio. For the North Pacific Portions of GIWA, the authors specifically seek contributions and support from PICES and its member nations. In their view, PICES /MEQ should play a coordinating role in developing information on the status of the North Pacific environment. Dr. Shimizu brought up the point that compared to nearshore areas and marginal seas, there is a relative dearth of pollution data for the open ocean. If the focus of GIWA is wholly open ocean, it would seem inappropriate for MEQ at this time. However, MEQ agreed that obtaining more information on pollution in the open ocean is a worthy topic for future research, probably best realized in joint efforts with other PICES committees like BIO and POC. Dr. Tkalin and others pointed out that several agencies (e.g., GEMP, WESTPAC) are already doing global environmental studies, and that the GIWA proposal would not necessarily cover new ground. After some discussion, MEQ suggested that although it lacks the resources for involvement at this time, possibly PICES could assume a peripheral "contractor" role with GIWA, perhaps via a graduate student hired specifically for this purpose and housed within the PICES Secretariat. MEQ also needs more information about the relationship between GIWA and other United Nations programs, and the level of resource demand such involvement will place on PICES.

Since PICES will have to reply to the GIWA initiative, Dr. Addison undertook to prepare a draft review of the paper and draft reply for circulation to MEQ members early in January. Dr. Kilho Park will make some enquiries of his contacts in the UN agencies about the status and intent of the GIWA project, for incorporation into the draft response. This draft would be amended to reflect comments received from MEQ and would be

forwarded to the PICES Chairman to form the basis of a reply to UNEP.

**Action: Drs. Addison and Park**

**Other business**

The general concept of sponsoring both a "topic session" and a "paper session" at annual MEQ /PICES symposia was briefly revisited. After discussion, MEQ members recommended that we continue to adopt this dual session concept in convening PICES VII. Several members questioned whether or not PICES should begin to establish and publish its own scientific journal, in order to better disseminate our findings to the research community. This was judged to be too expensive and time-intensive to be practical at this time. Rather, it was suggested that MEQ and PICES require that each participating author bring a minimum of 50 copies of their respective papers to their sessions at the time of presentation.

Policy and planning issues regarding PICES Working Groups were also discussed. At some point in the near future, changes in the focus of future research topics being planned by MEQ will require the formation of additional WGs. It is unclear to MEQ whether or not a given PICES Scientific Committee may have more than one WG at a time. This issue will require further clarification from the PICES Governing Council.

**Adjournment**

The MEQ Scientific Committee concluded its meetings for PICES V, and was adjourned by Chairman Dr. Addison at 1730 hours on Thursday, October 17, 1997.

**Scientific Program**

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

*Processes of contaminant cycling.* (MEQ)  
Convenor: Dom-Beom Yang (Korea)

K.W. Lee, H.S. Kang, S.H. Lee. Trace elements in the Korean coastal environment

J.Y. Zhou. Brief introduction to “Sources, transport and environmental impact of contaminants in coastal and estuarine areas of China”

A.V. Tkalin. Accumulation of trace metals, radionuclides and organic chemicals in the Japan Sea mussels

S. Toda. Mariculture and the environment: the importance of water movements

R.F. Addison. Trends in organochlorine residue concentrations in Arctic ringed seals from Holman, NWT from 1972 to 1991: what do they tell us about processes of organochlorine transport and distribution

L.M. Gramm-Osipov, S. Belkovskaja. Physico-chemical modelling by computer of interaction river waters with seawaters for solution some geometrical and ecological problems

D.S. Moon, M.H. Lee, C.W. Lee. The distribution characteristics of anthropogenic radionuclides in the East Sea (Sea of Japan)

D. Aminin, I. Agafonova, S.H. Kahng, J.R. Oh, S.H. Lee. Use of fluorescent probes for biochemical monitoring of environmental contamination

M.W. Han, J.H. Shim. Biogeochemical cycle of organic phosphorous in coastal sediments of Deukrayang Bay, Korea

L. Harding. Levels of organotin in water, sediments and oysters (*Crassostrea gigas*) at aquaculture sites in British Columbia

X.R. Ning, Z. Liu, J. Shi, Y. Cai. The biological productivity front in the Changjiang estuary and Hangzhou Bay, and its ecological effects

## Endnote 1

## Participants and Observers

### Canada

Richard F. Addison (Chairman)

### China

Jia-Yi Zhou

### Japan

Makoto Shimizu

### Korea

Dong-Beom Yang

Kwang Woo Lee

Hak Gyoon Kim

### Russia

Lev M. Gramm-Osipov

Alexander V. Tkalin

### U.S.A.

Usha Varanasi

Paul Kilho Park

C. Michael Watson (rapporteur)

### Observers

Colin D. Levings (WG 8) (Canada)

J. Roderick Forbes (Canada)

Jong-Geel Je (Korea)

Hee-Sook Kang (Korea)

Jae-Ryoung Oh (Korea)

Ming-Jiang Zhou (WG 8 Co-chairman) (China)

John Stein (WG 8 Co-chairman) (U.S.A.)

S. Allen Macklin (U.S.A.)

Arkady V. Alekseev (Russia)



## Endnote 2

### Report of Working Group 8 Practical Assessment Methodology

The meeting of WG 8 was convened at 09:00 on October 17, 1997 (see Appendix 1 for participants and observers). Dr. John Stein pointed out that Dr. Brenda Sanders had tendered her resignation from the Group for medical reasons.

Dr. Colin Levings agreed to serve as rapporteur.

The meeting agenda (Appendix 2) was reviewed and approved. The overall objective of the meeting was to review and refine the draft workplan for convening a Practical Workshop in Jiaozhou Bay, Qingdao, China, aimed at harmonizing approaches and methods among PICES countries when assessing ecological impacts of polluting.

Considerable time was dedicated to refining the workplan (Annex 4). As a result of the discussions, Annex 5.3 in the Working Group report from PICES V was removed from the current draft. This Annex (5.3) will be retained as part of the background information file of the Working Group. Comments from Prof. M.J. Zhou were of particular value. He also gave a very informative review of the sampling and oceanographic investigations that had been conducted to date in Jiaozhou Bay. In addition, he reviewed the list of questions about logistics for the Workshop that has been developed at PICES V. He provided written responses to almost all the questions. Prof. M.J. Zhou gave the name of Ms. Tian Yan, (address: Institute of Oceanology, Chinese Academy of Science, 7 Nanhai Road, Qingdao 266071; phone: (86-532) 287-9062-6121 (office); fax: (86-532) 287-0882; email: tianyan@ms.qdio.ac.cn), as

a contact for further details on arrangements and facilities at Qingdao.

The Working Group developed recommendations (Annex 2) to the MEQ Committee, which noted that the remaining funding for the workshop should be solicited from PICES member country agencies. If appropriate other international agencies could be approached; however, this approach was concluded to have a lower probability of success. The recommendations are followed by background information (Annex 3) on the development of the revised draft of the workplan (Annexes 4 and 5).

The draft meeting report and recommendations to the MEQ Committee were approved by the working group for submission to the MEQ.

Dr. Stein mentioned that colleagues had asked if there was any interest among WG participants in developing either a PICES journal or approaching an existing journal as a medium for publishing papers presented at the meetings. If so, perhaps this concern could be carried through via the WG to the Science Board. However, the members present thought that the present system of extended abstracts was satisfactory; publishing symposium/special session papers by one of the approaches above was not discussed.

The meeting was adjourned at 15:30 on October 18, 1997. Dr. Stein and Prof. M.J. Zhou thanked the members for their work, and especially thanked Dr. Jong-Geel Je for inviting the group to a wonderful lunch at a local fugu restaurant.

## Appendix 1

### Participants and Observers

#### Canada

Richard F. Addison  
Colin Levings\*

#### China

Ming-Jiang Zhou\* (Co-Chairman)

#### Japan

Makoto Shimizu

#### Russia

Alexander Tkalin\*

#### U.S.A.

John E. Stein\* (Co-Chairman)

#### Observers

Jia-Yi Zhou (China)  
Hak-Gyoon Kim (Korea)  
Jong-Geel Je (for Dong-Beom Yang\*)  
L.M. Gramm-Osipov (Russia)

\* WG 8 Implementation Group for the Practical Workshop

## Appendix 2

### WG 8 Working Group Meeting Agenda

October 17 and 18, 1997

**Goal of meeting:** Revise and refine work plan for the Practical Workshop. Develop strategy for securing funds needed to conduct the workshop.

**Start time:** 9:00 AM

1. Welcome and Logistics: Stein
2. Introductions of Members and Observers: Stein
3. Appoint Rapporteur
4. Review progress since PICES 5, Nanaimo: Stein and Levings
5. Review and modify workplan, revise workshop timeline: all members
  - a. Workplan review and revision:
    - i. Background on Workshop Development
    - ii. Workplan
      - Purpose
      - Objective
      - Specific Goals
      - Study Parameters
      - Criteria for Selection of Sites
      - Biological and Chemical Analyses (App. 5.3 - 5.5)
      - Expected Products

- iii. Logistics for analysis of samples during practical workshop at host lab
- iv. Analysis of samples following workshop, not at host lab
- v. Data Management, statistical analyses, report preparation, etc.
- vi. Budget
- b. Revise timeline for implementing the Practical workshop Flow Chart (Annex 5.1)
- c. Discuss sources of funds to support workshop and strategy for acquiring funding
6. Develop recommendation to MEQ Committee
7. Consideration, review and approval of the recommendations and meeting report
8. Closure of the meeting

## Appendix 3

### Recommendation to MEQ Committee

WG 8 recommends that the MEQ Committee accept the modified plan (Annexes 3 to 5) for the Practical Workshop developed during the WG meeting that preceded PICES VI (Pusan, Korea). The revisions to the workplan were made in further recognition of the need of PICES countries to work toward harmonizing approaches and methods for assessing marine pollution effects.

During PICES V, the Governing Council approved funds to support operational expenses of the Workshop, whereas the funds to support participation (travel expenses) of member country scientist in the Workshop had not been secured. WG 8 recommends that the most viable option for securing funds is for MEQ committee members to seek the travel funds for their participating scientists through their member countries.

The Working Group reconfirmed that this workshop is a necessary step in establishing scientific cooperation for future collaborative efforts and in the harmonization of approaches of PICES member countries in assessing the broader scale impacts from human activities on North Pacific marine habitats essential to living marine resources.

#### Background on Workshop Development

PICES WG 8 (formerly WG 2) has discussed approaches to fulfilling its terms of reference at meetings in Seattle, Nemuro, Qingdao, and Nanaimo (coinciding with the PICES Second, Third, Fourth and Fifth Annual Meetings). Briefly, the aim of WG 8 is to promote the collection and exchange of information about approaches PICES member countries use by assessing the biological impact of marine pollution. The WG8 agreed to approach this by organizing a *practical* Workshop, during which participants could work together to evaluate methods used to assess ecological effects of pollution. The format of the Workshop is being

developed along the lines of the successful Intergovernmental Oceanographic Commission/Group of Experts on the Effects of Pollutants (IOC/GEEP) workshops whose results have been published in Marine Ecology Progress Series (vol. 46 (1988) and vol. 91 (1992)) and in the Journal of Experimental Marine Biology and Ecology (vol. 138 (1990)).

Jiaozhou Bay, China, was selected for this workshop, because extensive data sets describing biota and contamination in the Bay are available from the Institute of Oceanology, the State Oceanic Administration (SOA), and other institutions and Universities, and there are laboratory facilities on the Bay, including a joint Korea/China Center. The bay is influenced by a range of human activities that will allow the evaluation of methods that are being used in PICES countries to assess the biological effects of pollution. For these reasons, Jiaozhou Bay is a good site to examine harmonization of methods used by PICES member countries for assessing biological effects.

In regards to the logistics for conducting the workshop, Prof. Ming-Jiang Zhou has extended an invitation to use the facilities and research vessels of the Institute of Oceanology, Academia Sinica, for the workshop. In addition, Dr. D.B. Yang from Korea Ocean Research and Development Institute (KORDI) has subsequently confirmed that the joint Korea/China Center in Qingdao may be able to offer additional facilities. The facilities are critical in carrying out a core set of analyses during the workshop, thus allowing first-hand observation and exchange in a wide range of techniques being used in assessing biological effects.

An informal Workshop Implementation Team was formed by the MEQ and WG 8 at the PICES Fourth Annual meeting. The team has had ongoing correspondence, and an informal *ad hoc* meeting of some of the North American

members was held in Seattle in June 1996 to develop a work plan. Implementation team members tentatively identified the kinds of sampling and analyses to be carried out and suggested possible participants from all the PICES member countries. This draft list and tables outlining the suite of analyses proposed was sent to the Workshop Implementation Team members in Russia, Japan, China and Korea that were unable to attend the *ad hoc* meeting. Their review, advice and suggestions were sought and comments incorporated into a revised draft workplan as appropriate. The revised workplan was further refined and formally adopted by WG 8 at PICES V, Nanaimo, Canada (October 1996). At PICES V, the MEQ submitted the Workplan to the Science Committee and the plan was subsequently approved by the Governing Council. The Governing Council also approved PICES funds to support operational expenses for conducting the Workshop in Qingdao, China. By April 1997, literature searches on Jiaozhou Bay had been conducted, a bibliography developed, and several key papers were translated to English, and distributed to members. Unfortunately, approval to conduct the workshop in Jiaozhou Bay and the necessary funding to support travel of participating scientists were not obtained in time to carry out the workshop in 1997. At PICES VI in Pusan, it was anticipated that final revisions to the workplan would be made following discussions with scientists from the laboratories in Qingdao.

### **Practical Workshop Workplan**

#### Purpose:

Work towards harmonizing approaches and methods used in assessing ecological impacts of human activities on the environmental quality of North Pacific marine ecosystems.

#### Objective:

To work cooperatively in assessing ecological impacts of contaminants on benthic invertebrate and fish communities.

#### Specific Goal:

To evaluate and compare methods used to assess ecological effects of chemical contaminant exposure.

#### Study Site:

Six sites within Jiaozhou Bay, China, and one reference site in close proximity to the bay (potentially Laoshan Bay). The sites in Jiaozhou Bay are shown in Figure 1 and were selected according to criteria in Annex 1. The sites to be evaluated were also selected based on geographic location, existing background information, ongoing monitoring, and logistics such as proximity to appropriate laboratory facilities in the Qingdao area.

#### Workshop:

1. The workshop will commence with a reconnaissance survey to assess the feasibility of obtaining sediment samples and fish and invertebrate specimens necessary to evaluate the methods being tested (see flowchart in Annex 2). Discussions will also be held with local monitoring staff, other investigators, and fishers. Duration of this preliminary work will be 1 week; 2-4 people of variety of backgrounds will work with the Chinese scientists. Daily activity reports might be sent out by email by Prof. M.J. Zhou to workshop participants. During a brief period after the reconnaissance survey (1 week), the workshop design will be refined based on information collected during the reconnaissance survey. The cooperative workshop will begin 1 to 2 weeks after the reconnaissance survey.

2. Biological responses to be evaluated will include; benthic community structure; sediment quality (bioassays), demersal fish health and condition, oyster chambering, gastropod imposex, biota age and size relationships; and biochemical changes (e.g., cytochrome P-4501A induction, acetyl-cholinesterase inhibition, bile metabolites) (see Annexes 3 and 4). These data

will also be used for interpretation of organism, population, and community responses. As appropriate, replicate samples will be collected to allow scientists to analyze the same sample to assess reproducibility. The biological responses will be evaluated in the context of exposure to different classes of chemical contaminants such as polycyclic aromatic hydrocarbon (PAHs), pesticides, chlorinated hydrocarbons, selected metals and organotins (e.g., TBT).

3. During the cooperative activities there will be up to 24 participants, approximately 4 from each PICES member country. This effort may be augmented by other scientists at their expense.

4. Analyses will be carried out cooperatively at the Institute of Oceanology, the Korea/ China Joint Center, and the Yellow Sea Fisheries Institute in Qingdao. In addition routine analyses (e.g., aging) that do not involve cooperative evaluation will be conducted at laboratories in Qingdao. If feasible and necessary, evaluations will be conducted at other laboratories. Data Coordinator will be Dr. John Stein (or designee), who will be responsible for preparing data collection sheets and incorporating measurements and calculations into a data base.

5. The workplan is being developed to encourage comparison and harmonization of methods currently being used by scientists in PICES countries for evaluating ecological effects of pollutants. It is anticipated that a suite of methods will be identified which will complement existing evaluation methods being used in various PICES countries. All work is being designed to be scientifically sound and publishable.

6. The preferable time for the Workshop is May to early June 1998, or possibly between

mid-September and the end of October 1998 (see timeline, Annex 5). The workshop will consist of a one week reconnaissance survey and 2 weeks of cooperative activities.

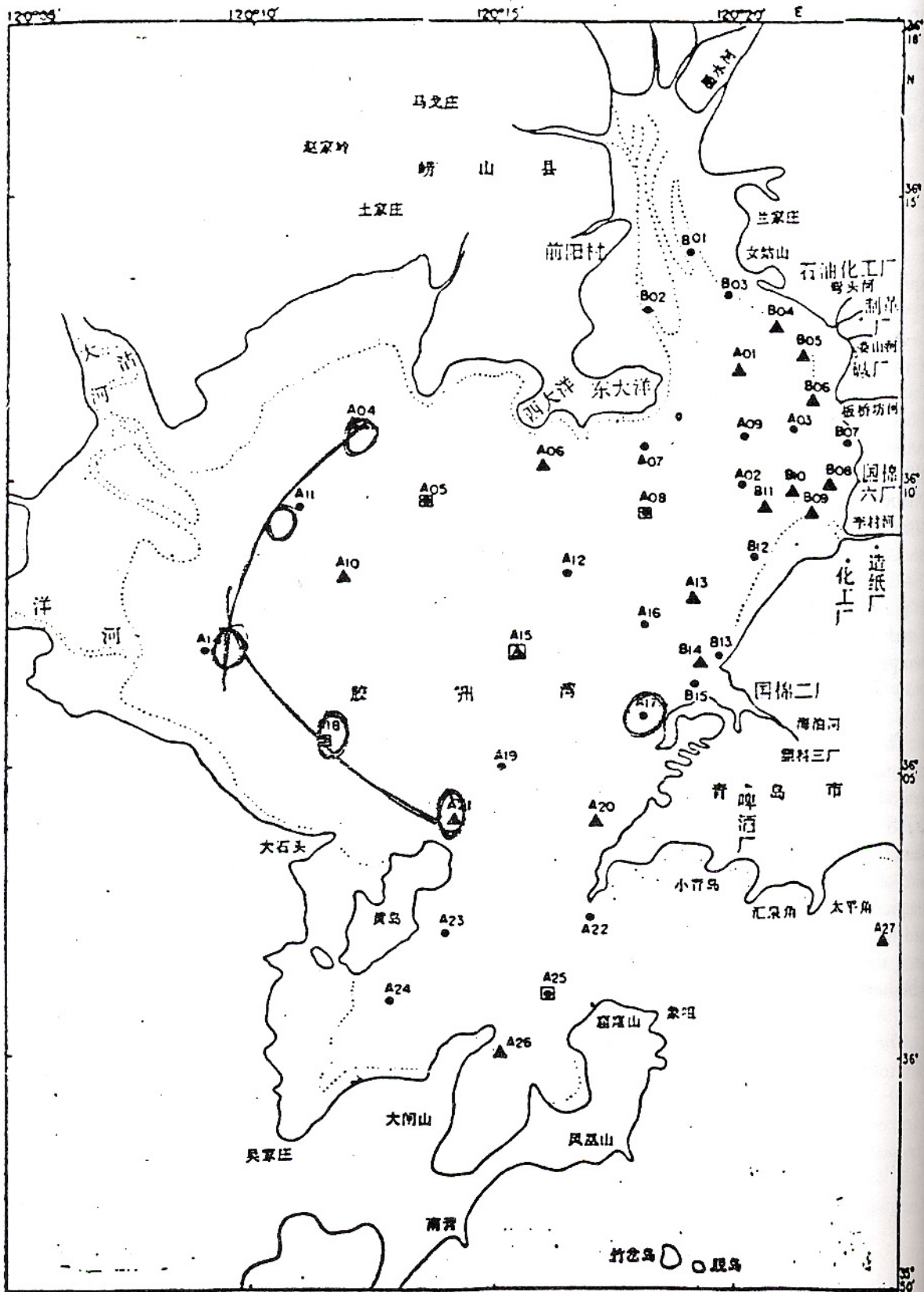
7. It will be necessary to have wrap up meetings for the workshop. In October 1998 at PICES VII we would review preliminary results and discuss the format of a descriptive report on the field work possibly to be published in the PICES Scientific Report series. It is proposed to have a more complete discussion of results during the PICES VIII meeting in October 1999. Final publication of results in the scientific literature, as appropriate, to follow soon after.

Figures and Tables in Annexes expand on the information presented above and include: a chart of proposed sampling sites; Sampling-site selection criteria; a flowchart for the Workshop and follow-up activities; methods to be evaluated and responsible investigators; and a timeline for implementing and conducting the workshop; and the workshop budget.

#### **Expected Products of Jiaozhou Bay Practical Workshop**

1. An improved appreciation by PICES participants of the approaches and techniques used by other member countries to assess the effects of marine pollution, and improved mutual understanding and technology transfer among scientists from PICES countries.
2. The generic results should be applicable to other coastal areas in the PICES region. The data will be archived and made available to PICES country scientists. A series of papers evaluating the methods for characterizing the effects of pollution on aspects of the ecology of Jiaozhou Bay is anticipated.

Figure 1. Chart of Jiaozhou Bay China, showing proposed sites for evaluating methods to assess ecological effects. Specific site locations will be determined during the reconnaissance efforts that will precede the practical workshop.



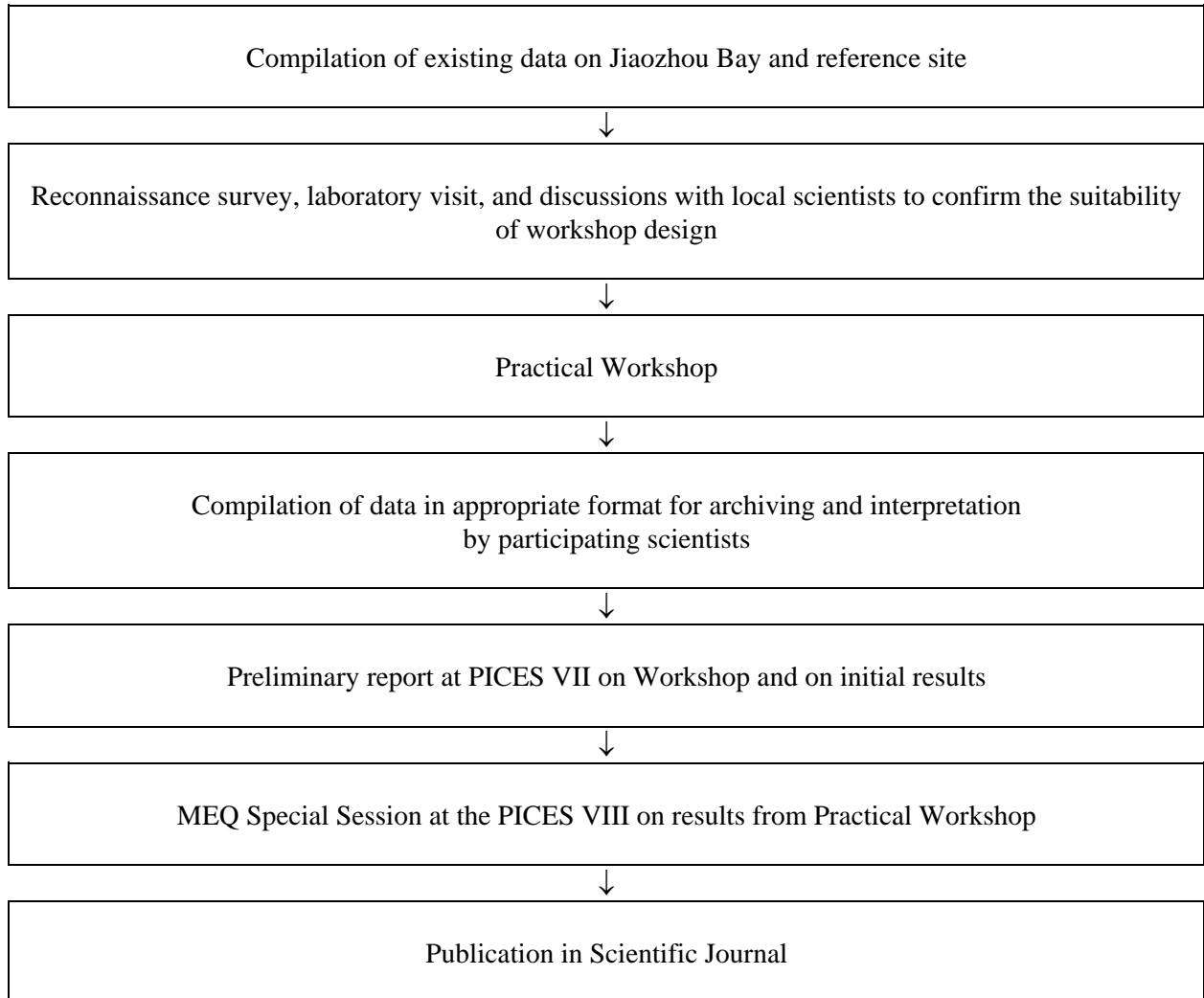
## Annex 1

### Criteria for selection of sites in Jiaozhou Bay and the reference site, e.g., Laoshan Bay.

- 5 to 7 meter depth (the majority of Jiaozhou Bay)
- "muddy sediment"
- potential different pollution sources
- intertidal invertebrates present (e.g. gastropods)
- avoid dredged areas or shipping lanes
- at least two sites with fish present
- comparable oceanography (estuarine circulation)
- aquaculture bivalve species similar
- similar wild mollusc species (e.g. *Crassostrea gigas*)

## Annex 2

### Flowchart for Practical Workshop



**Annex 3**

**Methods for determining ecological effects of contaminant exposure**

<u>Methods to be Evaluated</u>	<u>Current participants</u>
<p>For molluscs:</p> <ul style="list-style-type: none"> <li>•chambering (oyster)</li> <li>•imposex (gastropod)</li> <li>•age/size relationships, growth rate</li> </ul> <p>Biomarkers:</p> <ul style="list-style-type: none"> <li>•genetic damage (comet assay)</li> </ul>	<p>Canada (Levings)</p> <p>Korea (Oh), Japan (TBD), China (Zhou)</p> <p>China (Zhou)</p> <p>US (Stein)</p>
<p>For benthic fish:</p> <ul style="list-style-type: none"> <li>•health and condition (condition factor, HSI, GSI, tissue lipids)</li> <li>•age/size relationships</li> </ul> <p>Biomarkers:</p> <ul style="list-style-type: none"> <li>•CYP1A</li> <li>•AChE (brain/muscle)</li> <li>•Bile metabolites</li> </ul>	<p>US (Stein)</p> <p>China (Zhou)</p> <p>Canada (Addison)/ US (Stein)/ Korea (Yang)</p> <p>Canada (Addison)/Korea (Yang)</p> <p>US (Krahn)</p>
<p>For benthic community:</p> <ul style="list-style-type: none"> <li>•abundance/diversity</li> <li>•sediment quality (bioassays)</li> </ul>	<p>Russia (Tkalin)/China (Zhou)/Korea (Je)</p> <p>Canada (Levings)/China (Zhou)</p>

Abbreviations:

AChE = Acetylcholinesterase

CYP1A = cytochrome P4501A

GSI = gonadosomatic index

HSI = hepatosomatic index

TBD = to be determined



**Annex 4**

**Information Needed for the Practical Workshop**

<b>Biological Parameters</b>	<b>Information needed</b>
Species identification	observation at time of collection (use photographs)
Length and weight	measurements conducted at time of collection
Sex	observation at time of collection
Age	collection of otoliths or shells
Maturation stage	observation at time of collection, gonad weight, for gonadosomatic index
Stomach fullness	observation at time of collection, weight of contents
Stomach taxonomy	stomach samples preserved
Condition factor	whole body, liver, and gutted body weight at time of necropsy
Other observations:	observable lesions, parasites, deformities, etc.; observations conducted at time of collection (use photographs)
<b>Sediment Characteristics</b>	observations on sediment characteristics (use photographs); TOC, TON, grain size, minerology, metals and organic contaminants
<b>Water characteristics</b>	measurements conducted at time of collection; temperature, salinity, dissolved oxygen, turbidity, nutrients
<b>Sample identification<sup>1</sup></b>	sample number, date collected, site location, method of collection, DGPS, water depth, etc., observations conducted at time of collection

<sup>1</sup> The numbering scheme will be devised to ensure that all samples are handled “blind” by the researchers conducting analyses (i.e., without the participants knowing the origin of the sample).

Abbreviations:

DGPS = Differential Global Positioning System

TOC = total organic carbon

TON = total organic nitrogen

## Annex 5

### Timeline for Jiaozhou Bay Practical Workshop

- Oct. 1996 Contact with Head of China PICES Delegation (completed).
- Oct. 1996 Approval by PICES Science Board and Governing Council of funds to partially support the workshop.
- Dec. 1, 1996 Data compilation on biology, oceanography, and pollution; and the translation and distribution of some key papers were initiated (contract established in consultation with M.J. Zhou). (partially completed April 1997)
- Oct. 1997 WG 8 met at PICES VI to refine workplan and discuss logistics.
- Jan. 31, 1998 Necessary approvals granted, and any modifications to workplan made.
- Feb. 15 1998 Deadline for notification of participating scientists of start date for workshop.
- Mar. 15, 1998 Final draft workshop timetable to be completed by participants and/or designates; budget finalized.
- Apr. 15, 1998 Supplies for workshop on site.
- May/Jun. 1998 Practical Workshop
1. week preliminary survey, laboratory visit, discussions with scientists in Qingdao
  2. week cooperative workshop
- Jul. 30, 1998 Summary report of workshop activities completed by participants will constitute the draft of the final report for WG 8 activities.
- October 1998 Present or develop at the PICES VII working group meeting the following:
- preliminary results
  - follow-up analyses
  - data archive and distribution procedures
  - proposed publication format
  - designation of report editor
  - one comprehensive (40 mins) presentation on the workshop as part of MEQ session.
- Dec. 1998 All workshop results available to participants.
- Jun. 1999 Complete statistical analyses and interpretation of findings, participants begin preparation of reports to be presented at PICES VIII.
- Oct. 1999 Presentation of workshop findings at PICES VIII meeting, complete papers submitted for compilation as workshop report.

**Annex 6**

**Estimated Costs for Jiaozhou Bay Practical Workshop (CDN\$)**

1. Travel	
8 participants (4 each Canada and US) round trip air fare (\$1,500 each person)	\$12,000
16 participants (4 each from China, Russia, Japan and Korea) round trip air fare \$500 each person	\$8,000
2. Accommodation and meals	
a. Laboratory visit and reconnaissance Survey: 3 participants for 7 days (\$100 dollars/day/person)	\$2,100
b. Practical Workshop 24 participants for 15 days (\$100 dollars/day/person)	\$36,000
3. Vessel costs (fishing vessel charter, fuel for research vessel)	
a. Fishing vessel 14 days @ \$300 per day	
b. Fuel for research vessel \$300	\$4,500
4. Supplies and shipping (laboratory supplies, reagents, disposable equipment, transport of equipment, air cargo expenses)	
	\$14,000
5. Contract for literature review on Jiaozhou Bay (\$1,000 expended to date)	
	\$1,500
<b>TOTAL ESTIMATED COST:</b>	
	<b>\$78,100</b>
Funds Contributed by PICES (for Items 3-5)	\$20,000
Funds Needed from PICES Member Countries	\$54,100

Publication costs, costs of any subsequent travel or "wrap-up" conferences are not included above. In previous IOC/GEEP workshops, all these items have been considered desirable, although most of the costs have usually been borne by individual investigators or their agency. It is proposed that the "wrap-up" symposium be conducted as part of PICES VIII. Availability of PICES travel funds will be important to insure that participants can attend PICES VII and VIII, so that an initial assessment of the workshop can be conducted and additional planning for report preparation can take place (PICES VII), and that the "wrap-up" conference (PICES VIII) will be well attended.