

REPORT OF MARINE ENVIRONMENTAL QUALITY COMMITTEE



The MEQ Scientific Committee met on Thursday, October 22, 1998, at PICES VII in Fairbanks, Alaska, U.S.A. The meeting was convened from 1330 to 1730 hours. See Endnote 1 for participants.

Introductions

Since MEQ Chairman Dr. Richard F. Addison was unavoidably unable to attend PICES VII, Prof. Makoto Shimizu of Japan agreed to chair the MEQ Meeting. Prof. Shimizu welcomed all participants, and asked that each introduce themselves and their affiliations. Dr. C. Michael Watson served as rapporteur.

Adoption of MEQ agenda

The Chairman then offered a proposed agenda for the meeting. A brief discussion ensued from the floor, during which Science Board Chairman Dr. Makoto Kashiwai reminded the group of the necessity for MEQ and other Scientific Committees to make the Science Board aware of their recommendations as soon in the process as possible, so that Science Board would have more time and opportunity for adequate discussion and consideration of the various issues at hand. After further discussion, the proposed agenda was unanimously accepted, and the meeting was called to order.

Election of new MEQ Chairman

Because Dr. Addison's tenure as MEQ Chairman expires this year, it was necessary for MEQ to elect a new Chairman at this time. The MEQ Committee unanimously expressed its gratitude for Dr. Addison's leadership and efforts, and especially for his work and dedication in helping develop critical groundwork for the proposed MEQ Practical Workshop.

As per the PICES Rules of Procedures, Executive Secretary Dr. W. Doug McKone called for

nominations. Dr. Alexander V. Tkalin was unanimously selected as the new MEQ Chairman-Elect.

Bering Sea Ecosystem Biophysical Metadatabase Project: presentation by Ms. Sonia O. Hamilton, Metadatabase Coordinator, NOAA

As a follow-up to Mr. Allen Macklin's introduction of this database to MEQ at our PICES VI Meeting (1997), Ms. Hamilton briefly updated MEQ on recent progress. The Bering Sea Biophysical Metadatabase is dedicated to advancing the understanding of the structure and function of the Bering Sea Ecosystem, through the development of a collaborative research tool for fisheries-oceanography and ecosystem investigations. Its mission is to facilitate and enhance the ability of researchers, managers, students, fishermen, and the general public to investigate and understand the functioning of the complex ecosystem of the Bering Sea.

"Metadata" refers to data about data, rather than to the actual data *per se*. Objectives are to determine what data exist, where it is located, and who holds the data. Also, to provide standardized descriptions of the data holdings, to develop an indexed annotated catalogue (the actual metadatabase), and make this information available through various mechanisms including the World Wide Web.

Because the metadatabase references only the existence of data and information products, 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) metadata standards. The Bering Sea Metadatabase was recently selected by the principal agencies of the Bering Sea Ecosystem Initiative and the North Pacific Research Council as the primary vehicle

for data sharing and exchange on the Bering Sea ecosystem among agencies and scientists conducting research in the Bering Sea. The metadataabase has recently joined efforts with TCODE, and now has approximately one thousand individual sets of information.

Ms. Hamilton hoped that MEQ /PICES and their various colleagues will contribute as much as possible to the Bering Sea metadataabase, and stressed that the actual data itself will remain under the control of the researcher or similar source person. The program is interested in contaminant-related data, and will be receptive to any other types of information relevant to the Bering Sea. The metadataabase now has established a home page, at: <http://www.pmel.noaa.gov/bering/mdb/toc.html>

Dr. Shimizu led a brief discussion of this issue. MEQ agreed to study the issue further, and to advise Ms. Hamilton of our likely level of participation after the PICES Annual Meeting.

Review of minutes from MEQ Meeting, PICES VI

To help familiarize newer attendees with the recent history of MEQ and its activities, Rapporteur Dr. Watson briefly sketched the evolution of MEQ /PICES, and its Working Groups, through the series of six prior sequential Annual Meetings held at Victoria, Seattle, Nemuro, Qingdao, Nanaimo, and Pusan. He then highlighted key points from the 1997 PICES VI MEQ Meeting at Pusan, Republic of Korea. First was an overview of MEQ's long-term plan and continuing effort to sponsor and carry out a "practical workshop" originally planned for the Western Pacific. The planning and coordination for the practical workshop has been undertaken by WG 8. The goal of the workshop is harmonization of research and analytical methodologies among participating scientists from the six PICES member countries.

The concept of such a workshop was first put forth at Nemuro (PICES III, 1994), with the goal of holding the practical workshop at Jiaozhou Bay

(Qingdao, Shandong Province), People's Republic of China, and a target implementation date of spring, 1998. As a contingency that the Qingdao site might not be available because of time constraints and other factors, MEQ at PICES VI selected the Chinhae-Masan Bay region in the Republic of Korea as an alternate possible site for the workshop. Dr. Watson then referred back to the receipt of the January 22, 1998 letter sent to PICES by Chinese authorities in Beijing, informing PICES "... that the present situation in Jiaozhou Bay is not suitable to host the workshop". He also related that for the proposed Korean fallback site, it had then become obvious that the process of obtaining full government permission to utilize the alternate workshop site might take longer than our workshop timeline would allow. Thus, the plan for the workshop needed to be significantly altered as to venue and time. A detailed description of the events surrounding the scheduling of the Workshop is provided in the letter from Dr. Addison to Dr. Watson which is appended to this report (Endnote 2).

A brief review was then given of the MEQ PICES VI Scientific Sessions, which had been convened by Dr. Dong-Beom Yang. The MEQ Topic Session, "Processes of Contaminant Cycling" was very well received, with eleven papers presented. An excellent poster session was also noted. The joint MEQ/BIO Session, "Harmful Algal Blooms", was also very well received, with eleven papers presented. This session provided an excellent overview of HABs around the Pacific, some of the various contributing factors to HABs, and one paper even recounted the notation of various HABs in Korea during ancient times. The MEQ Best Presentation Award was given to Dr. Dmitry Aminin, of the Far Eastern Division of the Russian Academy of Sciences, Vladivostok, who presented a joint Russian-Korean paper entitled "Use of fluorescent probes for biochemical monitoring of environmental contamination".

Dr. Watson also outlined the four MEQ Topics which were proposed at Pusan for the PICES VII symposia in Fairbanks. These included (1) a session outlining the research design and

preliminary results of the proposed Jiaozhou Bay Workshop (subsequently cancelled; see above) (2) a joint MEQ/BIO Session entitled "Contaminants in high trophic level biota: linkages between individual and population responses"; and (3) an MEQ Topic Session, "Science and technology for environmentally sustainable mariculture". It was also resolved to continue the MEQ Paper Session along the general theme of "Processes of contaminant cycling". Specific sub-themes which should continue to receive specific MEQ focus also included "marine oil spills", "HAB toxins", and "metal speciation /biogeochemical cycling".

The PICES VI MEQ Meeting also included discussions about establishing a more concrete set of criteria for shaping the future activity and focus for MEQ. It was suggested that MEQ/WG 8 select a long-term goal of preparing 3 separate "white papers", to help guide future MEQ activities. The suggested topics were (1) "Environmentally sound mariculture: status and technology needs", (2) "HABs: causes, consequences and mitigation", and (3) "MEQ/PICES interactions with GIWA: a feasibility study". These three issues are still in the planning and preparation process.

Dr. Watson also discussed and summarized various remaining MEQ business items occurring at PICES VI. These included briefings on HABs, (Mr. Forbes, NOAA), and also on the Bering Sea Metadatabase, (Mr. Macklin, NOAA). MEQ also continued its discussions from prior sessions about interactions with the PICES Technical Committee on Data Exchange (TCODE). MEQ also had extensive discussions regarding future focusing of any "new" working groups which would eventually be established to replace WG 8 after the completion of the MEQ practical workshop.

Business arising from the previous agenda item

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

PICES VIII Scientific Sessions: Proposals for future session topics

Dr. John E. Stein then led a discussion to set forth MEQ's future activities for PICES VIII (Vladivostok). A lengthy dialogue ensued about the general topic of offshore oil and gas exploration, which is currently planned for at least two major sites at Sakhalin Island, and is a very important topic in the Russian Far East. Dr. Colin Levings noted there are suggestions that the moratorium for exploratory drilling off the coast of British Columbia might be lifted. After extensive discussion and consideration, the following topics were chosen for the MEQ scientific sessions at PICES VIII:

- a. A proposed joint MEQ /BIO session entitled "Coastal pollution: eutrophication, phytoplankton dynamics and harmful algal events". Rationale supporting this topic include: (a) nutrient pollution and eutrophication are associated with HAB events and are a concern for all PICES countries, particularly Russia, Japan and China; (b) HAB events are of concern to Canada and the US on the North American West coast, however, support for research is meager compared to North American East Coast; and (c) because of development of new techniques there is considerable new information from monitoring recent HAB events.
- b. An MEQ Topic Session entitled "Ecological impacts and mitigation of oil spills and oil exploration". Much discussion revolved around the topic of oil spills *per se*, versus oil drilling/exploration. There is great interest in Russia about modeling and forecasting harmful environmental effects of such oil and petroleum related phenomena. Industrial stakeholders are also very interested in gaining experience in assessing such environmental impact, much after the fashion of the Prudhoe Bay experience gained by their professional counterparts in the U.S.A.
- c. Various topics for a MEQ Paper Session for PICES VIII were also discussed. It was

strongly suggested to keep the MEQ Paper Session very broad and interdisciplinary, so as not to exclude participation of scientists presenting MEQ issues with special relevance to the far northwestern Pacific region. It was also suggested that MEQ be more clear in specifying the interdisciplinary breadth and scope of the various papers we are soliciting for PICES VIII. After much discussion, it was agreed that the MEQ Topic Session for PICES VIII will be "Impacts of Pollution in Coastal Areas". Subcategories of interest to the MEQ Committee for this PICES VIII topic will include, but not be limited to, such areas as: harmonization of methods, assessment of biological effects of toxic chemicals, marine pollution, modeling, contaminant cycling, ecotoxicology, ecosystem effects, biomarkers, and other indicators of marine environmental quality.

Beyond PICES VIII; implications for PICES IX (Japan):

- a. Continuation of the MEQ's "Mariculture" theme: At both PICES VI and PICES VII, MEQ Scientific Sessions on environmental impacts of mariculture proved to be timely and well attended. It was pointed out by Prof. Shimizu that there is a continued high level of interest in this topic, especially among PICES scientists from Japan, Korea and China. After discussion, it was unanimously agreed that MEQ should reconvene its mariculture theme as a Topic Session at PICES IX in Japan. This MEQ Topic Session will be "Science and technology for environmentally sustainable mariculture: impacts and mitigation in coastal areas".
- b. Impacts of climate change: The MEQ also recognized and highlighted an additional key topic, which should be included in future plans for MEQ symposia, and which merits further discussion and consideration. This is the issue of "Climate change and its impact on the fate and effects of contaminants in the Pacific region". MEQ agreed to retain and revisit this topic in its planning cycle for

future symposia.

Report of Working Group 8, PICES VII: Dr. John E. Stein (Co-Chairman, WG8)

Dr. Stein summarized the findings of WG 8's PICES VII Meeting, which took place October 18-19, in Fairbanks prior to the PICES opening sessions. The purpose the meeting was to review and refine the draft work plan for convening the MEQ Practical Workshop. The purpose of the workshop, also described previously, is to harmonize approaches and methods among PICES countries when assessing ecological impacts of pollution.

- a. Overview and Recent Developments in the Workshop Plan: Dr. Stein briefly reiterated some of the history of the workshop plan, explaining that over several years prior, MEQ/WG 8 had hoped to conduct the workshop at Jiaozhou Bay, China, with the Chinhae-Masan Bay in Korea serving as an alternate choice, should the logistics or other circumstances somehow preclude holding the workshop in China during the desired (May, 1998) timeframe. But as mentioned earlier in the meeting, on January 22, 1998, PICES Executive Secretary McKone received a letter from Mr. Zuo-Fu Gan, Deputy Director-General of the Ministry of Agriculture, Beijing, stating that the conditions were not suitable to hold the workshop in Jiaozhou Bay. Shortly afterward, it also became obvious that if MEQ were to host the workshop in our alternate chosen site --Korea--, the timeframe and necessary steps to obtain bibliographic information about the ecosystem, plan the logistics and receive the various permits would extend many months beyond our original time frame for carrying out the project.
- b. Modifications to the Workshop Plan: WG 8 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. Revisions to the work plan were made in continued recognition of the need of PICES countries to work toward harmonizing approaches and methods for assessing marine pollution effects.

- i. Change in location: Because of the various logistic and other problems outlined above which preclude holding the workshop in the Western Pacific as originally planned, Dr. Stein reported that through the efforts and recommendations of Drs. Addison and Levings, WG 8 recommends to MEQ that a more practical and accessible location – Vancouver Harbour (British Columbia, Canada)-- be utilized for the practical workshop. Vancouver Harbor is a large, multi-use urban embayment, and is relatively close to two major Canadian governmental marine pollution laboratories. Via the Puget Sound and Georgia Basin continuum, it is also easily accessible to vessels, equipment and personnel from the Seattle NMFS Laboratories to the South. Vancouver Harbour also has a relatively extensive database of prior marine pollution studies. Dr. Stein asked that MEQ consider and accept the WG 8 proposal to use Vancouver Harbour for the workshop, which would take place May 24 - June 8, 1999.
- ii. Goals and scientific design: Dr. Stein explained that other than changing the location from the Western Pacific to Vancouver Harbour, the specific goals and essential scientific design of the workshop remain essentially the same as set forth in previous MEQ/WG 8 planning sessions. However, there is some likelihood for the inclusion of a few additional pollution-related study topics (e.g., endocrine disruptors) in the technical scope of the study as it becomes more finalized.

- iii. Participation and planning: It was deemed critical by both MEQ and WG 8 that participation by at least 2 scientists from each of the PICES member countries would be necessary for a successful workshop. It was also recommended that a Canadian scientist be appointed as a Co-Chairman of the Implementation Team, if the alternate Workshop site, Vancouver Harbour Canada, is accepted.
- iv. Funding needs: Dr. Stein also reviewed funding plans for the workshop, which date back to PICES V in Qingdao, at which the Governing Council first approved \$20K in funds to support the workshop. Total estimated cost of the Vancouver workshop is now estimated at \$33,300. This sum also does not include travel, lodging and meal costs for US and Canadian Scientists, nor does it include member country support for supplies and analytical costs for analyses of additional samples following the Practical Workshop, nor costs of data analysis and reporting. Because the change of venue to Vancouver, there are now less operating costs required for vessel support, laboratory space and support, supplies, etc. Research vessels, laboratory space, a technician, and sampling equipment will be supplied at no charge by both Canada and the U.S.A. Mindful of these new considerations in the plan, WG 8 pointed out that there were two basic options for securing adequate travel funds for scientists from PICES member countries to participate in the Vancouver Workshop: (a) to seek the travel funds for their participating scientists through their respective member countries, or (b) to reallocate funds within the original PICES/MEQ operational budget (see Annex 6 of WG 8 Report), and /or seek additional funds from the PICES Secretariat. With this new projected budget in mind it was thus recommended that MEQ request the PICES Science Board to continue support

at \$20K.

- v. Research time line: The proposed date for the MEQ Practical Workshop is now May 24 - June 8, 1999, with a preparatory session on May 25 to prepare the final agenda, brief all participants and finalize tasks.
- c. Presentation of Workshop results: Discussion then arose about how MEQ should present preliminary results from the practical workshop. It was agreed that preliminary results of the workshop will be discussed and evaluated at a special MEQ/WG 8 session at PICES VIII (Vladivostok). At these preliminary sessions, MEQ will schedule a presentation outlining 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. At PICES VIII, a task team will also be identified to complete the final report of the practical workshop. A presentation of the final results from the workshop will take place in a special MEQ session at PICES IX (Japan), followed by publication in a scientific journal.
- d. Summary of MEQ decisions regarding WG 8 plan for MEQ/WG 8 Practical Workshop: It was unanimously resolved that MEQ will conduct its practical workshop May 24- June 8, in Vancouver Harbour, British Columbia, Canada. MEQ also approved the WG 8 Report, and recommended that Science Board accept the proposed changes in funding outlined in Annex 6 and discussed in detail as outlined above. It also approved the appointing of an additional WG 8 Workshop Implementation on-site Co-Chairman, Dr. Colin Levings, to be tasked with assisting Drs. Stein, Addison, Tkalin, and Prof. Zhou, in planning and implementing the Vancouver Practical Workshop May 24 - June 8, 1999.

Report on MEQ Scientific Sessions

Session Co-Convener Dr. Stein reported on the three MEQ Sessions which had taken place at PICES VII. The MEQ Topic Session "Science and technology for environmentally-sustainable mariculture" had seven excellent papers. A very broad spectrum of topics was presented, ranging from feed requirements, to genetic drift and the changing role of hatchery stocks, to off-site contamination from medication used in fish farms, etc. Filling in for a paper which had been canceled due to unavoidable circumstances, Dr. Shimizu provided MEQ Topic Session attendees to an excellent overview of recent developments and future trends in Japanese mariculture.

The MEQ Paper Session continued with our core theme, "Processes of contaminant cycling". Although several cancellations occurred due to unavoidable travel and funding problems, the session nonetheless enjoyed five excellent presentations, covering issues of biomarkers /bioassays, and the geochemical cycling of elements in estuarine systems, all of which were very pertinent and appropriate to the goals of our ongoing MEQ research theme.

A joint MEQ/BIO Session entitled "Contaminants in high trophic level biota: linkages between individual and population responses" was also held. This session was extremely well attended, and very successful. Papers embraced areas ranging from climate change, to fate and transport, bioaccumulation and metabolism, and health assessment in fish, marine mammals, and even possible implications for humans. Dr. Stein noted that although appropriate researchers on contaminants in birds had been invited, none were able to attend. The results of such a successful joint session led MEQ to agree unanimously to continue to pursue such interdisciplinary joint sessions in the future. Also, MEQ was encouraged by the higher attendance and quality and number of presentations as compared to sessions at previous meetings.

Best Presentation Award

After lengthy discussion of the various papers presented at the three various MEQ-sponsored sessions for PICES VII, MEQ voted unanimously to award the Best Presentation to Dr. Peter S. Ross, Visiting Fellow, Contaminants Sciences Section, Institute of Ocean Sciences, Sidney, B.C., Canada. Dr. Ross's winning presentation, entitled "Marine mammals at the top of the food chain: ecological sentinels", and co-authored with Dr. Richard Addison, was one of several excellent papers given in the joint MEQ/BIO session on contaminants in high trophic levels.

Update on Global International Waters Assessment (GIWA) Program Proposal

This issue originated during last year's meeting at Pusan, at which time GIWA had formally approached MEQ/PICES and its member nations to ask for our cooperation and support. Since the focus of GIWA is traditionally upon the open ocean, rather than coastal areas, MEQ has been conducting further review of the request before deciding whether or not to formally participate and what role to assume. Drs. Addison and Park of MEQ have explored the likelihood of common functions shared between MEQ and communicated their findings to Dr. William G. Doubleday. Dr. Addison drafted a letter from Dr. Doubleday (on behalf of PICES) to Dr. J.M. Bewers (on behalf of GIWA). This stated that MEQ recognizes that some of the aims of GIWA are close enough to those of PICES that it is desirable for the two bodies to discuss what practical objectives they could address collaboratively, and that PICES is therefore interested in continuing discussions with GIWA to identify immediate objectives of interest to both groups. When those objectives are defined, and the resources required to address them are identified, then PICES would make a final decision about its involvement. MEQ members will be informed of PICES' level of involvement and recommended course of future action with GIWA as soon as a final decision is made.

Other business

- a. Strategic Plan, Vision Statement, and future directions of MEQ: Considerable discussion was devoted to updating the MEQ strategic plan, and the request by Science Board to have a final plan delivered to them soon. Much reference was made to the need for continued progress on developing the three "white paper" topics proposed at PICES VI (Pusan) as a comprehensive tool for future MEQ planning and scientific focus. The MEQ agreed to continue to play a strong inter-sessional role in developing and drafting the three discussion papers, on topics of interest to it and other committees. The three topics will be: (1) "Environmentally sound mariculture: status and technology needs", (2) "Harmful algal blooms (HAB): causes, consequences and mitigation", and (3) MEQ/PICES interactions with GIWA: a feasibility study".

These "white papers" would provide much of the basis for member country decisions on MEQ's activities over the next few years. It was also suggested and agreed that prior to PICES VIII, MEQ should work toward developing a comprehensive Vision Statement for Science Board, which will be based heavily upon overviews and prioritizations of the MEQ-related research and policy needs of each member nation.

It was agreed that the MEQ Committee would develop, intersessionally, a strategic plan. The draft plan will be discussed and made final at PICES VIII. Drs. Richard Addison, current Chairman of MEQ, and Alexander Tkalin, Chairman-Elect of MEQ, will develop the review draft.

- b. Development of new MEQ-related Working Groups, and the fate of WG 8: With completion of the Vancouver Practical Workshop in May, 1999, and the WG 8 meeting at PICES VIII, the scientific mission of WG 8 will likewise end. In the near future, changes in the focus of future research topics

being planned by MEQ will thus require the formation of new Working Groups. With this in mind, what should be the next critical scientific task(s) of subsequent Working Groups which will replace WG 8 in advising the MEQ Committee? After appropriate discussion, MEQ agreed and resolved that increased effort will be devoted this year toward defining and convening a new Working Group to guide and support our evolving future MEQ research activities. This issue will require further clarification from Science Board.

- c. Interdisciplinary nature of MEQ, and advantages of assimilating other PICES scientists in related fields: Discussion revolved around the issue of whether or not MEQ would be the appropriate PICES Scientific Committee to best provide a forum, and a PICES niche, for chemical oceanographers, marine bird and mammal scientists, and various other scientists who currently participate in PICES but whose interests and research focus may not necessarily be a good fit with the 3 other PICES Scientific Committees. It was generally agreed that it is appropriate for MEQ to embrace and encourage a wide and diverse group of scientific membership, and that our group is sufficiently interdisciplinary to serve a wide range of interested ocean scientists.
- d. PICES Web page: Several Committee members noted that in the announcement for PICES VII and in the “online” registration form, there was no mention of the MEQ Paper Session. In addition, the Committee recommends inclusion on the PICES Web page of a description of topic areas for the MEQ Paper Session.

NOTE: MEQ suggests the following text for inclusion on the PICES Web page under the MEQ Committee section:

The theme areas for the MEQ paper session at PICES Annual Meetings are as follows:

Ecosystem effects of anthropogenic

substances

Indicators of marine environmental quality

Ecotoxicology

Biological effects of toxic chemicals

Biomarkers of contaminant exposure and effects

Contaminant cycling

Nutrient cycling

Harmonization of methods

Modeling

MEQ Report to Science Board

The MEQ Committee discussed and endorsed the report of WG 8, and the recommendation of the WG to change the venue for the Practical Workshop to Vancouver Harbour, British Columbia, Canada. The Committee also appointed Dr. Colin Levings of Canada as a Co-Chairman of the Implementation Team for the Practical Workshop. In addition, the MEQ Committee concluded that the tasks of WG 8 would be complete at the conclusion of PICES VIII, at which time a task team will be identified to complete the final report of the Practical Workshop.

The MEQ Committee drafted the following recommendations to the PICES Science Board:

- a. The MEQ Committee accepts the change in venue for the Practical Workshop to Vancouver Harbour, Canada, and recommends continued support by PICES of \$20K for the workshop. Attendance by at least two scientists from each member country is critical to the success of the workshop in achieving the stated goal and objectives.
- b. The MEQ Committee proposed to BIO a joint session on “Coastal pollution: eutrophication, phytoplankton dynamics, and harmful algal events”, for PICES VIII in Vladivostok.
- c. The MEQ Committee recommends that the Topic Session for PICES VIII be “Ecological impacts and mitigation of oil spills and oil exploration”. The Convener of the Topic Session will be Dr. Alexander V. Tkalin.

- d. The Committee also recommends that a follow up session to the mariculture session at PICES VII be held as a Topic Session for PICES IX in Japan. The proposed title is “Science and technology for environmentally sustainable mariculture: impacts and mitigation in coastal areas”.

Adjournment

The MEQ Scientific Committee concluded its meetings for PICES VII, and was adjourned by Acting Chairman Prof. Shimizu at 1730 hours on Thursday, October 22, 1998.

Scientific Program

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

Science and technology for environmentally-sustainable mariculture. (MEQ) Convenor: John E. Stein (U.S.A.)

Conrad Mahnken. The status of aquaculture in North Pacific Rim nations - was Peter Larkin right?

Colin D. Levings, S.F. Cross & S.J. Gormican. A preliminary examination of the transfer of oxytetracycline (OTC) from farm fish to fauna adjacent to a net-pen operation in British Columbia

Lee W. Harrell. Perceptions, attitudes and biological realities associated with wild fish and fish held in artificial culture facilities

Gregory T. Ruggerone & D.L. Alverson. Potential effects of farmed salmon on wild salmon stocks in the Pacific Northwest

Ronald W. Hardy. Global feed requirements to sustain expansion of aquaculture production

Thomas A. Flagg, C. Mahnken, J. Colt, D. Maynard & R. Iwamoto. The endangered species act and the changing role of artificial propagation

Makoto Shimizu. Mariculture in Japan (special short presentation)

Contaminants in high trophic level biota - linkages between individual and population responses. (MEQ/BIO Joint Session) Co-Convenors: John E. Stein (representing R.F. Addison) & Linda Jones (U.S.A.)

Ross J. Norstrom. Persistent organic pollutants in arctic marine mammals

Peter S. Ross & R.F. Addison. Marine mammals at the top of the food chain: ecological sentinels

John E. Stein, M. Arkoosh, T. Collier & E. Casillas. Estuarine pollution and juvenile salmon health

Kimberlee B. Beckman, G.M. Ylitalo, M.M. Krahn, R. Towell & J.E. Stein. Organochlorine levels and immune system function in northern fur seals (*Callorhinus ursinus*) from St. George Island, Alaska

Todd M. O'Hara & V. Woshner. Contaminants and health assessment research in arctic Alaska wildlife: biologists, veterinarians, and subsistence hunters take on the challenge

Robert B. Spies. Research and monitoring in the wake of the Exxon Valdez oil spill: the long-term dividends

Cynthia T. Tynan. Effects of climate change on the transport, pathways, and availability of contaminants

Sandie O'Neill, J. West, L. Johnson & M. Myers. Chemical contaminant exposure and associated biological effects in Puget Sound fishes

Endnote 1

Canada

Colin D. Levings*

China

Japan

Makoto Shimizu*

Korea

Kwang-Woo Lee

Participants

Russia

Lev M. Gramm-Osipov

Alexander V. Tkalin*

U.S.A.

John E. Stein* (representing Usha Varanasi)

C. Michael Watson

* WG 8 member

Endnote 2

November 30, 1998

Dr. Michael Watson

Rapporteur, PICES MEQ Committee

USEPA, 1200 6th Ave.,

Seattle, WA 98101-3188

U.S.A.

Dear Michael:

Now that I am stepping down as Chairman of MEQ, this seems to be an appropriate time to review the work of the Committee over the past three years. I hope this record will be useful to my successors.

The main work of MEQ has been to plan a practical workshop, which will have the objective of harmonising approaches used by PICES member states to assess the effects of marine pollution. (This objective was embodied in the terms of reference of WG 2, later WG 8, which reported to MEQ.) The idea of a practical workshop was first outlined at PICES II (Seattle, 1993); it was to be modelled on the successful IOC/GEEP Workshops whose proceedings have been published elsewhere (Mar. Ecol. Prog. Ser., vol. 46, 1988; J. Exp. Mar. Biol. Ecol. vol. 138, 1990 and Mar. Ecol. Prog. Ser. vol. 91, 1992). The idea was subsequently discussed and approved at PICES III (Nemuro, 1994). In 1995, PICES met in Qingdao, and at the meeting of WG 8 which immediately preceded the full PICES meeting, Prof. Ming-Jiang Zhou proposed that the workshop be held at the Academia Sinica Institute of Oceanology in Qingdao, and that Jiaozhou Bay (an industrialised harbour) and a suitable reference site on the Shandong peninsula be the focus of the workshop. This invitation was accepted by WG 8 and the proposal approved by MEQ and subsequently by SB and the Council at PICES IV.

The next two years involved considerable work by WG 8 and others. Prof. Ming-Jiang Zhou and his colleagues provided lists of equipment and laboratory space to be made available at his Institute, and provided several publications and reports which described oceanographic conditions, biota and contaminant concentrations in various environmental "compartments" in the region. Several of these articles were translated at PICES' expense. At the same time, WG 8 members refined the plans for the workshop, based on this information; this involved at least one meeting in Seattle of North American members. At the WG 8 and MEQ meetings at PICES VI (Pusan, 1997), the final plans were presented and approved, and endorsed by SB

and the Council. At that meeting, MEQ also discussed the desirability of having a “fallback” site, and agreed to consider the Masan-Chinhae Bay area in Korea for this.

Following PICES VI, I drafted (for Bill Doubleday’s signature) a formal request to the appropriate Chinese authorities for permission to run the workshop in spring 1998. This was refused on the grounds that “... the present situation in Jiaozhou Bay is not suitable to host the workshop” (letter, Mr. Zuo-Fu Gan, Jan. 22, 1998). (PICES had, in fact, written to Chinese authorities in late 1996 and early 1997 on the subject of the workshop, but had received no reply.) Following Mr. Gan’s letter, we reverted to our fallback position of using the Masan-Chinhae Bays in Korea; however, after several discussions with the Korean scientists involved, it became clear that a workshop could not be organised there at short notice. In the light of this, John Stein, Colin Levings and I undertook to move the workshop to West Vancouver, where it is now scheduled for spring 1999 (see MEQ Report, PICES VII, 1998).

There are lessons for MEQ (and other PICES Committees) in this. The most important one is probably that Committee members and delegates must realise that *SB and GC endorsement of a Committee recommendation implies a commitment by Council Delegates to try to implement that recommendation*. Although the recent events I have described surrounding the planning of the practical workshop have been frustrating, the experience will not have been wasted if PICES learns from it.

Finally, although most of our effort has focussed on organising the practical workshop, MEQ has had other activities. Probably the decision with the furthest-reaching implications is our agreement to support the GIWA project, at least to the extent of keeping in touch with GIWA (MEQ Report from PICES VI, Pusan). It is in the nature of UN-supported programmes to move ahead only slowly, but assuming that PICES will become involved in GIWA, this will have a considerable influence on the MEQ’s activities over the next few years.

I hope this summary of our activities will be a useful record for the committee. Despite the frustrations of the last year or so, I have enjoyed my involvement with PICES and I have appreciated very much the opportunity to interact with a very pleasant and stimulating group.

Yours sincerely

(signed)

R.F. Addison
Head, Contaminants Science

Endnote 3

Report of Working Group 8 Practical Assessment Methodology

The meeting of WG 8 was convened at 0900 on October 17, 1998. Attendees are given at the end. Dr. John E. Stein noted that Prof. Ming-Jiang Zhou, WG 8 Co-Chairman, was not able to attend PICES VII. Dr. Colin Levings agreed to serve as rapporteur.

The meeting agenda was reviewed and approved. The overall objective of the meeting was to review and refine the draft workplan for convening a Practical Workshop in Vancouver Harbour, Canada, aimed at harmonizing approaches and

methods among PICES countries when assessing ecological impacts of pollution.

Dr. Levings gave a presentation on the proposed study area and members commented on the overall study design for the proposed practical workshop. Vancouver Harbour was accepted as a proposed site and the workplan was amended accordingly. There was substantial discussion of options for funding travel to the Practical Workshop.

Participation by at least 2 scientists from each of the PICES member countries was deemed critical to the success of the Practical Workshop.

The WG members present approved the draft meeting report and recommendations to the MEQ Committee.

The meeting was adjourned at 1430 h on October 18, 1998.

Appendix 1

Participants and observers

Canada

Colin Levings*

China

Japan

Makoto Shimizu

Yoichiro Ishibashi (observer)

Korea

Russia

Lev M. Gramm-Osipov

Alexander V. Tkalin*

U.S.A.

John Stein (Co-Chairman)*

*Member of WG 8 Implementation Group for Practical Workshop

Appendix 2

Recommendation to MEQ

Working Group 8 recommends that the MEQ Committee accept the modified plan (Annex 3 to 5) for the Practical Workshop developed during the WG meeting that preceded PICES VII (Fairbanks, Alaska). The new proposed site for the Practical Workshop is Vancouver, Canada. Revisions to the workplan were made in continued 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. The WG 8 recommends that the MEQ Committee accept the budget in Annex 6. The WG 8 also points out that there are two basic options for securing travel funds for scientists from PICES member countries to participate in the Workshop: 1) to seek the travel funds for their

participating scientists through their member countries, 2) to reallocate funds within the operational budget given in Annex 6 and or seek funds from the PICES Secretariat. In addition, WG 8 recommends that a Canadian scientist on the Workshop Implementation Team be appointed as a Co-Chairman of the Implementation Team, if the alternate workshop site, Vancouver Harbour, Canada, is accepted.

The WG 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 and history 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 the 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 WG 8 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/GEPP) 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 regard to the logistics for conducting the workshop, Prof. Ming-Jiang Zhou extended an invitation to use the facilities and research vessels of the Institute of Oceanology, Academia Sinica, for the workshop. In addition, Dr. Dong-Beom Yang from Korea Ocean Research and Development Institute (KORDI) subsequently

confirmed that the joint Korea/China Center in Qingdao could offer additional facilities.

The MEQ and WG 8 formed an informal Workshop Implementation Team at the PICES Fourth Annual Meeting. The team 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 Board, and the plan was approved subsequently 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 were 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 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. Immediately following PICES VI, the PICES Chairman formally requested consideration by the Chinese government to grant approval for conducting the workshop in Jiaozhou Bay. On January 22, 1998, the Chinese authorities notified PICES that the request for the workshop to be held in Jiaozhou Bay was denied.

The Chairman of the MEQ Committee then

pursued options for an alternate site. Korean representatives at PICES VI suggested that a site in Korea was possible as an alternate site in the eventuality that the workshop could not be conducted in Jiaozhou Bay. After consultations with Korean MEQ members, it was concluded that permission from Korean authorities for conducting the workshop in Korea could not be given in time to have the workshop in the spring of 1998 or 1999. Given the time constraints it was concluded that an alternate site in North America should be investigated. Drs. Levings and Addison proposed Vancouver Harbour as an alternate, and subsequently developed a presentation for to be given to the WG 8 at PICES VII in Fairbanks.

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 the 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:

Contaminated sites and reference sites within Vancouver Harbour will be sampled. (See Annex 1). The sites are shown in Figures 1 through 3 (Goyette and Boyd 1989, Environment Canada, Regional Program Report 89-02) and were selected according to criteria in Annex 1. The sites to be evaluated were also selected based on geographic location, existing background information, previous and ongoing monitoring, and logistics such as proximity to appropriate laboratory facilities in West Vancouver.

Workshop (see flowchart in Annex 2):

1. The workshop will commence with a meeting

to discuss monitoring approaches used by the various PICES countries and a review of the sampling and analysis schedule for the Practical Workshop. The meeting on monitoring approaches will occur the day before the Practical Workshop starts.

2. The biological responses to be evaluated include: benthic community structure; sediment quality assessment (bioassays), demersal fish health and condition (including histopathology), biota age and size relationships; biochemical changes linked to contaminant exposure (e.g., cytochrome P-4501A induction, bile metabolites), and assays to detect endocrine disrupting chemicals (e.g., the YES bioassay) or exposure to endocrine disrupting chemicals (levels of vitellogenin in male flatfish such as English sole) (see Annex 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. Assessing the relationship of the biological responses to contaminant exposure requires information on current levels of contaminants in biotic and abiotic compartments of the study site. Concentrations of the following classes of chemical contaminants, polycyclic aromatic hydrocarbon (PAHs), tributyltins, dioxins, chlorinated hydrocarbons, selected metals, and endocrine disrupting chemicals will be determined in sediment or biota as appropriate.
3. During the cooperative activities there will be up to 16 scientists participating in the workshop, with at least 2 scientists from each PICES member country. Other scientists may augment this effort, at their own expense.
4. Samples will be obtained using the NOAA research vessel HAROLD W. STREETER, which is equipped with most of the appropriate onboard trawls and grabs. Analyses will be carried out cooperatively at the West Vancouver Laboratory of the

Canadian Department of Fisheries and Oceans, using specialized instruments from other laboratories. In addition routine analyses (e.g., aging) that do not involve cooperative evaluation will be conducted at other laboratories, such as at the Pacific Biological Station in Nanaimo. Scientists participating in the workshop will collect additional (replicate) samples for further analyses to be done after the Practical Workshop. Data Coordinator will be Dr. Colin D. Levings (or designee) with cooperation from Dr. John E. Stein (or designee). The data coordination efforts will include preparing data collection sheets and incorporating measurements and calculations into a database.

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 proposed time for the Workshop is May 24 to June 8 1999 (see timeline, Annex 5). On May 24 a half-day orientation meeting will be held. The workshop will consist of a one-day meeting on May 25, 1998 (convened by Drs. Levings and Stein) to discuss monitoring approaches used by PICES member countries, followed by cooperative sampling and analysis of biotic and abiotic samples from May 26 to June 5. Preparations for sample shipment, archiving, and data organization will be concluded by June 8.

7. It will be necessary to hold meetings following the Practical Workshop. In October 1999, at PICES VIII, we would review preliminary results in the WG 8 meeting and discuss the format of a descriptive report on the fieldwork possibly to be published in the PICES Scientific Report Series. A paper will also be prepared for presentation at PICES VIII. It is proposed to have a more complete discussion of results during the PICES IX meeting in October 2000. 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 Vancouver Harbour 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 Vancouver Harbour is anticipated.

Figs. 1-3. Charts of Vancouver Harbour, B.C., Canada, showing proposed sites (Stations 11b, 15, 16, 19, 35, 38) for evaluating methods to assess relationships between contaminant exposure and biological and population level effects. Proposed reference sites are PEI and a site in outer Howe Sound (latter site not shown). The Howe Sound site is approx. 25 km. northwest of Vancouver Harbour.

Annex 1

Criteria for selection of sites in Vancouver Harbour

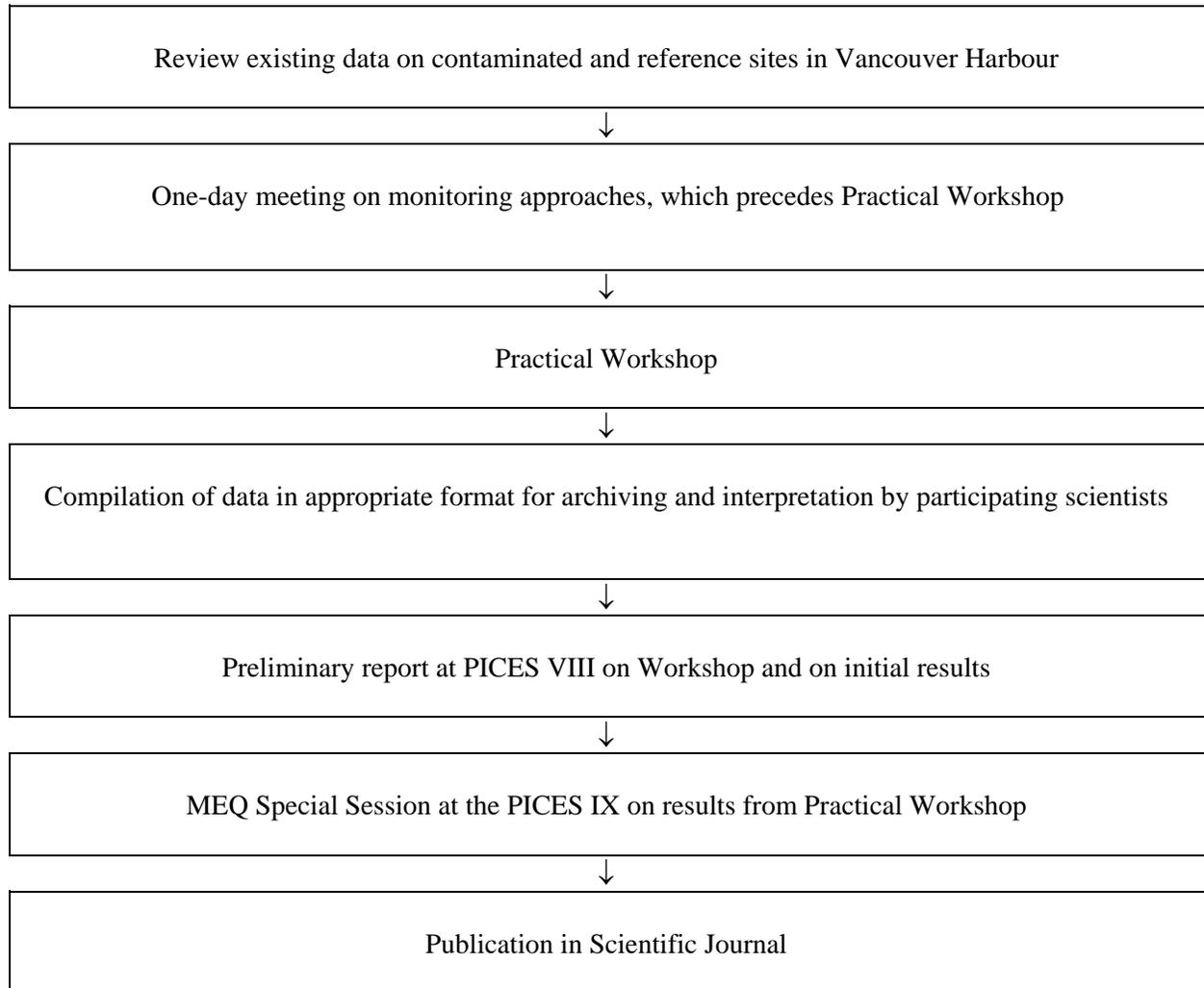
- Sites previously sampled
- Comparable sediment types
- Potential different pollution sources
- Benthic invertebrates present
- Avoid dredged areas
- Sites with flatfish species present
- Sites with mollusc species present (mussels, clams)
- Comparable oceanography (estuarine circulation)

Sampling Sites in Vancouver Harbour

Site (SN = station number)	Primary Contaminant at the Site
Port Moody	
2 Trawl sites Port Moody 1 (SN 35) Port Moody 2 (SN 38)	Polycyclic Aromatic Hydrocarbons
Inner Burrard Inlet	
4 Trawl sites Inner Burrard 1 (SN 11B) Inner Burrard 2 (SN 15) Inner Burrard 3 (SN 16) Inner Burrard 4 (SN 19)	Heavy Metals Non-Point Source (Combined Sewer Outfalls)
Outer Burrard	
1 Trawl site Outer Burrard (SN PE1)	Reference site (fish)
Outer Howe Sound	
1 Trawl site Outer Howe Sound 1	Reference site (benthos/sediment)

Annex 2

Flowchart for Practical Workshop



Annex 3

Methods for Determining the 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"> •contaminant levels •condition factor and other ecophysiological methods for mussels •imposex (gastropod) •age/size relationships, growth rate 	<p>Russia (Tkalin)</p> <p>Canada (Levings)</p> <p>Korea (TBD), China (Zhou)</p> <p>China (Zhou)</p>
<p>For benthic fish:</p> <ul style="list-style-type: none"> •contaminant levels •health and condition (condition factor, HSI, tissue lipids, etc) •histopathology •age/size and food habit relationships <p>Biomarkers:</p> <ul style="list-style-type: none"> •CYP1A •vitellogenin in males (for EDCs) •YES bioassay (for EDCs) •bile metabolites 	<p>Russia (Tkalin)</p> <p>USA (Stein)</p> <p>Canada (Levings/Devlin/Kent), USA (Myers)</p> <p>Canada (Levings)</p> <p>Canada (Addison), Korea (Yang)</p> <p>USA (Johnson), Japan (TBD)</p> <p>USA (French)</p> <p>USA (Krahn)</p>
<p>For benthic community:</p> <ul style="list-style-type: none"> •abundance/diversity •sediment quality (bioassays) <p>sediment contaminants</p>	<p>Russia (Belan), China (Zhou), Korea (Je)</p> <p>Canada (Levings), China (Zhou)</p> <p>Canada (Addison), USA (Krahn) Russia (Tkalin)</p>

Abbreviations: CYP1A cytochrome P4501A, HSI = hepatosomatic index, EDCs = endocrine disrupting chemicals, TBD = to be determined, YES = yeast estrogen system

Annex 4

Ancillary Information Needed for Conducting the Practical Workshop

Biological Parameters	Information needed
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)
Sediment Characteristics	observations on sediment characteristics (use photographs); TOC, TON, grain size, minerology, metals and organic contaminants
Water characteristics	measurements conducted at time of collection; temperature, salinity, dissolved oxygen, turbidity, nutrients
Sample identification¹	sample number, date collected, site location, method of collection, DGPS, water depth, etc., observations conducted at time of collection

¹ 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

History for Proposed Jiaozhou Bay Practical Workshop

October 1996	Contact with Head of China PICES Delegation.
October 1996	Approval by PICES Science Board and Governing Council of funds to partially support the workshop.
December 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). (Completed April 1997).
October 1997	WG 8 met at PICES VI to refine workplan and discuss logistics.
January 1998	Request to conduct Practical Workshop in Jiaozhou Bay was denied.

Timetable for Vancouver Harbour Practical Workshop

October 1998	WG 8 met at PICES VII to revise workplan to hold workshop in Vancouver, B.C., Canada.
January 5 1999	Deadline for confirmation of participation by scientists from PICES countries.
February 15 1999	Conference call to review workplan and draft timetable for Workshop.
March 15, 1999	Final draft of the workshop timetable to be completed by participants and/or designates; completed list of supplies.
April 15, 1999	Supplies for workshop on site.
May 24 - June 8, 1999	Conduct Practical Workshop on monitoring approaches used by PICES member countries
September 15, 1999	Summary report of workshop activities completed by participants. The report will constitute the final draft of the activity report for discussion and review at PICES VIII meeting.
October 1999	Discuss or develop at the PICES VIII working group meeting the: <ul style="list-style-type: none">- preliminary results- follow-up analyses- data archive and distribution procedures- proposed publication format- designation of report editor- one comprehensive (40 min.) presentation on the workshop as part of MEQ session.
December 1999	All workshop results available to participants.
June 2000	Complete statistical analyses and interpretation of findings, participants begin preparation of reports to be presented at PICES IX.
October 2000	Presentation of workshop findings at PICES IX meeting, complete papers submitted for compilation as workshop report.

Annex 6

Estimated Costs for Vancouver Harbour Practical Workshop (Can.\$)

1. Travel (see attached table)	
8 participants (4 each Canada and USA) round trip	\$NC
8 participants (2 each from China, Russia, Japan and Korea) round trip air fare \$1500 each person	\$12,000
2. Lodging and Meals (see attached table) (See attached memo and memo from proposed housing facility)	
8 participants for 15 days at \$40 dollars/day/person	\$4,800
3. Vessel Costs (Provided by Canada and USA)	\$NC
4. Laboratory Space (Rental)	\$1,500
5. Supplies and Shipping (laboratory supplies, reagents, disposable equipment, transport of equipment, air cargo expenses)	\$14,000
6. Contract for literature review on Jiaozhou Bay	\$1,000
TOTAL ESTIMATED COST:	\$33,300
Funds Contributed by PICES	\$20,000
Funds from PICES Member Countries*	\$13,300
TOTAL FUNDS:	\$33,300

*Funds accounted reported here do not include travel and lodging and meal costs for US and Canadian scientists. Also, they do not include member country support for supplies and analytical costs for analyses of additional samples following the Practical Workshop, nor costs of data analysis and reporting.

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 IX.

PICES travel funds may be needed to assist some scientists in attending PICES VIII and IX. Attendance by participating scientists at PICES VIII and IX will be important to the overall success of the workshop. At PICES VIII, an initial assessment of the data from the workshop will be conducted, additional planning for report preparation will take place, and one presentation in the MEQ session will be given on the what was accomplished during the workshop and initial results. At PICES IX, the MEQ Topic Session may be used as a venue for formally presenting the results of the Practical workshop.

Detailed Description of Funding to Support Travel, Lodging and Meals for PICES Member Country Scientists to Participate in the Vancouver Harbour Practical Workshop

Travel by PICES Country [Country (number of scientists)]	Funding Source (\$Can. Funds)
Canada (4) China (2) Korea (2) Japan (2) Russia (2) United States (4)	Canada PICES funds allocated to Workshop (\$3 K) PICES funds allocated to Workshop (\$3 K) PICES funds allocated to Workshop (\$3 K) PICES funds allocated to Workshop (\$3 K) United States
Lodging and Meal Costs [Country (number of scientists)]	Funding Source
Canada (4) China (2) Korea (2) Japan (2) Russia (2) United States (4)	Canada PICES funds allocated to PW (\$1.2 K) PICES funds allocated to PW (\$1.2 K) PICES funds allocated to PW (\$1.2 K) PICES funds allocated to PW (\$1.2 K) United States