REPORT OF FISHERY SCIENCE COMMITTEE

Approval of agenda

The Chairman, Dr. Chang-Ik Zhang, opened the meeting. The agenda was reviewed and approved by all members (see Endnote 1). The Chairman appointed Dr. Gordon H. Kruse as rapporteur. The FIS Committee welcomed one new member, Dr. Tokimasa Kobayashi (Japan).

Review of WG 12 Report

Dr. Robert S. Otto summarized the activities of WG 12. WG 12 convened its third meeting in Fairbanks, Alaska, U.S.A., during October 14-17, 1998 (see Endnote 2). The main objectives of this meeting were to review ocean processes that may control crab and shrimp recruitment and to review problems of sampling and data analyses used to assess trends in abundance. 8 of 15 members from 5 countries participated in the meeting of WG 12.

Dr. Otto discussed a number of WG 12 recommendations:

1. Continue WG 12 activity beyond its current (third) year and to modify the Terms of Reference for WG 12. Proposed changes were to redefine the area covered to include the PICES area as far west as the Yellow Sea to reflect lack of information from China (Term of Reference A), to identify agencies and institutions rather than individuals who conduct work on crabs and shrimps (Term of Reference B), and to include consideration of marine sanctuaries for their effects on crab and shrimp populations (Term of Reference E).

2. Establish a Working Group on introduced species.
3. Request participation from North Korea and the People's Republic of China.
4. Hold an inter-sessional meeting (August or early September 1999 in Asia) focussed on spatial structure of populations; the effectiveness of marine sanctuaries; and restriction of fishing activities on crabs and shrimps.

FIS reviewed the interim report and recommended the following:

1. After much discussion, FIS supported the proposal to convene one more inter-sessional meeting so that WG 12 can conclude its work within one year. FIS requests a completed, final report from WG 12 at PICES VIII in Vladivostok.

2. FIS denied the request to modify the Terms of Reference to include consideration of marine sanctuaries for their effects on crab and shrimp populations. FIS is very concerned about broadening the Terms of Reference that might jeopardize the completion of WG 12 in one year.

3. FIS expressed regret that WG 12 continues to lack participation from the People's Republic of China and encourage Chinese scientists to contribute to WG 12 activities.

4. FIS accepted the interim report of WG 12 to be published in the PICES 1998 Annual Report.

Relations with other organizations

Dr. Zhang reported on the development of Memoranda of Understanding (MOU) between PICES and the North Pacific Anadromous Fisheries Commission (NPAFC) and with ICES. Both MOUs are nearly finalized for signing. Among other items, the MOU with NPAFC calls for the coordination of the place and dates of annual meetings. FIS noted that PICES received a request from NPAFC for non-anadromous

catch statistics for their yearbook, and that the MOU between PICES and NPAFC needs to be signed before the next step can be taken.

Publication of reports

The book on the Bering Sea is nearly ready to be published by Alaska Sea Grant. This was a product of the Bering Sea Working Group. Proceedings of the REX Workshop held in 1997 were published as PICES Scientific Report No. 9, "Climate Change and Carrying Capacity: Workshop on the Development of Cooperative Research in Coastal Regions of the North Pacific". Progress reports from Working Groups 8-12 were published in the PICES Annual Report for 1997.

New Working Groups

Three proposals were submitted to FIS for new Working Groups. Two were proposed in 1997: "Climate Change and Shifts in Fish Production" (originally proposed by Dr. Richard J. Beamish) and "Stock Assessment and Methodology Development" (originally proposed by Dr. Mikhail Stepanenko). The third was proposed for 2000 by Dr. Tokio Wada. Although the name of the new WG was not specified, it will address climate change and fisheries management.

Given the recommended continuation of WG 12 for one more year, FIS took no action on proposals for new Working Groups. However, FIS discussed similarities among the proposed new Working Groups and noted that a FIS Topic Session at PICES VIII on "Climate Change and Fisheries Management" would be an ideal mechanism to further develop Terms of Reference for a future Working Group.

CCCC Program and CCCC Task Teams

Dr. Zhang noted that the revised Terms of Reference of the CCCC Program were approved.

Travel support

Dr. Zhang noted that PICES provided travel support for him to attend the meeting of SCOR Working Group 105. A summary of this meeting was published in PICES Press Vol. 6 No. 1 in January 1998, and a full report is available via the PICES web page. A joint symposium on "The Ecosystem Effects of Fishing" will occur in March 16-19, 1999, in Montpellier, France. Peer reviewed papers will be published in the ICES Journal of Marine Science. FIS recommended Dr. Zhang's participation in the symposium and partial support (per diem for the symposium) for travel costs.

Pandalid Shrimp Symposium

Dr. Zhang noted that NAFO, ICES and PICES are co-sponsoring an International Pandalid Shrimp Symposium in Halifax, Nova Scotia, Canada, during September 8-10, 1999. Members of WG 12 are actively involved.

Scientific items of interest

Dr. Wada reported on the REX Workshop on the "Small Pelagic Species and Climate Change in North Pacific Ocean" which occurred immediately prior to PICES VII. More than 25 scientists from 10 countries participated.

Dr. Gordon A. McFarlane reported on BASS. The 1997 symposium proceedings are nearly ready to be published in *Progress in Oceanography*.

Ms. Patricia Livingston (Co-Chairman of the CCCC Implementation Panel) reviewed current proposals for scientific sessions. A REX workshop on herring and zooplankton was recommended prior to the next Annual Meeting in Vladivostok. CCCC recommends a symposium on results from GLOBEC and GLOBEC-like research at the next PICES Annual Meeting. At the PICES meeting in 2000, there are proposals for a workshop on the

design of iron fertilization experiments and a symposium on climate change on small pelagics.

Six inter-sessional workshops are proposed. One, to be held on the west coast of North America, would address indicators of regime shifts. Also, the MONITOR Task Team is planning a workshop on intercallibration of sampling gear in October 1999 prior to the PICES Annual Meeting. The BASS Task Team proposed to hold a workshop in mid-1999, to determine how the ecosystems of the subarctic Pacific gyres function and how they respond to regime shifts. In 2000, proposed inter-sessional workshops include "El Niño and Beyond" in April in La Jolla, U.S.A., a MODEL workshop in February in Nemuro, Japan, and a joint ICES/PICES workshop on Zooplankton Production and Ecology in March or April in Hawaii, U.S.A.

Dr. Bernard A. Megrey presented a proposal on a "Workshop on the Application of Scientific Visualization to Marine Ecosystem Analysis" to be convened by Drs. Bernard A. Megrey, Thomas C. Royer, and Igor I. Shevchenko. The proposal is sponsored by TCODE. FIS supports this proposal for a workshop to be held immediately prior to the PICES Annual Meeting in 1999 or 2000.

FIS Session Topic for PICES VIII

FIS supports a proposal by Dr. Wada for a FIS session topic at the next Annual Meeting on "GLOBEC and GLOBEC-like Studies and Fisheries Management". The purpose of this session is to identify ways that GLOBEC studies can be applied to sustainable use of fisheries resources. The session would be co-convened by Dr. Wada. A Co-Convenor from U.S.A. or Canada is being sought, and Dr. Gordon H. Kruse is an interim contact. After the conclusion of the FIS Committee meeting, FIS members recommended the possibility to seek Co-Convenors from all six PICES countries.

Best Presentation Award

FIS voted for the best presentation award from talks presented during the FIS Paper Session and FIS/CCCC joint session. The award went to Mr. Jae Bong Lee for his excellent presentation titled "The impacts of climate changes on the marine fisheries resources in Korea".

Arising issues

Dr. Zhang drafted a "Review of Activities and Strategic Workplan of FIS Committee". The report was requested of Scientific Committee Chairmen to review the Committee activities and to recommend a three-years workplan. FIS reviewed the report, and provided editorial remarks. A final document was prepared (see Endnote 3).

Dr. Allen Macklin presented a report on the Bering Sea Ecosystem Biophysical Metadatabase. The purpose of the project is to facilitate research, management, and education. Dr. Macklin reported on the geographic distribution of contributors, showed how a search of the database is conducted, and showed how data records can be entered electronically by their web site. Assistance is sought to identify colleagues with data that can be contributed to this metadatabase.

Dr. Zhang indicated that PICES should seek a U.S. or Canadian member to serve as a contact for PICES so that the scientific content of the home page can be improved. Dr. Kruse accepted this responsibility.

Scientific Program

The following scientific papers were presented from the FIS Committee and CCCC Program jointly-sponsored part of the program.

*Climate change and carrying capacity of the North Pacific: Recent findings of GLOBEC and GLOBEC-like programs in the North Pacifi*c. (FIS/CCCC Joint Session) Co-Convenors:

Anne B Hollowed (U.S.A., R. Ian Perry (Canada) & Takashige Sugimoto (Japan)

Roger Harris. GLOBEC and GLOBEC-like research programs in the Atlantic

Alex Smirnov, E.T. Burden & N.P. Smirnov. Environmental change in the North Atlantic region and the health of terrestrial and marine biotic resources

Chang-Ik Zhang & J.B. Lee. The impacts of climate changes on the marine fisheries resources in Korea

Kaoru Nakata. Long term fluctuations of the biomass and size composition of copepods in the Kuroshio and the Japanese slope water in relation to climate

Mitsuyuki Hirai & T. Goto. Effects of hydrographic conditions on the formation of spawning grounds for sardine, *Sardinops melanostictus*, in the Japan Sea

Makoto Kashiwai, T. Wada, D. Ware, C. Robinson & O. Yamamura. Carrying capacity change of Oyashio Shelf ecosystem with disappearance of Japanese sardine

Orio Yamamura. Temporal variability of food-web structure in the Oyashio-Kuroshio transition region

Kenneth L. Denman, M.A. Peña & S.P. Haigh. Modelling the response of the planktonic foodweb to climate variability in the subarctic Pacific

David L. Mackas. Season, size and depth partitioning of copepod production in the subarctic Pacific

Michael Fogarty. Overview of U.S. GLOBEC research activities.

Takashige Sugimoto. Overview of Japan GLOBEC research activities

Suam Kim. Overview of Korea GLOBEC research activities

Richard D. Brodeur, P.T. Strub, F. Schwing, M. Ohman & H. Batchelder. Retrospective data analysis in the U.S.-GLOBEC northeast Pacific (NEP) Program

Albert J. Hermann & H. Batchelder. Modeling activities within the U.S.-GLOBEC northeast Pacific Program

Kerim Aydin. Pacific salmon carrying capacity, ecosystem structure, and density dependent predator-prey interactions on the high seas

Anne B. Hollowed, S.R. Hare & W.S. Wooster. Pacific basin climate variability and patterns of northeast Pacific marine fish production

Boris N. Kotenev, A.S. Krovnin & V.V. Maslennikov. Changes in year-class strength of pollock stock in the Russian EEZ of the Bering Sea in relation to climatic variations in the North Pacific

J.J. Goering, S. Henrichs, T.K. Rho, S. Smith, T.E. Whitledge, C.T. Baier, R.D. Broderr, D.M. Blood, J.M. Napp, J.J. Cullen, R.F. Davis, J.D. Schumacher, P.J. Stabeno, G.L. Hunt, Jr. & G.L. Swartzman. Southeast Bering Sea carrying capacity (SEBSCC): ecosystem dynamics research in a marginal sea

Vidar G. Wespestad & B.A. Megrey. On relationships between cannibalism, climate variability, physical transport and recruitment success of Bering Sea walleye

Bernard A. Megrey. Application of fuzzy logic to forecasting Alaska walleye pollock recruitment

Jacke Helle. Ocean Carrying Capacity Program

Dean A. Stockwell & T.E. Whitledge. GLOBEC 1998: Preliminary monitoring data from the Gulf of Alaska

Thomas Weingartner. The Gulf of Alaska GLOBEC long-term observation program (LTOP)

Bruce Finney. Long-term variability in sockeye salmon abundance in the Gulf of Alaska and California current systems

R.J. Beamish, G.A. McFarlane & R. Sweeting. The impacts of decadal scale changes in climate on the Strait of Georgia ecosystem

Susan E. Allen, C. Vindeirinho, R.E. Thomson & D.L. Mackas. Upwelling currents around a shelf-break canyon and influences on zooplankton

Claire L. Smith & M.G. Foreman. Progress report on the development of a biophysical model for the west coast of Vancouver Island

Ruben J. Veefkind, J.J. Whiticar, J.N.C. Whyte & R.I. Perry. Measuring the stable carbon isotope ratio of individual fatty acids, a novel tracer in marine foodweb studies?

Stephen R. Okkonen. Altimeter observations of the mesoscale eddy-field along the shelfbreak in the central Bering Sea

Endnote 1

Participants and observers

Canada
Gordon A. McFarlane (for Richard J. Beamish)

China

Japan
Tokio Wada
Akihiko Hara
Tokimasa Kobayashi

Korea
Chang-Ik Zhang (Chairman)
Suam Kim

Russia

U.S.A.
Richard Marasco (for Loh-Lee Low)
Gordon H. Kruse

Endnote 2

Report of Working Group 12
Crabs and shrimps

Introduction

Working Group 12 (WG 12) held its interim meeting in Fairbanks, Alaska, U.S.A., from October 14 to 17, 1998, just prior to the main meeting of PICES. This was the third meeting of WG 12 but only the second in which both North American and Asian members were present. The Working Group welcomes Mr. Zhi-Meng Zhang, who replaces Mr. Sheng-Min Ren of China, but sadly reports that we still have had no participation or correspondence from China.

The main purposes of the third meeting were to review oceanographic processes that may affect recruitment to stocks of crabs and shrimps in the PICES region (generally north of 33^{o} North Latitude) and to review problems of sampling and data analysis used to assess trends in abundance. WG 12 also invited Drs. Kashiwai and Livingston to speak on the topics of 1) PICES as an organization, and 2) the PICES-GLOBEC Program and its components. WG 12 wished to review these two topics in order to better focus on the problems of completing our work and recommending how various topics concerning crabs and shrimps might best be integrated into PICES for longer term consideration.

Attendance was 8 of 15 members in 1998 as compared to 11 of 15 members in 1997. Five nations were represented in both years.

As was true in 1997, WG 12 members unanimously agreed that it was desirable for scientists from the People's Republic of China and North Korea to attend future meetings. This concern was re-iterated in 1998 for the reasons detailed in our 1997 report.

Review of Terms of Reference

WG 12 considered the terms of reference formally adopted by FIS in 1997. There was a lot of discussion as to the importance of introduced species. While our terms of reference seem adequate relative to introduced species, this problem needed to be more broadly considered. WG 12 also considered changes to terms of reference as indicated in **bold** type below and requests that they be formally

approved or disapproved (with guidance) by the FIS.

WG 12 is established to:

1. Consider those crabs, shrimps and lobsters that are utilized in commercial, subsistence or recreational fisheries **within the portion of the PICES area as far west as the Yellow Sea**. This may include introduced species if they are directly important or impact human utilization of any other marine species. (FIS declined to change this item in favor of anticipated participation by the Republic of China.)

2. Identify **agencies, educational institutions and scientific societies or other formally constituted groups** from each **nation** that are performing scientific work on the distribution, recruitment, larval transport, migration, population dynamics, and influences of environmental conditions for crabs and shrimp**s in the PICES area.** (FIS felt this could be accommodated in the WG 12 final report without Changing terms of reference).

3. Identify available data that would assist in the analyses of factors affecting abundance trends.

4. Review and exchange current knowledge and data concerning factors affecting abundance and survival of crabs, shrimps and spiny lobsters and identify key scientific questions regarding reasons for abundance fluctuations.

5. **Consider marine sanctuaries of various sorts and their effects on conservation of crab and shrimp stocks.** (FIS felt that this would better be included as an item in the WG 12 final report.)

After considerable discussion, WG 12 members agreed unanimously that we cannot finish our work in a timely manner if we continue to include Chinese coastal waters which are located west of the Yellow Sea. We have received no information concerning crab and shrimp stocks in this area and see little way of acquiring reasonable amounts of information in a timely manner. Conversely there has been a lot of information exchanged between China and Japan or Korea during various meetings and diplomatic negotiations concerning fisheries in the Yellow Sea and adjacent areas of the East China Sea. WG 12 thought that we could acquire sufficient information to meaningfully discuss stocks from these two areas with or without Chinese participation. Members wish to emphasize that it is not our desire to exclude participation by Chinese scientists.

Reasons for changes in other Terms of Reference are that WG 12 wishes to clarify our intent respecting item 2 and that we consider that crab and shrimp stocks have more localized spatial distributions and critical habitats than are frequently manifested for stocks/ populations of finfish, micronekton or plankton respecting item 5. WG 12 also noted that several protected areas now exist as areas closed to bottom trawling to protect crab stocks and that various marine sanctuaries are being planned or proposed in the United States, Canada and Japan.

Oceanography and recruitment

A. Overview

The PICES region contains approximately 65% of world crab resources and 23% of world shrimp resources according to United Nations (FAO) landing statistics. Unfortunately, it is not currently possible to deduce the importance of many individual resources from UN/FAO statistics or the contribution of aquaculture as opposed to harvest of wild stocks. The PICES region encompasses all of FAO Area 61 (Northeast Pacific), a small part of Area 71 (Eastern Central Pacific) and most of Area 67 (Northwest Pacific). As an approximation, landings from the PICES region would include all landings in Area 61, only U.S. landings from Area 71 and summed landings from Chinese, Japanese, North Korean, South Korean and

Russian marine waters from Area 67. It is unclear how Chinese waters south of 33º North Latitude should be included or excluded.

WG 12 identified the stocks of concern within our terms of reference in our 1996 report and will publish a final list with our final report. Here we note that major stocks of crabs and shrimps inhabit or historically occurred in all of the PICES Regions identified by the CCCC Program but not in the deep waters underlying the Eastern and Western Subarctic Gyres. There appear to be few trans-boundary stocks with respect to PICES Regions although a given region may contain multiple stocks of a species. For example, the eastern Bering Sea Region contains three stocks of red king crab (*Paralithodes camtschaticus*): Norton Sound, Bristol Bay and Pribilof Islands. PICES Regions hence serve as useful geographic units with respect to crab and shrimp stocks.

Our discussions were limited to well known stocks as examples of various processes and their effects rather than a systematic consideration for all stocks that we have identified. This was necessary due to the large number (ca 120 for crabs and 65 for shrimps) of stocks involved and the fragmentary information available for many of them. In general it appears that spatial structure is extremely important in the maintenance of recruitment of crab and shrimp stocks.

B. Crabs

Dungeness crab (*Cancer magister*) have cyclic populations in northern California, Oregon and Washington with peaks and troughs every 8-10 years. Landings 1970-1996 minimum 5,000 t (1974) to maximum of 26,000 t (1977). A collapse of central California stock occurred 1956-1970 with little recovery since. British Columbian and Alaskan landings are more consistent from year to year and do not display cyclic patterns. Fluctuations in Alaskan landings may have been market-related at times.

Hypothesized environmental and ecological effects include elevated temperatures, nemertean worm predation on clutches, salmon predation on larvae, and various cyclic phenomena (cannibalism, up welling, wind stress, geostrophic flow, fishing effort). Fishing impacts that complicate recruitment trends include ghost pot fishing and fishery handling of sub-legal males and females. The fishery selects the largest males and there is the possibility of females not getting bred or that there is significant evolutionary selection against fast growing crabs.

The list of factors used to explain changes in Dungeness crab populations is a fair sampling of factors that are thought to control crab populations in general. Additionally, predation on adults, parasitism and epizootic diseases are known to be important in a number of King and Tanner crab populations.

There has been no general agreement as to the mechanisms responsible for cyclic trends in Dungeness crab abundance observed from northern California through Washington. In Canada, larval sampling has shown that megalopae off the west coast of Vancouver Island use wind driven currents that reverse seasonally as a mechanism of longshore dispersal before eventual shoreward transport. Such mechanisms are by no means certain as to settlement location. Of Vancouver Island, megalopae may be concentrated in boundary areas between surface currents of opposing direction, and this may limit opportunity for them to reach shallow water, where survival after settlement is maximised. The confinement of outer coast megalopae to the upper 25 m of the water column is a behavior that apparently fosters beneficial transport. By contrast, megalopae resultant from spawnings in the Fraser River delta area within the Strait of Georgia find themselves in an estuarine circulation pattern, where surface water (<100 m) flows outward through the Strait of Juan de Fuca and is replaced by an influx of saltier water at depth. Strait of Georgia larvae make daily vertical migrations (surface at night, at depth

during daylight) of about 160 m, and with the long day length, are thereby effectively retained within the Strait of Georgia oceanographis system. This is an example of very different larval behaviors, despite the close geographic proximity of the two populations, resulting in transport favorable for each population. Hypothetically, such behaviors probably evolved relatively rapidly, perhaps within a few thousand years at most, as the Strait of Georgia didn't exist ca 10,000 years ago, as it was glaciated. It therefore seems quite plausible that different crab or shrimp populations of other species may also have population-specific behaviors which help spatially-structured adult populations persist. Care must therefore be taken in suggesting dispersal patterns for species as a whole, and for even specific populations unless dispersal patterns from those populations have been specifically studied.

Red king crabs (*Paralithodes camtschaticus)* are annual spawners with relatively high fecundity and small eggs, as compared to blue king crabs (*P. platypus)* which are usually biennial spawners with lesser fecundity and somewhat larger eggs. From an oceanographic point of view, this is curious, since blue king crab tend to form localized populations around offshore islands of the eastern Bering Sea. Hypothetically either localized transport mechanisms or demersal larval behavior might be involved in maintaining populations of blue king crab. Both species inhabit the Pribilof Islands and other areas where their dynamics may be explored. However, to date, oceanographic information in near shore areas has been insufficiently described and larval surveys, mostly just for relative abundance with a specific survey design, have been sporadic.

In many areas of the Gulf of Alaska and northern British Columbian coast, populations of king crab seem to spawn predominately in near shore areas and may spend their entire life span in bays or fjords.

The West Kamchatka stock of red king crabs seems to follow a basic denatent-contranatent life history pattern, where adults are positioned up current from juvenile nursery grounds and a contranatent ontogenetic migration to the adult habitat. Sub-population units of adults have there own seasonal pattern of offshore-onshore migration that is apparently mediated by temperature. Positioning of females at the time of egg-hatching relative to long-shore currents appears important. The life history pattern of Bristol bay red king crab appears similar to that of the west Kamchatkan stock except that there is currently only one area or sub-population of adults. In both populations, the spatial structure of adults appears to be important and the critical juvenile habitat appears to be limited in area.

Tanner (*Chionoecetes bairdi)* and snow (*C. opilio)* crabs have broad distributions across several zoogeographic provinces and PICES Regions. In general, their distributions are less patchy and they form fewer apparent stocks than king crabs. Snow crab range from the Beaufort Sea to the Sea of Japan, and also occur in the northwest Atlantic. Since snow crab inhabit several zoogeographic provinces and its life history is well known, the species provides an excellent opportunity for comparative retrospective analysis. Deep water members of the genus are less well known, although there are developing fisheries in both Asia and North America. For example, the Japanese Tanner crab, or benizuwai gani, *Chionoecetes japonicus,* is fished in Japanese, South Korean and possibly North Korean waters. Near Kodiak, recent studies of Tanner crab reproduction have shown different spawning behaviors of primiparous and multiparous females. Primiparous females spawn singly while multiparous females form dense aggregations of mounded females that are apparently a mechanism which facilitates larval release. Mounding of females seems to be timed so as to release larvae during the highest spring tides of the year. This is an extreme example of spatial population structuring related to spawning and larval release, as this behavior is not found at other times of the year.

C. Shrimps

Pandalid shrimps are protandric hermaphrodites, and larger, older individuals that support fisheries are mostly mature females. Two species dominate trawl fisheries. Ocean pink shrimp, *P. jordani* are distributed from northern California to British Columbia and northern pink shrimp, *P. borealis*, are distributed from British Columbia to the Bering Sea. Alaskan trawl fisheries also included *P. goniurus, P. hypsinotus, P. platyceros* and *Pandalopsis dispar*.

Pandalid shrimp populations and fisheries in Alaska collapsed in the late 1970's and most fisheries remain closed today. Very small trawl fisheries for side striped shrimp, *Pandalopsis dispar*, and pot fisheries for spot prawns, *P. platyceros*, still persist in some areas. Spot prawns are an economically important fishery in British Columbia. The collapse of the pandalid shrimp complex in Alaska was concurrent with both the late 1970's oceanographic regime shift and a sharp increase in predator populations, particularly Pacific cod (*Gadus macrocephalus*) populations. Landings of ocean pink shrimp also declined sharply in the late 1970s, reaching their lowest levels in 1983, but in contrast with northern pandalid shrimps, have increased in abundance since then. Landings of *P. jordani* have undergone two cycles between 1970 and 1995. The recovery of *P. jordani* contrasts sharply with other pandalids to the north and would also be a good species for retrospective study.

Pandalid shrimps occur in the western Bering Sea, the Okhotsk Sea and in the Japan/East Sea as far west as Korea, providing additional possibilities for comparative study. It is frequently unclear whether recruitment to populations or mechanisms that concentrate adults are most important in forming high densities of pandalid shrimp in open ocean environments. Both environmental effects and oceanographic forcing appear important in recruitment of pandalid shrimp stocks in the western Gulf of Alaska.

Four species of penaeid shrimps are important in the Yellow Sea. Several of these species are found in southern Japan as well. Peneid shrimps differ from pandalids in that they are not hermaphroditic, are semelparous rather than multiparous, and are relatively short lived. Most species complete their life spans in less than two years and frequently within one year, while northern pandalid shrimps typically live for at least three years and frequently for 7-8 years. Both transport by currents and inshore-offshore migrations appear to be important, relative to larval recruitment.

Sampling and data analysis

Topics discussed included skewed distributions resulting from aggregated populations and methods of dealing with them, and catchability experiments and visual methods of sampling, such as a LASER Line Scan System. A synopsis will be provided at a later date.

Plenary session

1. Requests that FIS formally adopt changes in the WG 12 terms of reference or otherwise provide guidance as to how we should proceed.

2. Recommends that FIS consider the possibility of convening a working group on introduced species. This recommendation was occasioned by discussions of the introductions of green crab (*Carcinas maenas*) and two species of mitten crabs (*Eriochier* spp) into the United States Pacific coast and the subsequent spreading of their geographic ranges.

3. WG 12 restates our request that scientists from North Korea are asked to participate in WG 12 activity.

4. WG 12 again requests the participation of Chinese scientists. There has been no response from the Chinese members of the WG as to the last 3 meetings of WG 12. Although Mr. Zhi-Meng Zhang has been

appointed to replace Mr. Sheng-Min Ren, no action has ensued.

5. How to proceed in the future?

    a. Time of year to hold an Interim Meeting was discussed, and it was agreed that August or early September were best. The place of the meeting was not agreed upon, although it was accepted that it should be held in Asia to facilitate representation from Asian nations. The place of the meeting is to be determined by correspondence.

    b. The 1998 interim meeting should focus on the following:
        i. Spatial structuring of crab and shrimp populations.
        ii. Consideration of the effectiveness of marine sanctuaries and restrictions of fishing activities on crabs and shrimps.
        iii. Conclusion of WG 12 activities and provision of final report to FIS.

Appendix 1

Participants and observers

Canada
Glen Jamieson

China

Japan
Hideo Sekiguchi

Republic of Korea
Sung Yun Hong
In Ja Yeon

Russia
Boris Ivanov
Vitaly Rodin (Co-Chairman)

U.S.A.
David A. Armstrong
Robert S. Otto (Co-Chairman)

Observers
Makoto Kashiwai (Chairman, Science Board)
Alexander A. Kurmazov (Russia)
Patricia Livingston (PG/IP Co-Chairman)
Alan M. Springer (U.S.A.)
Bradly G. Stevens (U.S.A.)

Endnote 3

Review of Activities and Strategic Workplan of FIS Committee

Prepared by Chang Ik Zhang, Chairman, FIS Committee

1. Introduction

During PICES VI, the Science Board proposed that Chairmen of all the Scientific Committees prepare a review of activities during his/her term of office and a proposal of strategic workplan for the next three years, which will be discussed at PICES VII prior to the election of new Chairmen. The discussion of the strategic workplan was to be completed during the FIS Committee meeting and reported to Science Board.

2. Mission and responsibilities of the FIS Committee

According to Rule 12, the Council may establish permanent Scientific Committees for any specific purposes to meet the Organization's needs; the permanent Scientific Committees shall each consist of not more than three members, designated for the purpose by each Delegation, who may be accompanied by experts and advisers.

There are currently four permanent Scientific Committees. Each Scientific Committee elects a Chairman from amongst its members for a period of three years. The Chairman shall not seek re-election for the immediate succeeding term. The Chairman takes office at the conclusion of the Annual Meeting at which elected.

The Committees are responsible for reviewing and coordinating scientific investigations in the subject or area defined by the Committees' responsibilities. The Chairman's responsibility involves:

1. Chairing meetings;
2. Preparing agenda and circulating it to members one month before any meeting;
3. Communicating with Committee members and ensuring that work is carried out in accordance with the program and to obtain records thereon;
4. Compiling a general review of the work done and results achieved;
5. Annually furnishing Science Board with a summary report of the Committee's deliberations and recommendations together with an annotated estimated account of their financial needs;
6. Preparing an annual report reviewed and revised by the Committee that should be provided to the Secretariat no later than one month after the Annual Meeting.

The Scientific Committees organize Topic and Paper Sessions. Their portion of the program consists of invited and/or contributed papers relevant to topics selected by the Committee (Topic Sessions) and contributed papers relevant to the general interests of the Committee (Paper Sessions). The Scientific Committees have the responsibility of organizing sessions they sponsor, which includes the designation of convenors for their Topic Session. Committee Chairmen normally convene their Paper Sessions or designate other Committee members to undertake this responsibility.

3. Distinction among the phases

Phase 1, i.e. the 3 years from PICES I to PICES IV, was the period to establish structure of organization and to set it into activities included in the motivation of the establishment of PICES.

Phase 2, i.e. the 3 years from PICES IV to PICES VII, is the period toward maturity to develop relations with other organizations and to develop policy and ways of performing activities expected of the Organization.

4. Achievements and major scientific decisions by FIS Committee

Phase 1:

PICES I: - Established WG 3 on Dynamics of Small Pelagics in Coastal Ecosystems

PICES II: - Became one of the four permanent Scientific Committees
- Renamed WG 3 as Coastal Pelagic Fish
- Recommended the development of PICES-GLOBEC Program

PICES III: - Jointly established PICES-GLOBEC Program (CCCC Program)

Phase 2

PICES IV: - Completed WG 3 on Coastal Pelagic Fish
- Established the new WG 12 on Crabs and Shrimps
- Supported the establishment of CCCC/REX Task Team
- Identified the need to study the separation of fishing effects from environmental effects in the dynamics of fish populations
- Recommended a Topic Session on 'Ecological effects of truncated age and size distribution and fishing on fish populations'

PICES V: - Elected new FIS Chairman
- Recommended PICES representation in SCOR-WG 105 activities
- Stressed the need to develop close relationships with regional fisheries commissions
- Recommended a joint Topic Session on 'Models for linking climate and fish' for PICES VI with BIO
- Discussed future perspectives for PICES

PICES VI: - Accepted revised Terms of Reference of WG 12
- Carried out a joint session with BIO successfully
- Recommended a joint Topic Session on "Research findings of GLOBEC and GLOBEC-like research in the North Pacific" with CCCC Program
- Endorsed the REX Symposium/ Workshop on small pelagic species
- Supported convening an inter-organizational symposium on the 1997/98 El Niño event
- Recommended participation in SCOR WG 105 meeting in Hobart, Australia

PICES VII: - Discussed FIS Strategic Workplan

5. FIS Strategic Workplan for Phase 3: PICES VII to X

Phase 3, i.e. the 3 years from PICES VII to PICES X, shall be the period to develop functions as a matured organization cooperating with other organizations as an equal partner and to develop functions to produce creative PICES scientists in member countries, as well as to continue putting enough efforts for the internal maturity.

5.1 Interactions with fisheries commissions

PICES has no authority for fishery management. However, fisheries research can contribute to the use and management of fisheries resources. FIS believes that this is a critical part of its mission. Therefore, FIS should develop ways to interact with other fisheries commissions to accomplish this goal.

5.2 Establishment of new Working Groups

During the initial stage of PICES activity, there are some cases that show lack of understanding on the Terms of Reference or on the purpose of establishing a Working Group. It is necessary to develop workflow for the proper establishment of Working Groups, by deepening focal subject through a preceding topic session and designing workshop.

Working Groups need to work closely with the sponsoring Committee to ensure they are "on track."

5.3 Selection of Topics for Topic Sessions

Selection of topics for FIS Topic Session should be based upon a long-term strategic plan. The following criteria will be used to prioritize FIS topics:

- Meet the needs of as many member countries as possible
- Increase activities in support of fisheries research
- Enforce support for cooperative programs of PICES
- Give opportunities for PICES initiatives
- Elicit interests of excellent scientists

5.4 Inter-organizational cooperation and coordination

PICES should send delegates or liaison to attend important international coordinating meetings - e.g., IOC, ICES, and SCOR. One other possible area for FIS might be a collaborative open-ocean sampling program - perhaps in conjunction with the GOOS-LMR Panel. There are some other organizations and structures that promote and enhance investigations on the continental margins, but research studies that sample the open ocean are necessary.

5.5 Scientific contribution from PICES

There is a need to consider the role of PICES as a publisher of "high-level" scientific publications. It may be important for PICES to provide timely scientific publications on fisheries and ocean sciences. This might be a useful way for PICES to work with an existing publisher/journal (e.g., Fisheries Oceanography) for the "high-quality" publications. This issue should be referred to the Study Group on Publications for resolution.