

REPORT OF FISHERY SCIENCE COMMITTEE

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The Fishery Science Committee met on the morning of October 13, 1999, in Vladivostok. The Chairman, Dr. Chang-Ik Zhang, opened the meeting and welcomed new members, Drs. George W. Boehlert (U.S.A.) and Victor V. Lapko (Russia) (*FIS Endnote 1*). The agenda was reviewed and approved by all members (*FIS Endnote 2*). The Chairman appointed Dr. Douglas E. Hay as rapporteur.

Election of Chairman (Agenda Item 2)

As per the PICES Rules of Procedure, Executive Secretary Dr. Alexander S. Bychkov called for nominations. Dr. Tokimasa Kobayashi nominated Dr. Hay (Canada), and he was elected by acclamation as the new Chairman of the FIS Committee. The Committee unanimously expressed its gratitude for Dr. Zhang's leadership and efforts.

Report of Working Group 12 on Crabs and Shrimps (Agenda Item 4.1)

Dr. Robert S. Otto, Chairman of WG 12, summarized their activities. WG 12 convened its fourth and final meeting in Qingdao, China, from August 10-14, 1999. Dr. Otto presented an interim report (*FIS Endnote 3*), reviewed the activities of this meeting and briefly discussed problems related to the species diversity and assembly of data related to crabs and shrimps. Following the presentation there was discussion about the status and completion date for the final report. The FIS Committee noted that in the 1998 report (PICES VII) FIS requested "a completed, final report from WG 12 at PICES VIII in Vladivostok". Dr. Otto indicated that he was hopeful that the final report could be presented at PICES IX. This report will be submitted to the FIS Committee for their

review.

Travel support (Agenda Item 4.4)

PICES provided partial support for Dr. Chang-Ik Zhang to attend a joint SCOR WG 105 and ICES Symposium on "The Ecosystem Effects of Fishing" in Montpellier, France, in March 1999.

FIS Strategic Plan: accomplishments and changes (Agenda Item 5)

The Committee reviewed the details of the FIS Strategic Workplan for Phase 3: PICES VII to X, as presented in the 1998 Annual Report, Section 5, pages 86-87. The Committee agreed to make changes to 4 sub-sections, as indicated below.

Establishment of new Working Groups (revised)

In the course of its work, the FIS Committee may identify specific research questions which may require further cooperative assistance. Working Groups may be established to address these issues. Approved Working Groups must establish terms of reference and a workplan to accomplish their goals, subject to review by FIS. Working Group meetings, topic sessions, or workshops should be developed as needed to complete the objectives. The FIS Committee should monitor the progress of its working Groups to ensure timely completion of their work.

Scientific contribution from FIS (revised)

In deliberations of its Working Groups, symposia, and special sessions, the FIS Committee should strive to maximize the

dissemination of work products to the broad scientific community. To the extent possible, consideration should be given to publication in established series of fisheries and ocean science.

Integration of biological interactions and physical impacts (new)

FIS will encourage the development of an integrated understanding of the interaction among species. This will include incorporating impacts of climate and physical oceanographic variability.

Coordination of research programs and data exchange

FIS will encourage the reporting of results of national research programs, and TCODE's work for collecting and distributing information for PICES nations on an annual basis.

Review the scientific activity in the CCCC program and the international GLOBEC (Agenda Item 6.1)

The inclusion of environmental indices in stock assessment processes was illustrated by several of the presentations at the PICES Eighth Annual Meeting. This was followed by a general discussion of how FIS can interact with CCCC. There may be opportunities for a joint FIS/CCCC workshop concerned with the biological/physical sciences that examine effects of climate on recruitment processes.

In subsequent discussion, it was suggested that FIS could play a role to assist with coordination between national activities connected with the CCCC Program. Specifically, FIS could (1) provide lists of research institutes which conduct CCCC programs; (2) determine the coordinator from each national institute; (3) present national research programs connected with fisheries; and (4) establish a Working Group on the coordination of stock assessment

activities, inventory assessment methods and determination of priority of methodology development. It was acknowledged that these are useful suggestions; much of these activities is presently conducted by other groups, including TCODE, the CCCC Program and GLOBEC.

Participation in the CCCC and GLOBEC programs is highly encouraged.

SCOR WG 105 activity (Agenda Item 6.2)

SCOR WG 105 and ICES held a symposium on "The Ecosystem Effects of Fishing" on March 16-19, 1999, in Montpellier, France. A "Report of the Activity of SCOR Working Group 105" was submitted to PICES in February 1998, and introduced in PICES Press, Vol. 6, No. 1. The "Report on the ICES/ SCOR Symposium on Ecosystem Effect of Fishing" was published in PICES Press, Vol. 7, No. 2. SCOR WG 105 will complete its activity after the final summary report with a concluding paper presented at the coming SCOR Annual Meeting. Many of the papers presented at that meeting will be published in an issue of ICES Journal of Marine Science.

Relationship with regional fisheries organizations or commissions (Agenda Item 6.3)

The MOUs with the North Pacific Anadromous Fish Commission (NPAFC) and ICES were signed in November 1998 (see pp. 29-32 in the 1998 Annual Report).

The FIS Committee briefly discussed (1) the proposed UNDP-GEF North Pacific Transboundary Project and (2) the NPAFC/PICES Juvenile Salmon Workshop, and recommended that PICES endorse them.

Arctic Monitoring and Assessment Programme (AMAP) (Agenda Item 6.4)

The objective of this project is the assessment of climate change in Arctic regions. Although the focus of this project is narrow relative to the broader scope of PICES, there are a number of important species whose distributions extend into Arctic waters. For this reason, the FIS Committee endorsed the suggestion that a formal connection to this programme be established.

PICES/GOOS relations (Agenda Item 6.5)

The MONITOR Workshop provided a forum for PICES scientists to learn about GOOS and to develop recommendations for PICES future involvement. The Science Board Chairman, Ms. Patricia Livingston, reported that PICES could benefit from some GOOS activities, such as the attempt to determine the monitoring activities of various countries. Also many PICES activities should be of interest to GOOS. In particular, PICES may consider pointing out the existence and importance of fisheries data to GOOS. For these reasons the FIS Committee recommended sending a representative to the GOOS meeting in Chile.

New Working Group(s) (Agenda Item 6.6)

Three proposals for new Working Groups were presented at the meeting. Dr. Richard J. Beamish proposed a Working Group to examine "Climate change and shifts in fish production". Dr. Mikhail Stepanenko recommended a Working Group to examine "stock assessment and methodological development". Dr. Tokio Wada recommended a Working Group to examine "Climate change and fisheries management". In addition, there was a suggestion from Dr. Boehlert for a future Working Group to consider "Habitat selection and habitat utilization by migratory species in the North Pacific".

The Committee noted the close similarity of

the proposals by Drs. Beamish and Wada, and recommended that these be unified with the title: "Climate change, shifts in fish production, and fisheries management", with Drs. Beamish and Wada as Co-Chairmen. The Co-Chairmen drafted the rationale and terms of reference as indicated below.

Terms of reference for a new Working Group on Climate Change, Shifts in Fish Production, and Fisheries Management

It was generally agreed that climate and ocean changes have a directed impact on the population dynamics of species of interest to the FIS Committee. The Working Group will identify key examples of species that have been affected by climate and ocean changes. The impact of these physical changes will be assessed in relation to fishing effects. The impact of inter-annual and decadal-scale physical changes will be investigated. Where possible, the mechanisms linking climate and ocean changes to changes in the populations dynamics will be described or hypothesized. Using these mechanisms and indices of climate change, the Working Group will investigate the possibility of long-term forecasting of changes in population dynamics and ecosystem structure.

FIS Topic Session for PICES IX (Agenda Item 7)

FIS supported a proposal by Dr. Yasunori Sakurai to hold a one-day Topic Session at the PICES Ninth Annual Meeting on "Short lifespan squid and fish as keystone species in North Pacific marine ecosystems". Recommended convenors are Drs. Yasunori Sakurai (Japan) and Richard D. Brodeur (U.S.A.).

FIS endorsed a proposal for a 2-day acoustic workshop, sponsored by Hokkaido University, to be held in Hakodate, in conjunction with the PICES IX.

FIS noted and endorsed the recommendation from the REX Task Team for a 2-day workshop with the first day examining trends in North Pacific herring populations and the second day examining trophodynamic interactions in ecosystems that support herring populations.

FIS endorsed the proposed joint REX-BASS Workshop/Symposium to examine linkages between the production in subarctic gyres and resulting impacts in coastal and transition zones.

Best Presentation Award (Agenda Item 8)

FIS voted for the Best Presentation Award from talks presented during the FIS Topic and Paper Sessions. The award went to Dr. Svetlana Davidova (Russia) for her excellent presentation titled "Spawning of subtropical species in Peter the Great Bay in 1991-1998".

FIS Endnote 1

Participation List

Canada

Richard J. Beamish
Douglas E. Hay
Gordon A. McFarlane

Korea

Jin-Yeong Kim
Suam Kim
Chang-Ik Zhang (Chairman, FIS)

China

Qi Sheng Tang

Russia

Victor V. Lapko
Mikhail Stepanenko

Japan

Akihiko Hara
Tokimasa Kobayashi

U.S.A.

George W. Boehlert

FIS Endnote 2

Agenda

1. Welcome and introduction of members
2. Election of new Chairman
3. Discussion and approval of agenda
4. Review of the implementation of PICES VII decisions
 - 4.1 Review and adopt the WG 12 Final Report (98/S/1c)
 - 4.2 Relations with other organizations and program (98/S/2c)
 - 4.3 Publications of reports (98/S/3a)
 - 4.4 Travel support (98/S/6a)
 - 4.5 Co-sponsored meetings (98/S/7a)
5. FIS Strategic plan: accomplishments and changes
6. Scientific items of the interests
 - 6.1 Review the scientific activity in the CCCC Program and the international GLOBEC
 - 6.2 SCOR WG 105 activity (98/S/6a)

- 6.3 Relationship with regional fisheries organizations or commissions
 - a. UNDP-GEF North Pacific Transboundary Project
 - b. NPAFC-PICES Juvenile Salmon Workshop
- 6.4 Discussion on involvement in Arctic Monitoring and Assessment Programme (AMAP)
- 6.5 PICES/GOOS relations: outcome

- 6.6 Possibility to establish new Working Group(s)
- 7. Proposals for the session topic for PICES IX
- 8. Discussion of Best Presentation Award from FIS
- 9. Discussion of any other arising issues
- 10. Draft of report and summary of FIS recommendations to Science Board

FIS Endnote 3

Interim Report of Working Group 12 on Crabs and Shrimps

Introduction

Working Group 12 (WG 12) held its interim meeting in Qingdao, China, from August 10 to 14, 1999. The main purposes of the fourth and last meeting were to consider:

1. Crab and shrimp fisheries of China including aquaculture.
2. Spatial structuring of crab and shrimp populations.
3. Effectiveness of marine sanctuaries and restrictions of fishing activities on crabs and shrimps.
4. Conclusion of WG 12 activities and provision of final report to FIS.
5. 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 1999 as also occurred in 1998. This was the first meeting at which all six member nations were represented (WG 12 Annex 1). A comprehensive review of Chinese fisheries within the PICES area was the major undertaking of the meeting.

Members re-iterated their belief that it is desirable for scientists from North Korea to attend future PICES meetings since we

were unable to receive information over the full range of some stocks.

Review of Terms of Reference

WG 12 considered terms of reference formally adopted by FIS in 1997 and again reviewed in 1998. It was agreed that they should be reconsidered depending upon the context in which crab and shrimp are to be included in future PICES deliberations. Accordingly, terms of reference were to:

1. Consider those crabs, shrimps and lobsters that are utilized in commercial, subsistence or recreational fisheries. This may include introduced species if they are directly important or impact human utilization of any other marine species.
2. Identify persons from each country that are performing scientific work on the distribution, recruitment, larval transport, migration, population dynamics, and influences of environmental conditions for crabs and shrimps.
3. Identify data that are available 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.

Consideration of Chinese crab and shrimp fisheries

A. Overview

The PICES Region contains all of the Northeast Pacific (FAO Area 61), the U.S. portion of the East Central Pacific (Area 71) and most of the Northwest Pacific (Area 67). Looked at in this way and making appropriate deductions for fresh water species, landings by Taiwan or various territorial possessions, the PICES Region contains approximately 43% of world crab resources and 23% of world shrimp resources according to 1991 - 1995 United Nations (FAO) landing statistics. Of these amounts, Chinese production would be 40% of crabs and 80% of shrimps over the same period. Until our meeting, it was not 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. Although the PICES Region encompasses most of Area 67, it was also unclear what portion of Chinese waters should be included in the PICES area and how much production was due to aquaculture rather than the harvest of wild stocks. Most of what follows concerning wild stocks is condensed from a report titled "Overview on the Crustaceans in the Chinese Waters of the PICES Region" by Zhi-Meng Zhaung and Jing-Yao Deng. Aquacultural information was provided by "History and Present Status of Shrimp Culture in China" by Sheng-Li Cai and Qing-Yin Wang. Both reports were delivered at the WG 12 meeting in Qingdao. Chinese waters of the PICES Region include the Bohai Sea, the Yellow Sea and the portion of the East China Sea north of 24°N (Taiwan Straits). These waters contain about 300 species of crabs and shrimps if one excludes anomurans (mostly hermit crabs, Paguridae) but includes stomatopods (particularly *Squilla*). Generally, the northern waters of China have fewer species of crabs and shrimps than southern waters. Since most Chinese shrimp fisheries exploit penaeid shrimps and most crab fisheries exploit Portunidae (the swimming or blue crabs) the following example suffices:

Table. *Average catch during the 1980s*

Area	Peneid Species	Portunid Species	Landings (t)
South China Sea	90	40	70,000
East China Sea	51	20	255,000
Yellow Sea	10	4	
Bohai Sea	3	2	98,300
Total commercial crabs and shrimps 30 species			465,800

While the decrease in taxa may reflect increasingly estuarine conditions as well as latitude, crab and shrimp species in Chinese PICES waters are largely derived from southern groups. These generally have shorter life spans than their northern

counterparts. For example, most commercial shrimps in Chinese waters reach commercial size in six months and complete their life cycle in about one year, while pandalid shrimps in Russian waters complete their life cycle in about five years.

Crabs and shrimps in the Bohai and Yellow Seas have been fully exploited while those in the East China Sea still show considerable potential for expansion.

B. Consideration of Chinese crab fisheries

The gazami or blue crab (*Portunus trituberculatus*) is the most important species in China as a whole, and as well as in the PICES Region. This species and several other portunid crabs are intensively aquacultured in some areas of China including parts of the East China Sea coast, and it is not possible to separate aquacultural production from wild harvests. There are intensive Chinese fisheries for wild stocks of gazami crab in the Yellow and Bohai seas, where crab culture is absent. Important fisheries for this species also occur in Japan and Korea, making this the world's largest single species crab fishery. This is the only crab of any importance in the Chinese portion of the PICES Region.

Gazami crabs are frequently harvested as by-catch in trawl fisheries in the East China and Yellow Seas. They are abundant in the Bohai Sea where they are harvested with drift nets (a type of gill net) and bottom trawls. The species inhabits shallow waters in the summer months and migrates to deeper water as the sea cools in autumn. Females and later males migrate to spawning grounds in summer, peak mating occurs in September and there may be two incubations per year. Larvae are planktonic and have 6 larval stages. Incubation and larval development occur over a period of 20-30 days. Gazami crabs may reach 650 g but most in commercial catches are from 140 to 340 g. Both males and females are harvested.

Catches have been stable or increasing overall but there is evidence of depletion in some areas. For example, the Wenzhou fishery landings were 6,800 t by 300 vessels

in 1978 but 10,400 t by 2000 vessels in 1982. The combined Bohai and Yellow Sea catch ranged from 15,800 to 65,900 t and averaged 29,588 t from 1987 to 1997. In contrast, the catch in all Chinese waters rose from 104,535 t in 1987 to peak at 292,000 t in 1994, but has averaged 237,841 in the past five years of record. Various management measures such as closed seasons and protected areas are being considered to protect spawning stocks and reduce the catch of immature crabs.

C. Consideration of Chinese shrimp fisheries

Three groups of shrimps are important wild stocks in the PICES area of Chinese waters. These are the mantis shrimps (*Oratosquilla oratoria*, one species only), the penaeid shrimps (15 species of which *Penaeus chinensis*, *Metapenaeus joyneri* and *Trachypenaeus curvirostris* dominate penaeid fisheries) and the akiame shrimp (*Acetes chinensis*). An additional six species of shrimps (four families) are considered major species but are either of small importance to fisheries or not distinguished in landings. Unlike crabs, shrimp are cultured in coastal areas within the PICES region. The major cultured species are all penaeids (*P. chinensis*, *P. monodon* and *P. japonicus* dominate). We were not able to report the species composition or production within the PICES Region at this time. For this reason and in the interests of brevity, consideration of shrimp aquaculture will be deferred to our final report.

Mantis shrimps are stomatopods of the family Squillidae and not closely related to the much more familiar decapod shrimps. We include them here as they are unique and interesting although of only small importance, except in the Bohai Sea. Mantis shrimps are widely distributed in Chinese waters and they are also found in Korea and Japan, where they were

historically more important than the present. Compared to decapod shrimps in the area, these are slow growing and reach 150 to 175 mm length at age 3. The maximum size is 210 mm (113 g) for females and 177 mm (68 g) for males. Mating occurs in September and October. They tend to live in burrows during the winter season (December to March) leading to low catch rates but catch rates are similar during other months. Larvae occur in plankton samples in May, and they persist in the plankton for 4-5 months. Larvae reach a maximum size of 26 mm as compared to 30 mm for the first benthic stages which are observed in November. In 1982 the spawning biomass was estimated at 2,500 t and overall abundance was estimated at about 5,000 t.

The blue shrimp (*T. curvirostris*) is extremely widely distributed from Africa to Australia as well as southern and eastern Asia, including China, Japan and Korea. Despite wide distribution, directed fishing occurs largely in China. In the PICES region, the blue shrimp is particularly abundant in the Bohai and Yellow Seas where the coastal waters of Shandong Province are major fishing grounds, as are certain Korean waters. It is also found in the East China Sea. Most fishing occurs during the reproductive and wintering seasons when dense schooling occurs. The habitat is generally 20 to 40 m in the Bohai and Yellow seas. Spawning begins in May and peaks in June and July. As is true of other penaeids, diet includes small molluscs and particularly planktonic polychaetes and crustaceans. Chinese landings from the Yellow and Bohai Seas have increased drastically over the past 20 years and averaged 48,018 t for 1988-1997, as compared to 15,557 t during the previous decade. While there is potential for further development in the South and East China Seas, the Yellow and Bohai Seas are considered over-exploited. Management measures being considered include catch quotas on the wintering population, time-

area closures to protect spawning concentrations and effort limitation for both motorized trawling and fixed nets.

Economically, the fleshy prawn (*P. chinensis*) has been the most important commercial species in the Yellow and Bohai Seas. It has also been extremely important in China as a whole where landings averaged 167,527 t from 1986 to 1995. In the Yellow and Bohai Seas, fleshy prawns have been exploited by Korea and Japan as well as China. Japan stopped fishing in 1987. Landings from 1986-1995 were 14.7% Korean, 5.1 % Japanese and 80.2% Chinese while averaging 7,916 t. Landings in China as a whole as well as the Bohai and China Seas have declined in recent years. There are two populations in the Yellow-Bohai Sea area. One is found in the western coastal waters of Korea while the other is found in both Korean and Chinese waters. Although the two populations have separate migratory patterns, there is some overlap in the Yellow Sea wintering grounds. Fleshy prawns tend to follow the 6°C isotherm as they begin their shoreward migration in March. The summer months are a feeding period that culminates with mating in October-November. There is a massive mortality of males immediately after spawning that leads to large changes in sex ratio. The species has been well studied because of its importance to both aquaculture and fishing. Fishing, growth and mortality rates are well described as are diseases. Cohort analysis, yield per recruit modeling and stock-recruitment relationships are being used in stock assessment. Because hatchery techniques are available, enhancement through the release of post-larval juveniles is being used to augment natural reproduction and has shown some promise. Currently, trawling is forbidden in the Bohai Sea and that fishery is conducted with fixed nets and drift nets. Trawling is the usual means of fishing elsewhere by all nations involved.

The shiba shrimp (*Metapenaeus joyneri*) is distributed in shallow (< 20 m) waters of the Bohai, Yellow and East China Seas. Landings are about 5,000 t annually, but statistics are very imprecise. Shiba shrimp tend to be localized in distribution with little migration. Chinese catches are dominated by shrimps of 100-110 mm length and weights of 11-13 g. Spawning occurs in March-May and again in September-December. Landing data for China were not presented, but FAO data show Korean landings varying from 2,086 to 7,852 t from 1986 to 1995.

The akiame shrimp (*Acetes chinensis*) is a sergestid shrimp found in China, Korea and Japan and is among the northernmost species of the genus. Landings constitute the largest single species shrimp fishery in the world according to 1995 FAO statistics (409,995 t). The vast majority of world landings are taken in China with Korea a distant second according to FAO statistics. In China, they are the most important catch of various fixed (bag-like) nets. Chinese landings averaged 223,934 t from 1976 to 1997 with an average of 197,108 t (90.0%) coming from the PICES Region. In the Bohai Sea the fishery has a 300 year history and currently accounts for about one third of all landings there. They are also extremely important in the East China Sea. Within the Chinese PICES Region, 45.6% of landings are from the Bohai-Yellow Sea area and 54.7% are from the East China Sea (1976-1997). These production figures are nearly astounding considering that the body lengths of mature paste shrimp are 17-32 mm for males and 18-43 mm for females (A 43 mm female is approximately 0.5 g). Spawning occurs twice per year and both brood stocks die after reproduction.

We thank our Chinese colleagues for introducing us to shrimp aquaculture and particularly for including a trip to their experimental station.

Spatial structuring of crab and shrimp

populations

This topic was considered briefly following our consideration of Chinese fisheries and aquaculture. Findings were similar to those concerning sampling structure during our 1998 meeting. The existence of discrete aggregations at fine spatial scales is well known for many crab and shrimp stocks. At large spatial scales, meta-population structure is often perpetuated by larval drift occasionally to the point that some geographical units may be non-functional from a reproductive standpoint. Further illustration of these problems is planned in the final report.

Effectiveness of marine sanctuaries and restrictions of fishing activities on crabs and shrimps

This topic was also briefly considered. There are apparently no marine sanctuaries that were established primarily to protect crabs and shrimps. Those that might be useful in this regard protect habitat for a multiplicity of purposes (e.g. no dredging, dumping, mineral exploration, removal of artifacts, etc) other than perpetuation fisheries. This does not preclude establishing sanctuaries for this purpose and we recognized that sanctuaries are being considered in management planning for a variety of fisheries. Most frequently, closures to fishing gear of certain types are used in the management of crabs and shrimps. These latter "sanctuaries" are best treated as individual cases in our final report.

Other matters

The Working Group noted with pleasure that the NAFO/PICES/ICES Symposium "Pandalid Shrimp Fisheries - Science and Management at the Millennium" was to take place in Dartmouth, Canada, September 8-10, with Jim Boutillier of WG 12 as the PICES Co-Convener. We were glad that

we could participate in its planning. As an afternote, the symposium was the first dealing with world-wide pandalid shrimps since the International Pandalid Shrimp Symposium held by University of Alaska Sea Grant in Kodiak, Alaska, in 1979. There were 96 participants including eight invited speakers to four sessions. Sessions included: 1) Environmental and Trophic Considerations) Stock Assessments, 3) Management, and, 4) Harvesting and Processing. There were 23 oral presentations and 15 posters. The symposium was attended by representatives of 15 nations.

WG 12 was also glad to note that the meeting of colleagues fostered by WG 12 has led to a cooperative Canadian-Korean project whereby Dr. Inja Yeon will be working in Nanaimo with Dr. Glen Jamieson and colleagues.

Conclusion of WG 12 activities and provision of final report

This was the last meeting of WG 12 and no further financial resources will be necessary to complete our work. It was the unanimous intention of WG 12 to publish a document as a PICES Scientific Report, over the course of the next year. Drafting is in progress and most statistical series are contained in our meeting documents. This would provide the first synoptic look at shrimp and crab stocks in the North Pacific. It is our intent that this be a living document.

Long-term PICES consideration of crabs and shrimps

Crab, shrimp and lobsters in the PICES Region simply encompass the

conventionally exploitable crustacean resources in the North Pacific. This is how we have treated them in a first-time look. We felt it would be a mistake to allow this sort of effort to be eroded by time. We hence recommend continuation of WG 12 efforts by a "Committee on Crustacean Fisheries" that would convene every third year to update statistical series and research summaries and perhaps consider one special topic. This would be similar to the way some working groups have proceeded in ICES (eg., majid crabs). In general, the WG did not see the need for a committee to meet annually as most research topics would readily fit into the current FIS topic sessions.

How crustacean issues might best be integrated into PICES for longer-term consideration is not clear. We were reminded of the tremendous diversity of crustaceans during our deliberations and particularly concerned that we were not dealing with the tremendous trophic importance of the groups that provide fisheries as well as those that do not. We stopped short of recommending a Working Group concerned with crustacean trophodynamics. We do however recommend that a group be identified to integrate crustaceans in a regional experiment involving the Bohai/Yellow Sea area. In this regard we also recognized the need to develop a statistical system based on area of capture rather than area of landings.

We continue to recommend that a "Working Group on Introduced Species" be established.

WG 12 Annex 1

Participation List

Canada

Jim Boutillier

Glen Jamieson

China

Shen-Li Cai
Ji-Sheng Chen
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Japan

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Robert S. Otto (Co-Chairman)