The state of the western North Pacific in the first half of 1997

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Mr. Takashi Yoshida is a Scientific Officer of the Oceanographical Division of the Climate and Marine Department at the Japan Meteorological Agency (JMA). He is working as a member of a group in charge of monitoring and forecasting sea surface temperature and sea surface current in the western North Pacific. Based on *in situ* and satellite data, this group makes various oceanographical products. One of the main products is the "Monthly Ocean Report", which is published and distributed by JMA every month. Mr. Yoshida is now involved in developing a new analysis system of sea surface and subsurface temperature to improve sea surface temperature forecasts in the western North Pacific. His recent research interest centers on water masses distribution and its variation in seas east of Japan and the Okhotsk Sea.

Sea Surface Temperature

Figure 1 shows monthly mean Sea Surface Temperature (SST) anomalies in the western North Pacific from January to June 1997. These charts are based on the JMA's objective SST analysis for 1x1 degree grid points over the western North Pacific using in situ observations reported from ships and buoys. The anomalies are computed from the JMA 1961-90 climatology. One of the most remarkable features in the first half of 1997 is that notable positive SST anomalies, which have been observed since the end of 1995, continued in the region north of 45˚N. Time series of regional mean SST anomaly for region A (45-53˚N, 150-180˚E) shows that the SST anomaly has kept exceeding +0.5˚C during the first half of 1997, though the anomaly has gradually reduced since it reached +2˚C at its peak in October 1996 (*Figure 2*). Along 40˚N from the Japanese coast eastward to the date line, negative SST anomalies have developed in May and June 1997 and those exceeding -1˚C widely covered the area in June 1997.

Oyashio and Kuroshio

Figure 3 shows temperature distributions at the depth of 100m east of Japan for February and June 1997. These charts are based on the JMA's objective 100m water temperature analysis for 0.25x0.25 degree grid points in seas adjacent to Japan using in situ observations reported from ships and buoys. In the figure, temperatures colder than 5˚C are recognized as the Oyashio cold water. The Oyashio cold water displayed typical seasonal variations during the first half of 1997. In February 1997, the Oyashio cold water occupied the area southeast of Hokkaido and its major part didn't extend southward over 40˚N except for the small patches of the cold water around 39˚N, 147˚E. After February, the Oyashio cold water has bifurcately penetrated into the area east of Honshu along the western and eastern side of the warm core ring centered at 41˚N, 144˚E. The penetrations are called the coastal and off-coastal branches of the Oyashio cold water or the first and second Oyashio Intrusions. The penetrations have formed a cold water pool east of Honshu and the southernmost part of the pool reached 38˚N, 142˚E in June 1997. The Kuroshio has kept taking a non-large-meander path south of Japan since the summer of 1991.

Sea Ice in the Okhotsk Sea

In the 1996/97 winter, drift ice came in sight at meteorological observatories along the Okhotsk Sea coast of Hokkaido from late January to early February and came on shore at the coast from mid- to late February. The first date of drift ice on shore was

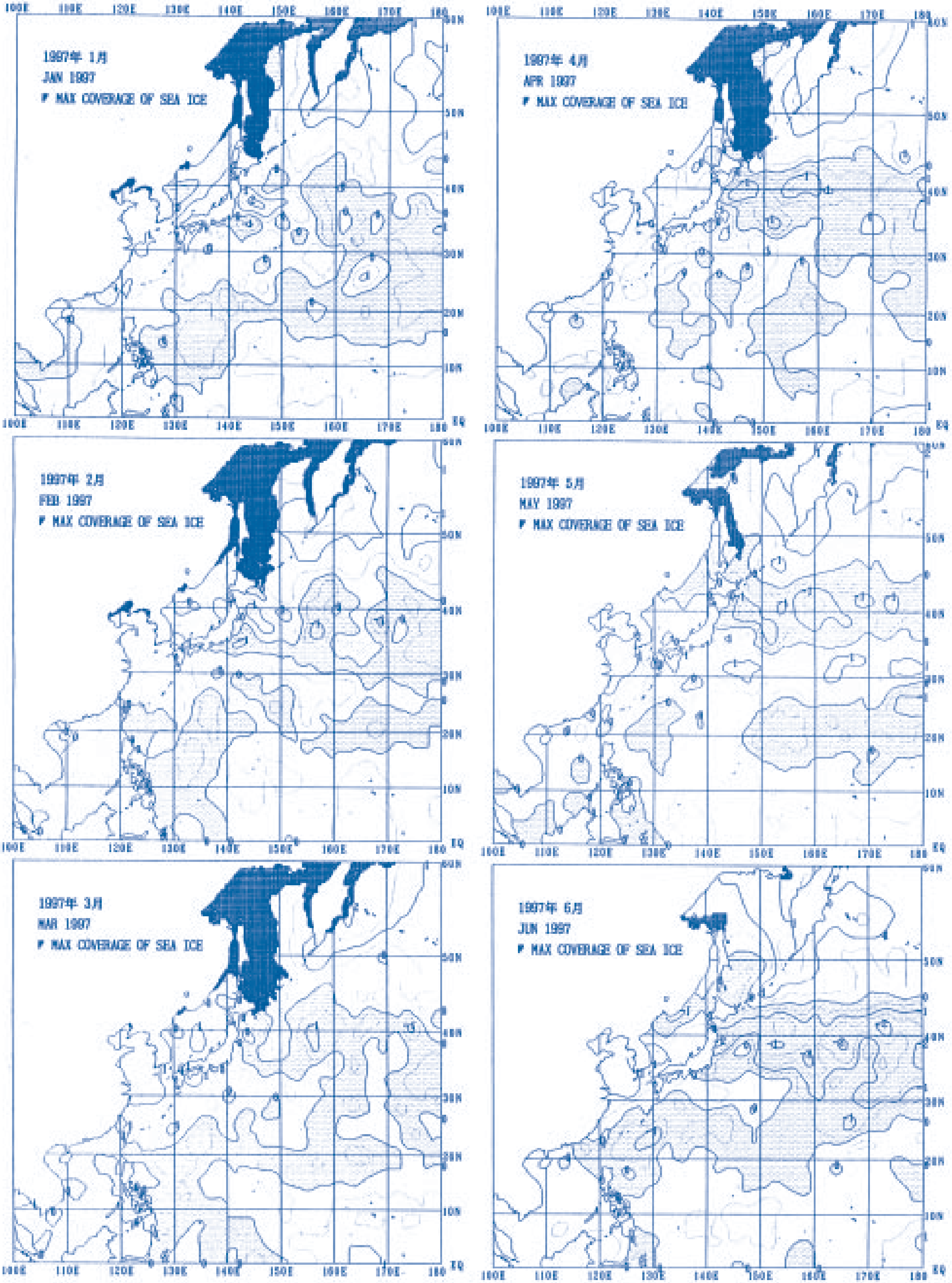
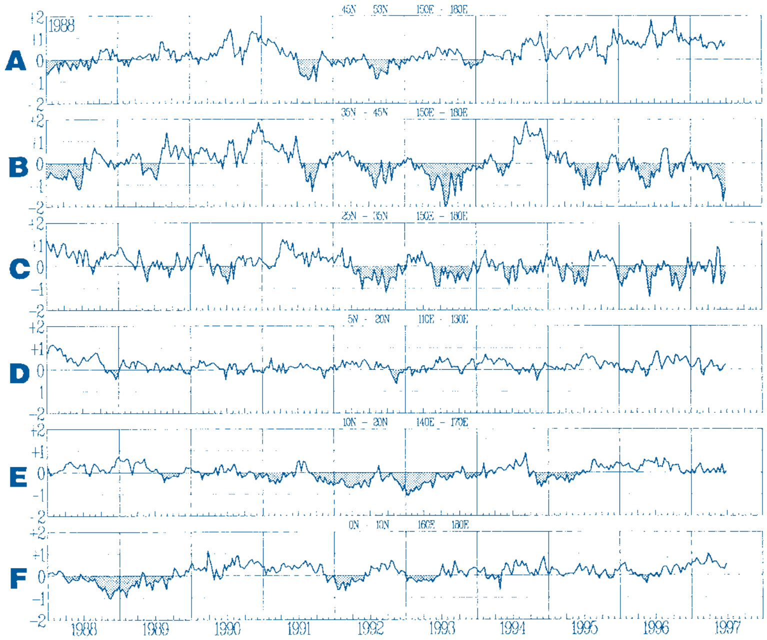


Fig. 1 Monthly mean sea surface temperature anomalies (˚C). Anomalies are departures from the JMA 1961-90 climatology. Contour interval is 1˚C and additional contours of 0.5˚C are shown by broken lines. Negative anomalies are shaded.



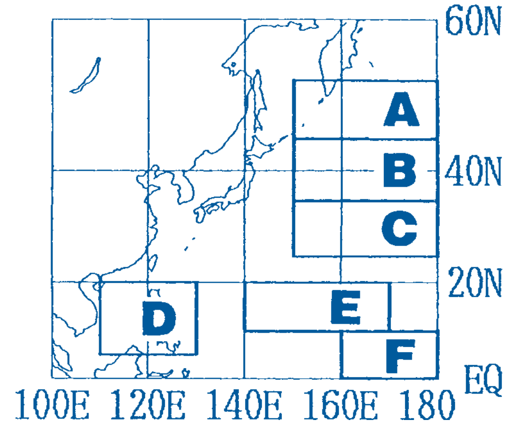


Fig. 2 Time series of the ten-day mean sea surface temperature anomalies (˚C), computed from the JMA 1961-90 climatology for the areas shown in the right panel. Negative anomalies are shaded.

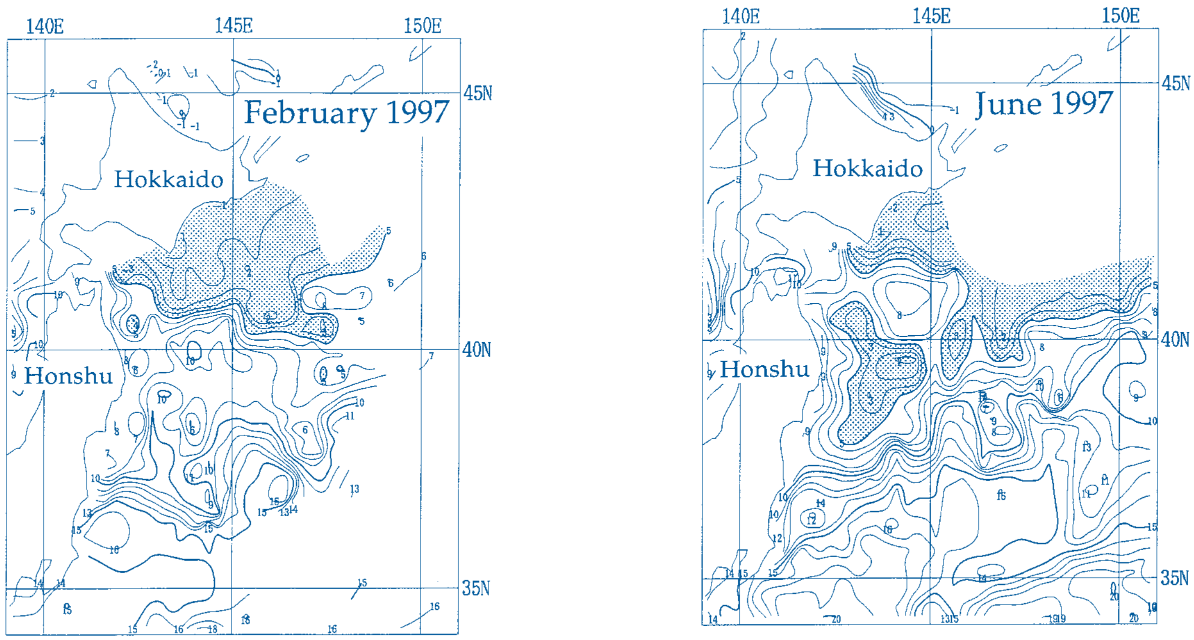


Fig. 3 Temperature (˚C) at the depth of 100 m east of Japan for February 1997 (left) and June 1997 (right). Contour interval is 1˚C. Areas colder than 5˚C are shaded.

about 10 days later than the 30 years (1961-90) average at almost every station and the date of ice breakup was earlier than the average at every station. Hence, the length of the ice season in the 1996/97 winter was shorter than the average at every station. Sea ice extent in the Okhotsk Sea was nearly equal to the 20 years (1971-90) average in December and smaller than the average from January to the end of the ice season. The sea ice extent was the smallest among the past 26 years at the end of January and from late April to late May. The outflow of drift ice into the Pacific Ocean was significant from mid- to late March.

Carbon Dioxide

JMA made observations of carbon dioxide (CO_2) in the western North Pacific on her cruises in January-February and June-July in 1997. The concentration (partial pressure) of CO_2 in surface water was lower than that in the overlying atmosphere in January-

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were anomalous, the currents over the basin and shelf were unusual. Typically there is a moderate flow (5–10 cm s^{-1}) northwestward along the 100m isobath (*Figure 1*). This year, however, trajectories of satellite–tracked drifters revealed no net flow from May through August. In addition, stronger volume transports were observed in the Bering Slope Current (BSC) and the Aleutian North Slope Current (ANSC). The flow in the deep basin is cyclonic gyre, with a strong, steady ANSC flowing northeastward along the Aleutian Islands turning northwestward into BSC, an eastern boundary current (*Figure 1*). Typically transports in these flows range from 2–4x10^6 m^3 s^{-1}. This year, baroclinic transports from March through July were greater than 6x10^6 m^3 s^{-1}. The transport through Amchitka Pass, the primary source of flow in the ANSC, was 5x10^6 m^3 s^{-1}, also larger than earlier measurements

The long-term effects of this summer on the Bering Sea ecosystem are not known and likely will remain a mystery until the year class strength of a variety of fish can be determined. The percentage of birds which died and the influence of this on the ecosystem is also unknown and must be evaluated. Hopefully, enough observations were made this year to elucidate the mechanisms that resulted in the coccolithophorid bloom and attended changes in the biota.

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-February south of Japan, implying that atmospheric CO_2 was being absorbed into the ocean (*Fig. 4a*). This is a typical feature of the carbon dioxide distribution in the western North Pacific in winter. On the other hand, CO_2 concentration in surface water was higher than that in the atmosphere in June-July south of Japan. In the seas east of Japan, CO_2 concentration in the sea surface water was much lower than that in the atmosphere in June-July. The CO_2 concentration difference was particularly large from 30˚N to 45˚N east of Japan, and the difference of 120 ppm observed at 43˚N, 153˚E in the June-July cruise was the largest difference observed since 1989 by Ryofu Maru in the western North Pacific (*Fig. 4b*). Similar pattern of the distribution of CO_2 difference in the seas east of Japan was observed during the Ryofu Maru cruise in April-June 1996 (PICES Press Vol.5 No.2).

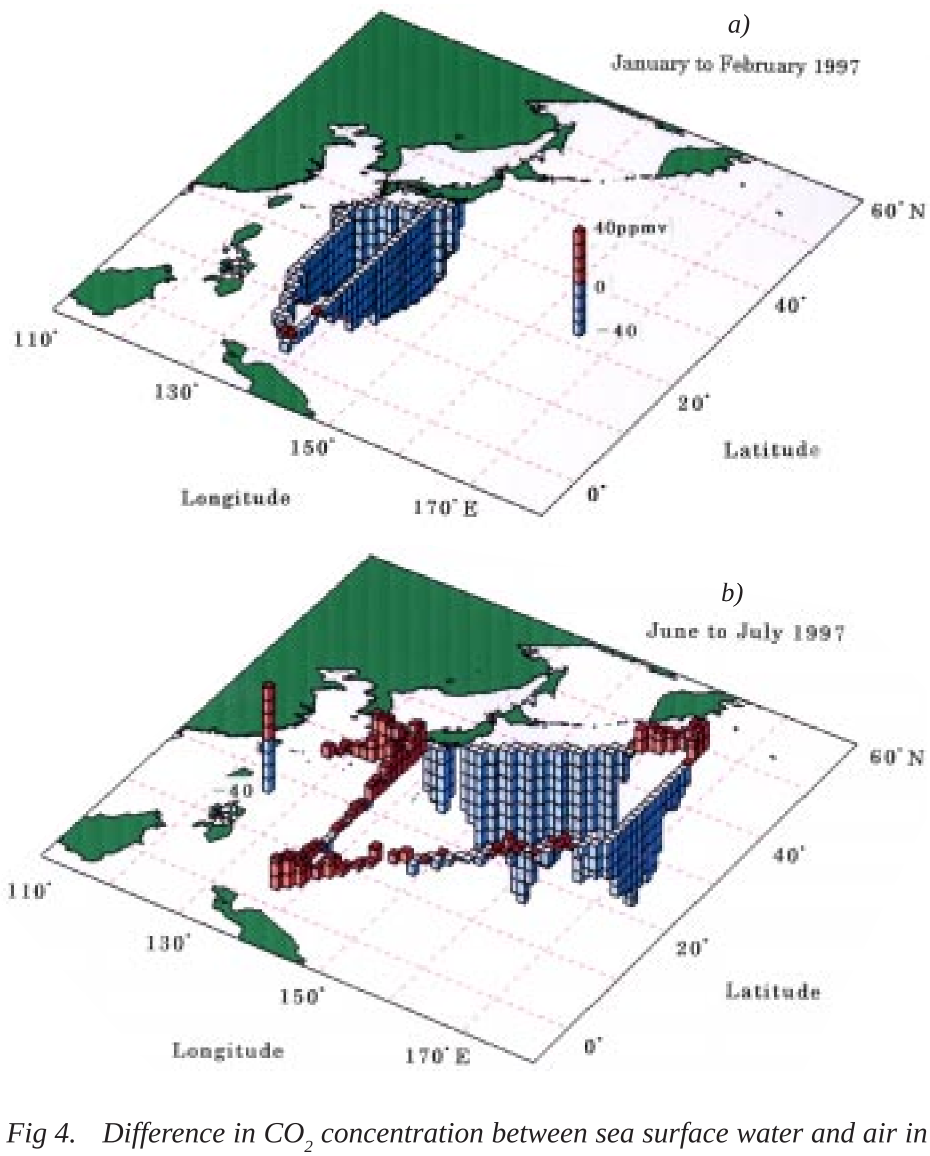

Fig 4. Difference in CO_2 concentration between sea surface water and air in January-February, 1997 (a) and June-July, 1997 (b). Red upward bars indicate that the ocean was emitting CO_2; blue downward bars indicate absorption of CO_2 by the ocean.

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Oceanography Committees); Processes of Contaminant Cycling (Marine Environmental Quality Committee); and Harmful Algal Blooms: Causes and Consequences (Biological Oceanography and Marine Environmental Quality Committees). Three of these sessions were joint sessions co-organized by various Scientific Committees. This is a natural reflection of the achievements of PICES as a multi-disciplinary international marine science forum.

The Best Presentation Awards, first introduced at PICES V to encourage speakers to make an effort to overcome language barriers by providing a clear presentation, were given to the following winners this year with congratulations; the FIS Award to Dr. Jin-Yeong Kim (Korea) for her paper entitled "Spawner-recruit relationship of anchovy, engraulis japonica, and environmental factors in the southern waters of Korea"; the POC Award to Dr. Young Jae Ro (Korea) for his paper entitled "Recent investigation of the polar fronts of the East Sea by CTD profiling and ADCP tracking"; the BIO Award to Dr. Atsushi Tsuda for his paper on "Life cycles of *Neocalanus flemingeri* and *N. plumchrus (calanoida, copepoda)* in the western Subarctic Pacific"; the MEQ Award to Dr. Dmitry L. Aminin (Russia) for his paper entitled "Use of fluorescent probes for biochemical monitoring of environmental contamination"; and the Science Board Award to Dr. Paul J. Harrison for his presentation on "Phytoplankton dynamics in the northeast Subarctic Pacific Ocean: bottom-up and top-down control".

The CCCC Implementation Panel, recognizing that the Program is entering a new implementation phase, revised the statement of purpose for the Program, the terms of reference, and modified the structure of the Implementation Panel. Distinct new aspects of the Implementation Panel structure are a Task Team-based Executive Committee and the formation of a new MONITOR Task Team. The terms of reference of MONITOR include: suggesting improvements in the monitoring of the Subarctic Pacific by extending the activities of the disbanded WG 9 on Monitoring of Subarctic Pacific by addressing questions of standardization and intercalibration of measurements, particularly in the area of biological collections; assisting in development of a coordinated monitoring program to detect and describe events, such as the effects of El Niño in the Subarctic Pacific; and reporting on the PICES activities to be implemented in conjunction with the international Global Ocean Observing System (GOOS) Program.

Another important decision of PICES VI was the establishment of two new Working Groups: WG 13 on CO_2 in the North Pacific (POC) and WG 14 on Effective Sampling of Micronekton to Estimate Ecosystem Carrying Capacity (BIO). WG 13 is expected to propose a plan for cooperation with the North Pacific Task Team of the Joint Global Ocean Flux Study Program (JGOFS/NPTT). These Working Groups are expected to contribute in evaluating the relative importance of components missing in PICES activities. The existing Working Groups, WG 8 on Practical Assessment Methodology, WG 11 on Marine Mammal and Sea Birds and WG 12 on Crabs and Shrimps, will continue their activities.

The Communication Study Group, established at PICES V, recommended improvement in PICES communication to Science Board and was then disbanded. Recognizing the fact that the publication of good scientific papers is of critical importance to an organization like PICES, a new Publication Study Group was established to review the publication and translation policy, the desirability of establishing a peer reviewed publication series and a PICES editorial board, and other matters concerning PICES publications. Members of this Study Group are Drs. Warren Wooster (Chairman), William Doubleday, Makoto Kashiwai, and Paul LeBlond.

Any organization and its substructures need a medium and/or long-term strategic workplan, especially if chairmen have a definite term of office. Science Board decided to discuss and prepare a strategic workplan for the Scientific Committees and Science Board at the PICES VII. The chairmen of Science Board and three Scientific Committees (BIO, MEQ and POC) will be replaced at the end of the next Annual Meeting. They were instructed by Science Board to develop such plans by that time. The discussion of a strategic workplan will give committee members an opportunity to understand the views of the candidates in time of election.

Support provided by Mr. Seong-Ho Song (MOMAF), Prof. Chang-Ik Zhang (FIS Chairman), Dr. Jang-Uk Lee (NERDI), Mr. Won-Seok Yang, students and others helped PICES VI be a very enjoyable and successful meetind.

See you at PICES VII, Fairbanks, Alaska, in October 1998!

Makoto Kashiwai, PICES Science Board Chairman