

Cover: Three Gorges, China.
(Photo: W. Y. Chiau)

APEC ECONOMIC LEADERS' DECLARATION

*Los Cabos, Mexico
27 October 2002*

**Bulletin on APEC
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Bulletin on APEC MRC

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We discussed the fundamental contribution of trade to economic growth, and the need for APEC to strongly support the multilateral trading system, while implementing our commitments.

- We called on Ministers to continue negotiations that will open markets and enhance the multilateral trading system, foster economic growth and poverty reduction particularly in developing economies, promote sustainable development, improve disciplines, improve WTO coherence with other institutions, and provide opportunities for all citizens of the world.
- We welcomed the launch of new multilateral trade negotiations in Doha and encouraged all economies to pursue substantive negotiations in all areas of the Doha Development Agenda (DDA) by the agreed timelines to ensure that the deadline of 1 January 2005 to conclude such negotiations is met. We called for progress across all areas in the lead-up to the 2003 WTO Fifth Ministerial Conference in Cancun.
- We agreed that these negotiations hold the prospect of real gains for all economies, and particularly developing economies, in the areas of agricultural reform, improved market access for goods and services, and clarification and improvement of trade disciplines.

We gathered in Los Cabos for the 10th annual APEC Economic Leaders' Meeting to strengthen economic growth by implementing the APEC vision of free, open and prosperous economies. We agreed on the importance of fighting terrorism, which poses a profound threat to our vision. We resolved to continue and accelerate progress towards the achievement of the Bogor goals as a central element to deliver our ultimate goal of equitable and shared prosperity, and concurred on the need to maximize political support for the pursuit of free and open trade and investment. We acknowledged that APEC is engaged in the implementation of important measures, consistent with the theme of this year's meeting "Expanding the Benefits of Cooperation for Economic Growth and Development – Implementing the Vision." We are determined to translate our APEC vision into concrete benefits for the wider APEC community through greater assessment, accountability and action. We affirmed our commitment to a more inclusive world economy, notably through our individual and joint efforts on micro-enterprises, access to information, human capacity building, financing and health.

Implementing the APEC Vision of Free and Open Trade and Investment

- We agreed that one of the objectives of the negotiations should be the abolition of all forms of agricultural export subsidies, and unjustifiable export prohibitions and restrictions.
- We also remain committed to on-going work in the negotiating group on rules. Such negotiations are aimed at clarifying and improving disciplines under the Agreements on the Implementation of Article VI of the GATT 1994 and on Subsidies and Countervailing Measures, while preserving the basic concepts, principles and effectiveness of these agreements and their instruments and objectives.
- We agreed that APEC should further contribute to the DDA negotiations by encouraging and coordinating confidence building activities in all areas of the agenda, including investment, competition, trade facilitation, transparency in government procurement, and trade and environment.
- We welcomed work in APEC to ensure all economies develop the capacity to participate effectively in the DDA negotiations. We encouraged the WTO to build on APEC's leadership towards more effective and coherent programs and delivery of trade-related technical assistance.
- We supported the early accession of Russia and Viet Nam to the WTO.

- We called for an exchange of views in APEC on regional and bilateral trade agreements, noting that these agreements need to be consistent with WTO rules and disciplines and APEC's goals and principles.

We discussed how to implement pro-growth policies in the Asia-Pacific region. Last year we agreed on an updated vision for APEC in the Shanghai Accord that stressed implementation of commitments to expand trade and investment, broadened the basic mission to include new economic developments, and underscored the need for economic and technical cooperation.

We recognized the significant progress made during this year and acknowledged the importance of the timely implementation of the Shanghai Accord, which will advance our commitment to achieve the Bogor goals and support the multilateral trading system. Today, in Los Cabos, we:

- Endorsed the APEC Trade Facilitation Action Plan which will implement our commitment to cut transaction costs by five percent in the APEC region by 2006.

We recognized the significant economic and trade benefits which can accrue from trade facilitation and took special note of the Action Plan's call for providing appropriate capacity building assistance to developing economies. We directed our Ministers to continue moving forward with the selection and implementation of trade facilitating actions and measures and to assess the benefits of associated transaction cost reductions.

- Adopted the attached Statement to Implement APEC Transparency Standards, and directed that these standards be implemented as soon as possible, and in no case later than January 2005. We agreed that economies that may implement these standards earlier, under domestic law or an international agreement, will accord their benefits immediately to all APEC economies.
- Endorsed Pathfinder Initiatives on advance passenger information systems; the revised Kyoto Convention on the Simplification and Harmonization of Customs Procedures;

*The seas and oceans are a diverse ecosystem on Earth.
(Photo: W. Y. Chiau)*



The Kingdom of Thailand is honored to host the Asia-Pacific Economic Cooperation forum in 2003. It will be a valuable opportunity to further strengthen economic cooperation and promote friendship among the member economies of APEC. Informal SOM is to be held on December 12-13, 2002 in Bangkok.



For more information:
<http://www.apec2003.org/eng/index.html>

electronic SPS certification (e-cert); electronic certificates of origin; mutual recognition arrangement of conformity assessment on electrical and electronic equipment parts II and III; and corporate governance.

- Adopted the attached Statement to Implement the APEC Policies on Trade and the Digital Economy, which contains a set of targets related to trade policies for the New Economy, also as a pathfinder initiative.
- Urged all APEC members to consider participating in these initiatives and instructed officials to continue to identify pathfinder initiatives that will deliver real benefits to APEC members.
- Praised the strengthened Peer Review process of the Individual Action Plans for monitoring our process to achieving the Bogor goals.
- Endorsed the broadened Osaka Action Agenda, which reflects our strong commitment to the achievement of the Bogor goals, while responding to changes in the global and regional economy.

Strengthening Economic Fundamentals

We discussed economic recovery and noted that uncertainties on the

strength and pace of the expansion still remain. In this context, it is crucial to strengthen the soundness and efficiency of financial systems, particularly through better credit culture and strengthening of banking supervision, and to continue with broader structural, regulatory and institutional reform, which complement open market policies, promote sustained economic growth and good governance, withstand economic shocks and create a better business environment for all.

- We welcomed the outcomes of the Ninth Finance Ministers' Process. We firmly believe that prudent and transparent fiscal management will help maintain macroeconomic stability, lower interest rates and raise economic growth.
- We resolved to work towards avoiding structural fiscal deficits and enhancing the efficiency of public expenditure.
- We agreed to promote more openness, diversity, and competitiveness in our financial markets, including through the development of regional bond markets. In this connection, we commended the Finance Ministers' initiative to organize policy dialogues to identify impediments to the development of securitization and credit guarantee markets and to develop detailed action plans and report progress to APEC Leaders in 2003.

- We recognized that adequate levels of savings are necessary for economic stability and growth, and that it is essential to put in place the institutional framework and structural reforms that allow the most efficient allocation of savings so that both domestic and foreign savings are channeled into productive investment.
- We resolved to strengthen trust in markets and investor confidence by implementing measures to improve corporate governance standards and practices in APEC member economies and promote the transparency of policies affecting trade and investment. We recognized the need for member economies to regularly review their corporate governance practices to reflect the changing market environment.
- We welcomed the implementation of the e-APEC Strategy and called for accelerated work to put in place sound macroeconomic policies, a legal and regulatory regime that will stimulate investment and technology development to promote e-business and broadband networks, and programs to ensure that our people have access to the Internet and the skills to use it.

- We endorsed the commitment of APEC Energy Ministers to energy market reform and greater transparency to attract the significant private investment needed to ensure that our region's growth and development goals are supported by adequate energy infrastructure.
- We acknowledged the importance of structural reform in achieving trade and investment liberalization and facilitation and agreed to further promote dialogue and work in this area.

Counter-Terrorism and Economic Growth

We discussed the challenge posed to the region's security and prosperity by terrorist organizations, noting the need to strengthen security while maintaining the smooth flow of goods, capital and people that has been key to the region's economic growth. We welcomed the efforts of member economies and APEC fora in response to the 2001 Leaders' Statement on Counter-terrorism.

- We condemned in the strongest terms recent terrorist acts in the APEC region, and reaffirmed our determination to enhance cooperation on countering and responding to terrorism.
- We adopted the Los Cabos Statement on Fighting Terrorism and Promoting Growth, in which we commit to taking a series of concrete steps that will protect and make more efficient the flows of trade, finance, and information.

- We called for the development of capacity building programs to assure that all economies are able to implement all elements of the statement.
- We also endorsed the strengthening of energy security in the region under the mechanism of the APEC Energy Security Initiative, notably the reporting of monthly oil data, which was highly commended by the 8th International Energy Forum, last September.

Towards Equitable and Shared Prosperity

We discussed APEC's work on capacity building and economic and technical cooperation. In order to enhance our accountability, we instructed Ministers to improve the focus of our economic and technical cooperation and capacity building objectives and ensure that our actions are duly monitored and assessed, fully support APEC's trade and investment liberalization and facilitation goals and address the challenges of globalization.

We agreed on the need to build partnerships with international financial organizations and the private sector in the pursuit of APEC capacity building and economic and technical cooperation objectives.

We acknowledged that it is essential to assess our work to ensure that economic and technical cooperation and capacity building objectives are effectively implemented. The involvement of the APEC Secretariat in this work is fundamental, and we

acknowledged the need to also involve other APEC stakeholders in this work such as ABAC, Women Leaders' Network and the APEC Study Centers.

We commended the realization of the Dialogue on Globalization and Shared Prosperity as a central effort to discuss the benefits and challenges of globalization in a constructive manner.

- We noted the importance of addressing the social dimensions of globalization and acknowledged the need for developing social safety nets to minimize the costs of structural change.
- We recognized that globalization is the driving force of economic progress and agreed on the need to aim our economic and technical cooperation activities to empower people, as well as micro, small and medium enterprises, through improved access to information, human capacity building, financing and health care.

*A peaceful lake in Hokkaido, Japan.
(Photo: W. Y. Chiau)*





*An arched island in Palau.
(Photo: W. Y. Chiau)*

- We noted that Internet use in APEC had more than doubled since we set our connectivity goal in Brunei in 2000. We reiterated our commitment to realizing our goal of universal access by the year 2010 and we recognized the importance of focusing on further action on connectivity for rural areas; micro, small and medium enterprises; women; youth; and the disabled.
 - We noted the contribution of the e-APEC Strategy, the Beijing Initiative on Human Capacity Building and the APEC Human Capacity Building Strategy for the New Economy as an effective response to the need for transforming the digital divide into a digital opportunity. We welcomed the expansion of cyber-education and called for more activities aimed at improving teacher quality, promoting language study and facilitating more use of distance learning. We also welcomed significant progress in the revitalization of the APEC Education Foundation and expansion of the Consortium for APEC Cyber Education Cooperation.
 - We welcomed the outcomes of the Meeting of Ministers Responsible for SMEs and noted the progress on the APEC Integrated Plan of Action for the Development of SMEs (SPAN) including the incorporation of micro-enterprises development issues.
- We also acknowledged the substantial contribution of micro, small and medium enterprises to trade and economic development in the APEC region. In this context, we called on ministers and officials to develop programs to remove obstacles inhibiting their growth, including as regional exporters.
- We welcomed the outcomes of the High Level Meeting on Micro-enterprises and believe that attention to micro-enterprises is key to making progress towards our objectives of gender equity, economic growth, poverty alleviation, and the strengthening of social safety nets. We welcomed the decision made by the Ministers Responsible for SMEs to establish a sub-group for micro-enterprises development. We call for coordination in developing the sub-group's action plan, taking into account the work being conducted by relevant APEC fora and other APEC stakeholders.
 - We agreed that micro-financing is crucial for the expansion of micro-enterprises, and we praise efforts to develop and promote market-based micro-finance to assure micro and small businesses and entrepreneurs have access to capital.
- We agreed that government action should create an enabling policy environment and a legal and regulatory framework for the growth
- and expansion of sound and sustainable micro-financing intermediaries, fostering their gradual and full integration into the domestic financial system.
- We acknowledged that investing in health will benefit economic growth, worker performance and productivity, and poverty alleviation. We need to be more effective with our investment at every stage of the health care process, including primary prevention against disease risks, and focusing on most vulnerable populations.
 - We instructed Ministers to build on work underway to establish a regional public health surveillance network and an early warning system to monitor and respond to critical disease outbreaks in the region, and critical threats such as bio-terrorism.
 - We directed Ministers to assist developing economies to build the capacity to establish their own self-sustaining health-care services accreditation regimes.
 - We called for the establishment of a life-sciences innovation forum comprising government, private sector, and academia representatives to develop a strategic plan for life-sciences innovation in the region. This should include, as a priority, addressing the challenges of risk detection and prevention, treatment and cure of the communicable and lifestyle diseases which afflict our people.

We pledged to accelerate the safe use of biotechnology products based on sound science and welcomed the conclusion of the first Agricultural Biotechnology Dialogue. We called for capacity building initiatives that support our goals.

We recognized that a healthy environment and a focus on the quality of life of our citizens are essential to sustainable economic growth. In this regard, we welcomed the contribution of APEC Energy Ministers, Ministers responsible for ocean related matters and other APEC fora to the World Summit on Sustainable Development (WSSD).

We agreed to continue making valuable contribution and follow-up work to the WSSD.

We commended progress under the 21st Century Renewable Energy Development Initiative, and noted the importance of oceans for food security and sustainable economic development.

Reaching Out to our Communities

We discussed efforts to engage in meaningful dialogue with our communities, particularly business people, women, and youth.

We also discussed the need to involve a larger community in APEC's activities.

➤ We welcomed the work of Ministers in updating APEC guidelines on non-member participation to make them more encouraging of genuine engagement with our communities and directed Ministers to implement the guidelines by ensuring APEC fora are proactive in identifying and engaging outside organizations.

➤ We welcomed ABAC's report on "Sharing Development to Reinforce Global Security". We place great value on ABAC's contribution to the APEC agenda and have instructed Ministers to consider the report carefully.

We noted that APEC is already pursuing a number of initiatives identified by ABAC in areas such as counter-terrorism, corporate governance, promotion of micro-enterprises development and support for the WTO Doha Development Agenda.

➤ We endorsed APEC's work on gender issues and welcomed the recommendations of the Second Ministerial Meeting on Women. We recognized the need to eliminate gender inequalities in social and economic life, particularly recognizing the value of the multiple roles that women play in the economy. We also recognized the unique challenges globalization presents for women, including indigenous women.

➤ We welcomed the outcomes of the APEC Young Leaders' and Entrepreneurs Forum with Social Responsibility, which provided a valuable opportunity for young entrepreneurs to discuss the opportunities afforded by the new economy.

➤ We reaffirmed our belief in APEC's fundamental principles, including voluntarism, consensus-building, individual and collective actions, flexibility, and open regionalism.

(Information available online at <http://www.apec2002.org>)

High Seas Biodiversity

The workshop will run from **17 – 20 June 2003 and will be held in Cairns, Australia**. The workshop will involve legal, scientific and policy experts, and will aim to provide an increased international understanding and awareness of the biodiversity in the deep oceans and high seas and to identify possible measures for conservation and sustainable management, including through appropriate legal instruments and management tools.

For more information on the High Seas Biodiversity Workshop please contact:
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THE THIRD APEC ROUNDTABLE MEETING ON THE INVOLVEMENT OF THE BUSINESS/PRIVATE SECTOR IN THE SUSTAINABILITY OF THE MARINE ENVIRONMENT

Meeting Report and Summary Conclusions



***October 30-31, 2002,
Kaohsiung, Chinese Taipei***

Group photo of the 3rd APEC Roundtable Meeting in Kaohsiung, Chinese Taipei.

The Third APEC Roundtable Meeting on the Involvement of the Business/Private Sector in the Sustainability of the Marine Environment was held from 30-31 October 2002, in Kaohsiung, and was attended by representatives from: Australia; Canada; Japan; Philippines; Singapore; Chinese Taipei and the United States of America. Representatives from the business sector (petroleum, tourism, engineering), academia, government and non-governmental organisations also attended. The list of participants is attached as Annex 1.

Opening

Dr. Krista Singleton-Cambage, Australia, gave the opening address and conveyed the apologies of Ms. Alison Russell-French, APEC MRC WG Lead Shepherd, Australia, for not being able to attend the meeting.

She expressed hope that the sharing of information at this meeting will help to achieve the objectives of promoting public and private sector participation and partnerships. She also stated that it is important, particularly in the spirit of the 1997 Action Plan for the Sustainability of the Marine Environment and the 2002 Seoul Oceans Declaration, that APEC seek to coordinate its activities closely with other forums, noting the outcomes of the World Summit on Sustainable Development.

Dr. Liang Y.F., Chinese Taipei, opened the meeting and welcomed the participants. He stated that Chinese Taipei is in the process of establishing Ministry of Maritime Affairs. He also introduced the efforts of the Environmental Protection Administration in marine pollution control.

Dr. Samuel Chan H.H. (Vice-President for Academic Affairs, National Sun Yat-sen University, Chinese Taipei), welcomed

participants and stated that he was glad that the University and the Environmental Protection Administration were co-organising and hosting this meeting in Kaohsiung.

Following a round of introduction of all participants, Dr. Liang noted that participants came from government, non-government, business and academic institutions and looked forward to significant discussions that will contribute to sustainable development of the marine environment.

Election of Officers and Adoption of Agenda

The overall meeting was chaired by Dr. Liang Y.F. Dr. Chou Loke-Ming, Singapore was rapporteur for the meeting. The meeting adopted the agenda (Annex 2).

Background Briefing

Dr. Wen-Yan Chiau, Chinese Taipei, provided the background leading to this meeting, which is organized to further the 1997 “APEC Action Plan on Sustainability of the Marine Environment”, the 2000 “Action Strategies and Work Programmes” and the 2002 Seoul Declaration of APEC Ocean-related Ministerial Meeting. This meeting provides a forum for stakeholders from government agencies, academia, business sector, and NGOs to examine how best to promote public and private sector partnership and participation for the sustainable use of the marine environment, and to identify implementation activities for consideration by the MRC WG and FWG.

Session I – Integrated Ocean and Coastal Management

(The meeting proceedings contain copies of the session presentations in full – this summary provides only a few key points from each presentation and the discussion following each presentation)

Chairs: Amb. Amado Tolentino, Philippines; Dr. Chiu L. Chou, Canada.

Global Climate Change and Fisheries Production – Dr. Kawasaki Tsuyoshi, Japan.

- Fisheries management is based on the equilibrium theory on which Maximum Sustainable Yield's have been calculated.
- Environmentally-induced variations in stock size are not considered, which accounted for failures in fisheries management of stocks such as Peruvian Anchoveta, Pacific halibut and Atlantic cod.
- Global climate change causes synchronous long-term, high-amplitude variations in

population abundance of species such as sardines, and are referred to as “regime shifts” .

- Regime shifts can now explain long-term variability in many species of marine organisms. These shifts are driven by global oceanic currents and have occurred three times in the last 50 years. Anthropogenic activities can disrupt the natural cycles of regime shifts, resulting in tremendous effect on marine fisheries production. The effect will be greater on Asian countries because of the greater dependence on fish as a source of animal protein.

Integrated Ocean and Coastal Management in Chinese Taipei: A Review – Dr. Wen-Yan Chiau, Chinese Taipei.

- Rapid development, heavy pressures, incompatible uses and sectoral management of the coastal and marine environment have contributed to environmental degradation.
- An improved mechanism to enhance integration and coordination is required, and the establishment of a Ministry of Marine Affairs should help to improve on the current situation and facilitate more effective and rational use of the marine and coastal environment.

Lessons Learned from a Failure Partner Case: Sutsaou Wildlife Reserve, Tainan, Chinese Taipei – Dr. Min-Hwang Liang, Chinese Taipei.

- The Sutsaou Wildlife Reserve in Tainan is the first of Chinese Taipei' s wetlands to be protected. Collaborative management by NGOs was adopted in 1989 but broke down by 2001.

- Important learning lessons included the need for an initial plan, a strong champion, the careful selection of stakeholders that support the common goal, a democratic decision-making process, the proper application of scientific research, and third-party mediators.
- Failed projects have learning lessons that are as valuable as successful projects, and it is important to consider and share these lessons throughout the wider region.

Session II – Marine Protected Areas

Chairs: Ms. Roselita C. Paloma, Philippines; Dr. Liang Y.F., Chinese Taipei.

Marine Protected Areas: Status and Demand – Dr. Kwang-Tsao Shao, Chinese Taipei.

- Chinese Taipei' s marine biodiversity is rich but threatened by habitat degradation and human pressure.
- MPAs are useful tools to protect marine living resources. Existing “Coastal Protected Areas” are not effective because they did not include the subtidal zone, could not effectively protect the whole habitat and do not have law enforcement.
- MPAs relevant to modern day needs are required, particularly to protect Taiwan' s rich reef systems. They should have proper management plans and the capacity to implement them.

Marine Protected Areas of Southeast Asia: Expanding Management and Perception Horizons – Dr. Chou Loke-Ming, Singapore.

- Less than 15% of Southeast Asia's 650 MPAs are effectively managed.
- Consideration should be given to the many different forms of management operating at different scales and levels across the region. These include community-based management, management by resort operators, and unintended management by the business sector and military.
- Research is needed to understand and protect larval sources and sinks, migratory species that go across political boundaries.
- Multi-use protected areas should be examined and promoted.

Contaminant Levels in Biota and Sediments and a Need for a Contaminant Exclusion Zone for the Musquash Estuary, Marine Protected Areas Site Initiative – Dr. Chiu L. Chou, Canada.

- Indicator species (such as lobsters) are important to characterize contaminants and monitor spatial and temporal extent of marine contamination. Contaminants may not be detected from the water column or benthos, but bioindicators are reliable.
- MPA boundaries should be adequately large to protect sensitive habitats, and the creation of a "Contaminant Exclusion Zone" should be considered.



Dolphin (Photo: W. Y. Chiau)

- This CEZ should be created to prevent upstream discharge from industry from impacting the MPA.
- Contaminant distribution, oceanographic and hydrographic features should be considered in the establishment or delineation of MPA boundaries.

Session III – NGOs and Environmental Education

Chair: Dr. K.T. Shao, Chinese Taipei.

The Progressive Role of NGOs – Amb. Amado S. Tolentino, Philippines.

- NGOs have contributed much to WSSD preparations and can be more effective. Chapter 17 of Agenda 21 (Rio Declaration) calls for a strengthening of the role of NGOs as partners for sustainable development.
- Certain rules of conduct that NGOs need to observe include focusing the debate on specific problem instead of arguing on basis of general principles; openness to alternatives;

recognizing their roles not as decision makers but as supporters, advisers, sources of expertise and catalysts of change.

- Environmental NGOs need guidance on the complexities of free trade to be more involved with APEC's environmental initiatives.
- Some developing countries have strong NGOs with established reputation. Cooperation and networking between them would be useful. Many national NGOs with a regional umbrella have been established. ESCAP has an existing network link with NGOs.

Environmental Law-making with Public-Private Participation – Ms. Roselita C. Paloma, Philippines

- Philippine lawmakers, recognizing the concept of sustainable development authorize the creation of a Technical Working Group (TWG) in Congress.
- The TWG is a multi-sectoral body where public-private participation takes place.
- The TWG is made an integral part of lawmaking process to ensure that laws are effective, enforceable and address the concerns of the various stakeholders.
- Listening to public views, consulting the stakeholders and getting them part of the policy-making at an early stage is an effective way of making them appreciate and understand the policy, thus implementation can be easier.

From Rio to Johannesburg, from Johannesburg to Taiwan: What is the Next Step for Chinese Taipei's NGOs? – Dr. Yung-Jaan Lee, Chinese Taipei.

- The dilemma of environmental NGOs in Chinese Taipei was examined. Rapid development seem to show that environmental NGOs are weak and unable to stop pollution and environmental degradation. Since 1987, rapid increase of NGOs occurred but environmental degradation however is worse.
- Many NGOs have small membership and do not focus on fund raising, resulting in funding constraints. NGOs depending on funds from government are wary of criticizing the government and cannot be totally independent.
- Many East Asian NGOs such as in Japan and Korea also face the same problems and this presentation, if translated into Japanese and Korean will be useful to NGOs in these countries. From Japan's experience, change in government policy can be induced by criticism from NGOs.
- Chinese Taipei will from next year organize NGO conferences. Network established with Chinese Taipei's students studying abroad to provide information on environmental movements overseas. Need open and frank dialogue between NGOs and GOs.

Environmental Education Experiences in Japan – Dr. UI Jun, Japan.

- In 1970s, environmental awareness in Japan was low. Dr. UI Jun shared his personal experiences in educating the public on the Minamata problem. He gave public talks to victims,

researchers, NGOs, and all parties concerned on the root cause of the disease.

- The production of a video programme "Polluted Japan", which graphically depicted major environmental impacts on humans helped eventually to induce change in policies regarding industrial waste management.

Session IV – Special Forum on Marine Science and Aquaculture Park.

Chairs: Dr. Kawasaki Tsuyoshi, Japan; Dr. Chiu L. Chou, Canada)

The Use of Biotechnology and its Concerns for Impact in the Marine Environment – Dr. Ching-Lin Tsai, Dr. Lee-Shing Fang and Dr. Chiau W.Y., Chinese Taipei.

- Marine biotechnology has great potential. Problems to the marine environment include pollution from biotechnology products such as novel chemicals, and genetic manipulation.
- Bio-index need to be established to monitor impact of pollution from biotechnology sources.
- Two steps to protect marine environment – establish 1) standards for genetic pollution, and 2) ISO system to regulate biotechnology industry.
- For aquaculture, comprehensive system needed to cover not only production aspects, but also establishment of Marine Environmental Quality guidelines, control of site selection, species, marketing and insurance (against typhoons).
- EIA should be extended to cover environmental impact of exotic species used in aquaculture. ISO certification process should be

considered to ensure fish product quality, which will improve marketability.

Recommendations

Chairs: Amb. Amado Tolentino, Philippines; Dr. Y.F. Liang, Chinese Taipei.

The meeting supported the following recommendations for consideration by the MRC WG:

- The importance of sharing information on coral reefs and fisheries was noted, given their particular importance to the region and the continued destruction that they face. The meeting supported the establishment of a coral reef and fisheries network as proposed by Australia and Thailand through the Fisheries Working Group and the Marine Resource Conservation Working Group and recommended that relevant government agencies, NGOs and industry work together to pursue this project.
- In view of marine biotechnology development, research is needed on the impact of the industry to the marine environment. This will help to institutionalize the adoption of environmental risk assessment of biotechnology products (chemicals/GMOs).
- A study on networking and capability building of marine-related NGOs in APEC region will help strengthen NGO involvement.

- A study on the various models and their performance improvement of marine management regimes covering policies, lead agencies, marine legislation and ocean-related laws should be conducted. It should include a review of strategies and techniques used by various countries. The focus should include continuous capability building and should involve the highest levels of policy makers.

- A case study of the well managed MPAs in the region should be made to identify success factors which can be applied to other MPAs, consistent with the Seoul Oceans Declaration.

- It is important to develop marine environment quality (MEQ) guidelines, particularly for MPAs.

- It will be useful to share case studies on marine environment-related policies and legislation, and the effective implementation of marine-related legislation.

- Information sharing on marine education programmes will be useful. It is important to identify target audiences – children, fishermen, public, and develop education materials specific to these groups. Existing educational systems such as schools and aquariums can be involved in the process. NGOs can facilitate networking with users such as coastal fishermen which have little

influence in decision making.

- It is noted that for future MRC WG meetings, host member economies should invite more of the industry and business sector to improve their participation and involvement in APEC processes.

Adoption of the Report of the Meeting

The meeting adopted the report of the meeting.

Closing

Chairs: Dr. Krista Singleton-Cabbage, Australia; Dr. Y.F. Liang, Chinese Taipei.

Dr. Krista Singleton-Cabbage provided a summary of the meeting in which a wide variety of issues were discussed including

- the establishment of MPAs, as a tool for protecting the marine environment
- the need for community-based management
- the importance of incorporating local knowledge into decision-making processes
- the need for transparent and inclusive legislative processes (Philippines example)
- government institutions
- role of NGOs, both to work with government agencies and also to offer alternatives for government to consider

- overall importance of truly integrated approach to coastal zone and oceans management

- involvement of all relevant parties in management of the local environment, including industry and communities

- the need to plan aquaculture projects and consider biotechnology impacts.

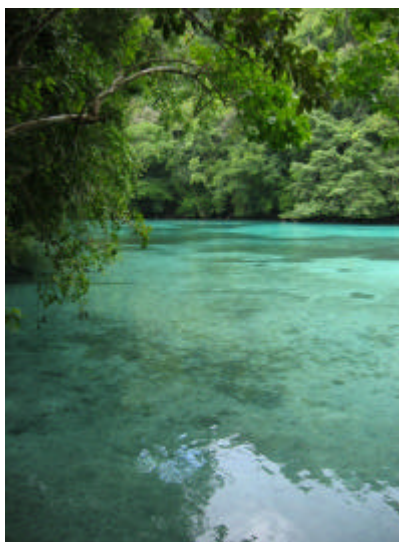
The main question is how to better incorporate other partners, such as industry and NGOs in the work of APEC. Further meetings and discussion should focus on helping these external groups to learn about APEC and how to get involved. The focus should also be on how APEC member economies can learn about the experiences of industry and NGOs, which can help guide their decision-making processes.

Dr. Singleton-Cabbage expressed appreciation to Chinese Taipei for again hosting a Roundtable meeting, and to Dr. Chou L.M. for serving as rapporteur. She expressed confidence that the information participants have gained from all the speakers and the open discussions will help to shape the future work of the MRC WG. On behalf of Ms. Alison Russell-French, the MRC WG Lead Shepherd, she thanked all speakers and participants for their contributions to the MRC WG.

Dr. Liang Y.F. expressed his appreciation to all participants for contributing to the Roundtable meeting, and to Dr. Chiau W.Y. for organizing the meeting, and to Dr. Chou L.M. for being the rapporteur.

The Johannesburg Declaration on Sustainable Development

From our Origins to the Future



Maintaining good quality of marine environment deserves priority.
(Photo: W. Y. Chiau)

Johannesburg, South Africa

10 September 2002

- We, the representatives of the peoples of the world, assembled at the World Summit on Sustainable Development in Johannesburg, South Africa from 2-4 September 2002, reaffirm our commitment to sustainable development.
- We commit ourselves to build a humane, equitable and caring global society cognizant of the need for human dignity for all.
- At the beginning of this Summit, the children of the world spoke to us in a simple yet clear voice that the future belongs to them, and accordingly challenged all of us to ensure that through our actions they will inherit a world free of the indignity and indecency occasioned by poverty, environmental degradation and patterns of unsustainable development.
- As part of our response to these children, who represent our collective future, all of us, coming from every corner of the world, informed by different life experiences, are united and moved by a deeply-felt sense that we urgently need to create a new and brighter world of hope.
- Accordingly, we assume a collective responsibility to advance and strengthen the interdependent and mutually reinforcing pillars of sustainable development – economic development, social development and environmental protection – at local, national, regional and global levels.
- From this Continent, the Cradle of Humanity we declare, through the Plan of Implementation and this Declaration, our responsibility to one another, to the greater community of life and to our children.
- Recognizing that humankind is at a crossroad, we have united in a common resolve to make a determined effort to respond positively to the need to produce a practical and visible plan that should bring about poverty eradication and human development.

From Stockholm to Rio de Janeiro to Johannesburg

- Thirty years ago, in Stockholm, we agreed on the urgent need to respond to the problem of environmental deterioration. Ten years ago, at the United Nations Conference on Environment and Development, held in Rio de Janeiro, we agreed that the protection of the environment, and social and economic development are fundamental to sustainable development, based on the Rio Principles.

To achieve such development, we adopted the global programme, Agenda 21, and the Rio Declaration, to which we reaffirm our commitment. The Rio Summit was a significant milestone that set a new agenda for sustainable development.

- Between Rio and Johannesburg the world's

nations met in several major conferences under the guidance of the United Nations, including the Monterrey Conference on Finance for Development, as well as the Doha Ministerial Conference. These conferences defined for the world a comprehensive vision for the future of humanity.

- At the Johannesburg Summit we achieved much in bringing together a rich tapestry of peoples and views in a constructive search for a common path, towards a world that respects and implements the vision of sustainable development. Johannesburg also confirmed that significant progress has been made towards achieving a global consensus and partnership amongst all the people of our planet.

The Challenges we Face

- We recognize that poverty eradication, changing consumption and production patterns, and protecting and managing the natural resource base for economic and social development are overarching objectives of, and essential requirements for sustainable development.
- The deep fault line that divides human society between the rich and the poor and the ever-increasing gap between the developed and developing worlds pose a major threat to global prosperity, security and stability.
- The global environment continues to suffer. Loss of biodiversity continues, fish stocks continue to be depleted, desertification claims more and more fertile land, the adverse

effects of climate change are already evident, natural disasters are more frequent and more devastating and developing countries more vulnerable, and air, water and marine pollution continue to rob millions of a decent life.

- Globalization has added a new dimension to these challenges. The rapid integration of markets, mobility of capital and significant increases in investment flows around the world have opened new challenges and opportunities for the pursuit of sustainable development. But the benefits and costs of globalization are unevenly distributed, with developing countries facing special difficulties in meeting this challenge.
- We risk the entrenchment of these global disparities and unless we act in a manner that fundamentally changes their lives, the poor of the world may lose confidence in their representatives and the democratic systems to which we remain committed, seeing their representatives as nothing more than sounding brass or tinkling cymbals.

Our Commitment to Sustainable Development

- We are determined to ensure that our rich diversity, which is our collective strength, will be used for constructive partnership for change and for the achievement of the common goal of sustainable development.
- Recognizing the importance of building human solidarity, we urge the promotion of dialogue and cooperation among the world's civilizations and peoples, irrespective of race,

disabilities, religion, language, culture and tradition.

- We welcome the Johannesburg Summit focus on the indivisibility of human dignity and are resolved through decisions on targets, timetables and partnerships to speedily increase access to basic requirements such as clean water, sanitation, adequate shelter, energy, health care, food security and the protection of bio-diversity. At the same time, we will work together to assist one another to have access to financial resources, benefit from the opening of markets, ensure capacity building, use modern technology to bring about development, and make sure that there is technology transfer, human resource development, education and training to banish forever underdevelopment.
- We reaffirm our pledge to place particular focus on, and give priority attention to, the fight against the worldwide conditions that pose severe threats to the sustainable development of our people. Among these conditions are: chronic hunger; malnutrition; foreign occupation; armed conflicts; illicit drug problems; organized crime; corruption; natural disasters; illicit arms trafficking; trafficking in persons; terrorism; intolerance and incitement to racial, ethnic, religious and other hatreds; xenophobia; and endemic, communicable and chronic diseases, in particular HIV/AIDS, malaria and tuberculosis.
- We are committed to ensure that women's empowerment and emancipation, and gender equality are integrated in all

*Chitose Salmon Aquarium, Hokkaido, Japan.
(Photo: W. Y. Chiau)*



activities encompassed within Agenda 21, the Millennium Development Goals and the Johannesburg Plan of Implementation.

- We recognize the reality that global society has the means and is endowed with the resources to address the challenges of poverty eradication and sustainable development confronting all humanity. Together we will take extra steps to ensure that these available resources are used to the benefit of humanity.
- In this regard, to contribute to the achievement of our development goals and targets, we urge developed countries that have not done so to make concrete efforts towards the internationally agreed levels of Official Development Assistance.
- We welcome and support the emergence of stronger regional groupings and alliances, such as the New Partnership for Africa's Development (NEPAD), to promote regional cooperation, improved international co-operation and promote sustainable development.
- We shall continue to pay special attention to the developmental needs of Small Island Developing States and the Least Developed Countries.
- We reaffirm the vital role of the indigenous peoples in sustainable development.
- We recognize sustainable development requires a long-term perspective and broad-based participation in policy formulation, decision-making and

implementation at all levels. As social partners we will continue to work for stable partnerships with all major groups respecting the independent, important roles of each of these.

- We agree that in pursuit of their legitimate activities the private sector, both large and small companies, have a duty to contribute to the evolution of equitable and sustainable communities and societies.
- We also agree to provide assistance to increase income generating employment opportunities, taking into account the International Labour Organization (ILO) Declaration of Fundamental Principles and Rights at Work.
- We agree that there is a need for private sector corporations to enforce corporate accountability. This should take place within a transparent and stable regulatory environment.
- We undertake to strengthen and improve governance at all levels, for the effective implementation of Agenda 21, the Millennium Development Goals and the Johannesburg Plan of Implementation.

Multilateralism is the Future

- To achieve our goals of sustainable development, we need more effective, democratic and accountable international and multilateral institutions.
- We reaffirm our commitment to the principles and purposes of the UN Charter and international law as well as the strengthening of multi-lateralism. We support the leadership role of the

United Nations as the most universal and representative organization in the world, which is best placed to promote sustainable development.

- We further commit ourselves to monitor progress at regular intervals towards the achievement of our sustainable development goals and objectives.

Making it Happen!

- We are in agreement that this must be an inclusive process, involving all the major groups and governments that participated in the historic Johannesburg Summit.
- We commit ourselves to act together, united by a common determination to save our planet, promote human development and achieve universal prosperity and peace.
- We commit ourselves to the Johannesburg Plan of Implementation and to expedite the achievement of the time-bound, socio-economic and environmental targets contained therein.
- From the African continent, the Cradle of Humankind, we solemnly pledge to the peoples of the world, and the generations that will surely inherit this earth, that we are determined to ensure that our collective hope for sustainable development is realized.

We express our deepest gratitude to the people and the Government of South Africa for their generous hospitality and excellent arrangements made for the World Summit on Sustainable Development.

The 6th Asia-Pacific NGOs' Environmental Conference

Kaohsiung Declaration



President Chen Shui-bian gives his opening remarks at APNEC-6.
(Photo: W. Y. Chiau)

Kaohsiung, Chinese Taipei

1 November 2002

We, more than 300 specialists in the field of environmental science, environmental law, environmental management and the representatives of various NGOs congregating from 14 countries in the Asia-Pacific region, have participated in the sixth Asia-Pacific NGOs' Environmental Conference (APNEC-6) held from November 1-4, 2002 in Kaohsiung, Taiwan. Through these two days of discussion, we noted the following:

- The evidence throughout the region indicates a rapid diminution in biodiversity. NGOs and local communities in this region are playing an active role in identifying and responding to this threat.
- Wetlands, including inter-tidal areas, are one of the most important and productive ecosystems in the region, but they are under severe threat from reclamation and unregulated development. Urgent measures are needed to preserve natural wetlands and restore damaged wetlands.
- The rehabilitation of aquatic and terrestrial ecosystems is

being managed in a fragmented manner. There is urgency for a holistic approach to improve the effectiveness of rehabilitation and avoid further damage to the natural environment.

- In many countries of the region, despite significant progress made during the past decade on the development of legislation, technology and institutions for environmental management, conventional industrial pollution problems persist. One reason for this is lack of enforcement of existing laws and regulations as well as lack of resources and resolve.
- There is increasing concern about hazards created by recycling and reusing wastes, particularly the internationally and regionally traded wastes.
- Energy consumption in the region is dramatically increasing and this is contributing to the growth in greenhouse gas emissions and acid precipitations. The problem is aggravated due to a lack of commitment to developing and utilizing green energy.

- Military bases and armed conflicts have contributed to environmental destruction.
- The problems noted in items 5, 6 and 7 above, are increasingly transborder in character and should be dealt with accordingly.
- NGOs continue to play a leading and crucial role in environmental education and public awareness, and in promoting and mobilizing public participation in conservation efforts. New initiatives are being launched in a number of countries, including community-based colleges in Taiwan, that will enhance environmental awareness.

And, we have agreed that:

- Biodiversity conservation and sustainable development should be firmly integrated into national land use planning, consistent with the provisions of the Convention on Biological Diversity. NGOs should continue their involvement in the implementation of the national biodiversity conservation strategies and relevant land use plans.



*The last glimpse at Three Gorges, China.
(Photo: W. Y. Chiau)*

- Strategic environmental assessment should be promoted, while the existing systems of environmental project-based EIA need to be further strengthened and made more effective, for example, by requiring post-development monitoring and follow-up as well as increased opportunities for public participation.
 - Countries in the region should develop adequate national wetlands conservation laws and policies, designate clear authority and take actions to preserve and make wise use of wetlands.
 - Integrated ocean and coastal management should be accorded priority on the national agenda to strengthen the performance of marine affairs, for example, by reviewing the existing institutional arrangements and/or establishing a lead agency (such as ministry) on the management of ocean and coastal environment.
 - All coastal reclamation projects should be subject to thorough environmental impact assessment.
 - All marine protected areas, natural coastlines, tidal flats and estuaries should be preserved and restored using measures that take into account ecological constraints.
 - The control of water pollution, stabilization of land and soil, as well as the provision of habitats for wildlife, deserve the priority, and should be essential elements on every country's environmental agenda in relation to the rehabilitation of the natural environment. The application of new information, information technology and the concept of "Total Maximum Daily Loading (TMDL)" can provide a means for better river and watershed management.
 - Support should be provided for the development of water management policies, encompassing regulatory and market-based instruments (such as, water pricing policies) that ensure communities have equitable access to safe-drinking water and promote more economical water usage by municipalities and irrigators. Such policies should also be aimed at maintaining the integrity of aquatic as well as terrestrial ecosystems.
 - All private and public industries must adopt best occupational and environmental health and safety management practices in order to avoid environmental disasters and health hazards to humans.
 - Both domestic and international control over movements and disposal of hazardous waste should be strengthened. This should be based on the identification and establishment of an inventory of hazardous wastes and a 'cradle-to-grave' tracking strategy. NGOs and local communities will contribute to this effort by providing information, the 'right to know' as well as by monitoring. The establishment of NGO networks will facilitate this task.
 - Governments which have not done so yet should establish procedures, both legal and administrative, to facilitate and expedite dispute settlement, and provide support for litigation, insurance and compensation for victims suffering from occupational and environmental hazards.
- NGOs are encouraged to provide support for assisting the victims, especially in the settlement of cross-national disputes by means of networking amongst NGOs in the Asia-Pacific region.
- NGOs should become more proactively involved in ensuring authorities implement and enforce environmental laws.
 - NGOs should lead efforts to promote environmental education at the community level and through formal education system in each country. Networking amongst environmental educational centers is strongly encouraged to achieve this goal.
 - Greater cooperation between the private and public sectors should be encouraged to address existing and emerging environmental challenges, and NGOs should play an active role in facilitating this partnership to build a sustainable society.
- Adopted on November 3, 2002, in Kaohsiung, Taiwan by the participants of the 6th Asia-Pacific NGOs' Environmental Conference (APNEC-6). We, the participants in the Conference, wish to express our gratitude to the organizers of APNEC-6 (Foundation of Ocean Taiwan, Wetlands Taiwan, National Sun Yat-sen University, Asia-Pacific Environmental Council, Japan Environmental Council, Ramsar Center Japan, International Research Foundation for Development – East Asia Network) for their hospitality.
- We welcome the offer of Nepal to host the 7th Asia-Pacific NGOs' Environmental Conference.

Global Climate Change and the Fisheries Production

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Salmon is an important fishery resource.
(Photo: W. Y. Chiau)

Historically there have been two theories developed for explaining mechanisms of fluctuations in fish populations, equilibrium theory and environmental determinism, which, however, have been incompatible with each other, but the debate on the mechanisms is supposedly nearing to an end by the emergence of regime shift theory.

Current fisheries management regime has been supported by the equilibrium theory, which presupposes that rate of natural increase of a fish population (rate of recruitment + rate of individual growth - rate of natural mortality) as a function of population size is in equilibrium with rate of fishing mortality as a function of fishing effort, and rate of change in abundance due to environmental variability is neglected as tending to the null when averaged over periods of time. Therefore, by manipulating the fishing effort a stock manager would be able to adjust the stock level as he likes.

A constant catch would be gained year by year under a fixed fishing effort and the highest catch is called Maximum Sustainable Yield, MSY. Most international fisheries have been regulated to make it their goals to achieve the MSY, which is explicitly stated as the target of management in the UN Convention on the Law of the Sea. However, the MSY theory is scientifically problematic because environmentally-induced variations in stock size are intentionally neglected in the theory, despite they are the heart of the variational issues of natural populations. As a logical necessity, most management issues dealt with based on the theory for major fish stocks such as Peruvian anchoveta, Pacific halibut and Atlantic cod have ended in failure.

In the early 1980s, it was pointed out that catches of sardine populations distributed at a long distance from each other in the world oceans, Far Eastern, Californian and Chilean sardines, had undergone synchronous long-term, high-amplitude variations during the 20th century and it would be difficult to explain these synchronous fluctuations in abundance by variations in local hydrologic conditions and they are possibly subject to the global climate change (Kawasaki,1983). The globally-occurring concurrent variations are called regime shift.

More recently, it became evident that the Peruvian anchoveta , the largest fish stock in the world, and the Japanese anchovy have experienced fluctuations in phase with but different in sign from the Far Eastern and Chilean sardines, both of which are the second highest in abundance, respectively.

Very recently, many other similar events of long-period variability in marine organisms from phytoplankton to predatory fish like tunas and cods have been emerging, showing that the regime shift is a universal principle covering the whole marine ecosystems (Kawasaki,2002).

Since the mid-1970s, return rate of chum salmon liberated from Japan had increased rapidly until 1996, which, however, has been falling dramatically thereafter. The return rate is, in other words, survival during the marine life of chum salmon and it is assumed that its variations are due to the regime shift of climate-ocean-marine ecosystems (Kawasaki,2002),

On the other hand, climate-ocean indices such as Southern Oscillation Index (SOI), North Atlantic Index (NAO) and Pacific Decadal Oscillation Index (PDOI) have indicated marked regime shift, which are deemed to drive the regime shift in marine ecosystems, implying that the regime shift is a structural shift on the interdecadal scale of the earth system. During the past 50 years, global regime shifts have occurred three times, in the years 1976/77, 1988/89 and 1997/98.

What are mechanisms that drive the regime shifts? Ocean currents continually exchange water throughout all the oceans and from the surface to the depths. In the current mode, warm water flows northward along the east coast of North America towards the Greenland Sea. The warm water exchange heat with the cooler air by intensive evaporation, becoming cooler and more saline. Near the Greenland Sea, the water becomes denser, producing North Atlantic Deep Water (NADW), which flows southward along the floor of the Atlantic. From there it continues around the Horn of Africa and, still near the bottom, flows into the North Pacific, where it upwells to the surface. Surface water moves south, passing between Asia and Australia and finally catching the tail of the Gulf Stream east of Central America. The large-scale circulation is called thermohaline circulation.

Climate scientists identified three modes of ocean circulation, each of which is associated with a different climate (Taylor, 1999).

The current mode produces the warmest conditions in the North Atlantic. Surface water sinks in two regions, the Greenland Sea and Labrador Sea, and a large quantity of



*What are mechanisms that drive the regime shifts?
(Photo: W. Y. Chiau)*

surface water and heat is drawn from the tropics to replace the downwelling North Atlantic water (Dickson et al., 1996). The intensity of convection at each of the two sites and the hydrographic character of their product have been subject to major interdecadal change. The evolution of winter convective activity was in phase but different in sign at the two sites.

There is a strong evidence of a direct influence of the shifting atmospheric circulation on the oceans, which is the ocean's response to forcing by NAO. The NAO is a large-scale alternation of air mass between the Icelandic Low and the Azores High centers of action. The index of NAO variability is the difference between Iceland and Azores, which shows signs of a 70-year period (Dickson et al., 1996).

The global synchrony of variations in many fish groups across the trophic levels is supposedly driven by fluctuations in the formation rate of the NADW at the two sinking sites, which are directly affected by the variability in the NAO,

The second mode of the thermohaline circulation occurs when surface water sinks in only one area of the North Atlantic. Less surface water downwells to the bottom, so smaller amounts of warm surface water and heat are drawn north to replace sinking water.

In the coldest mode, no water sinks in the North Atlantic; hence no warm water is drawn north, bringing about a cooler climate to northern Europe and the Atlantic coast of northern North America.

The most recent climate change seems to have occurred about 11,650 years ago, when the climate was switched from the coldest mode in the Wisconsin ice age to the current warm mode in the Holocene. At that time, climate over the North Atlantic became warmer and wetter (ice accumulated over Greenland) and the thermohaline circulation seemingly became stronger. This change of 5 to 10 degrees Celsius within 20 years is unprecedented in recorded history and would be disruptive if it were to repeat (Taylor, 1999). Today's regime shift system seems to have evolved as the current mode of the thermohaline circulation had been developed.

Rahmstorf (1997) showed by his numerical models how surprisingly sensitive ocean circulation can be to changes in freshwater discharge into the North Atlantic. If the climate system is near the threshold between stable modes, a small change in the amount of freshwater entering the North Atlantic will force a large and rapid shift to a different ocean circulation pattern.

Human activities have become so pervasive that they influence all Earth's compartments and processes. In particular, the atmospheric concentration of carbon dioxide has risen from 280 ppm in 1750 to 367 ppm in 1999. The effects of this

increase in CO₂ concentration are very likely to be responsible for the global increase in temperature seen over the last 50 years.

Global warming could switch off one of the two main sites, or even both the two, of convection linked to the formation of NADW. Global warming is expected to warm the surface water and increase precipitation in higher latitudes, both of which reduce water density and move the Atlantic closer to the threshold (Rahmstorf, 1999). The crucial question is how closer? Wood et al. (1999) simulated the shutdown in Labrador Sea convection, which will occur not later than 2030, leading to the second mode circulation. Consequently, global warming could disrupt the rhythmical waves of the regime shifts of marine ecosystems, and have a tremendous effect on the fisheries production throughout the world oceans.

Fisheries production in Asian countries is far more abundant than those in each of the other areas. In the year 2000, production of crustaceans in Asian countries was 6.2 million tonnes, much more abundant than 0.9 million tonnes in the second-ranking North American countries. Production of marine fish in Asia was 32 million tonnes, as compared with 17 million tonnes in South America that ranked next. Concerning freshwater fish, Asian area produced 26 million tonnes but the production in African countries in second place was only 2.5 million tonnes (Shindo, pers.comm.).

Furthermore, fisheries productions are no more than delicacies for Westerners but for most Asian people they are principal sources of animal protein.

Destruction of the regime shift systems resulting from the global warming will do a serious damage in particular to the Asian nations.

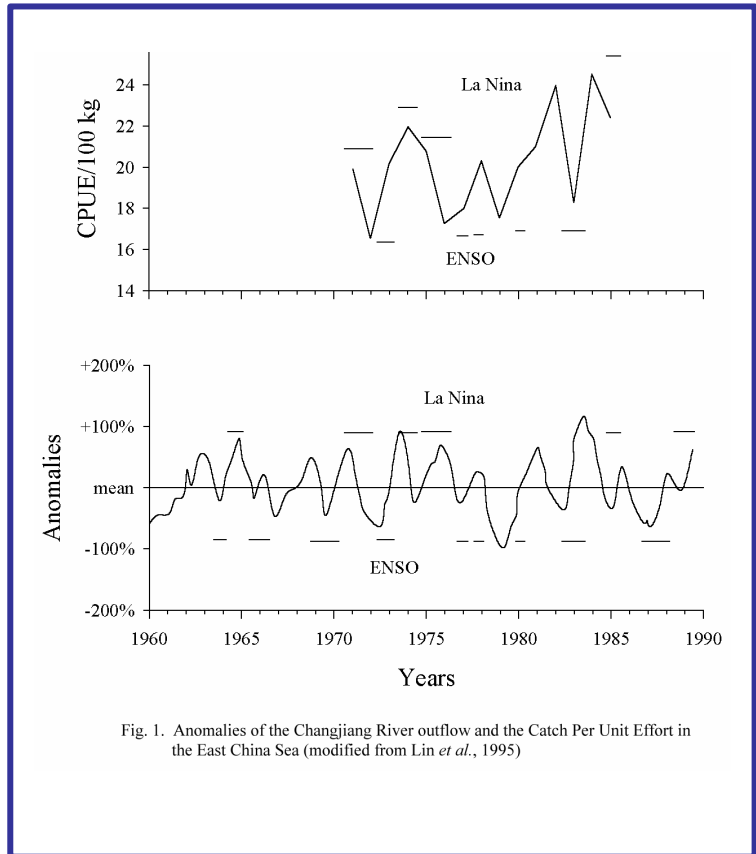


Fig. 1. Anomalies of the Changjiang River outflow and the Catch Per Unit Effort in the East China Sea (modified from Lin *et al.*, 1995)

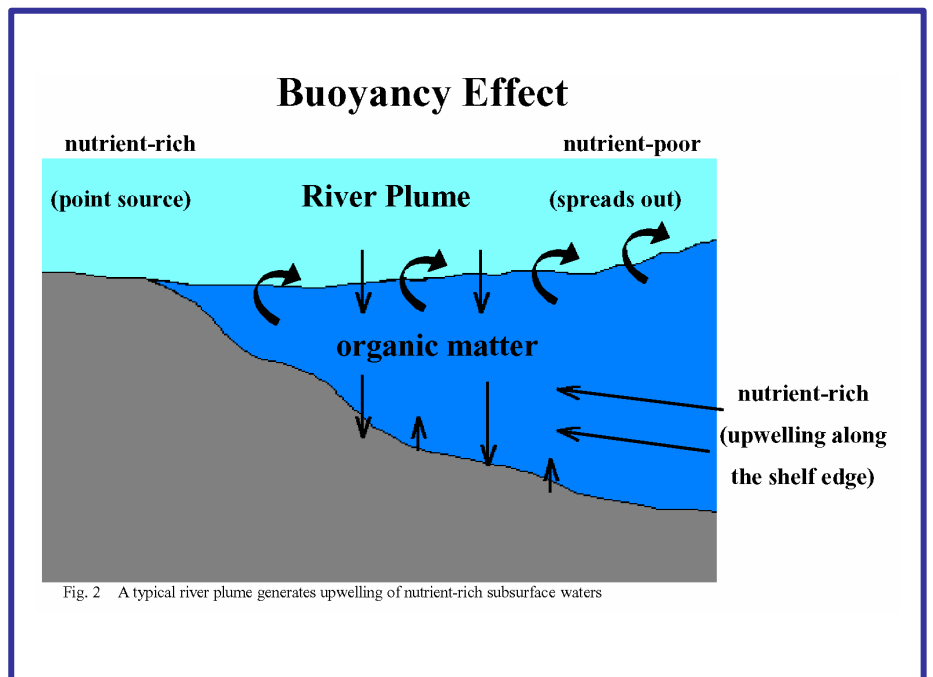


Fig. 2. A typical river plume generates upwelling of nutrient-rich subsurface waters

Damming and its potential impact on productivities beyond the estuaries: the case of the Three Gorges

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*Canal construction at Three Gorges Dam, China.
(Photo: W. Y. Chiau)*

Introduction

The major biogeochemical role of river systems in the global carbon cycle has commonly been considered to be the fluvial export of total organic carbon and dissolved inorganic carbon to the oceans (0.4 - 0.8 and 0.4 Gt C yr⁻¹, respectively). It is true that these fluxes represent but small components of the global C cycle, but they are nonetheless significant when compared to the net oceanic uptake of anthropogenic CO₂. Aquatic carbon exports from terrestrial ecosystems, however, are not solely limited to fluvial discharge; on the contrary, early measurements, for example, in the Amazon have suggested that global CO₂ efflux (fluvial export plus respiration) from the world's rivers could be to the order of one Gt C yr⁻¹.

Richey *et al.* (in press) have recently demonstrated that the outgassing of CO₂ from rivers and wetlands of the Amazon Basin constitutes an important process of carbon loss, one equal to $1.2 \pm 0.3 \text{ Mg C ha}^{-1} \text{ y}^{-1}$.

This carbon probably originates from organic matter transported from upland and flooded forests, and is then respired and outgassed downstream. If extrapolated across the entire basin, the resulting flux of about 0.5 Gt C y⁻¹ is substantial indeed.

While the computations of fluvial and evasion flux are becoming progressively better constrained for the Amazon, elsewhere in the humid tropics such as Southeast Asia this is not the case. In terms of development, Southeast Asia sharply contrasts with the Amazon, on account of the extraordinarily rapid pace of development and population growth in the former, hence the need for reservoirs and irrigation. Obviously, this has placed dramatically increasing pressure on its river basins and downstream coastal ecosystems.

Damming and its potential impact on productivities beyond the estuaries:

True, we cannot ignore the longer-term changes in regional weather patterns and climate that result in altered flow regimes, but changes in hydrology are an immediate consequence of dam construction and large-scale water diversion for irrigation. These changes, undoubtedly, have significant effects on water resources. Nevertheless, rivers are the major conduits for the passage of water, nutrients, organic material and particulate matter from land to sea, and naturally the input of nutrients and organic matter nurtures fish-breeding in the estuaries. However, most central to dramatic reductions in fish stocks in connecting estuaries, as well documented, is the completion of a large dam, such as the Nile River's Aswan Dam in Upper Egypt. Briefly put, dams block the down-stream transport of particulate matter which is an important source of nutrients and food for aquatic biota.

The effects, however, go far beyond the estuaries. The Three Gorge's Dam in China is a case in point.

Clear evidence has shown that, despite a large riverine input of nutrients to the East China Sea (ECS), it is in fact only a small fraction (7% for P and 33% for N) of the external nutrient supply supporting new production that is actually from that input. The major nutrient supply originates from the on-shore advection of subsurface Kuroshio waters (Chen, 2000).

Chen (2002) has additionally documented that the completion of the Three Gorge's Dam on the Changjiang (Yantze) River is most likely to give way to considerably diminished productivity in the ECS, currently home to the largest fishing grounds in the world. Simply cutting back the Changjiang River outflow by a mere 10% will not only reduce the cross-shelf water exchange by about 9% because of a reduced buoyancy effect, but also at the same time, it will diminish the onshore nutrient supply by almost the same amount. It thus clearly follows and should come as no surprise whatsoever that primary production and fish catch in the ECS will decrease proportionately, a fact supported by the decrease in catch per unit effort (CPUE) of fisheries in El Niño years when the Changjiang River outflow was reduced (Fig. 1). As a further example, a ~50% reduction in the Huanghe (Yellow) River discharge from 1982-1983 and 1992-1993 resulted in a 35% decrease in primary productivity in the Bohai Sea (Lu *et al.*, 1999).

From a global perspective, as stated earlier, approximately 40% of the fresh water and particulate matter entering the oceans are transported by the ten largest rivers by means of a buoyant plume (Fig. 2) on the open shelves.

Hence, these shelves also, of course, face diminished fish production when damming reduces freshwater outflow.

The South China Sea Regional Carbon Pilot Project:

Known as the Global Carbon Project (GCP), three international global environmental change research programmes - the IGBP, the IHDP and the WCRP - have begun to collaborate their efforts to monitor, assess and predict the evolution of the carbon cycle. *The South China Sea Regional Carbon Pilot Project* is a newly-formed contribution to the GCP agenda for pilot research in the South China Sea (SCS) region.

The goals are to provide initial funding in order to develop several theories vis-à-vis carbon cycles in the SCS region, such as its biogeochemical dimensions and fisheries along with their interactions and feedback, among others.

This will be achieved by determining and explaining the following:

- Patterns and Variability: the current geographical and temporal distributions of the major stores and fluxes of carbon and associated elements in the SCS region, including the deep SCS basin, shelves, estuaries and river basins;
- Processes, Controls and Interactions: the underlying mechanisms and feedback that control the dynamics of the regional aquatic carbon cycle which encompasses its interactions with water and nutrient cycles as well as fisheries; and
- Future Dynamics of the Carbon Cycle: the range of plausible trajectories in the future as concerns the dynamics of the regional aquatic carbon cycle.



*The construction of Three Gorges Dam, China in June 2001.
(Photo: W. Y. Chiau)*

The proposed work of the SCS Regional Carbon Pilot Project was approved by the SARCS Regional Council in Hanoi on 12 Oct., 2002. It will be organised around rapid-turnaround Pilot Activities with funding to Southeast Asia Regional Center for START (SARCS) nations being provided by the National Science Council of China-Taipei (Calls for proposals - with a mid-Feb., 2003 deadline - are available at maywang@sarcs.org.tw); an 18-month time frame will be allotted for the delivery of the initial results. The initial Pilot Activities will cover:

- Rapid Assessment: Literature review of the SCS regional carbon cycles.
- Patterns: Enhanced understanding of space-time patterns in contemporary carbon cycles.
- Capacity-Building: Training programmes for scientists in the SARCS region.
- Regional Reservoir Development: Carbon cycle consequences of regional reservoir and water diversion developments.
- Emergence: Emergent properties of the coupled human-carbon-water- fishery system.
- Future: Evolution of aquatic carbon sources and sinks through the 21st century.

The end-products of the research programme are envisioned as being:

- Greater in-depth knowledge of current patterns of the SCS regional carbon sources and sinks;

- Future projections of carbon sources and sinks in aquatic environments in the SCS region;
- New understanding of the multiple processes controlling carbon cycles (including dissolved and particulate as well as organic and inorganic carbon, CO₂ and CH₄ in the aquatic environment and air-water exchanges);
- A Systemic Framework of the coupled biogeochemical and physical interactions controlling carbon cycles implemented in a series of interconnecting models;
- More effective coordination among the research, monitoring and assessment communities, which will facilitate the capability for rapid assessments and responses to trends and unforeseen developments in carbon cycles;
- Enriched ability of scientists in the SARCS region;
- Upgraded output from national and international research and monitoring programmes through better coordination, linkage and information exchange;
- Outreach and communication products, including syntheses of research and assessment activities in journal issues and books; electronically available resources (charts, graphics, presentation material); and educational resources (posters, leaflets); and
- Proposals for detailed analyses.

Major stakeholders of the SCS *Regional Carbon Pilot Project* are the scientific, assessment, and policy communities dealing with quantifying and predicting carbon budgets and fishery resources on regional, national and local scales; and specialists in regional development with regard to mitigation measures so as to minimize the impact on environmental, economic and social issues. Because of the integrative nature of the project, there will be a need to build upon many existing projects under the umbrella of the *SCS Regional Carbon Pilot Project* and to work closely with many communities whose spheres of interest intersect but do not overlap. It is particularly important to work with research communities coordinated through SARCS, IGBP (in particular, LOICZ, SOLAS and OCEANS), IHDP, WCRP and GCP as well as with assessment and policy communities dealing with the consequences of changes in the carbon cycle, vulnerability, and the links to water resources and food systems.



*A bridge to be merged under water.
(Photo: W. Y. Chiau)*