Swedish Agency
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Management of Large Rivers to Secure Functions of Coastal Ecosystems

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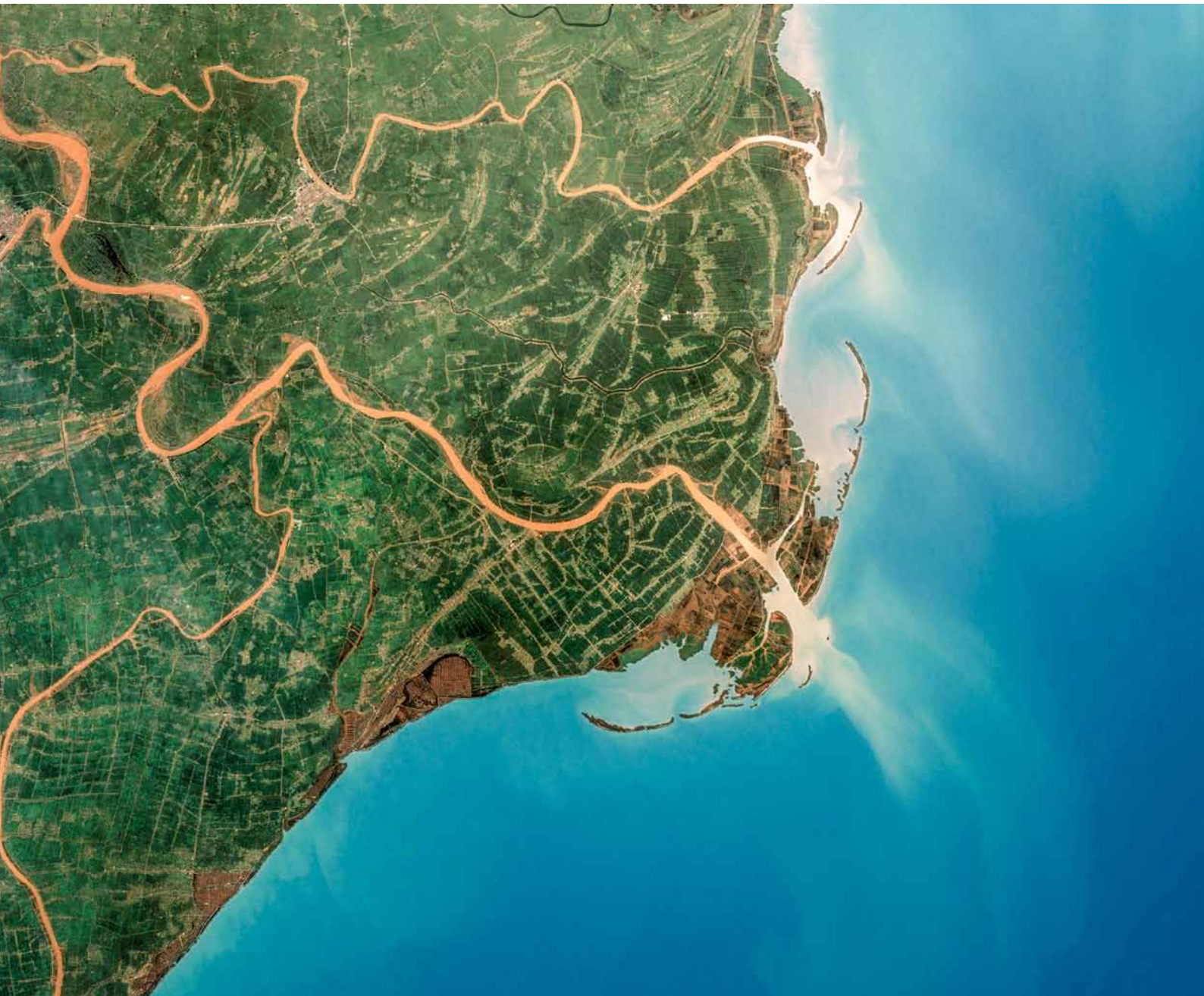

Management of Large Rivers to Secure Functions of Coastal Ecosystems

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Seminar organized by the Swedish Agency
for Marine and Water Management at
World Water Week 2015 in Stockholm

Swedish Agency for Marine and Water Management
Box 11 930
404 39 Göteborg, Sweden
Tel. +46 (0)10-698 60 00
www.havochvatten.se/en
havochvatten@havochvatten.se

Director General: Ingemar Berglund
Editor: Arne Andreasson, Peter Funegård, Karin Bjerner, Annie Hermansson
Cover Photo: Science Photo Library / IBL Bildbyrå
Report Photos: Kat Singer
Layout: Karin Enberg, Vid Form AB
Swedish Agency for Marine and Water Management
Box 423, 401 26 Göteborg, Sweden

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Introduction

Increasing competition for limited freshwater resources in combination with effects of climate change in coastal areas and in river basins is a global problem to ensure good environmental status of coastal aquatic ecosystems. The aquatic ecosystems are affected by a wide range of human activities. Some of the main problems have been understood as overexploitation, water pollution and changes in water flow because of dams and other constructions in water. In addition, sand mining and illegal pumping of freshwater for irrigation and loss of connectivity with negative impacts on fish populations and biodiversity have contributed to a severe situation in many large river systems. At the same time millions of people in developing countries are dependent on healthy coastal aquatics ecosystems for their livelihoods.

The current degradation shows linkages from the source of a river to coastal and marine areas. Intensified human activities upstream have impacts downstream and in adjacent coastal and marine areas, but the linkages are little understood and considered in present management systems. There is a lack of effective institutional mechanisms globally, regionally and nationally in order to address and mitigate these complex issues in a holistic manner. Climate change causes additional negative impacts on the aquatic environment, especially in densely populated coastal areas.

The United Nations has adopted 17 Global Goals for Sustainable Development as a means to address the global challenges facing the world today. Two of the goals, 6 and 14, aim at achieving healthy water and oceans. They contain ambitious targets that address many of the environmental challenges in river, coasts and seas and can, if properly implemented and applied, lead to healthy oceans and water in benefit for poor rural people in coastal areas.

Global Goals for Sustainable Development (former Sustainable Development Goals, SDG)

The United Nations has adopted a new agenda for sustainable development in 2015 as a follow up on the Millennium Development Goals (MDG) which expires in the end of 2015. The agenda consists of 17 goals and 169 targets that address the major global challenges in need to be solved in the next 15 years. The goals have been drawn out by an open working group consisting of government representatives and in broad consultation with the civil society. The Global Goals are universal which means they apply to both developing and developed countries.

GLOBAL GOAL 6

Ensure availability and sustainable management of water and sanitation for all

Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all

Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

GLOBAL GOAL 14

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

The complex interface between land and oceans captures the key challenges for a holistic management and long-term sustainable use of the resources within the systems. In order to address these challenges an understanding of the key flows and interlinkages is needed as well as new and innovative management approaches. The concept Source-to-Sea has been formulated by several international organisations as a means to visualize, explore and understand the linkages between land-river-coasts and seas. It is also important to address these linkages in order to enable the realization of several of the Global Goals for Sustainable Development, especially goal 6 and 14.

Action Platform for Source-to-Sea Management (S2S Platform)

Action Platform for Source-to-Sea Management was established by SIWI in 2014 to collaborate on the challenges surrounding the governance and management of natural resources in the source to sea continuum. It brings together different actors from the freshwater, coastal and marine communities. It is an informal platform to support integrated and innovative approaches to governance and management from source to sea and generate and share knowledge on effective and valuable experiences. The platform is open to governments, private sector, scientific community, civil society organizations and UN agencies that are committed to improving coherence and coordination in land, water and coastal management. Read more on siwi.org.

During the World Water Week with the theme "Water for Development", 23 – 28 August 2015, The Swedish Agency for Marine and Water Management organized a 90 minutes seminar which addressed challenges and opportunities in four major globally important river basins and their adjacent coastal and marine regions: the Red River and the Mekong River in Asia, the Zambezi river in Africa and Paraná river in Latin America. The recently adopted Global Goals for Sustainable Development with focus on goal number 6 especially target 6.5 and 6.6 and goal 14 formed the basis for the panel discussion during the seminar. In light of these goals, recommendations for a sustainable management of globally important river systems were presented.

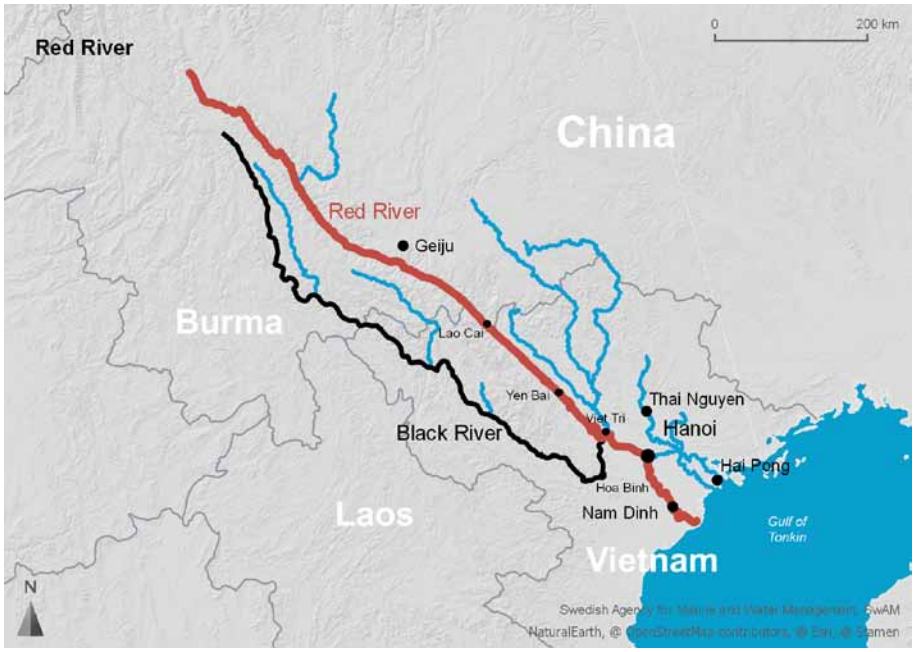
Presentations

Anna Jöborn, Swedish Agency for Marine and Water Management (SwAM), welcomed the participants on behalf of the agency and introduced the moderator of the seminar, Axel Wenblad, President of WWF Sweden and former Director General of the Swedish Board of Fisheries. The moderator briefly defined the scope of the seminar and introduced the speakers.[1]

Management of the Red River in China and Vietnam

Trong Tu Dao, Director of the Centre for Sustainable Water Resources Development and Adaptation to Climate Change (CEWAREC), Hanoi, Vietnam presented the management of the Red River in China and Vietnam.

The Red River originates in Yunnan Province in China and flows into the Gulf of Tonkin in South China Sea, through Vietnam. It has a catchment area of 169 000 km², almost equally divided between China and Vietnam, 48 and 51 % respectively, and with a small portion in Lao PDR. Approximately 35 million people live in the catchment area and the river is 1200 kilometre long and ends in a 15 000 km² delta.



[1] The PowerPoint presentations are available online at www.havochvatten.se/en

The total water volume is 134 billion m^3 and the flow of water varies significantly between rainy and dry seasons. These fluctuations are important for the river management and causes widespread flooding during the wet season, while there are serious water shortages during the dry season. The water resources are 3828 m^3 per capita, hence lower than the international standard of 4000 m^3 per capita.

The water in the Vietnamese part of the basin is mainly used for agriculture (more than 50 %), followed by industry (16 %), environment (15 %), aquaculture (10 %) and domestic use (3 %). The proportions are similar in China.

Trong Tu Dao
Director of the Centre for Sustainable Water Resources Development and Adaptation to Climate Change (CEWAREC), Hanoi, Vietnam.

Major challenges

Trong Tu Dao defined major challenges for the development and management of the Red River water resources as rapid population growth, hydropower development, sand mining and, linked to these, pollution, loss of biodiversity and changes in water flows. Additionally climate change is expected to result in less rain in the dry season and sea level rise.

The rapid population growth has resulted in huge yearly demands for water from the river, 2.4 billion m^3 in China and ten times as much, 24 billion m^3, in Vietnam. Population increase and industrial development also imply significant increases in energy demand and consumption.

Hydropower development in the river and its tributaries is a major problem for river basin management. The installed capacity in the Chinese part of the catchment area is 2,385 MW, with seven plants in the Lixianjian River, ten in Panlong River, and two on Yanjiang. In Vietnam the capacity is almost three times higher, 6,562 MW in eight large plants. In addition to the large plants there are numerous smaller installations in the tributaries, both in China and Vietnam. The construction of dams for hydropower generation causes

significant changes in flow patterns. Downstream of the dams there are serious erosion, causing loss of land. The dams also constitute obstacles to fish migration and less nutrients for the fish populations

An additional challenge is the legal and illegal sand mining which also causes significant changes in flow patterns. Sand mining and pumping water for irrigation has significantly lowered the river beds and the permanent pumping stations along the river no longer works.

The current development also leads to increasing deforestation for cultivable land and accumulation of sediments in the reservoirs as well as resettlement of poor rural families with negative socio-economic impacts for local communities. Changes in the water flow affect the delta, causing land degradation. An additional problem is lack of water for irrigation especially during the dry season. Pollution originates from domestic waste, mostly discharged untreated into the rivers, from approximately 4000 industrial plants, eight industrial zones and 450 craft villages resulting in severe impacts on the living resources and loss of aquatic biodiversity.

Conclusions and management recommendations

Trong Tu Dao emphasised that many of the above mentioned challenges are transboundary in nature. Changes in water flow and water pollution have impacts both in China and Vietnam and there is no comprehensive mechanism to deal with or settle transboundary issues between the countries. He recommended the establishment of a transboundary basin cooperation mechanism between China and Vietnam. He highlighted the need for cooperation regarding research and information exchange as well as data and knowledge sharing. On the national level he stressed the importance of good water governance and the application of integrated water resources management principles.

Management of the lower Mekong River Delta and the value of fish resources

Hans Guttman, independent consultant and former Chief Executive Officer (CEO) of the Mekong River Commission, provided an overview of the Mekong River system, defined major management issues and formulated a set of recommendations to address these.

The Mekong River in Southeast Asia is 4800 kilometre long with a drainage area of 795 000 km^2. It originates in China and flows through Myanmar, Lao PDR, Thailand, Cambodia and Vietnam to reach South China Sea. The Mekong River discharges 475 km^3 per year. There is an important seasonal variation in the flow between the wet and dry seasons. However, the lake Tongle Sap (14 000 km^2 in the wet season) plays a significant role for the mitigation of seasonal variation. During the wet season the lake fills up with water, which is then released during the dry season. It contributes to almost half of the flow during the dry season and is thus a significant factor preventing drought.[2]

[2] The importance of Tongle Sap is reflected in the 1995 agreement.

The Mekong River Commission for cooperation in river management was established in 1995 and the countries constituting the Lower Mekong River: The Cambodia, Lao PDR, Thailand and Vietnam are members to the commission. The countries of the Upper Mekong River, China and Myanmar are dialogue partners to the commission. The member countries have agreed to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin including irrigation, hydropower, navigation, flood control, fisheries, timber floating, recreation and tourism.[3] The aim is to optimize the multiple-use and mutual benefits of all riparian's and to minimize harmful effects. Today the management is predominantly on the national level. The agreement provides a comprehensive framework for collaboration between the countries.

Hans Guttman

Independent consultant and former Chief Executive Officer (CEO) of the Mekong River Commission.

[3] Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin 5 April 1995, Article 1.

Major challenges

Impacts of human activities on global, regional and local levels have resulted in sea level rise, deteriorating habitats, low river flows, pollution and dams blocking fish migration. Upstream activities have impacts on the delta and coastline through changes in water flows, sediments, connectivity and pollution. Of these, pollution is still a minor issue in the delta. The use of water in the delta itself, which is important, has increased substantially over the last decades. The main reason has been the expansion of irrigation for rice cultivation and of cage fish culture which has caused local pollution.

Hydropower dams, which have been built in the Upper Mekong, mainly in China, have had a limited impact on the water flow. They are influencing less than 20 % of the total flow in the dry season. However this may change if or when more dams will be built in the tributaries. A major impact of dam construction is loss of connectivity blocking the migration of fish and fish larvae. This have impacts on total fish production and is often offset by increased aquaculture production. In addition to the larger dams there are literally hundreds of smaller dams in the tributaries, all locally impacting on connectivity and collectively having a major impact on the overall natural fish population.

Sediment transport is an important issue, which is influenced by the dam buildings in China. Prior to dam construction, the sediment transport was estimated to 150 million tons per year and is now down to 72 million tons. Sand excavation for construction and land fills also contribute to changes in sediment transport. An estimated 50 million tons are excavated annually. Changes in sediment transport seemingly influence the delta in a significant manner. Over the last 1000 years the delta has expanded with about 45 meters per year. However, recent studies show that the delta now is retreating.

Conclusions and management recommendations

There are grave concerns about the potential future expansion of hydropower and irrigation and the effects it might have on water flows, sediment transport, connectivity and pollution. Other important aspects are impacts on fisheries and coastal erosion. There is a need for studies to estimate the scale of impact of present human activities and future planned and expected developments. The agreements on flows in the river may need to be revisited, since they only focus on drought and floods. In addition to water flows, there is also need to consider sediment transport. The threatening amount of sand excavation needs to be regulated and policies for improving connectivity should be formulated and implemented.

Chumnarn Pongsri, Secretary-General of the Southeast Asia Fisheries Development Centre (SEAFDEC), focused his speech on fisheries and fisheries-based livelihoods in the Lower Mekong River Basin and discussed Mekong River Basin management from a fisheries sector perspective.

Fisheries are an integral part of people's livelihoods in the Mekong River Basin and coastal areas. It contributes to food security, meets nutritional demands and sustains livelihoods as well as socio-economic development. The fisheries sector benefits from the river being an aquatic ecosystem with high biodiversity. The sector operates within the dynamics of a diversified ecosystem with a broad range of resource users and complex governance, involving several sectors and governments.

Chumnarn Pongsri
Secretary-General of the Southeast Asia Fisheries Development Centre (SEAFDEC).

Major challenges for fisheries management

There is competition for water resources, with hydropower and irrigation as prioritized sectors, while the fisheries sector is partly ignored. This, in spite of the fact that there are a large number of small-scale fishers operating in the river basin. The fisheries are multi-gear and multi-species with a large portion of the catches being consumed within the households. Due to poor documentation of the total catches and total value of the fisheries sector there are inherent difficulties in data collection. Available statistics underestimate the value of the Mekong River Basin fisheries. This contributes to the low attention given to the sector in comparison with hydropower and irrigation sectors.

Improved policies for sustainable use of inland fisheries resources would rely on better information on value and importance of the resources, which would support communication with policy makers and other sectors. There is a need for improved data collection and analysis using methods adapted to the disperse nature of the fisheries sector. The Mekong River Commission has for example developed improved methods for data collection through fish

consumption surveys, which could be used more widely.

Dam buildings and other constructions, which create obstacles to water flow is a serious problem for habitats and fish populations. These prevent and block the migration of fish and reproduction and dispersion of aquatic species. This poses serious threats to species requiring upstream/ downstream migration and leads to loss of biodiversity and impacts on overall fish production. There is a need to develop fish pass models suitable for the species of Southeast Asia. Mitigation to these problems are possible through the construction of fish passages or "fish ways" at the smaller dams. However, Chumnarn Pongsri suggested that such mitigation may not be economically feasible in larger dams.

Water flow fluctuations are another important characteristic of the Mekong River. There is a natural fluctuation, which is caused by an abundance of water during the wet season and low water levels during the dry season. These natural fluctuations are disrupted and changed by the fluctuation of water levels caused by the construction of dams and operation of hydroelectric power plants. The changing water levels during, for example, peak electricity production, disturb reproduction patterns for species, for which spawning is triggered by water flow. There is an urgent need to develop measures to mitigate the effect of changes in water flows and fluctuations in water levels.

The fisheries are highly seasonal and after the wet season large amounts of fish are caught with stationary fishing gear. New innovative methods for processing of large volumes of fish, while enhancing fish quality, hygiene and safety are needed in order to conserve these catches for consumption during off-season periods. Furthermore value added products should be promoted.

Conclusions and recommendations for improved fisheries management

Fisheries management in the Mekong River Basin needs to acknowledge that management areas can often not be geographically confined to one country. Instead fisheries management in the river requires the engagement of several authorities and countries to result in maximum socio-economic welfare, without negative environmental impact. Several management concepts and approaches have been tested, such as a catchment/ecosystem approach and integrated water resources management, applying an ecosystem approach to fisheries management as developed by the Food and Agricultural Organization (FAO) and promoted by SEAFDEC, among others. The difficulties in applying these management concepts include limited capacities in the riparian countries. The lack of capacity refers to human resources, budgets, government support, laws and regulations. Chumnarn Pongsri concluded his presentation by calling for support from the international community to promote and enhance the capacities of the less developed countries in the application of integrated management approaches.

Zambezi River runoff and coastal fish production – A contribution for sustainable integrated river management

António Mubango Hoguane, Associate Professor, School of Marine and Coastal Science, Eduardo Mondlane University, Quelimane, Mozambique, explored in his presentation the links between river flows and coastal fish production based on research in the Zambezi River.

The Zambezi River, the fourth longest in Africa, has its origin in the North-Western Province of Zambia and touches Angola, Namibia, Botswana, and Zimbabwe before the delta enters the Indian Ocean in Mozambique. The river is 2574 kilometre and its drainage basin is 1 390 000 km². 41 million people live in the Zambezi river basin. There are two major hydroelectric power stations in the river; Kariba (1,626 MW) and Cahora Bassa (2,075 MW), which affect the river flow. The irrigation potential from the river is three million hectare.

Tourism is important along the river, with Victoria Falls as a centre for interest. Artisanal, small-scale fisheries are providing livelihoods. Fisheries are also important in the big reservoirs created by the dams in Kariba and Cabora Bassa as well as in the delta and adjacent coastal areas.

Water flows and fisheries

Before the construction of the major dams, there were five to six years cycles of floods and drought along the river. These events have evened out through flow regulation and the annual flow pattern has changed drastically. Originally there was a high flow during February – March, followed by low flow levels during the rest of the year. Through the dams and hydroelectric power generation the flow has levelled out and reduced the fluctuations between the

seasons. The flow in the wet season has decreased with 40 % and increased in the dry season with almost the same magnitude.

António Mubango Hoguane discussed the relations between the flows and coastal fisheries, mainly shrimp and artisanal fisheries, and stated that the runoff from the Zambezi River correlates with shrimp availability. This was explained by low runoff in the dry season that allows the shrimp juveniles to enter and be sheltered in the mangroves. High flows in the wet season flushes the shrimps towards the fishing grounds. There is also a correlation between artisanal fisheries, which mainly catch estuarine species as Engraulidae, Clupeidae, Sergestidae and Penaidae, and the runoff. High flows in the river bring nutrients to the delta and coastal areas, which promotes growth of phytoplankton. Also, the less saline, water functions as a protection for larvae and juveniles against predators.

António Mubango Hoguane
Associate Professor, School of Marine and Coastal Science, Eduardo Mondlane University, Quelimane, Mozambique.

Conclusions and management recommendations

The dams provide an opportunity to manage the river, to enhance ecological functions and boast fisheries production. Fluctuations in flow from the river can, according to the presented model, explain about 60 % of the fluctuations in fish catches in the coastal area adjacent to the delta. António Mubango Hoguane concluded that an annual increase in the runoff with 20 % would result in an increase in the shrimp catches with 450 tons and an increase of 2500 tons in the artisanal fisheries. He recommended that management of the river flows should consider the potential of increasing shrimp and fish production in adjacent coastal areas.

Water management, hydropower and environment programs in Paraná River, Brazil

Nelton Friedrich, Director of Coordination and Environment Directorate at ITAIPU Binacional, Foz do Iguacu, Brazil presented the experiences with the programme Cultivando Água Boa along the Paraná River in La Plata River Basin. The programme, which started in 2003, was 2015 given the "Water for Life" UN – Water Best Practice Award.

La Plata River Basin is one of the largest in the world and encompasses Argentina, Bolivia, Brazil, Paraguay, and Uruguay. The basin is 3 200 000 km² and 45 % of the basin lies in Brazil and 30 % in Argentina.

Cultivando Água Boa started with the aim to implement innovative governance connecting water, energy, environment and food production. The programme also addresses health, education, social inclusion, climate change. Engaging local players is a key for success.

Within the larger river basin system, the programme selects "micro-basins", which are the basis for the work. In each of the 29 micro-basins, the programme follows the same approach with community sensitization and establishment of governing bodies (Steering Committee, Education collective). This is followed by workshops to create partnerships and to reach "water pacts" with signed agreements, engaging communities. Finally, actions are implemented and evaluated, providing feed-back into the process.

Challenges in the micro-basins are erosion and eutrophication, inappropriately constructed roads, and deforestation. The programme has addressed these problems in 217 micro-basins. It has been a large environmental education programme involving all local stakeholders in the micro-basins, with formal and informal training and training in communication. The aim is to

change and develop values and the programme focuses on "ethics of care" for the environment and society.

More than 1 300 km of fencing of forests has been erected to combat deforestation and 43 million trees have been planted in biodiversity corridors along rivers. The corridors are on average 210 meters wide and the length is 2400 kilometre. This implies 738 863 tons of carbon sequestration per year. The programme has promoted soil conservation in an area of more than 30 000 hectare, established 165 community water supplies and improved 2 500 kilometre of roads.

To combat eutrophication the programme has further promoted bio-gas installations. Chicken and milk production in the river basin area causes eutrophication and production of methane gas. To address this the programme has promoted small producers to install bio-gas plants connected to a thermos-electrical bio-gas plant, producing energy for the area. Surplus production of electricity is sold to the local power company.

The programme promotes fish production through aquaculture and construction of fish passages for enhanced connectivity. Fish passages are now a prerequisite for dam construction.

Nelton Friedrich
Director of Coordination and Environment Directorate at ITAIPU Binacional, Foz do Iguacu, Brazil

Nelton Friedrich stressed that community participation and commitment, a holistic approach and recognition of the dynamics and complexity of relations between society and nature lays the basis for the programme. He advocated cooperation, exchange and sharing of good practices as well as an international network of knowledge exchange and cooperation.

Panel discussion and recommendations

Anna Jöborn, Swedish Agency for Marine and Water Management (SwAM), and Birgitta Liss, Stockholm International Water Institute (SIWI), were invited by the Moderator to take part in the following panel discussion with the five speakers. Axel Wenblad asked the panellists to reflect on the Global Goals for Sustainable Development number 6 especially target 6.5, 6.6 and goal 14, how they are interlinked and can be promoted through actions discussed during the seminar. The discussion mainly focused on the importance of cooperation and stakeholder engagement, land-river-sea linkages and sector integration.

Importance of cooperation and stakeholder engagement

The panel noted that there has been progress in Integrated Water Resources Management (IWRM) over the last decade, through the establishment of an enabling environment, which can be beneficial for the achievement of Global Goal number 6. However, there are still challenges to overcome.

Integrated Water Resources Management is complicated in a transboundary context and the need for cooperation is increasingly necessary when substantial developments upstream in a river and its tributaries have profound impacts on the country (-ies) downstream. When competition for water use in a river shared by two or more countries, formal structures, like the Mekong Agreement and its commission, can provide mechanisms for collaboration. The rationale for cooperation, either within formal or informal structures is sharing of benefits. It is imperative to find benefits for all cooperating parties in this process. The panel found that pressure from the international community could be instrumental in promoting such structures and collaboration.

International law, conventions and agreements can also be instrumental in fostering sustainable management. However, they need to be underpinned by a real sense of need for cooperation.

Active and constructive stakeholder engagement is also important in achieving an integrated approach to management of riverine, coastal and marine ecosystems and to ensure that the Global Goals are achieved. It is crucial to engage the local players and to work bottom-up in order to seek innovative solutions for management and for financing implementation. When developing new management systems local knowledge and awareness of both ecological and social aspects is essential for sustainable use and conservation of the aquatic ecosystems.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Importance of land-river-sea linkages

In order to address the environmental challenges in the source to sea continuum and enable the achievement of the Global Goals 6 and 14, there is a need for further integration of effort and measures in existing management systems, such as IWRM and Integrated Coastal Zone Management (ICZM). There has been up to 70 % decline in aquatic biodiversity over the last 40 years, which stresses the importance of such collaborative efforts. The concept Source-to-Sea has over the recent years gained more attention in the international community. At an event organized by SIWI during the World Water Week the Source-to-Sea concept and how this can ensure sustainable development was discussed. It was highlighted that the linkages between land-river-coast-sea have to be considered when implementing new global commitments. SIWI has earlier established an Action Platform for Source-to-Sea, in which partners can collaborate to strengthen management, linking downstream effects of upstream activities. The Swedish Agency for Marine and Water Management is a concrete example on how source to sea challenges can be addressed and managed. The agency has an overarching responsibility for managing fresh water and marine water that enables a more holistic approach. The development of the Swedish programs of measures for the EU Water Framework Directive and the EU Marine Strategy Framework Directive have aimed at coincide measures and actions between the two directives in order to ensure a management system that takes the linkages between land-river-seas into consideration.

Importance of sector integration

The panel noted that the fisheries sector was often not enough considered in relation to the importance of fisheries and aquaculture for livelihoods, food safety and nutrition and the progress towards the Global Goals for Sustainable Development. There are often unintentional negative impacts on fisheries from river developments, for example dam buildings, breaking the connectivity, which is essential for fish production. The problems caused by the big dams have gained large attention, but the cumulative impact of tens of thousands of small dams could be drastic with regard to connectivity. In these smaller dams mitigation in terms of fish passes are affordable and should be promoted whereas the economic feasibility of fish passes in larger dams probably requires a more thorough investigation and evaluation from case to case.

Conclusions

Human activities upstream in rivers have negative environmental impact on coastal aquatic ecosystems of which millions of people in the developing world are dependent on for their livelihoods. Some of the main problems have been identified as hydropower development, sediment extraction and pollution with impacts on ecosystem functions and services.

In order to address the environmental challenges it is important to identify critical flows in the source to sea continuum. The degradation of ecosystems in the continuum illustrates the lack of understanding of these flows that are connecting the systems. In addition the linkages in existing management systems on land, in the coastal zone and in the oceans, which are often handled separately, needs to be further understood. Hence it is crucial that existing management tools are developed into integrated management approaches, such as management based on a source to sea approach to address these linkages and to resolve the environmental challenges in aquatic ecosystems.

The land-river-coasts linkages are also important in order to enable the realization of the implementation of several of the Global Goals for Sustainable Development. Availability of clean freshwater and protection of aquatic ecosystems will be two of the most important issues to improve living conditions for the poor riverine and coastal communities. Linking goal 6 and 14 and their targets and indicators is therefore essential to ensure livelihoods of poor communities that depend on the natural resources from the aquatic ecosystems.

Furthermore, the implementation of the Global Goals for Sustainable Development and targets will require concerted and coordinated actions at all levels and between all sectors. Active engagement of all stakeholders, effective dialogue, including poor communities, civil society and the private sector are also important conditions.

The integration between the management systems of large rivers with their estuarine and coastal areas is a challenge and the future development will require new methodologies and innovative institutional arrangements. Hence, the application of a source to sea management approach is essential in order to secure a sustainable development.

Annex 1 Programme

Management of large rivers to secure functions of coastal ecosystems

16:00 Welcome by moderator, Axel Wenblad, Chairman of WWF Sweden.

16.05 Management of the Red River in China and Vietnam. Trong Tu Dao, Director of the Centre for Sustainable Water Resources Development and Adaptation to Climate Change (CEWAREC), Hanoi, Vietnam.

16.15 Management of the lower Mekong River delta and the value of fish resources. Hans Guttman, Independent consultant and former Chief Executive Officer, Mekong River Commission (MRC), Vientiane, Lao PDR and Dr. Chumnarn Pongsri, Secretary-General Southeast Asian Fisheries Development Center (SEAFDEC), Bangkok, Thailand.

16.40 Management of the Zambezi River basin to maintain healthy coastal ecosystems. A.M Hoguane, Associate Professor, School of marine and Coastal Sciences, Eduardo Mondlane University, Quelimane, Mozambique.

16.50 Management of the Amazonas River system and actions to protect the ecosystem. Nelton Friedrich, Director for the Co-ordination and Environment Directorate at ITAIPU Binacional, Foz do Iguacu, Brazil.

Panel discussion

17.00 Possible recommendations and actions for improved river basin management to be considered in the decision process regarding the post 2015 Global Goals for Sustainable Development.

Panelists:

- Anna Jöborn, SwAM
- Birgitta Liss Lymer, SIWI
- Trong Tu Dao, CEWAREC
- Hans Guttman, Independent consultant and former CEO of MRC
- Chumnarn Pongsri, SEAFDEC
- A.M Hoguane, Eduardo Mondlane University
- Nelton Friedrich, ITAIPU Binacional

17.25 Summary and wrap-up by moderator.


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Swedish Agency for Marine and Water Management
Postal address: Box 11 930, SE-404 39 Göteborg
Visiting address: Gullbergs Strandgata 15, 411 04 Göteborg
Tel: +46 (0)10-698 60 00
www.havochvatten.se/en