

Conserving Our Coastal Environment

A summary of UNU's research on sustainable management of the coastal hydrosphere in the Asia Pacific region

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Preface

In East Asia more than seventy percent of the population live in coastal areas, and depend on marine and coastal resources for food, employment and income. In South Asia, coastal populations are vulnerable to extreme weather events and survive on diminishing coastal resources. In the western Pacific region, small island states suffer degradation to their coral reefs and natural coastal resources from the encroaching pressures of development and climate change. The work of United Nations University (UNU) in this region spans the range of these concerns, promoting education, research and awareness raising amongst a community comprising scholars and coastal managers who have much to learn from each-other.

This report presents a broad overview of the current state of efforts to protect and conserve our coastal environment in Asia and the Pacific, reflecting upon the work that is being done by the experts in UNU's network and other collaborating international organizations. UNU has developed a complementary approach to existing work on the coastal environment, identifying outstanding areas of need and focusing projects within those areas. One of the most significant contributions of UNU's work is the capacity development of research and scientific institutions in the East Asian region to undertake environmental pollution monitoring. This effort has helped the institutions in understanding the extent of pollution coming to coastal areas from land-based sources, as well as in initiating other monitoring programmes. The findings from this monitoring programme have raised awareness among the general public while influencing national policies to manage the coastal pollution.

Working with our partner organizations, UNESCO's Man and the Biosphere Programme (MAB) and the International Society for Mangrove Ecosystems (ISME), UNU has pursued the connections that need to be made between scientists and coastal managers in understanding and protecting a web of interconnected coastal habitats: coral reefs, mangrove ecosystems and seagrass habitats. The full range of threats to the coastal environment that are commonly identified in this region are examined in this report.



Strategies for the protection of the coastal environment are discussed in the report in the context of national, regional and international policy frameworks. These are offered as an essential complement to our firm belief in the importance of community-based coastal management and involvement of the full range of stakeholders. Whilst working to develop capacity at different levels amongst coastal communities, coastal managers, and scientists, UNU has also learned a great deal from the synergies and exchanges that can be achieved between these groups.

As UNU pursues its work on the Conservation of Our Coastal Environment, hosting regular international meetings of scientists and policy-makers, we are committed to ensure the widest possible benefit from our discussions. In 'bridging the gap' between theory and practice in this field, between scholars, governments, NGO's and coastal people, we uphold an inclusive view of the shared benefits of coastal areas. This, I believe, is UNU's contribution to securing the present and future benefits of the coastal environment to communities across Asia and the Pacific.

I am hopeful that this report serves as a guide for policy makers and scientists as well as non-specialists on the wide array of coastal conservation issues. Raising public awareness of coastal issues and enhancing the capacity of coastal managers to approach them wisely are the key pillars of UNU's strategy for improving coastal management in Asia and the Pacific. Through our work, UNU aspires to promote an informed regional perspective on the shared goal of the conservation of the coastal environment.

Prof. J.A. van Ginkel
UN Under Secretary General, and
Rector, UNU



Introduction

Coastal resources are critical to socio-economic development in the Asia and Pacific region. A vast majority of the population of the countries within the Association of South East Asian Nations (ASEAN¹) lives in coastal areas, and most communities depend on local resources for their livelihoods. The natural and economic resources in coastal areas are over-exploited. This leads to degradation of ecosystems, threatening of species and natural biodiversity resources, and an overall reduction in productivity.

Many efforts have been made to improve this situation in Asia and the Pacific in accordance with Chapter 17 of Agenda 21, which calls for integrated coastal management. There is a consensus that integrated and sustainable coastal resources management and planning is a way of meeting the needs of coastal communities without destroying the coastal environment for the future.

UNU, with its network of researchers, has been working to provide support to coastal managers in this region through capacity development for coastal monitoring, training activities for young researchers focusing on coastal ecosystems, research on policy-relevant issues, and dissemina-

tion of information to researchers, policymakers and the general public. From this sustained active involvement, UNU has been able to develop a regional and practice-oriented understanding of the sustainability of coastal resources. This document brings together the key findings and lessons from our work with scientists and professionals in this field.

The pressures placed on coastal ecosystems by over-exploitation for commercial and population-related reasons are briefly described in the first part of this booklet. The second part of the document examines the driving forces that contribute to the current stresses on the coastal ecosystems. Rapid population growth and economic development has occurred in the Asia Pacific region. As a result, the anthropogenic impacts on coastal areas have increased, leading to a rapid deterioration of the resources in this region. The third section of the document re-examines the strategies to solve these increasingly multi-layered problems, and discusses policy-making frameworks at different levels. A number of recommendations based on success stories are presented in the final section of the document.

The Asia and Pacific region – focus of this report



¹ The ten member countries are now Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei Darussalam, Viet Nam, Lao People's Democratic Republic, Burma/Myanmar and Cambodia, although some sources in this booklet were produced before the accession of the latter, more recently joined, member countries.

I. Degradation of Coastal Ecosystems

Human Dependence On Coastal Ecosystems in Asia and the Pacific

Damage to coastal ecosystems poses a direct threat to human survival in many parts of Asia and the Pacific. This is primarily because coastal resources are an important source of both food and income in this region, particularly for low-income groups. Coastal areas are also critical for commerce through ports, industrial development and biodiversity resources. Increasingly, coastal areas have become attractive for tourism and recreational purposes in addition to their other uses.

It is important to note that fish and seafood are primary sources of animal protein in this region. By the mid-1990's, the levels of consumption of fish and other seafood in most countries in Asia and the Pacific exceeded that of world per capita seafood consumption. This is because fish prices are relatively cheap in Asia, compared to other sources of animal protein, such as beef and pork (Tan *et al.* 1997). Already reductions in quality and cases of contamination are putting poorer communities at risk, because it is hardest for them to find alternative sources of food.

The fishing industries are amongst the most important economic activities in the region. This sector – mostly marine fisheries – provides a high



Photograph: Chu Phuc Kinh Luan (Viet Nam)

level of employment opportunities for the population. The number of people working in fisheries varies among countries, ranging from 1,600 people in Brunei Darussalam (Silvestre and Pauly, 1997) to over four million in Indonesia (ADB, 1997). The bulk of employment is in the various fishing activities that take place in shallow waters and around coastal shelves. Furthermore, aquaculture in particular can play a significant role in development for poor communities (Edwards, 2000). The number of people who are dependent upon fisheries for their livelihoods is therefore likely to rise over the coming years even in advance of population increases in those areas.



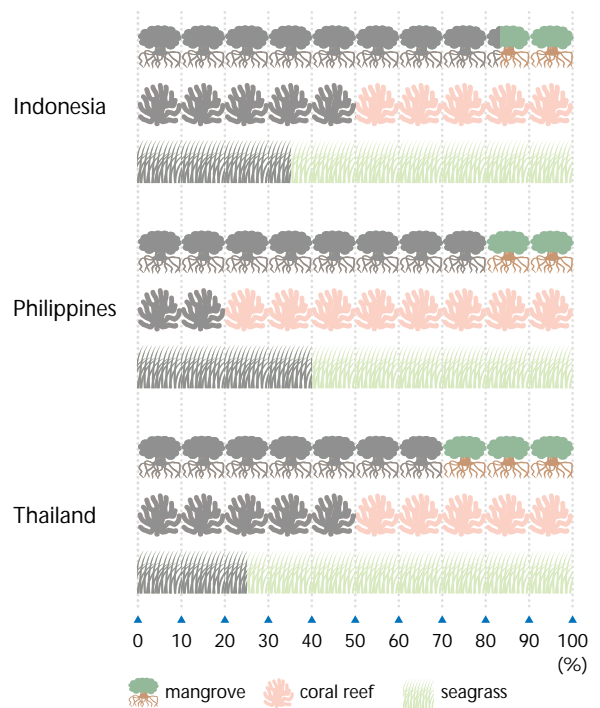
Fishing is crucial to the livelihoods of coastal communities in this region

Photograph: Tiong Tak Liong (Malaysia)

The health of the coastal ecosystems has an effect on the health of the populations that depend on them. A report on the health impacts of land-based coastal pollution has been included in a recent study produced by GESAMP (2001), describing a growing awareness of the risks, human and economic costs of infectious diseases related to bathing in contaminated water and the consumption of contaminated seafood. Further health impacts of exposure to coastal pollution continue to feature during UNU's research Symposia.

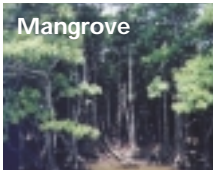

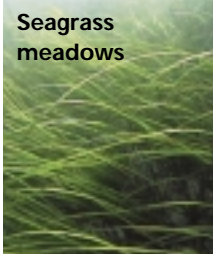

UNU has been involved in research on the conservation of important coastal habitats in Asia since 1977 (UNU, 1986). Figure 1. outlines the extent of the destruction of important coastal habitats, focusing on the status of mangroves, coral reefs, seagrass and mussel beds in Indonesia, the Philippines and Thailand. Recent research shows that harm to one coastal ecosystem may also have direct or indirect impacts on the other.

Figure 1. Percentage loss of habitats



From Jiang *et al.* 2001

Table 1. Causes of habitat modification and its effects on marine living resources

Habitat	Immediate causes of habitat destruction	Effects of habitat destruction on marine living resources
 Mangrove	Shrimp culture Wood-chip and pulp industry Urban development/Human settlements Domestic use, etc	Mangrove destruction can lead to loss of biodiversity and fisheries productivity. Mangroves are nursery areas for commercially important fisheries.
 Coral reef	Over-exploitation Destructive fishing practices Sedimentation Pollution associated with coastal development, etc Global warming	Reduction in reef fisheries, coastal tourism, threatened or endangered migratory species like marine turtles etc.
 Seagrass meadows	Land reclamation Sedimentation Land-based pollution Oil spills Heavy coral mining and collection from reef flats Fishing by pushnets, trawling Transportation and navigation, etc	Loss of biodiversity and fisheries productivity. Like coral reefs and mangrove, seagrass beds are highly diverse. A number of adult and juvenile fish species, sea cows and marine turtles are known to feed in seagrass beds.
 Mussel beds	Land-based contamination Shipping activities	Contamination of bivalves brings toxic chemicals into the food chain.

Source: Yihang Jiang, Hugh Kirkman and An Hua, 2001
Photographs: Masako Ebisawa, Coral Reef Alliance, Fred Short, Shinsuke Tanabe.

Degradation of Mangrove Forests

Over-exploitation of coastal areas has accelerated the degradation of mangrove forests. These areas provide ecological benefits such as protection from erosion, flooding, cyclones, typhoons and tidal waves (Primavera, 2000) and contribute to carbon sequestration to combat global warming, (Fujimoto, 2000).

In regions of Bangladesh where shrimp farms are densely concentrated, such natural disasters have cost thousands of lives. The destruction of mangroves also alters the regional water system and coastal habitats, affecting fisheries (Baran and Hambrey, 1998), coastal ecosystem balances, and climate stability. All of these effects reduce the fertility of land located in nearby areas (Biksham, Gujja, and Finger-Stich, Andrea, 1996). The leaf-litter detritus from mangroves is important to fisheries because it provides an essential source of nutrients for the trophic food web and juvenile fish. It is estimated that 90% of all marine organisms spend some portion of their life cycle within mangrove systems (Adeel and Pomeroy, 2002).

By the mid-nineties, about a quarter of the world's mangrove forests had been destroyed

By the mid-nineties, about a quarter of the world's mangrove forests had been destroyed. In Indonesia, which has extensive areas of mangroves – as much as 30 to 40% of the world's total, about 50% of the forest has been cleared during the past fifty years (Sudara, 1997). Other estimates are even higher. In Malaysia, approximately one third of the country's mangrove was lost during the same period, with the largest scale of losses on the western part of the peninsula (Sudara, 1997).

Deforestation of the mangrove areas is mainly related to economic and development activities in this sub region. Traditionally, the exploitation of mangroves was carried out on a small scale to provide for coastal communities' subsistence needs for items such as fuel, medicine, food and building materials. Commercial exploitation has increased the pressure on mangrove areas. In Singapore, much of the mangrove forest has been reclaimed for urban development (Sudara, 1997). Viet Nam lost many of its mangroves during the Viet Nam war, due to pesticide use (Hong, 2000).

Mangrove forests have been cleared for commercial and development purposes including fish and shrimp ponds, logging activities, human settlements, and agricultural and industrial developments

Huge areas of Asian mangrove have been converted to shrimp ponds. (Sudara, 1997; Yeung, 2001). Indonesia and Malaysia also use mangroves as an important source for the export wood-chip industry and for oil palm cultivation. Mangrove forests are also allocated for human settlements, and by the mid-1980's about 800,000 hectares of mangroves in Indonesia had been cleared for transmigration settlement.

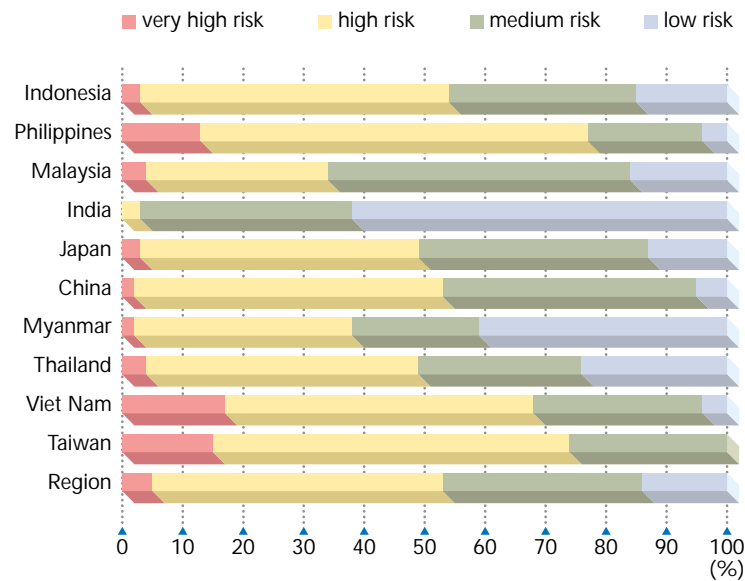
Coral Reefs Under Threat

Southeast Asia contains one quarter of the world's mapped reefs. Indonesia and the Philippines account for a major portion of these habitats. Reefs in both countries are noted for their extraordinarily high level of diversity, each containing at least 2,500 species of fish. The value of coral reefs to



Utilization of mangroves for urban development in Singapore – a look at the surroundings before (left) and after the development (right) Photographs: Sasi Nayar

Figure 2. Estimated cumulative threat to coral reefs (percentage by country)



Source: WRI, October 2000, Reefs at Risk in Southeast Asia

these countries includes the potential earnings from tourism as well as their ecological functions and species richness. This richness of species also makes the reefs an attractive terrain for 'bioprospecting' – exploring utilization of biodiversity resources for commercial uses like pharmaceutical applications.

Over 80% of the reefs in the ASEAN countries are at risk, and over half are at high risk

It is estimated by WRI that over 80% of the reefs in the ASEAN countries are at risk, and over half (56%) are at high risk. The WRI's *Reefs at Risk* evaluation found that over-fishing and destructive fishing are the most pervasive threats, affecting about 60% and 50% respectively. The coral reefs of South-East Asia are the most threatened of any region. Most of the coral reefs of the Philippines and Indonesia were assessed to be at high potential threat from disturbance. The destruction of coral reefs is mainly due to a combination of pressures, including destructive fishing, mining, pollution and sedimentation, tourism, trade in coral and global warming. Coastal development and sedimentation from inland sources each threaten approximately 20% of coral reefs in the region. (WRI, 2000).

Destructive fishing practices, including the use of dynamite, poison, and muro ami, are still practised, particularly in Indonesia, the Philippines and Thailand. Mining coral as a source of building materials and lime is an important problem in Indonesia and

the Philippines. As a result of over fishing, virtually all of the Philippines reefs, and 83% of Indonesia's reefs, are at risk.

The area with the highest coral damage in Thailand is around Phuket Island, mainly due to increased tourism activities. These activities, and the trade in coral are discussed in later sections of this document.

The destruction of coral reefs is mainly due to destructive fishing, mining, pollution and sedimentation, tourism, trade in coral and global warming

In addition to anthropogenic factors, the degradation of coral reefs is also caused by natural factors, such as typhoons, sea level rise, tidal movement, diseases and natural hazards. Coral bleaching events in 1998, causing the death of large areas of coral reefs have been correlated to the effects of El Niño. In Palau this caused a loss of slightly more than half of the formerly live cover (Golbuu *et al.* 1999), and approximately 16% of the world's coral reefs were destroyed (Wilkinson, 2000). These extreme climate events are also indirectly linked to climate change effects as part of global warming.

Depletion of Seagrass Beds

According to Sudara (1999), factors contributing to the degradation of seagrass beds include wastewater discharge from different sources, such as coastal industries and urban development, shrimp farms and other forms of coastal land development and mining. Seagrass beds are also affected by the activities of coastal fishing trawlers and their use of push nets and drag nets. Seagrass beds are sensitive to reductions in light regimes that may be caused by increased sediment loads in water, due to pollution, drag fishing or dredging and construction activities. This leads to loss of seagrass habitat and affects biodiversity and fisheries productivity. (Jiang, Yihang, Hugh Kirkman and An Hua, 2001).




Researchers at the University of Tokyo's Ocean Research Institute (ORI) have conducted monitoring of the effects of pollution on seagrass beds in coastal waters (Komatsu, 2000). There is a need to extend this activity to other parts of Asia.

Despite the existing research on the richness of seagrass beds and the threats that they face, there is still a vacuum in information regarding their true status



Seagrass beds are often found in close proximity to coral reefs and the two are closely linked components of an ecosystem Photographs: Fred Short

Table 2. Status of coastal biodiversity in the East Asian region

Country	Immediate cause of degradation	Seagrass species 	Fish species 	Endangered species 
Indonesia	Sedimentation, heavy coral mining and collection from reef flats	4	8	Dugong dugon 2 turtle sp
Malaysia	Coastal reclamation, oil spills, land-based pollution	12	165	3 turtle sp
Philippines	Industrial development, ports, recreation	10	15 sp 50fam	Dugong dugon: 4 turtle sp
Thailand	Waste disposal from domestic use and aquaculture, fisheries, collection for traditional medicine, land reclamation and development	16	172 sp 50fam	Dugong dugon: 4 turtle sp
Viet Nam	Fertilizer production, animal feed production, land reclamation for agriculture and aquaculture, mats and handicrafts	10	67 sp 37fam	Dugong dugon: turtle sp

Adapted from Talue-McManus, 2000

Like coral reefs and mangroves, seagrass beds are highly diverse. 40% of the total known species of seagrass in the world are recorded from the South China Sea alone (Morton and Blackmore, 2001). Adult and juvenile fish species, sea cows and marine turtles are known to feed in seagrass beds. Five of the world's seven endangered species of turtles living in seagrass beds are found in ASEAN (Talue-McManus, 2000). At least 67 species of fish were found in a survey of seagrass beds in the Gulf of Thailand and the Andaman Sea, conducted by the ASEAN-Australia Living Coastal Resources Project in 1987 (Sudara, 1999). Many of these species were determined to be economically important. In ASEAN as a whole, there are 318 fish species from 51 families associated with seagrass beds (Talue-McManus, 2000).

Seahorses, which live in both seagrass beds and coral reefs are under threat in China, Viet Nam and the Philippines due to the aquarium trade as well as to disappearing habitats (Vincent, 1996).

Mussels as Sentinels of Coastal Health

Mussels are convenient for monitoring the health of coastal ecosystems because they are found on virtually all coastlines. They stay in one place, and are continually exposed to pollution coming from land-based sources. For this reason, they are considered effective bio-indicators of pollution levels.

Contamination of mussel beds has been observed in the Asia Pacific Mussel Watch programme, co-organized by UNESCO-IOC and UNU,

with a project grant-aid to Ehime University from the Japanese Ministry of Education, Science, Culture and Sports of Japan. A training workshop was held by UNU in Thailand in March 1998, in which mussels from Japan, South Korea, Russia, China, the Philippines, Viet Nam, Malaysia, Cambodia, Thailand, Indonesia and India were collected and studied. Sediments, fishes, birds, small cetaceans etc. were also sampled from some of these countries. The programme found rising levels of contamination, and suggested that further monitoring of other species is needed.

During the monitoring of organotin and organochlorine compounds as part of the mussel watch programme, sediments and biological samples revealed widespread contamination along the coastal waters of Asian developing countries (Tanabe, 2000). The distribution of organotins detected in these studies were found to correlate with the level of industrialization of the surrounding areas. In Korea, pollution from Polycyclic Aromatic Hydrocarbons (PAH's) was investigated in harbour areas, and 'hotspots' located close to industrial areas (Yim *et al.* 2000).

The level of pollution in mussels correlates with the level of industrialization of the surrounding areas

Also, relatively high concentrations of organotin compounds were found at locations with intensive boating activities and coastal aquaculture facilities, implying the usage of tributyltin (TBT) as a biocide in antifouling paints used on boat hulls and in marine aquaculture.



Mussels are continually exposed to land- and sea-based pollution Photograph: Shinsuke Tanabe

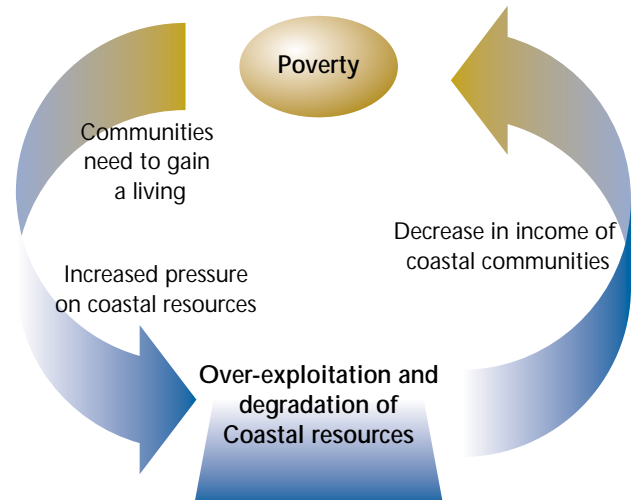
II. Driving Forces Behind Coastal Degradation

Poverty and Lack of Alternatives – A Vicious Cycle of Dependence, Over-Exploitation and Degradation

In many of the coastal areas in Asia and the Pacific where UNU has been working, a variety of different socio-economic conditions and activities coexist, with slum areas, subsistence fishing and scavenging taking place right beside large-scale development and toxic dumping. The results of such combinations tend to have the worst impacts on the poorest communities.

Coastal areas frequently support the livelihoods of the poorest sections of the population. (Panayotou & Panayotou, 1986). In these poor communities that rely on natural resources for their livelihoods, cycles of over-exploitation, degradation of resources, and further decreases in income can occur, due to the continuous degradation of the natural resources, and a lack of alternatives.

Figure 3. A vicious circle, locking in poverty and over-exploitation of coastal resources



(Credit: Naori Nakamoto)

Case Study: Seribu Islands, Indonesia

A community tied into a destructive dependence and over-exploitation of natural resources

Although there are several other major economic activities in the Seribu archipelago, e.g. mining and tourism, few local workers are involved. Research undertaken in 1990 on the region's fishing society by 'Gugus Analisis' (a community group), indicated that the people in the coastal areas lived at the margin of subsistence. The small income earned by the fishermen was used mainly for daily consumption and other necessities and none was left for savings and capital. 35% of the population were living below the poverty line. Only 40% of the islanders had permanent homes, while 34% lived in semi-permanent dwellings and 26% in temporary ones. This made it extremely difficult for them to consider moving into alternative occupations. The majority of workers were employed in the 'informal' sector, most (75%) as fishermen.

The socio-economic situation in the villages also made the villagers unable to develop new industries. The villages in the area were still classified as 'backward' by the government. Men still played the dominant role in the household. Women were limited to domestic work or to helping their husbands. Their only income-generating role was in small-scale trading, such as running tiny stalls to provide daily necessities. The average educational level of the islanders was rather low. About 50% dropped out of elementary school and few managed to obtain secondary school education.

Source: UNESCO, 2000

The case-study shown here demonstrates the range of problems that force poor communities to depend on over-exploitation of natural resources. These include:

- *lack of other resources/income and capital*
- *lack of formal homes, jobs and stability*
- *lack of education and awareness of coastal resource conservation*
- *lack of social capacity to organize management of coastal areas and to improve opportunities for the community*

The key recommendation that has emerged from UNESCO's work (2000) on community education in Jakarta is the importance of alternative income-generating activities together with social empowerment. Since many local people depend on coastal and marine resources for their livelihoods, a key strategy to reduce the pressures caused by this dependence is to provide supplementary or alternative activities that increase the local community's welfare in other ways. Only with such strategies can the economic drivers of the escalating degra-

dation and pressure be redirected, and subsequent over-fishing be limited.

The following table shows potential livelihood opportunities in a case-study coastal area of the Ulugan Bay, the Philippines. The land-based activities, such as poultry-farming, can be also considered as alternative livelihood-providers. However, in reality, as some participatory projects indicate, fishermen and coastal communities prefer to continue to pursue the activities that are directly related to coastal resources. The case study indicates that fishers are not willing to shift or veer away from fishing, because many fishermen consider fishing an easier job than farming, and one that can meet some of the family's basic needs (Fazi and Flewwelling, 2000). A recent study by Pollnac, Pomeroy and Harkes (2001) also finds particularly high levels of job satisfaction amongst fishers in southeast Asia. Radical changes from fishing to non-fishing activities seem unrealistic for fishermen.

Table 3. Potential livelihood opportunities in Ulugan Bay

Resource Area	Potential Livelihood Opportunity
Mangrove	Mariculture (prawn, milkfish, and so on) Tourism related to mangrove
Seagrass Beds	Fish cage/trap Seaweed culture
Coral Reef	Fish farming Culture of giant clam or samong Seaweed culture
Beach	Tourism Salt production
Tidal flats	Mariculture

(Fazi and Flewwelling, 2000)



Fishing is part of the way of life of coastal communities
Photograph: Ngo Dao Nam (Viet Nam)



Fishing villages in Thailand
Photographs: Sanit Aksornkoae

Introducing supplementary, rather than alternative, livelihood activities is likely to be the most effective strategy for reducing poverty and over-dependence on natural resources

UNESCO's work in Kamal Muara, Indonesia, revealed the important role that can be played by community self-help groups in the search for alternative livelihoods, through improving community organizational skills, providing a system for savings and loans, and it is anticipated that they will assist with small business (UNESCO, 2000).

Exploitation of Coastal Resources from Subsistence to Commercial Levels

While governments have prioritised commercial development in coastal areas over the past decades, they have often done so at the expense of the environment, and of the other smaller-scale activities that take place in coastal areas, such as the subsistence activities described in the previous section.

Successful management strategies will involve policy-makers, communities, and even consumers working together to achieve better practices within the coastal industries. Three key areas are discussed in this section: the fishing industry, shrimp farming and aquaculture, and agricultural activities.

Table 4. Transboundary Diagnostic Analysis for the South China Sea

Country	Population 1996 (10 ⁶)	Population 2005 (10 ⁶)	Current fish consumption (kg/p/y)	Total fish produced 1994 (10 ³ t/y)	Total fish required for food in 2005 at current per capita consumption	Degree of exploitation of capture fisheries (Low (L), Moderate (M), High (H))		Potential of culture production (Low (L), Moderate (M), High (H))	
						Marine	Inland	Marine	Inland
Cambodia	10.2	13.0	12.0	103	156	L	M	H	L
Indonesia	197.6	225.9	15.5	4,060	3,502	H	H	L	L
Malaysia	20.6	24.6	29.5	1,173	726	M	?	M	?
Philippines	69.3	84.3	36.1	2,657	3,043	H	H	L	L
Thailand	61.4	67.2	25.3	3,432	1,699	H	M	L	M
Viet Nam	76.3	88.0	13.4	1,155	1,179	H	M	M	M

(From Talue-McManus, 2000)

The Fishing Industry

ASEAN fish production increased substantially in the final two decades of the twentieth century-by more than 50% between 1983-85 and 1993-95, with Indonesia experiencing the greatest increase of 79% (WRI, 1998). More than 55% of the production was harvested from coastal areas, primarily (about 90%) from reef fishing. Although the total marine catch (3.3 million tons) was still below the estimated maximum sustainable yield of 4.5 million tons, some marine species, especially shrimp, have already been over fished (ADB, 1997). Over-fishing creates a threat to biodiversity, and thus threatens the future of both humans and other species in the area.

An analysis of fisheries in ASEAN countries and the trends of over-exploitation was produced by Talue-McManus (2000) (Table 4.). Despite the apparent threats to food security noted, this report also observed inappropriate exploitation patterns in all countries studied, except Cambodia.

The major reasons for increasing fisheries are a significant increase in population and increased demand on coastal products for domestic consumption and export

In addition, Talue-McManus (2000) observed over-fishing and destructive fishing practices in every country studied. Losses occurred due to commercial by-catch and post-harvest losses were also universally occurring. With further loss of stocks due to siltation, habitat destruction, reduced biodiversity and land-based pollution, these wasteful and damaging commercial practices can hardly be afforded.

New technologies have brought a substantial increase in marine fisheries, but they can also bring damage to the environment, as well as unintentionally killing more fish than were needed

Damaging new technologies introduced for commercial reasons include:

- **trawling** damages seagrass beds and causes turbidity
- **fine mesh nets** kill too many fish at one trip, leaving none to spawn
- **destructive fishing gears** such as dynamite harms coral reefs and seagrass. (Basiron, 1998), often causing large side-kills of larval and juvenile fish, and invertebrates
- **motorized fishing boats** cause disturbance and pollution



Photograph: from Brown and Fischer, 1920



Photograph: J. Primavera

Shrimp farming destroys mangroves in the Philippines



Shrimp farming in Central Thailand
Photograph: Sanit Aksornkoae

At the international level, a series of initiatives drawn up in 1995 exist to combat bycatch in particular. They include the Rome Consensus on World Fisheries, Article 7 of the Code of Conduct on Responsible Fisheries, the Kyoto Declaration and Plan of Action on the sustainable Contribution of Fisheries to Food Security. There is also an UNCLOS Agreement for the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stock. The need to implement these at regional and national levels remains.

Shrimp farming and aquaculture

Overexploitation by other types of local industry has taken place on land in the many coastal areas, including the Sundarbans, of India and Bangladesh, the largest mangrove areas in the world. Here, excessive wood harvesting and conversion of coastal areas to fish ponds have caused degradation, and increased flooding (Yeung, 2001, Hinrichsen, 1990). The destruction of the Chakaria Sunderbans in Bangladesh is documented by Hosain (2001), from the initial leasing of 3910 acres of the total 21,020.45 acres to landless families in 1929, until there were only 11 trees still remaining after the spread of extensive shrimp farming activities until 1986. Indonesia converts 10,000 sq km per year to brackish water ponds for cultivation of prawns, shrimps and milkfish, and loses another



Former shrimp farm replanted with mangrove plants in Thailand
Photograph: Sanit Aksornkoae

2,000 sq km to exploitation for woodchips (Yeung, 2001). Malaysia loses 5,000 sq km per year to this activity.

In addition to the loss of mangroves, shrimp farming also causes severe water pollution (Hidayati, 2000). In Thailand, each hectare of shrimp ponds produces 2,037.5 tons of discharge water per day (Songsanjinda, 1993).

The economic incentive for landowners to convert mangroves to shrimp farms and fisheries is often strong

Biksham and Finger-Stich (1996) found that 'the large immediate monetary benefits farmers can get for selling or leasing land to shrimp farms often induces them to sell their land and/or to become employees of the shrimp pond operators. But over time, the quantity and quality of agricultural output tends to decline as salinization, growing freshwater scarcity, and aquaculture's other negative environmental impacts begin to take effect'.

Unless farms are carefully managed, they may be abandoned after as little as two years, leaving the land totally unproductive. Meaningful regeneration from that state might take 20 to 30 years.

Strategies have been developed and implemented in many parts of Asia for achieving sustainable use of mangroves, including plans for reforestation (Qureshi, 2000) and the inclusion of conserved mangrove zoning around cultivation areas (Primavera, 2000). The governments of Indonesia, Malaysia, and Thailand have established mangrove land use plans and also set up programs for reforestation in many areas of these countries (Sogierto, 2000). These cases have provided lessons for other Asian countries (Ida, 2000), and featured during UNU's workshop on mangrove conservation.

In many cases, a review of land-use planning classifications for development has been necessary (Senibulu, 2000). McMorrow, and Talip (2001) found that in Malaysia, whilst forestry, shifting cultivation and commercial agriculture were the causes of forest decline, policy instruments had shaped these destructive forces. In the case of Sabah, the critical policy measures were land alienation and gazettement, the land capability classification (LCC), and the land tenure system as enshrined in the land code. In a comparison of mangrove use in the Philippines, Viet Nam and Thailand, Ajiki (2000) similarly found that government policy was an important determining factor in the preservation of the mangroves, and that it worked best when it provided for local people to manage forests for their own use.

Table 5. Transboundary Diagnostic Analysis for the South China Sea

South China Sea subregions of Countries	Rice fields (10 ³ ha)	Aquaculture areas (10 ³ ha)	Fertilizer use (ton/year)	Pesticide use (ton/year)
Cambodia	1,835	No data	>40,000	No data
China	3,425	2,476	3,636,685	>89,423
Indonesia	4,966	243	5,670,117	28,706
Malaysia	535	7	No data	9,400
Philippines	1,236	20	181,084	No data
Thailand	8,613	No data	No data	No data
Viet Nam	1,500	No data	110,250	No data

(Talue-McManus, 2000)

Moreno-Casasola, (2000) further views community management plans as a source of social empowerment, whilst some schemes for common local ownership have been successful (Kakuma, 2000).

Agricultural Activities

Aquaculture-related and agricultural activities play an important role in increasing pollution around urban areas where farming is intensified, involving the use of large quantities of fertilizers. This, together with other biological and organic pollutants leads to BOD, eutrophication, and Harmful Algal Blooms (HAB's). China is the world's largest consumer of synthetic nitrogen fertilizers (Kraemer *et al.* 2001). Yeung describes how this has led to the occurrence of 'red tides' – a type of HAB – along the Chinese coast (Yeung, 2001). During the year 2000 there were a total of 28 red tide events on the Chinese coasts (Hu, 2001). Similar effects have also been recorded in Indonesia, Thailand, Brunei Darussalem, Singapore and Viet Nam (Azanza, 1998) and the Philippines.

The use of chemical pesticides and herbicides has increased during the past two decades introducing toxic and persistent chemicals into coastal ecosystems

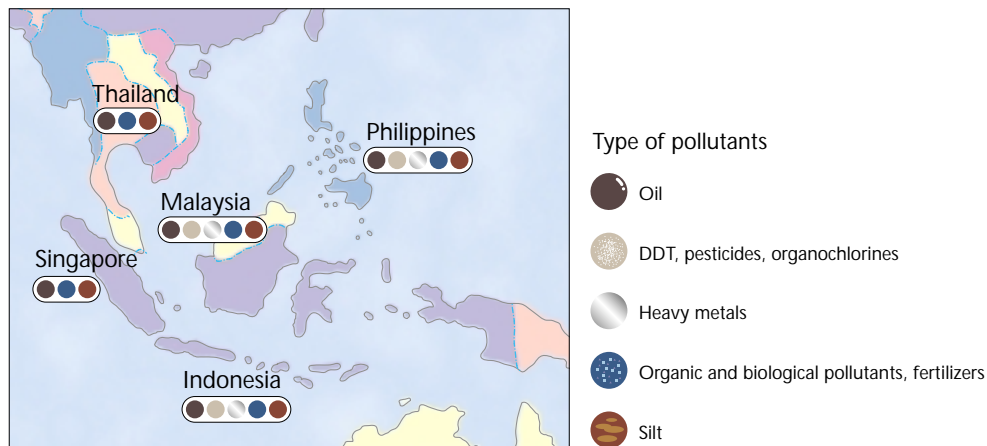
UNU has been managing an international monitoring programme on endocrine disruptor chemicals (EDC's) in the coastal waters of nine Asian countries. A number of pesticides observed in coastal waters are banned, still their use continues, and monitoring results show that the chemicals are leaching from soils and sediments. In countries such as China, they are the major source of coastal pollution (Yeru *et al.* 2002). In Malaysia's Selangor

River, for example, monthly sampling for 13 pesticides has been undertaken, analysing levels of lindane, aldrin, diazinon, heptachlor, chlorpyrifos, o',p'-DDE, endosulfan, dieldrin, p,p'-DDE, eldrin, endosulfan sulfate and p,p'-DDT. Not all of the 13 pesticides were detected, and different levels were recorded during different months of the year (Mohammad, 2001a). Tanabe (2002) suggests that these discharges have a global reach and significance, passing across the surface of the oceans to create a chemical sink in the Arctic.

The effects of these chemicals on exposed humans are not yet fully understood. In a study presented to UNU's International Symposium 2001, pesticide constituents like organochlorine and organophosphorus compounds were found in the blood of school-children in Malaysia (Mohammad *et al.* 2001b). UNU's most recent International Symposium, held in Hanoi focused on the issue of endocrine disruptor pollution from agrochemical use, including both human and environmental risks.

Efforts to reduce the use of harmful chemicals in agriculture require improved information and regulation for chemical products on the one hand, and the encouragement of more environmentally benign farming practices on the other. These include pest management rather than over-use of chemicals. Case studies of integrated pesticide management in China, Thailand and Malaysia have demonstrated the importance of these supplementary activities to policy-making for environmental governance in Asian countries (Adeel, 2002).

Figure 4. Major Types of Pollutants in Some ASEAN Member Countries



(Hidayati, 2000)

Socioeconomic and Demographic Changes – Population Growth, Urbanization, Industrialization and Large-Scale Development

Population growth and urbanisation trends

Changes to coastal habitats are occurring due to increasing human population pressure on coastal ecosystems. In addition to the replacement of coastal ecosystems with human settlements, this has also led to a dramatic increase in land-based pollution entering rivers and coastal waters.

Construction activities in coastal areas are leading to the removal of natural habitats, both from the areas to be developed, and also from adjacent areas, to be used as construction materials. Coral mining for the manufacture of

cement, sand-removal and cutting down trees are all examples of this. The construction process itself leads to the loss of soil, and increased sediment loads in runoff and rivers. In a study of the building of a new road on the island of Palau (Ridep Morris, 2001), the impacts anticipated included increases in nutrient runoff and sediment loads.

In many countries, a large proportion of urbanization is in informal settlements. Where there are degrees of informality surrounding the housing and service provision for large numbers of people, often with a lack of alternatives, there is little means of enforcement for land-protection or any other ‘command-and-control’ solution. Because of this, land-use planning alone is ineffective for solving the problem of over-inhabitation of urban coastal areas.

Pollution created by population growth and urban development is also a threat to coastal ecosystems.

Sewage and industrial outfalls, rivers, land runoff, and the atmosphere are believed to be responsible for most of the marine pollution



Increasing population creates a high demand for the development of coastal infrastructure, including ports
Photograph: Caroline King, UNU

In a recent paper, presented during a UNU capacity development workshop, Takada (2001) discussed the benchmark monitoring of the major chemicals present in coastal pollution around urban areas. These chemicals were attributed to sewage, detergents and petrol products. Figure 4. (above) shows the range of pollutants found on the coasts of five Asian countries. For East Asia, the identified priority is attention to pollution from sewage, which creates organic pollution (GESAMP 2001).

Currently, about 50% of the world’s urban sewage is directly discharged into the sea or nearby

Table 6. Population and estimated BOD generation and removal in selected South China Sea countries

Country	Population in South China Sea Subdivisions	Proportion of population in cities (%)	Population growth rate (%)	BOD generated (10 ³ t/yr)	BOD removed by sewage treatment (10 ³ t/yr)
Cambodia	1,985	89	2.7	36.2	No treatment
China	59,694	35	1.6	1,089.4	<109
Indonesia	105,217	48	2.9	1,920.2	364
Malaysia	10,336	15	3.3	188.6	53
Philippines	23,633	27	2.1	431.3	149
Thailand	37,142	0	1.4	677.8	89
Viet Nam	75,124	3	1.6	1,371.0	No treatment
TOTAL	313,131	>27	1.4	5,714.5	655

Notes: Population recalculated to 1996 using growth rate shown, obtained using a weighted mean method. Estimated BOD produced using 0.05 kg/person/day (WHO, 1993). BOD removal according to Koe and Aziz, 1995 (Source: Talue-McManus, 2000)

water bodies, according to Clark (1998). Yeung (2001) examines the pollution of South Asia's coastline, caused by lack of sewage treatment in particular. Nearly all near-shore waters along the urbanized coastline in South Asia are polluted with high bacteria counts, making seafood caught unfit for human consumption (Hinrichsen, 1990). Hidayati (2001) attributes this to the high population densities in these areas, and found that the highest proportion of sewage pollution was reported in the Strait of Malacca, near Bangkok in the upper Gulf of Thailand, and in the metropolitan areas of Manila and Jakarta.

Household solid waste is also a problem in many developing cities, and has been the target of a UNESCO Education Programme in Jakarta (UNESCO, 2000). This project found that 74% of the solid waste generated in Jakarta consisted of organic matter that could otherwise be made into compost. Urban landfill sites for waste disposal leach toxic chemicals. Ongoing research in areas close to the rubbish dumps of Manila has identified high levels of toxic chemicals, both in shellfish, and in human breast-milk (Prudente, 2001).

During a 1985 UNESCO workshop on Human-Induced Damage to Coral Reefs, the strand-line human-induced pollution was measured. The exercise was repeated in 1995 by Willoughby *et al.* The three most abundant items found during the 1995 survey were white polystyrene (38%), plastic bags (27%) and flip-flops (13%) – the same as those found in 1985, but in very different proportions. The 1985 figures were polythene bags (42%), footwear (28%), and polystyrene blocks (23%).

The total shoreline litter had increased by about two-fold during the intervening 10 years.

As the types of pollution and natural phenomena occurring in urban areas become more complex in both their origins and effects, the decisions concerning potential risks and benefits of activities for development will become more complex (Park, 2001). Increased attention to monitoring and enforcement of regulations will be necessary. Here, as UNESCO's (2000) recent work in Jakarta has shown, working with the coastal community, will be the key to success.

Industrial wastes

Industrial pollution involving Mercury caused a well-known disaster in Minamata, Japan, during the 1950's and 1960's and has subsequently been detected in Thailand and other parts of Asia (Chongprasith and Wilairantanadilok, 1998). Since then, the development of industry has been recognised as a major source of coastal pollution in Asia. According to Clarke (1998), wastewaters from heavy industries and mining may cause damaging pollution from the discharge of toxic substances including heavy metals (lead, mercury, cadmium, etc), radioactive elements, acids, Polyaromatic hydrocarbons (PAH's), and innumerable other toxic industrial chemicals such as Polychlorobiphenyls (PCB's).

Increases in heavy metal content in Jakarta Bay have been observed (1997) as a result of industrial waste (Mahbub and Kuslan, 1997). Pollution concentrations in marine animals are useful in determining the accumulation of these pollutants in the

food chain. Examples of these studies include work on Hong Kong's porpoises by Parsons (1998), in which trace metals were found and that on seals by Kajiwara and Tanabe (2002) in which high levels of organochlorines were detected. This work on marine animals also provides valuable information about the transfer of these pollutants from mothers to newborns through placenta and milk.

The growing field of research on Endocrine Disruptor Pollution has become central to the UNU project on Environmental Monitoring and Governance

Annual symposia have been dedicated to this subject for the past three years including presentations from scientists from China, the Philippines, India, Thailand and other parts of Asia. The growing emphasis on EDC's in UNU's monitoring work is due to the concerns raised by recent research (van Tongelen, 2001) on the effects of these chemicals, which are non-biodegradable, lipophilic, carcinogenic. EDCs monitored during UNU's environmental monitoring project include alkylphenols (found in industrial detergents and paints) such as pentachlorophenol (PCP), and nonylphenol (NP), which are found in untreated and treated industrial and municipal waste, and can affect hormonal development in humans and animals.

Another industry-related pollutant studied during the UNU monitoring project is Bisphenol-A, which is found in can linings and industrial products, and has been linked to serious human and animal health problems (Lee *et al.* 2001). In Manila, in addition to pesticides, phenols were found in the Meycauayan River and Tenejeros Rivers in the Manila Bay Area. This contamination

is probably contributed by the paper mills, wood processing plants and the plastics factories that are present in the areas around the rivers (Santiago, 2001). In China, pollution by bisphenol-A, alkylphenols and chlorinated phenols has also been found in river and seawaters.

HCB, DDE and DDT were detected in the Chinese seawater samples during winter. PCB's which come from dielectric fluid for capacitors, transformers, the production of carbon-free copy paper and the manufacture of ink are also monitored, and have previously been found in the waters of Jakarta Bay.

Large-scale development of coastal areas

Large-scale development often includes total reclamation of coastal land. These types of development not only eliminate the coastal ecosystems directly in that area, but more importantly, also degrade the quality of the remaining habitats adjacent to the developed area in a variety of ways. These include increase of sediment loads, smothering coral reefs and the burial of seagrasses and seaweed (Jiang *et al.* 2001). Yeung (2001) observes the suffocating effects on shellfish spawning areas of sedimentation from dredging and land-fill sites. Mobilization of sediment can go on for years once destabilizing influences have begun the process. The incentives for these activities are usually economic: Clarke (1998) noted that in Kuala Muda, Malaysia, a single landfill created US\$11.7 billion worth of real estate (The Straights Times, 1997).

A great deal of environmental damage is caused by the presence of ports. Clarke (1996) presents a case-study of the cumulative impacts of dredging in shipping ports, based on the example of Surat



Impacts of large-scale development are quite apparent in Singapore
Photograph: Sasi Nayar



Busy ports in the region result in significant environmental impacts (shown here in Nha Trang, Viet Nam) Photograph: Caroline King, UNU

Thani in Thailand. Turbidity is increased in the water around the port to a degree that cannot be tolerated by aquaculture or tourism. A recent Chinese Port and Airport Development Scheme involved the reclamation of 600 hectares of the coastal zone, the dredging of 880 million cubic metres of material and the dumping of 380 million cubic metres of contaminated mud. Fisheries, marine life and water quality were seriously affected (Wong, 1998). The ecological and public health risks associated with the disposal of such a large quantity of contaminated mud were found to be of particular concern (Chau, 1996).

In the Inner Gulf of Thailand, ports and harbours have been constructed in mangrove areas along the coastline. Various parts of mangrove areas in the country will be reclaimed for these purposes in the near future. Road Construction and land modification are maximal in those areas, and the on-site mangroves are totally reclaimed.

Resort development has led to the reclamation of some areas of mangroves. There are plans in the state of Johore, for example, for the mangrove around Gelang Patah to be used for such a purpose. On Pulau Redang (the marine area of this island is a Marine National Park), in the State of Terengganu, a golf resort is being established and some of the fairways cut through mangroves. However, utilization of mangrove areas in terms of resort development is not a common practice in Thailand yet. The one mangrove forest that has so far been used for such purpose is that at the

Phang-nga Bay mangrove forest where a resort hotel was constructed and has been operated by the local authorities.

Transboundary Influences – Shipping, Trade and Tourism

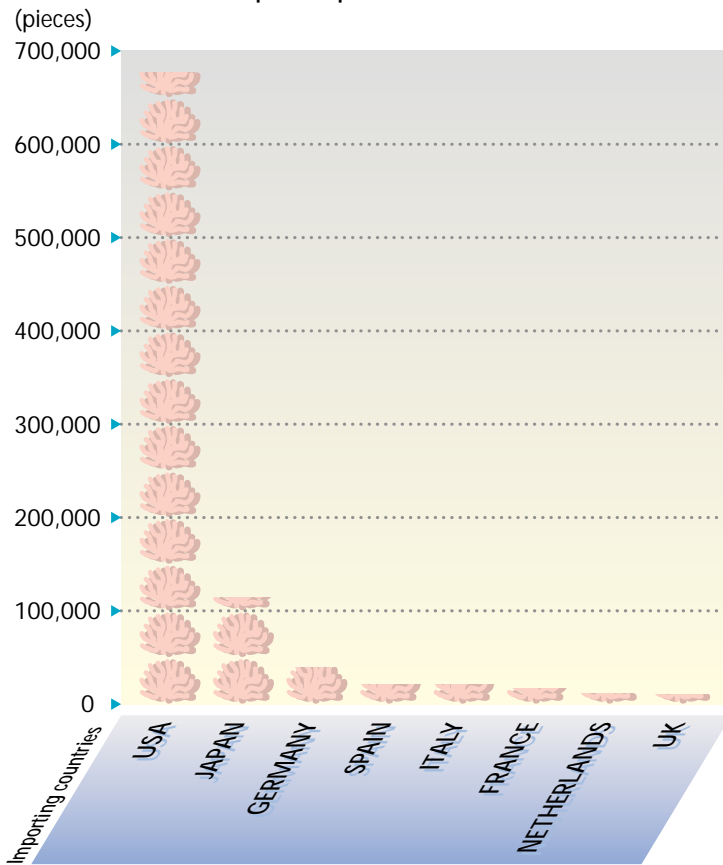
Sea-based Pollution from Marine Transportation

Shipping activities bring foreign chemicals and species that alter coastal ecosystems through the use and disposal of ballast water. Other forms of pollution that may be carried on ships are required to be cleaned off by some ports, such as Singapore, before entry. This often means that they are cleaned away in coastal waters elsewhere, causing pollution in the other locations.

The effects of international shipping ports on water quality in India was described to UNU by Srinivasen (2001) at a recent workshop. Concerns include the estuarine and coastal water quality where high oil and grease contents and phosphates from the handling of phosphate rocks have been found, degradation of sediment, contamination of soil and air and generation of vibrations, noise and other types of wastes.

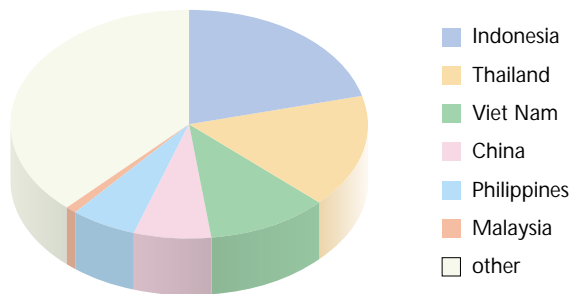
Accidental oil spillages are frequent in the Strait of Malacca (Ismail, 2001) and between 1987 and 1997, 89 oil spills were documented off the coast of Viet Nam (Nguyen, 1999).

Figure 5. Average annual trade of Indonesian corals for top 8 recipient countries 1985-95



Source: Talue-McManus, 2000

Figure 6. Japanese imports of shrimp from selected countries, 1994



Data: Ferdouse 1996, Talue-McManus, 2000

While use of organotin compounds in antifouling paints is banned in locations such as Japan and Hong Kong, they are still used elsewhere and can be found in the waters of Tokyo Bay and the Straits of Malacca as a result of their transport on foreign vessels (S. Hashimoto *et al.* 1998).

Due to the regional nature of the problem, cooperative actions need to be taken on these issues on a regional scale in order to prevent the simple transfer of pollutants from well-regulated to less regulated areas. The ASEAN Cooperation Plan on Transboundary Pollution, adopted in June 1995, covers atmospheric and ship-borne pollution and the movement of hazardous waste. Monitoring and information management are also essential to further understand the interactions at this level.

Regional Trade

International trade has increased the threats to coastal ecosystems, providing incentives for their depopulation and degradation both from within and outside the region. There are a series of trading activities that have a particular, direct impact on coastal ecosystems (Talue-McManus, 2000).

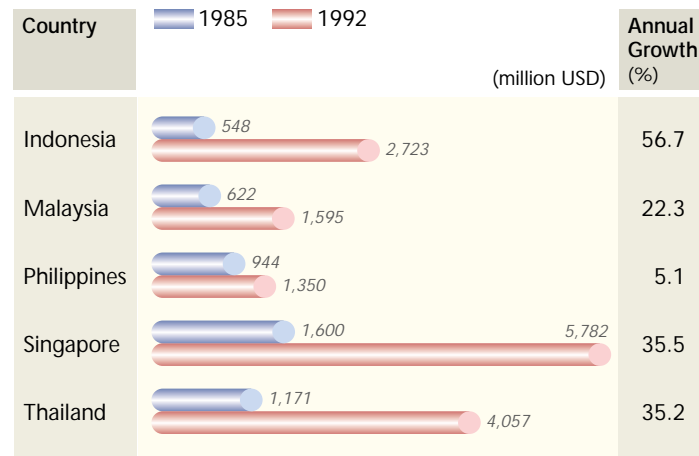
Exotic fish caught in Malaysia and Thailand are exported to other countries in and outside the region. Coral reefs are mined for corals, and for species of ornamental fish. Other reef species are sold as souvenirs or for private aquariums, including giant clams, shells, puffer fish, seahorses, starfish, sea urchins, sea fans, sponges, and "live rock" covered with tropical barnacles or other crustaceans (Coral Reef Alliance, 2002).

Particularly within the Asia and Pacific region, markets for natural resource products such as fish and shrimps for import to Hong Kong and Japan are causing overexploitation in some of the poorer countries.

Coastal resources are also frequently poached or illegally harvested for medicinal uses in countries such as the Republic of Korea, from where they are exported to the lucrative black markets of Pacific neighbors (JEC, 1997). The trade in sea-horses from Southeast Asia for Chinese medicine are a particular example of a global trade, supplying China (including Hong Kong and Taiwan), Singapore, Japan, Malaysia and South Korea, as well as the US (Vincent, 1996).

The transboundary problem of trade requires transboundary solutions. In the case of the illegal timber trade, unilateral actions in Thailand have been found to exacerbate the problems elsewhere. The major regulatory instruments for dealing with these transboundary threats to coastal ecosystems are international and regional agreements, such as

Figure 7. Growth in tourism in ASEAN, 1985-1992



Source: Sudara *et al.* 1994, in Talue-McManus 2000

the Convention on International Trade in Endangered Species (CITES). This treaty lists a number of species of coral, requiring export permits. The convention also lists threatened timbers. It is the only means by which importing countries can seize illegally produced timber. In addition to regulation, voluntary actions by traders and consumers can help to reduce harmful trades.

The importance of environmental monitoring under such circumstances cannot be overstressed. This is the only way to check the levels of loss and pollution of coastal habitats from diverse sources, and to identify the real degree of compliance with

and effectiveness of both regulatory and voluntary measures.

Tourism and Ecotourism

Tourism is often seen as a panacea for development, economic diversification and income generation. It is often characterized by rapid, short-term development, with the aim of generating quick earnings – ‘the boom of bust syndrome’ (Fazi and Flewwelling, 2000). In comparison, “Ecotourism” is defined as a low-impact, environmentally-sound and community-participatory activity in a given natural environment that enhances conservation



Tourism brings opportunities for local people (shown here in, Halong Bay, Viet Nam)

Photograph: Caroline King, UNU

of biophysical environment and yields economic benefits (Libosada, 1998).

Without a planned approach, tourism is more likely to have irreversible negative impacts on the environment in a very short space of time. The development of tourism needs appropriate planning and implementation in order to ensure sustainable use of coastal resources. In order to generate income for local communities and develop long-term environmental sustainability, community participation in tourism development is essential. Moreover, for enhancing participation and motivation in sustaining and protecting the coastal resources, the local people should benefit from the tourism in the areas surrounding their homes.

Tourism management planning is a priority, including assessment of community will, monitoring of coastal erosion, management of the coastline, coral reefs, mangroves and other important ecosystems, delineation of tourism zones, provision of services such as amenities and facilities for energy supply, freshwater supply, wastewater disposal, solid waste disposal, access and transport.

Without proper management tools and provisions, marine tourism results in the degradation of coastal resources

UNESCAP has conducted a preliminary study of the major impacts of tourism on the coastal resources of Southeast Asia (UNESCAP, 1992). Wong (1998), found that coastal resort development in Southeast Asia was largely unplanned and spontaneous in

order to meet tourist demand. He also found that there was a lack of understanding amongst tourism developers of the coastal ecosystems where their hotels were sited.

An example is Tasik Ria on the north coast of Sulawesi, Indonesia, where clearing of mangroves has led to coastal erosion, resulting in the need for sea walls, which in turn will further increase erosion and discourage beach formation. In the Transboundary Diagnostic Analysis for the South China Sea, Talue-McManus (2000) isolates the damage caused at construction and operational stages of tourism development. These are presented in Table 7. below.

Ecotourism will not succeed without careful management and sharing of environmental knowledge amongst local communities, international tour operators and visitors

Marine related ecotourism has been seen to possess a large potential for economic diversification and to make economic benefits available in coastal areas. With increased income from ecotourism, it is expected that exploitation of the coastal resources will be reduced and the welfare of local communities will be increased. There are some skeptics, however, who argue that ecotourism is often far from living up to its name (Mariott, 2001).

In the Asia-Pacific region, eco-tour operators report growth rates of 10 to 25% a year, and, as the UN General Assembly has designated 2002 the International Year of Ecotourism (IYE), this looks set to increase (Mariott, 2001).

Table 7. Environmental Impacts of Tourism

Stage of Tourism development	Actions and Adverse Impacts
Construction	<ul style="list-style-type: none"> • ribbon development along the beachfront • removal of natural tree-cover • filling in of wetlands, or conversion to open sewers • beach erosion due to poor design of structures • beaches fortified with sand mined from adjacent coral reefs • dredging to create sandy bottoms and navigation channels for boats • artificial beach construction through reclamation • increase in sediments flow to suffocate coral reefs
Operational	<ul style="list-style-type: none"> • pollution of the sea and beach by wastewater and sewage • removal or destruction of coral reefs by recreational activities • litter

Role of National Governments

National governments have a key role to play in sustainable coastal management. These functions can include monitoring, awareness and training of officials and communities, in addition to the legislating and regulating various aspects. Chapter 17 of Agenda 21 placed a pronounced emphasis on the importance of seeking integrated management and sustainable development of coastal areas, including exclusive economic zones, giving national governments a basis on which they could work to improve their policies for the protection of the coastal environment. In this way, national governments can provide the policy guidelines, a legislative base and institutional framework for the sustainable management of coastal areas (Rakodi and Treloar, 1997).

A policy model based on a mix of command-and-control and market based mechanisms can be recommended; this must include:

- Involvement of the community
- Public awareness raising
- Human and institutional capacity development
- Monitoring and assessment

This approach appears to have a great potential for developing countries of this region, where government financial resources are typically short. It is seen that incentives for communities and business to respond to alternative forms of pressures are particularly high. This approach is also a necessary accompaniment to the process of decentralization that is generally being undertaken in many Asian countries.

Increased community participation, capacity development and monitoring activities lead to increased local control of coastal resources. This requires a high level of cooperation and co-management with national governments.

According to UNESCAP, the new organizational model for environmental governance is characterized by: the role of government as a facilitator rather than provider; by a prominent role taken on by the private sector and civil society; and by pricing reform on environmental goods and services (UNESCAP, 2000). Furthermore, results and recommendations of East Asian country studies on chemical governance commissioned by the UNU repeatedly stress the importance of governments as information managers (Paoletto and Termorshuizen, 2001).

As governments take on their role in coordinating national sustainable development frameworks, based on Agenda 21, further reviews of policy-needs and supplements should be added in order to enable multi-stakeholder groups to participate in the policy and decision-making processes. The challenges of this role for Asian institutions are examined by Boyer (2000).

For both planning and management purposes, governments need to ensure the smooth coordination of sectoral policies, and responsibilities in coastal areas. In addition, it is necessary for governments to review existing policies, in order to remove laws that facilitate the destruction of coastal environments. An example of such a piece of legislation noted by Biksham *et al* (1996) and McMorro and Talip (2001), are Malaysia's Land-Use Laws, particularly the amended Land Acquisition Act (1991). These laws encouraged the over-proliferation of shrimp farms, and caused the loss of many mangrove areas through allowing development for "any purpose beneficial to the economic development of Malaysia." Such reviews of legislation can best respond to the identification of trends of degradation in the environment, when they are traced to pressures and human activities.

Regional Policy Framework

Regional Problems

Many of the problems affecting coastal areas in different countries throughout the region are inter-related. Examples that have been discussed during UNU's work include the effects of transboundary marine currents, migration of pollutants, international shipping, regional aquaculture markets and tourism development. Many of these are grouped in the section of this document on 'Transboundary influences', although many others of the pressures explored elsewhere are also interrelated through markets for goods and finance. These interrelations have a particular significance for policy-makers, often necessitating regional policy initiatives in order to tackle shared problems.

An example of the regional nature of the regulatory challenges is the case of regulations to control organotin compounds. In this case, banning of their use in some countries does not prevent their introduction into coastal areas through ships and vessels originating from countries that do not have such bans. Another national ban on the coral trade from the Philippines was effective in stopping some damage to that country's reefs, but may have

increased the trade from other neighboring countries (Talue-McManus, 2000). Similarly, Singaporean regulations for cleaning ships before entry to the port have caused them to offload dirty water elsewhere around the coast of Malaysia.

Tables 8. and 9. below show the existing major multilateral agreements in the region, and those made by ASEAN.

Regional Opportunities

Communities and governments can find support for their coastal environmental management programmes at both regional and international levels. Through these frameworks monitoring and information networks can be developed, comparative investigations carried out, and coordination of policies undertaken.

The regional interrelationships between habitats, environmental processes and disturbances and commerce have a particular significance for policy-makers, often necessitating regional policy initiatives

Regional Actions

Actions for coastal conservation at the regional and sub-regional level include the South Asia Cooperative Environment Programmes (SACEP) Strategy and Programme for the conservation of corals, mangroves, deltas, and coastal areas. The formation of these regional environmental action plans is endorsed by the Regional Seas Programme, initiated by UNEP. The range of Regional Seas plans in effect in Asia and the Pacific includes the South Asian Seas (SAS) Action Plan; the East Asian Seas (EAS) Action Plan; the South Pacific Regional Environment Programme (SPREP); the North West Pacific Action Plan (NOWPAP); the ASEAN's Working Group on ASEAN Seas and Environment; the ASEAN Senior Officials on the Environment (ASOEN); the Council of Petroleum's Plan for the Control and Mitigation of Marine Pollution. (GEO, 2000). In addition, ASEAN has been working to improve trade arrangements that support the environment and also aims to strengthen capacity in trade-environment policy analysis, planning, and evaluation, consistent with the principles of the General Agreement on Tariffs and Trade (GATT).

Table 8. Major regional environment-related agreements

Convention for the Protection of the Natural Resources and Environment of the South Pacific Region	Noumea 1986
Protocol for the Prevention of Pollution of the South Pacific Region by Dumping	Noumea 1986
Protocol Concerning Co-operation in Combating Pollution Emergencies in the South Pacific Region	Noumea 1986
Agreement on the Network of Aquaculture Centres in Asia and the Pacific	Bangkok 1988
Convention for the Conservation of Southern Bluefin Tuna	Canberra 1993
Convention to Ban the Importation into the Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific	Waigani 1995

Source: GEO 2000, UNEP

Table 9. ASEAN Agreements relating to the marine environment and coastal resources

Manila Declaration on the ASEAN Environment	Manila, 1981
ASEAN Ministerial Understanding on Fisheries Cooperation	1983
Bangkok Declaration on the ASEAN Environment	1984, Bangkok
ASEAN Agreement on the Conservation of Nature and Natural Resources	Kuala Lumpur 1985
The ASEAN Strategic Plan of Action on the Environment, under Strategy 6, promotes the protection and management of coastal zones and marine resources	ASEAN, 1994
The ASEAN Cooperation Plan on Transboundary Pollution, adopted in June 1995, covers atmospheric and ship-borne pollution and the movement of hazardous waste	ASEAN 1995
Memorandum of Understanding on ASEAN Sea Turtle Conservation and Protection	1997

Source: GEO 2000, UNEP

Regional Priorities

The promotion of environmentally sound management of toxic chemicals and hazardous wastes and the control of the transboundary movement of hazardous wastes are priorities under the ASEAN Strategic Plan of Action on the Environment, Strategy 7 (ASEAN, 1994). This involves the establishment of regional guidelines for assessing highly polluting industries and for the safe handling of potentially harmful chemicals entering the ASEAN region. In addition, it strengthens an information network on the transboundary movement of toxic chemicals and hazardous waste. The importance of this issue has been highlighted by many of the scientific presentations that have been made during UNU's workshop events. Other regional priorities for action have been developed by UNEP's Regional Seas Programme.

Growing concerns about the effects of air pollution on water quality, and regarding the impacts of climate change are also areas for regional cooperation including coastal protection.

Regional Institutions

International or regional institutions can make a contribution to the development of information, dissemination of existing knowledge and establishment of networks of national institutions and agencies working on the coastal environment. An example of this type of work is the UNU's network of experts focusing on coastal pollution and ecosystem impacts. Others include SEAPOL, the Southeast Asian Programme in Ocean Law, Policy and Management. Regional activities are also coordinated by UNESCO's Intergovernmental Oceanographic Commission (IOC), which has a series of regional sub-commissions, including WESTPAC, in the Western Pacific. This group develops and coordinates marine scientific research programmes in the region and assists in the coordination of ocean observations for ocean and atmospheric forecasting and coastal zone management.

International Policy Framework

International legislation can form a basis for regional and national initiatives. In this sense, it is a framework within which policy-makers should be able to work. Many of the directions given by the major Multinational Environmental Agreements (MEA's) within this framework offer guidance on identifying priorities for coastal management. Most salient ones include:

- Convention on Biodiversity (CBD) (*emphasizes indigenous right of ownership of species*)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (*calls for the protection of biodiversity*)
- Ramsar Convention (*protects wetlands, including mangroves*)
- UN Convention on the Law of the Sea (UNCLOS) (*for the protection and preservation of marine resources in the Exclusive Economic Zone and the high seas*)
- Global Plan of Action (GPA) (*for prevention of pollution from land-based sources*)

In addition to offering legislation, the international frameworks are important in offering coastal policy-makers and communities the tools that they need to develop effective coastal management strategies. Initiatives such as the Code of Conduct for Responsible Fisheries drawn together by FAO following the Cancun Conference in 1992 (FAO, 1995) can offer helpful frameworks within which better coastal management can be achieved.

Community-Based Coastal Management

UNU's work has brought to light many success stories in attempts to involve communities in local management planning for coastal areas. These have been showcased during its international workshops and symposia, for which the proceedings are available. These lessons emphasize the importance of community organization and underline the willingness of communities to work together when they can see the direct benefits in improvements to their livelihoods.

In more developed areas, working with the community has to include local industries. To obtain information about potential pollution risks, governments will need to offer incentives for information disclosure (taxes, threats by government, prizes, public recognition, increased sales) (Paoletto and Termoshuizen, 2001). They are one way of conducting a public policy dialogue, encouraging public awareness that can lead to pressure on industries as well as governments to reduce pollution levels. Rating systems, such as the the EcoWatch Program in the Philippines, make public the environmental performance, both good and bad, of industrial enterprises. According to the World Bank, which is undertaking environmental information and disclosure programs in Hanoi, Hohhot and Zhenjiang, even in countries with significant public ownership of industries and limited environmental regulatory capacities, this type of program has the potential to improve environmental performance at low cost.

This consideration must be at the core of any strategy for community involvement in coastal

management. Therefore, an assessment of community interests and potential for involvement is a necessary element in strategies for encouraging community participation. The box below shows the interests and potential for involvement of different stakeholder groups in a coastal community in Indonesia.

The key to community organization is the involvement of community interests

Yeung recommends that planners should consider public and community participation in development programmes, consisting of:

- a. the creation of increased opportunities for the rural poor to ensure participation
- b. raising local living standards through education, training and human resources development
- c. creating a sense of security for local people over the natural resources on which they depend for a living, as in the Bunaken National Park in Indonesia.

Awareness Raising

UNU has been working to contribute to public awareness raising concerning the importance and vulnerability of the coastal environment. This is an essential prelude to the policy and behavioral changes that are required for improved coastal conservation. According to COREMAP research in Indonesia (Hidayati, 2000), the percentage of people in the urban areas of South Sulawesi and Riau who recognize that the quality of Indonesia's

Table 10. The community and its organisations

Stakeholders organisation	Interest	Involvement
Formal institutions	Village development Community welfare	Supporting planning implementation, monitoring and evaluation of CBM Proper mediators between CBM and integrated coastal management at the upper levels
NGOs	Empowerment of coastal community Sustainable use of coastal and marine resources	Assist coastal community in the implementation of CBM
Lantanal	Coastal guard and security	Surveillance and enforcement supporting CBM

Source: Social Assessment COREMAP, 1997



Community-based mangrove restoration activities in Tamil Nadu, India

Photographs: Annamalai University



coral reefs is declining is 24% and 34%, respectively. Tried and recommended methods of raising public awareness include the use of TV, radio, books and other publications, research and public and events, education and awards programmes, and publicizing of success stories.

For the general public it is essential to increase:

- the recognition that coastal resources are limited and important
- the realization that the condition of coastal resources is under threat
- the understanding that people's livelihoods are directly and indirectly affected
- support for the existing laws and programs to protect coastal resources

For local communities, who utilize coastal resources directly, it is essential to:

- inform about the actual consequences of over-exploitation of coastal resources
- provide information about how the destructive fishing practices threaten coastal resources, but also give information about alternatives or ways to overcome those practices
- offer techniques and technologies for ecologically sound practices of coastal resources utilization
- deepen the understanding that the degradation of coastal resources affects people's livelihoods through employment, income, and food supply
- enhance the recognition that coastal communities have an important role in sustainable coastal resources management through introducing examples of how communities can be successful for community-based coastal management
- provide information about law enforcement for the protection of coastal resources

Human and Institutional Capacity Development

The evident need to develop the capacity of the scientific community in the region to undertake policy-relevant research and monitoring of coastal ecosystems cannot be over-emphasized. UNU is currently working with a network of institutions in Asia, providing such training and research in coastal ecology, and coastal management. Many of the findings of the project are the fruit of the discussions and mutual learning processes amongst coastal managers and scientists that have occurred during these activities.

It is important to bring together the key stakeholder groups, governments and organizations involved in coastal resource-use to increase collaboration regarding coastal resources management issues at local, national, regional and international levels. Networking also can contribute to the dissemination of the techniques used in education and training related to coastal resources management. The importance of building in-country capacity is emphasized in Chapter 17 of Agenda 21.

The UNU project "Environmental Monitoring and Governance in the East Asian Coastal Hydrosphere" has been working on capacity building assistance to the East Asian countries in leading research institutions. It has:

- Trained professional and researchers from China, Indonesia, Singapore, Thailand, Viet Nam, Philippines, Malaysia, and Korea, for environmental monitoring activities (1996-2002).
- Developed a monitoring manual in collaboration with the Shimadzu Corporation, Japan to assist in laboratory analyses.



International participants of the UNU-UNESCO-
Annamalai University Training Course on Mangroves
Photograph: Annamalai University

- UNU, UNESCO and Annamalai University have jointly carried out an annual training course focused on mangrove conservation through the "training the trainer" approach.

Monitoring and Assessment

If governments are to take on a new role as information managers, strategies for the monitoring and assessment of coastal areas should be a major priority. This will lend essential support to coastal management programs. Without monitoring, Sorensen (1993) argues that the success of programs is hard to gauge, as it was for the USAID program in South-east Asia. This also explains the ineffectiveness of many national policy regimes.

Rakodi and Treloar (1997) found that the information-gathering and database creation in South-east Asian countries was long (two to five years). The creation of effective research centers was recognized as an important part of data management by the Indonesian government during its COREMAP project. They are needed to house comprehensive information and to make it accessible and easy to find. It developed provincial centers for training and information provision, as well as to take on a key role in finding alternative solutions to management questions and problems. These could also be accessed from the national level to compare data (Hidayati, 2000). The process of maintaining uniform standards and techniques in information and research centers is also essential and inter-laboratory calibration is a key concern for UNU.

The interactions between policy-makers and scientists are of key importance. UNU regularly showcases its ongoing monitoring work through international workshops and symposia, bringing together the two groups.

The OECD has found that in most coastal areas, knowledge of the main causes and effects of pollution and physical degradation is sufficient to provide reliable advice as to practical control measures but further research is needed because existing databases and our understanding of the processes shaping the natural state of the marine environment are generally inadequate for reliable predictions about changes and trends (OECD)

In UNU's work on monitoring Endocrine Disrupting Chemicals, current research on the health effects of pollution is presented to complement the findings of environmental monitoring, and highlight the significance of the trends identified by environmental scientists.

The most important challenge for monitoring and assessment projects is therefore still to produce information that policy-makers can find relevant. Effective databases need to be developed to allow policy-makers to base their decisions on sound information. The UNU has developed an environmental monitoring database called LandBase (<http://landbase.hq.unu.edu>) through integration of GIS, to organize and disseminate the data and related information via the internet. LandBase contains information generated under the project, and is anticipated to be used to develop guidelines for regional coastal management planning.

UNU's workshop-oriented approach to knowledge transfer is proving successful because it is a discursive process amongst researchers from different participating countries. Information networks can also facilitate the collection and exchange of



Photograph: Annamalai University



UNU's GIS-based data dissemination portal called LandBase (<http://landbase.hq.unu.edu>)

information. UNU maintains such a network with the researchers who attend its workshops. UNEP also conducts co-ordination activities of this kind in the South Asia, South East Asia, the South Pacific and Greater Mekong subregions. The Coastal and Marine Environment Management Information System (COMEMIS), a collaborative project of UNEP and ADB, aims to develop and improve the capacities of all countries in the South China Sea region to engage in multisectoral analysis and apply geographic information systems for environmental impact assessment and management (UNEP, 1997).

Mapping of Threats and Prioritizing Action

It is important to identify specific areas that might be under a high level of threat from human activities. UNU and a number of other international organizations have agreed to team up to undertake a map-based assessment of "Coastal Habitats at Risk". This will include an inventory of mangroves and seagrasses in the region, the current status of mangroves, mapping mangroves in the region, highlighting the areas at further risk, and indicating major conservation activities and modes of community interaction. Interactions between mangroves and adjacent ecosystems will also be investigated. Threats from pollution, over-harvesting, aquaculture development, boating/shipping, flooding/freshwater input, siltation, and other coastal development activities will be examined. Such activities can raise the awareness of the local communities as well as policy makers and aid the identification of priorities for their conservation activities.

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Appendix I

List of UNU's Activities

International Conferences

Man and the Ocean, 1998, Iwate, Japan

Conserving Our Coastal Environment, 2002, Tokyo, Japan

Symposia

International Symposium on Environmental Management and Analysis of Hazardous Chemicals, 15-16 June, 1994, Tokyo, Japan

Environmental Governance and Analytical Techniques: Food Pollution and Industrial Wastes, 1-2 February, 1996, Tokyo, Japan

Environmental Governance and Analytical Techniques: Water Pollution and Water Quality Monitoring, 21 February 1997, Tokyo, and 24 February, 1997, Singapore

Environmental Governance and Analytical Techniques: Air Pollution and Air Quality Monitoring, 13 February, 1998, Kyoto, Japan

Environmental Governance and Analytical Techniques: Environmental Issues Related to EDC Pollution in East Asia, 9-10 February, 1999, Tokyo, Japan

Environmental Governance and Analytical Techniques: EDCs in East Asian Coastal Hydrosphere, 17-18 April, 2000, Kuala Lumpur, Malaysia

Industries and EDC Pollution, 9-10 February, 2001, Seoul, Korea

Tracing Pollutants from Agrochemical Use: Focus on EDC Pollution, 15-16 April, 2002, Hanoi, Viet Nam

Workshops

1st UNU-ORI Joint International Workshop on Marine Environment, 21-26 February, 2000, Tokyo and Otsuchi, Japan

International Workshop Asia-Pacific Cooperation: Research for Conservation of Mangroves, 26-30 March, 2000, Okinawa, Japan

2nd UNU-ORI Joint International Workshop for the Marine Environment: Coastal Ecology, Nutrient Cycles and Pollution, 3-8 December, 2000, Otsuchi, Japan

The 3rd UNU-ORI Joint International Workshop for Marine Environment: Coastal Ecology, Nutrient Cycles and Pollution, 21-26 October, 2001, Otsuchi, Japan

Training Courses

UNU International Training Workshop on Methodologies for Assessing Biodiversity in Estuaries, Mangroves and Coastal Waters, 2-16 March, 2000, Annamalai, India

UNU-UNESCO International Training Course on Mangrove Biodiversity, 5-19 March, 2001, Annamalai, India

UNU-UNESCO International Training Course on Mangrove Biodiversity, 4-18 February, 2002, Annamalai, India

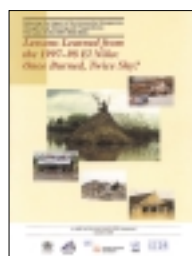
Appendix II

List of UNU's Publications



Books

Elisabeth Mann Borgese, *The Oceanic Circle: Governing the seas as a global resource*, UNU Press, Tokyo, 1998



Policy Briefs

Michael Glantz, Ed, *Once Burned, Twice Shy? Lessons Learned from the 1997-98 El Nino*, UNU Tokyo, 2001



Deny Hidayati, *Coastal Management in ASEAN Countries: The Struggle to Achieve Sustainable Coastal Development*, UNU, Tokyo, 2000

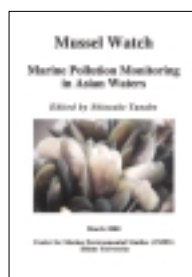


Proceedings

Man and the Ocean, 1998, Conference Proceedings, Iwate, Japan, UNU Press



Michael Glantz, Ed, *Once Burned, Twice Shy? Lessons Learned from the 1997-98 El Nino*, UNU Tokyo, 2001



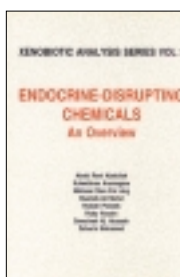
Shinsuke Tanabe, Ed, *Mussel Watch: Marine Pollution Monitoring in Asian Waters*, March 2000, Center for Marine Environmental Studies (CMES), Ehime University



Zafar Adeel, Ed, *East Asian Experience in Environmental Governance: Response in a Rapidly Developing Region*, UNU Press, Tokyo, Japan, 2002



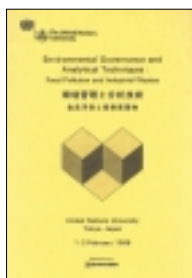
Asia-Pacific Cooperation on Research for Conservation of Mangroves, Proceedings of an International Workshop, 26-30 March, 2000, Okinawa, Japan, UNU



Abdul Rani Abdullah, Kulenthran Arumugam, Melissa Chan Pui Ling, Mustafa Ali Mohd, Rokiah Pendek, Ruby Husain, Samsinah Hj. Hussain and Zahurin Mohamed, *Endocrine Disrupting Chemicals: An Overview*



International Symposium on Environmental Management and Analysis of Hazardous Chemicals, 15-16 June, 1994, Tokyo, Japan, UNU



Environmental Governance and Analytical Techniques: Food Pollution and Industrial Wastes, 1-2 February, 1996, Tokyo, Japan, UNU



Tracing pollutants from agrochemical use: focus on EDC pollution, 15-16 April 2002, Hanoi, Viet Nam



Environmental Governance and Analytical Techniques: Water Pollution and Water Quality Monitoring, 21 February 1997, Tokyo, and 24 February, 1997, Singapore, UNU



Manuals

L. Kannan, AN Subramanian and T Balasubramanian, 2000, UNU International Training Workshop on Methodologies for Assessing Biodiversity in Estuaries, Mangroves and Coastal Waters Lecture Manual, Annamalai University, India



Environmental Governance and Analytical Techniques: Air Pollution and Air Quality Monitoring, 13 February, 1998, Kyoto, Japan, UNU



S. Ajmalkhan, S, AN Subramanian and T Balasubramanian, 2001, UNU-UNESCO International Training Course on Coastal Mangrove Biodiversity Lecture Manual, Annamalai University, India



Environmental Governance and Analytical Techniques: Environmental Issues Related to EDC Pollution in East Asia, 9-10 February, 1999, Tokyo, Japan, UNU



UNU-UNESCO International Training Course on Mangrove Biodiversity, 4-18 February, 2002, Annamalai University, India



Environmental Governance and Analytical Techniques: EDCs in East Asian Coastal Hydrosphere, 17-18 April 2000, Kuala Lumpur, Malaysia, UNU



CD's

Environmental Monitoring and Governance in the East Asian Coastal Hydrosphere, 2001, UNU



Industries and EDC Pollution, 16-17 April 2001, Seoul, Korea, UNU

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UNU's Partners in the Coastal Hydrosphere Project:



Partners in UNU's Project on Environmental Monitoring and Governance in the East Asian Coastal Hydrosphere:

