

Causal chain analysis

This section aims to identify the root causes of the environmental and socio-economic impacts resulting from those issues and concerns that were prioritised during the assessment, so that appropriate policy interventions can be developed and focused where they will yield the greatest benefits for the region. In order to achieve this aim, the analysis involves a step-by-step process that identifies the most important causal links between the environmental and socio-economic impacts, their immediate causes, the human activities and economic sectors responsible and, finally, the root causes that determine the behaviour of those sectors. The GIWA Causal chain analysis also recognises that, within each region, there is often enormous variation in capacity and great social, cultural, political and environmental diversity. In order to ensure that the final outcomes of the GIWA are viable options for future remediation, the Causal chain

analyses of the GIWA adopt relatively simple and practical analytical models and focus on specific sites within the region. For further details on the methodology, please refer to the GIWA methodology chapter.

The Causal chain analysis focuses on the linkages between the two GIWA concerns Habitat and community modification and Unsustainable exploitation of living resources, particularly the environmental and socio-economic impacts and causes of overfishing and destructive fishing practices. The causal chain diagram illustrating the causal links for Habitat and community modification and Unsustainable exploitation of living resources is shown in Figure 18.

The overall setting for the following analysis is summarised by Naess (1999) (see Box 7).

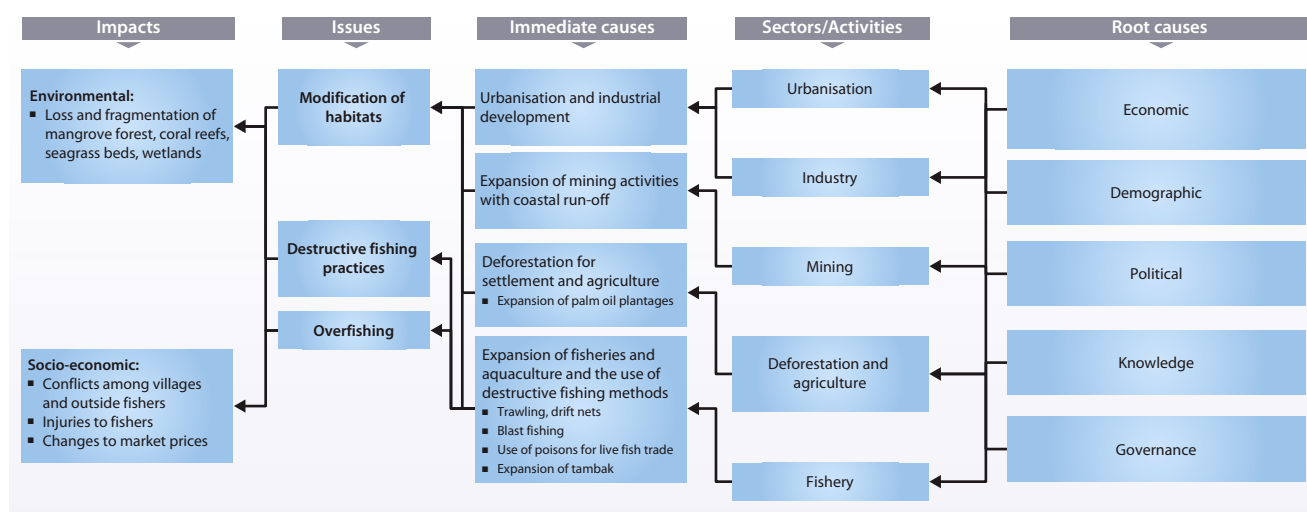


Figure 18 Causal chain diagram illustrating the causal links for Habitat and community modification and Unsustainable exploitation of living resources in the South China Sea region.

Box 7 Transboundary disputes in the South China Sea region.

More than 70% of the population in the South China Sea area live in coastal areas, and their dependency on the sea for resources and a means of transportation is high. Fisheries in the Southeast Asian region represented 23% of the total catch in Asia, and about 10% of the total world catch in 1992. At the same time, high economic growth is overshadowing environmental problems like overfishing, destructive fishing methods, habitat devastation and marine pollution. The environmental security aspect is therefore pertinent. High economic growth, often coupled with depletion of natural resources, intensifies conflicts like the one in the South China Sea. The fact that the area is rich in marine resources, and potentially rich in oil and gas, are some of the reasons why the claimants are aggressive and stubborn in their claims and political rhetoric. The environmental security concept refers to a field of research where the relationship between security issues and environmental issues is in focus. Increasing transboundary environmental problems generated by economic growth and a lack of commitment to protect and manage marine resources need integrated political action between the countries of the region. Fisheries make a good example. Their high economic value and the fact that seafood is the main source of animal protein for a rapidly growing coastal population, have made countries around the South China Sea publicly exhort their fishermen to venture into disputed waters to catch fish. This has resulted in a number of incidents, notably within the disputed Spratly area. Illegal fishing, overfishing, and poaching of rare species are not an exception, but the norm. In this case, the 'ASEAN way' represents an impediment to establishing regional regulatory instruments. While fish stocks are being depleted, and the ASEAN member states recognise the need for conservationist programmes, they continue to implement production-oriented policies and encourage their fishermen to catch more and more living resources.

(Source: Excerpted from Naess 1999)

Environmental and socio-economic impacts

- Loss and fragmentation of mangrove forests from development, including conversion for aquaculture;
- Loss and fragmentation of coral reefs from coastal development, sediment pollution etc. (Figure 19);
- Reclamation of wetlands for urbanisation, industry and agriculture;
- Loss and fragmentation of seagrass areas;
- Conflicts among villagers and outside fishers;
- Injuries to fishers;
- Changes to market prices.

Immediate causes

Urbanisation and industrial development

The countries bordering the South China Sea are undergoing intensive economic development, despite the Asian financial crisis of the late 1990s. The high population growth and population density has made the region a focus for the location of manufacture, and many multinational companies have relocated to the Southeast Asian region seeking to reduce labour costs. Political stability and low infrastructure costs, as well as a favourable climate for investment in a poorly regulated

and easily manipulated financial environment assist the growth of industry. This in turn contributes to growing urbanisation, as workers are drawn from the lowly paid rural occupations to the comparatively better paid urban industries. This is especially true of young women who make up much of the industrial working-class.

Poorly regulated development of industry, and the overcrowding that results from intensive resettlement near industrial areas, or within industrial dormitories, has had a detrimental effect on local environments. Wetlands have been reclaimed, many are poorly drained and subject to seasonal flooding, and mangrove forests have been removed in order to gain access to cheap land close to cities and the coast.

Expansion of mining activities with coastal run-off

As with industrial development, the growth of mining has resulted in the alteration of the coastal environment. Coral mining for building and making of cement is common, and the need for sand and gravel has been stimulated by the development of urban and industrial growth. Changes to the flow of rivers have been significant and siltation of river systems is common.

Deforestation for settlement and agriculture

The growth of the population in coastal Southeast Asia and the simultaneous growth of an affluent middle class have stimulated the demand for high quality timber for use as furniture and in building. Old growth rainforest timbers are especially prized, both in the region and abroad. With the rise in rural populations has come the need to expand agricultural areas to provide food for growing populations. The demands of the urban middle-class are also changing with the importation of western packaged foodstuffs and the fashion for American foods. This has means that more land has been given over to the production of varieties of food, not just staples.

Expansion of palm oil plantations

Palm oil plantations have increased in area right throughout the Southeast Asian and Pacific region. Coconut plantations and virgin coastal wetlands are now increasingly being removed and replaced by the more economically profitable oil palms. These are closely planted and the undercover areas are often dark, mosquito-infested and home to feral animals and pests, including snakes and rats. The land also becomes covered in refuse and palm branches and has a tendency to become sour. Plantations are often close to, or in, watercourses and coastal lowlands.



Figure 19 Islands and fringing reefs near Singapore showing a golf course and road development.
 (Photo: J. Oliver, ReefBase)

Expansion of fisheries and aquaculture and the use of destructive fishing methods

The growth of coastal populations, the high demand for fish as a source of protein (particularly needed by poor coastal populations) and the demand for high quality large fish for the luxury and tourist markets have all stimulated the rapid expansion of fisheries. There has been recent major expansion in large foreign capital commercial operations and mariculture, notably the development of the live fish trade. The live fish trade, where fish captured from regional waters are transported to large holding cages, sometimes in international waters, before shipping to the luxury market in Hong Kong, Singapore and China, provides improved, but still negligible returns for local fishers. Blast fishing, trawling and other destructive fishing techniques are 'endemic' in the region, including within MPAs, and have caused massive destruction to coral reefs (e.g. Hon Mun MPA, Vietnam) (Vo et al. 2002).

Trawling, drift nets, use of mechanised push nets by commercial operators

The intensive use of large-scale fish nets has been a major component in the overexploitation of fish and destruction of habitats in the South China Sea. Trawlers and drift net commercial operators are often part of foreign fishing fleets that are not based in the region and do not market products in the region. The value-added component of the industry, services, labour, accommodation, fuel and equipment supply, is also sourced away from the region, generally in north Asia. The region therefore suffers the effects of declining resources and environmental quality with few if any economic benefits, either short- or long-term.

- Trawling is a high capital industry, numbers of trawlers are not regulated and activities are not monitored. The result is widespread environmental damage.
- Large drift nets are a major environmental threat. Nets may be several kilometres long and many metres deep and trap virtually all

pelagic animals. When they are abandoned or lost, they drag over the bottom and collect any benthic marine organism regardless of size, protected status or possible economic use and continue to trap animals drawn to the trapped carcasses.

- Push-nets, nets attached to large poles spread from the front of a boat, scour the ocean bed and effectively remove bottom dwelling organisms. The three forms of netting over time can denude large productive marine areas.

Blast fishing by artisanal, small-scale commercial operators

In order to compete in a declining, overexploited market, local artisanal and small-scale commercial fishers are reverting to the use of explosives rather than line fishing (Figure 20). Blast fishing stuns all fish in the immediate radius of the explosive charge and these fish can then be gathered from the surface of the ocean; other organisms are shattered and die on the bottom. Fish caught using this method can be identified at the market by the glassy state of their eyes but are often sold cheaply due to size, type and quantity.



Figure 20 Damaged corals, North of Pulau Gut, Malaysia.
(Photo: B. Huzaimi, ReefBase)

Use of poisons by commercial and small-scale operators for live fish trade

Reef food fishes and ornamental aquarium fishes are frequently caught using cyanide and other poisons. The immediate effects are not noticeable, and as the market depends on a speedy delivery from fisher to market and diner, the final consumer is unaware of the method of catch. The aim of the live fish trade is to provide large fish, preferably species that are red or blue in colour (signs of good luck) quickly and cheaply. The diner however, is charged a considerable mark-up for the supply of fresh, live swimming marine organisms.

Expansion of tambak

Tambaks are small prawn and fish ponds built in mangrove areas, and are a popular means for increasing local fish production. However, the use of tambaks is not controlled and the water in most ponds is only cleaned and aerated by tidal action. The tambaks generally last only one or two seasons unless there is careful management of the water and walls; the ponds are then neglected and the area becomes useless for long periods. Many coastal mangrove forests have been lost to the construction of poor quality tambaks.

Root causes

Economic

Economic growth

Negative aspects of increasing economic growth have placed high pressures on the environment. While the financial and social stability of the Southeast Asian region have been welcomed after decades of stagnation and political crises, the management of the terrestrial and marine environments has been neglected.

Foreign aid

High levels of foreign aid have been expended in the South China Sea region, particularly as support for poverty alleviation programmes and infrastructure development (e.g. following the Vietnam War). Industrialisation is capital intensive, as are programmes to improve agricultural productivity and fishing efficiency. The region remains a focus for international aid. These programmes have both positive and negative aspects: production and employment have been increased; living standards for the general middle classes have improved; education and health facilities are comparatively high; but the overcapitalisation of fisheries has meant that high operational costs have forced fishers to seriously overfish, particularly in the inshore regions.

Market demand

Local and international market demands have been important in driving the exploitation of resources that have resulted in the destruction of habitats and community modification. A key example is the rapidly increasing demand for high quality, expensive fish and seafood, a product of rising living standards and the growth of the affluent middle-class in Southeast and East Asia.

Export pressures for forest products - building materials

Market demand, both local and international, for high quality rainforest timbers, is driving the forestry industry to use clear felling techniques.

Companies, some being Malaysian in origin, are now establishing operations as far away as Papua New Guinea where forests are relatively pristine. Economic pressures are driving this approach and most of the high quality material is exported as manufactured furniture or as sawn timber. The results are loss of ecosystems, reduction of native forests and erosion following the heavy wet season rains. Many of the rainforest areas that have been modified or destroyed are located in fragile environments, frequently mountainous with seasonally high rain, tropical storms and generally shallow soils.

Export pressures for fisheries products, aquarium trade and alien species

Economic growth, increasing prosperity and changing cultures have altered export market demand for diversity of fisheries foodstuffs. This has increased the exploitation of alien species once reserved for festivals or eaten by the richer members of local societies. In coastal communities, especially those marginalised by economic development, negative social attitudes, or lacking access to regional infrastructure, the pressures on marine resources are considerable. Poor communities still rely on catches of small fish, shellfish and animals collected by gleaning and strand gathering.

Increasing market demand in the live reef fish food trade has caused expanded use of large cages, in both national and international waters, as holding pens for live fish. The collection of fish by mother ships for rapid transport to markets in Singapore, Hong Kong and other wealthy centres supports the development of the industry. Many aspects of the fishery are in contravention of local and national regulations, but continue because of inadequate policing, lack of governance, local and regional corruption, and declining infrastructure.

The foreign aquarium trade that relied on the supply of high quality small ornamental reef fish to international markets is also highly profitable. The increasing popularity of live coral aquaria around the world increases the demand for particular, mostly colourful, species. This has contributed to changes in species composition/abundance, ecological structure and function of coral reefs that are closely targeted.

Overcapitalisation, technology ‘creep’, stock targeting

The commercial fishery in the South China Sea is overcapitalised and depends on rapidly changing technology in order to keep boats at sea for longer periods as well as specialised computer aids for locating shoals of species highly prized by the market. This has led to excessive stock targeting of particular species of fish, especially those in high demand.

Overcapitalisation, subsidies (national/international) to increase fish catch through improvement of gear, with increasing effort, and little or no consideration for long-term sustainability is widespread (e.g. in the Philippines there has been gear improvement but no consideration of habitat or stock sustainability). Competition among different fisheries sectors to continually increase catches usually overrides efforts to sustain fisheries.

Political

Military influence

The region has a high military presence, due to long periods of political instability, and the military in all countries have considerable political influence. China, to the north, exerts considerable influence in all regions of Southeast Asia and has growing economic power. Territorial disputes (e.g. Spratly Islands) with military involvement have contributed to the failure to implement ameliorative policies addressing habitat loss and overexploitation (e.g. establishment of a multilateral MPA network including Spratly Islands).

Demographic

Overpopulation - migration to cities

Rapid population growth and migration of rural populations to the large commercial and industrial cities of the region is a common aspect of social change in the last 20 years. The cities are centres of health, education and employment infrastructure and the rural poor have little opportunity to access a better quality of life in the provinces that have often been neglected by the urban-based bureaucracy and wealthy elite.

Most of the impacts and their immediate causes (poor management of agriculture, forestry, coastal fishing pressure and exploitation of inshore resources) are exacerbated by population growth and migration. Throughout the region, there has been significant settlement on ‘marginal’ lands in recent decades; coastal wetlands are often the only available land for the landless. It can be expected that this will continue. The recent purges of transmigrant settlers by local inhabitants in Indonesia is only one example of the consequences of internal forced migrations.

Poverty - limited access to other forms of livelihood

Poverty, overpopulation and the limited access to other forms of livelihood for the rural subsistence farmers and workers are all factors that continue to impact on the overexploitation of inshore fisheries and other living marine resources. Almost everything from the sea will be eaten or otherwise used, unless it is harmful. Biodiversity, protection of native stocks and environmental management are complex questions

to explain to people who are at subsistence levels reliant largely on their immediate environment for food.

Knowledge

Perpetuation of environmentally damaging traditional practices exacerbated by a lack of awareness of environmental change

At village and local community levels, traditional practices are still highly regarded, with both positive and negative effects. In regional Indonesia, for example, the Adat laws are still powerful and regulate daily life in villages. Awareness of the holistic nature of contemporary environmental management and broader issues such as climate change, overexploitation of marine resources, poor management of terrestrial soils and vegetation, and disposal of garbage and human wastes are still inadequate. Although the people are not ignorant, they need to be reached in ways that do not imply lecturing by government bureaucrats or foreign experts, and local attitudes and opinions must be considered. In many cases, the education resources are not available at a level of instruction suitable for regional communities that often have poor literacy and speak dialects.

Governance

Lack of political will, poor governance, inadequate regulation, multilateral/inter-sectoral disputes

Lack of political will, combined with inadequate legislation is a major driving force behind environmental degradation. Political structures in Southeast Asia are still dominated by hierarchy and patronage and democratic decision-making is not a feature of most policy making, even in countries with reasonably open electoral systems. The political and educated elite have extremely high levels of power in most regional societies.

Widespread, ineffective governance leads to the growth of corruption. This is endemic in many nations of the region. Bureaucratic inaction, lack of financial resources and a general mistrust of government officials at village levels makes it difficult to obtain accurate statistics on issues such as resource exploitation. Regional language differences, lack of education standards and complex notions of quantifying catch in provincial areas are also issues to be overcome in attempting to rectify the problems of overexploitation of marine resources.

Control of commercial fisheries by the operators in circumstances of poor governance and inadequate regulation foster the continuance of poor management practices. There is limited, generally ineffective, fisheries regulation and enforcement in the marine states of the region, as the resources required to maintain surveillance and effect prosecution of offenders is prohibitive.

All forms of natural resource exploitation are subject to considerable manipulation by bureaucratic agencies and entrepreneurial groups with vested interests in expansion of industry and wealth generation. Poor governance, which impacts on inadequate legislation, lack of management expertise and financial resources, and political interference in decision-making, has meant that environmental management programmes have often fallen short of their planned targets.

Efficient environmental management in Southeast Asian nations is still in its infancy. Fisheries management lags behind terrestrial environmental management. The large-scale nature of the commercial fishing industry means that it can manipulate government and bureaucracy and the consequent lack of incentives on the part of both industry and government to change the situation makes it possible for inappropriate practices to continue (Box 8).

In relation to management systems, major improvements are required in relation to:

- Lack of feasibility assessment (or EIA) in developing new fisheries, stock assessments and data for planning and managing fisheries;

Box 8 Commitments to multilateral programmes.

Although an Action Plan for the East Asian Seas was agreed upon as early as 1981, this plan has had minor effects on the South China Sea region, because of a lack of commitment by the signatory states to fund and undertake activities in accordance with the initial idea of the plan. Initially, only the five original ASEAN members joined the Coordinating Body on Seas of East Asia (COBSEA). Thus the scope of the East Asian Seas Action Plan was limited. This is not to say that nothing has been done regarding environmental problems, it is rather that the management of common resources depends on the individual state, or a sub-regional group of states. Numerous sub-regional projects have been established without help from the COBSEA, for example the Asian Development Bank's Coastal and Marine Environmental Management in the South China Sea project, involving Cambodia, Vietnam and China; and the Malacca Strait Co-operative Programme, established by Singapore, Malaysia and Indonesia. In addition to these three, a sub-regional programme on the Gulf of Thailand, including Malaysia, Thailand, Cambodia and Vietnam, seems to be on its way with help from the Southeast Asian Programme in Ocean Law, Policy and Management. Although there is a lack of a binding environmental agreement among South China Sea littoral states, ASEAN has achieved a lot in terms of bringing the ASEAN member states together in maritime environmental projects. The ASEAN Subcommittee on Marine Science (ASCMS) and the ASEAN Senior Officials on Environment (ASOEN) have been responsible for cooperative projects with Australia (the ASEAN-Australia Marine Science Programme), Canada (ASEAN-Canadian Marine Pollution Programme), the USA (ASEAN-US AID Coastal Resources Management Programme), Japan, the Republic of Korea, and the European Community. Most of these projects have come about as a result of cooperation among marine scientists, decision-makers and foreign aid agencies. Other projects have been established with help from NGOs, IGOs or international aid agencies. Various UN organisations have sponsored marine scientific research projects like the UN-ESCAP Regional Mineral Resources Development Centre and UNESCO's major Inter-Regional Project on Research and Training on Integrated Management of Coastal Systems (COMAR) in Asia-Pacific. An influential NGO is the International Centre for Living Aquatic Resources Management (ICLARM, now WorldFish Center), which has sponsored a range of activities, from conferences and workshops on waste management and marine pollution management, to the establishment of important databases like FishBase, ReefBase, etc. The Asian Development Bank (ADB), with assistance from the Swedish International Development Cooperation (Sida), has been managing a project since 1993 called Coastal and Marine Environmental Management in the South China Sea. The project aims at improving Vietnamese, South Chinese and Cambodian capabilities in coastal environmental management, and has succeeded in bringing the two ASEAN countries and China together.

(Source: Excerpted from Naess 1999)

- Introduction of management schemes by international ‘experts’ with no local knowledge;
- Top-down decision making systems;
- Little complementarity/communication across fisheries sectors in most nations (e.g. Thailand where there is some complementarity);
- Insufficient transboundary communication on fisheries statistics, planning and management, although FAO, ICLARM, UNEP-GEF and APEC fisheries advisory group among others, are working towards improving this;
- Insufficient collective vision for sustainability of fisheries e.g. ‘Tragedy of the Commons’ at local, national and regional levels;
- Permit issues: Some areas are not well defined in terms of necessity for permit (e.g. Spratly Islands, Sulu Sea) and foreign boats overexploit resources. In other areas, foreign boats gain permits to fish then overexploit resources, particularly in some MPAs. This can lead to tensions from local and international competition.
- There is a general lack of data, which contributes to the management difficulties (see Assessment, Overexploitation);
- There is endemic corruption, including the illegal selling of permits/licenses, and production of fake permits (e.g. Taiwanese boats ‘registered’ in Indonesia).

These all contribute to the lack of management control of exploitation of natural resources and development of capacity in the region.

Conclusions

The key root causes of Habitat and community modification and Overexploitation, and indeed of most other international waters-related issues, were easily identified and almost axiomatic throughout much of the region. However, addressing these root causes will continue to be extremely difficult. The rule of law is being steadily eroded in many areas, with endemic corruption among enforcement agencies and legislature, and there has been insufficient commitment and progress in effective implementation of multilateral treaties and agreements (Box 8). Thus, by 2020, the predicted population increase is expected to cause a moderate increase in impacts and pressures despite improved technical, policy and regulatory changes, surveillance and enforcement of regulations.