PART 5
CONSERVATION AND MANAGEMENT ISSUES

SUMMARY

- The aim of this section is to highlight the main conservation and management issues that need to be addressed through the management plan for the proposed Park. Most of the problems are caused by people and their activities.

- Constant pressure on marine resources has caused populations of fish and other edible and useful reef species to deline. This problem has been compounded by the use of explosives and other destructive fishing methods.

Figure 58. Groupers in the hold of a boat off Mantabuan. These fish are heavily targetted for the live food trade.

Figure 59. Catch from a fish trap set on the reef top – many specimens and at least 14 species have been caught.

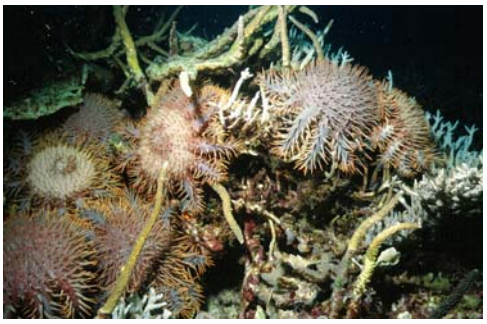
Figure 60. Reef gleaning can cause localised damage. Here coral blocks are being broken open to extract clams.

Figure 61. The effect of fish blasting on a reef in the proposed park.

- There are other pressures on the reefs, for example from plagues of coral-feeding starfish and warm water events caused by changes in the global climate.

- Mariculture has an important role to play in the development of the park, but it needs to be carefully managed to avoid negative impacts.

- Unregulated use of land and terrestrial resources in the past has led to some loss of biodiversity.



F. Dipper

Figure 62. Crown-of-thorns starfish, feeding on coral

Figure 64. The settlement of Tag Hawaian on Bodgaya, with surrounding island slopes cleared for cultivation.

Figure 63. Bleached coral

- There is a significant amount of rubbish in the sea and on land, and also a danger of pollution from the mainland or from developments on the islands.

- Recreational activities are currently at a very low level, and there are virtually no impacts. Possible consequences of tourism development are discussed in Part 9 of this plan.

- Poverty and the need to provide for daily needs are at the root of some of the problems mentioned above – such as over-exploitation of marine resources.

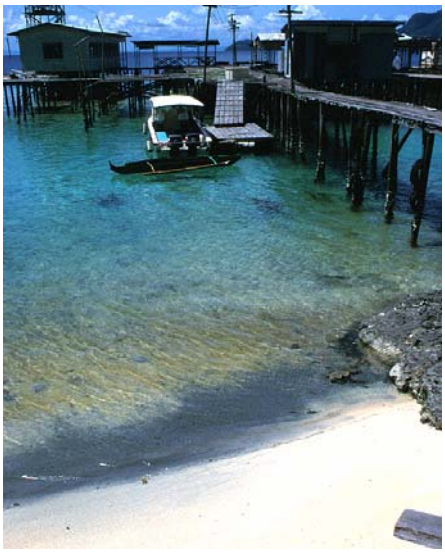


Figure 65. Black sand on Boheydulang beach, indicating pollution from organic wastes.

Figure 66. Fisherman on the Mantabuan reef top.

5.1. MARINE RESOURCE USE

5.1.1. Over-exploitation of target species

It is clear, even in the absence of historical scientific data, that most of the reefs in the proposed Semporna Islands Park have low populations of 'useful' species. Edible species such as fusiliers, snappers, sweetlips and groupers are noticeably few in number, it is rare to see large fish, and sharks have been conspicuous by their absence throughout the surveys. Full details are in *Semporna Islands Project: Reef Assessment and Monitoring* (Wood *et. al.* 2001).

It is very unlikely that these low populations are 'natural'. A comparison of the Semporna reefs with nearby Sipadan indicates the potential for the area. There has been no fishing on Sipadan for about 15 years. All the target groups mentioned above are present in large numbers and there are numerous sharks and huge schools of jacks and barracuda. The Bodgaya lagoon has been protected in the same way (it was 'off-limits' between 1963-1992 because of the Pearl Farm and now has the protection of the Security Forces and Sabah Parks HQ) and has noticeably higher populations of edible food fish and giant clams than the outer reefs. However, it is not directly comparable either with Sipadan or the outer reefs of the Semporna Islands, because of the sheltered, semi-enclosed environment.

Given the long history of harvesting in the area (exploitation of marine resources began at least in the late 1880s and has continued to the present day), it is not surprising that pressure on resources has caused populations to decline. Destructive fishing methods (see below) have also played a part. Even in 1980, people who fished in the area reported that they had to go further afield because of a lack of fish, over-fishing and the use of bombs and poisons (Piper, 1981).

There is no doubt that most of the reefs in the proposed Semporna Islands Park have been intensively harvested for edible species (e.g. fish, molluscs, sea cucumbers, lobsters) and decorative items (shells). If pressure is relentlessly high the targeted species can even be fished to local extinction. Species with a very small geographic range or naturally low populations are most at risk, as are high-value ones which may be heavily targeted. Only one specimen of *Tridacna gigas* (the largest of the giant clams) has been seen on the Semporna reefs (George & George, 1987), and adult humpead wrasse *Cheilinus undulatus*, another highly sought-after species, are also rare.

Over-fishing not only depletes stocks but can have significant secondary effects on other reef species or communities, or on the ecology of the reef as a whole. For example:

- Overfishing of triggerfish and pufferfish (among the few fish to feed on sea urchins) is thought to be responsible for some of the urchin outbreaks that have caused damage to corals (urchins graze on fine algal films that grow on reefs, and in doing so, erode the corals). Some of the most popular fishing areas in the Semporna Islands are infested with *Diadema* and this could be linked to over-fishing of sea-urchin predators.

- Removal of herbivorous fish such as parrotfish and surgeonfish can lead to an increase in algal cover. Algae grow very rapidly, and in the absence of grazers may spread over the reef, to the detriment of the slower-growing, reef building corals. Fortunately, algal overgrowth is not a serious problem on the Semporna reefs – possibly because there are large populations of grazing sea urchins and also reasonable numbers of small parrotfish and other herbivores.

- Over-fishing on a massive scale could degrade reefs because it involves wholesale removal of organic material which is normally 'locked into' the system. Reefs function effectively because nutrients are recycled within the reef system. The amount of organic matter or living resources (fish, molluscs, corals etc) that can be removed without damaging the reef ecosystem is limited, but it is not known whether this limit has been exceeded on the Semporna reefs.

5.1.2. Blast fishing

Blast fishing is a serious problem throughout much of South-east Asia, and has been carried out in the Semporna area for decades. It was well established in the 1970s, and probably much earlier than that (Wood, 1977). During the survey of the Semporna reefs carried out in 1980, fishermen living on the islands and visiting the area to fish admitted openly to the use of explosives (Piper, 1981).

Various types of explosive material and devices are used to stun fish, including dynamite. However, common practice in Sabah is to use artificial (chemical) fertilisers such as ammonium or potassium nitrate mixed with kerosene. The explosive mixture is packed into a container such as an empty bottle, with a fuse at the top. Fish aggregations are a favourite target and once located the fuse is lit and the bomb tossed into the water. Snorkellers then enter the water to collect up the stunned fish.

The reef rim is usually favoured for fish blasting because it supports better fish populations and is easily accessible. However, with the advent of hookah gear (air delivered to a diver via a long tube from a surface compressor), deeper reefs are no longer out of reach.

When explosives are used over reef areas, the force of the blast shatters corals, and kills both juvenile and non-commercial species of fish. The end result is habitat degradation, loss of biodiversity and waste of resources.

Figure 67. This fisherman on Sibuan lost his hand many years ago, while blast fishing. Precise timing is needed when deploying bottle bombs and accidents are not uncommon.

When coral rubble is seen on a reef it cannot always be assumed that this is the result of fish blasting. There are numerous other reasons why corals break up or collapse, including storm conditions or the aftermath of crown-of-thorns predation or coral bleaching (see 5.2). One feature of blasting is that it results in roughly circular areas of damage, but if a number of bombs are used then the circles join together to form a swathe of damage similar to that caused by storms.

In the absence of constant monitoring it is impossible to be precise about the amount of reef in the proposed park that has been damaged by fish blasting. Full discussion is in a separate publication (*Semporna Islands Project: Reef Assessment and Monitoring* (Wood *et. al.* 2001), but the main conclusion is that fish blasting has had caused significant damage over a long period.

When coral is broken up it produces rubble which lies on the reef surface. If the rubble is unstable, and constantly being moved around by waves or currents, there is little opportunity for young forms to settle. In these situations, blasted reefs may not recover at all, or only after decades. There are some patches of rubble on the Semporna reefs which may be in this situation.

Where the rubble is reasonably stable, there is a better chance of settlement. The fastest re-colonisers in these situations are often forms of reef life other than hard corals – such as algae and soft corals. Significant areas of shallow reef dominated by small soft corals growing over pieces of coral rubble are a feature of some of the Semporna reefs. Although, as explained above, the reason for the rubble being present is uncertain (see above), it is likely that at least some of it was created as a result of fish blasting – possibly many years ago. These significant shifts in community structure, away from hard corals towards soft corals, have implications for the future growth and productivity of the reefs.

One reassuring observation from surveys carried out during the Semporna Islands Project is that blast fishing is less rampant around the Semporna Islands than it was in the past. This may be due partly to better awareness and enforcement, but also to the fact that there are few fish aggregations left to target. However, ‘fresh’, crater-shaped areas of broken coral, and the sound of bombs going off are certain proof that some fish blasting is still occurring around the Semporna Islands. Fishermen living in the area say that they are not involved and that it is people from outside who are responsible.

Clearly it is very important that fish blasting is eradicated from the Semporna area, in order that biodiversity is retained and the value of the reef for fishing and tourism is not lost.

5.1.3. Other damaging fishing methods

There are a number of other methods of fishing and harvesting marine life that are causing some damage to the Semporna reefs. Where **traps** are placed on the reef itself they inevitably damage the coral, especially if they are pulled up and down the reef slope. If deployed in sandy areas, the traps are disguised and held in place by pieces of coral placed on top of the trap which have been taken from nearby coral clumps. Use of traps will be restricted within the park, and steps taken to ensure that corals are not disturbed.

Numerous **tangled lines** and a few small **nets** were seen on the reefs during the marine surveys. The nets cause much more damage than the lines because they abrade or smother underlying corals. Use of nets will be restricted under the management plan.

Trawling is occasionally carried out some distance away from the islands within the proposed park, and there was no evidence of any impacts on the coral reefs from this activity. However, deep water, hard and soft-bottom communities in the outlying areas of the park could be damaged, and for this reason it is recommended that trawling is not permitted within the park boundary.

Reef 'gleaning' involves harvesting of shells, sea-urchins and other types of marine life from the shallow reef top at low tide (Figure 60) and creates two main problems (apart from the possibility of over-exploitation). One is that 'trampling' of corals and other reef life inevitably occurs as people and boats move about in the search for suitable items. The other is that rocks are deliberately overturned and broken open to extract clams and other shells, causing habitat degradation. This activity will need to be highly restricted and carefully regulated in the future.

It is known that at least one dealer in Semporna illegally supplies **cyanide** to fishermen, for use in the lucrative live fish trade. Cyanide is a highly toxic substance which is used as a fish 'anaesthetic' but also kills non-target fish and invertebrates, and damages reefs in the areas where it is applied. It is quite likely that cyanide has been used on the Semporna reefs, and efforts to eliminate this practice will need to be intensified.

A traditional method of catching fish in pools and tidal situations is to use the roots of the **tua plant** ***Derris elliptica.*** These are crushed in seawater to produce a milky fluid which stuns fish. The effect on the ecology of the areas where the poison is applied is largely unknown, but there is no doubt that juvenile and non-target individuals would be affetced. This method appears not to be used a great deal now, and should not be permitted in the park.

5.2. OTHER PRESSURES ON REEFS

5.2.1. Crown-of-thorns starfish

The crown-of thorns (COT) starfish (*Acanthaster planci*) is a large species that feeds on living coral (Figure 62). Usually only one or two COT occur on any particular stretch of reef, at less than 10 COTS/ha hectare (10,000 m^2). Sometimes they occur in plagues, with an active-outbreak defined as more than 30 mature COTS/ha and a severe outbreak as more than 200 COTS/ha (information from the Great Barrier Reef Marine Park Authority).

A number of active and severe outbreaks have been recorded on the Semporna reefs over the survey period from 1998 – 2000, for example at Mantabuan North, Maiga East and Church Reef South-west. These starfish were also recorded during the 1980 survey, where aggregations were seen in the shallow areas at Bodgaya North and Boheydulang South Point (George & George, 1987).

The immediate impact of COTS plagues is coral mortality. Dead corals usually become smothered in algae, and if this condition persists, populations of herbivorous fish may increase, while populations of coral-feeders decreases. The dead coral tends to collapse within months if it is branching, but massive colonies stay intact for longer.

Even after years of research, the cause of primary population explosions of COTS is still unknown. However, some scientists believe that human activities may be playing a significant part, either by making the outbreaks bigger or more frequent in occurrence. For example, overfishing of natural predators may be promoting survival of greater numbers of juvenile and adult starfish. 'Bite-sized' juvenile starfish are preyed on by various fish that are heavily exploited on the Semporna reefs. Once the starfish reach an adult size they have relatively few predators. However, the important ones (triggerfish, pufferfish, humphead wrasse and giant triton shells) have been intensively harvested on the Semporna reefs. Whether or not these factors are implicated in the COTs outbreaks on the reefs is unknown, but there is no doubt that the starfish have caused significant damage in some areas and will continue to do so as long as they remain on the reefs.

The question of whether or not to try and control outbreaks remains contentious. The fact that COTS are natural inhabitants of reefs, and that outbreaks may also be natural are taken into account when deciding on action to be taken. It is generally considered best not to interfere, except in especially sensitive areas, and/or those used for tourism. However, anticipation of outbreaks is of crucial importance, so that efforts can be concentrated on saving the most important reefs before populations build up.

Feeding activities of COTS on some of the Semporna reefs has, and continues to have, a significant impact on live coral cover. Many feeding scars and dead coral colonies occurred at these sites, and several 'clean-ups' to remove the COTS were carried out during the Semporna Islands Project. The reefs are already under stress from other impacts, and it was considered it would be beneficial to prevent additional damage being caused by the starfish. Full details are in *Semporna Islands Project: Reef Assessment and Monitoring* (Wood *et. al.* 2001).

5.2.2. Coral bleaching

'Bleaching' of corals and anemones was recorded on many of the Semporna reefs during surveys in the latter part of 1998. Pale or white patches were visible on the coral, or the entire colony was white. Coral tissue was still present (Figure 63), showing that the condition was not due to coral predators (which remove the living polyps, leaving bare skeleton). Isolated colonies were bleached in most cases, but large tracts of coral were affected on a few reefs. It was seen to depths of about 20m, but shallower areas were worst affected. Full details are in *Semporna Islands Project: Reef Assessment and Monitoring* (Wood *et. al.* 2001).

Corals and other reef animals such as anemones bleach because of the loss of the pigmented symbiotic algae (zooxanthellae) that live in their tissues. On present evidence, the most likely explanation for bleaching is prolonged temperature increase. There is general agreement that elevated water temperatures have been at the root of many mass bleaching events, and suspicion that global warming may be implicated. Bleaching events occurred in many other parts of the world during 1998, coinciding with sea surface temperature increases of about 1^{o}C. If the abnormally warm conditions persist then the bleached corals die, and this was certainly the fate of quite a high proportion of those that bleached on the Semporna reefs.

Increased ultraviolet radiation (due to thinning of the ozone layer) may also be implicated. Most bleaching events coincide with periods when the sea is calm and clear, with fewer than usual particles to absorb the potentially harmful UV rays. It is also possible that mass bleaching may be connected with a general deterioration in reef health as a result of human activities.

It will be important for incidents of bleaching to be recorded and recovery (or mortality) monitored, but solving the problem is largely in the hands of governments and people around the world who are trying to reverse the global warming trend.

5.2.3. 'Black sponge' infestation

Several sites, but in particular Bodgaya West Reef and Maiga South Reef are severely affected by a very thin, encrusting black sponge. Despite the presence of some live corals, especially heads such as *Porites* and *Diploastrea*, much of the reef surface at these localities consists of rubble, dead standing coral and eroded limestone outcrops colonised by the black sponge. This is a new species, yet to be described, which appears to thrive in sheltered areas where the reef has been broken up. Also typical of this community is the anemone *Heteractis crispa*, the blue starfish *Linckia* and colonies of the calcareous tube-worm *Filogranella*, lying loose.

The black sponge infestation is clearly a phenomenon of significant ecological importance, which has to be considered in the context of management of the Semporna Islands reefs. Since nothing was known about the biology and growth of the black sponge, or what triggers its spread, an investigation is being carried out, the results of which will be published soon.

5.3. MARICULTURE

Seaweed farming was introduced to the Semporna Islands area in 1980 with the support of the Fisheries Department. It is now well established and providing a good income for many families. No assessments have been carried out on the impact of this activity, but it is generally considered that if the cultivation site is carefully chosen in the first place, and various procedures followed during operation of the farm, then damage should be negligible. For example:

- It is important that the strings of algae are not suspended over areas of dense coral growth because:
  - Shade cast by the algae could deprive the corals below of light needed for growth.
  - Pieces of algae may become detached, fall onto the corals below and smother them.
- The surface line that carries the strings of seaweed should not be tied on to corals. Instead, stakes should be driven into the sand, or anchor blocks put in place.
- Measures must be taken to prevent the polythene strings and plastic bottles (used as floats) from becoming detached and causing a litter problem.

One aspect of seaweed farming that has to be considered is that it occupies quite extensive areas of the sea that might be used for other activities. The presence of the long strings makes boat access difficult, and these potential conflicts of interest need to be avoided.

One outcome of seaweed farming is that it provides grazing for herbivorous fish such as rabbitfish. Their activities may reduce the yield of seaweed, but alternatively it might be possible to utilise the increased fish production.

It may be possible to introduce other types of mariculture to the Semporna Islands, such as farming of **giant clams** and **pearl oysters**. Such operations are potentially low-impact, but would have to be subjected to an impact assessment before they were allowed to start.

Good quality, high value fish are much in demand for local and international markets, and the possibility of establishing **'fish farms'** in the proposed park area has been discussed by various interested parties. Marine fish 'culture' is already well-established in the Semporna area (Komilus *et al.* 1999). It should, however, correctly be called 'grow-out', because all stocks are taken from the wild, rather than from hatchery-raised young. Currently, 'fingerlings' (juveniles) and adult fish are collected from the reefs and other marine habitats of the proposed Semporna Islands Park, but the grow-out and holding facilities are located elsewhere (e.g. Pulau Bum Bum) (Komilus, *et al.* 1999).

As recommended by Komilus *et al*, 1999, there is a need for a hatchery-reared supply of fingerlings in the Semporna area. The best location for this would be on the mainland, where electricity and other necessities could be supplied without difficulty. The lagoon and reefs areas of the proposed park are unsuitable as grow-out sites because of the environmental problems that would be created, particularly in relation to contamination and nutrient enrichment from waste food and faeces.

5.4. SHORELINE AND LAND USE

There is no doubt that all the islands in the proposed Semporna Islands Park have been affected by human activities, and that there has been some loss of biodiversity. It appears that changes began at the end of the nineteenth century with the arrival of Bajau people from the Sulu islands. Cultivation and use of terrestrial resources had begun at least by the late 1880s, when settlements were established on many of the islands. This resulted in changes to the natural vegetation and decline in the population of certain useful species.

A study of 1948 aerial photographs of the area indicate that many **changes to the land** had occurred by this time (Sugau *et al.* 1998). Vegetation over the whole of Tetagan and nearly all of the gentler slopes of Boheydulong (right up to the base of the rock outcrops) was already largely or completely secondary or cultivated. On Bodgaya, the main disturbed areas were the northern part of the 'neck' portion of the island (secondary forest), the area surrounding Kg Lok Buahan on the western arm of the island (cultivated clearings), and the easternmost tip of the island just adjacent to Boheydulang (secondary vegetation). This past forest clearance was for cultivation (food crops and fruit trees) as well as for timber, which was used for building boats and settlements, including the large and elaborate offshore fishing traps known as *bungsud*.

Since 1948, there have been expansions and contractions of various settlements, and subsequent changes to the vegetation as indicated by more recent aerial photographs. Several new settlements have been established on the north coast of Bodgaya and significant areas are under cultivation (Figure 64). However, the status of Bodgaya as a Forest Reserve (1933 – 1977) has helped to reduce use of timber on this island.

The entire vegetation of Tetagan is either regenerating (i.e., secondary) forest or old fruit orchards, and on Boheydulang significant areas behind beaches and on the earth slopes are regenerating. The regenerating forest on the weathered volcanic slopes had a tree composition not significantly different from good, intact patches of the coastal mixed forest on Bodgaya island (Sugau *et al.* 1998).

There has been **selective use of terrestrial species** since people first arrived on the islands and this has evidently caused a decline in the population of useful species. It was evident during the 1998 survey that use of trees as a timber resource was no longer significant, possibly due to the scarcity of commercial timber species (Sugau *et al.* 1998). Illegal felling and encroachment appeared minimal, although there were obvious signs of trees felled for their timber. Species locally used for timber included *Hopea sangal, Hopea beccariana, Shorea guiso, Intsia bijuga* and *Canarium asperum*. Some mangrove, *Rhizophora apiculata*, was collected for firewood and poles.

There was evidence that these trees were cut down for local timber consumption, especially on Bodgaya (both on the southern and northern side of the island). The survey team encountered a site on Bodgaya where newly felled logs of *Intsia bijuga* have been cut into planks using a chainsaw. At another site, old fellings had marks that indicated the use of axes.

No one appears to hunt larger prey now, probably because animals of value are no longer present. This was also the situation in 1980, when Piper (1981) reported that the Bajaus did not hunt because there was nothing left to catch apart from monkeys.

Action needs to be taken to prevent any expansion of land-clearing activities, and ensure that use of terrestrial resources is regulated. Regeneration of natural vegetation on the islands should be encouraged, although it may take many years for disturbed patches of forest to recover their original structure.

5.5. WATER QUALITY AND WASTES

Initial surveys carried out by the Fisheries Department indicate that water quality around the islands is good (see 1.3). However, in the absence of historical records, it is not possible to say whether it is better or worse than in the past.

Substances that cause deterioration in water quality may come from various sources and result from both natural events and human activities. Although the islands and reefs of the proposed park are between about 10-20 km from the mainland, they are still well within the distance that could be affected by river plumes carrying pollutants and sediment. Semporna town and neighbouring coastal villages have experienced considerable population increases and urbanisation over recent years, so it is likely that river water has become more polluted. There have also been changes in land use which are likely to have increased run-off to the sea.

The effect of clearance of natural forest on the slopes of Bodgaya, Boheydulang and Tetagan is unknown. Interference with the watershed and exposure of topsoil may have increased the amount of sediment run-off into the lagoon and onto the outer reefs, but this has to remain as speculation. It is certain however that the lagoon in particular is very vulnerable to pollution because of the low levels of flushing (Figure 65).

Currently, there are no organised systems for the disposal of sewage and rubbish in the proposed park. Rubbish of all kinds also floats into the area from outside, ending up on beaches, or stranded on coral and amongst mangroves.

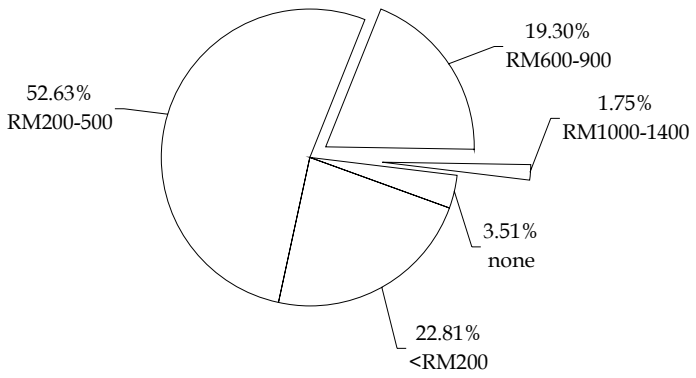
Beaches and mangrove close to the old pearl farm are unsightly from heaps of disused metal cages, floats and other rubbish. Elsewhere, both on Boheydulang and Bodgaya, there were accumulations of metal, plastic and styrofoam items in coves, especially behind some patches of mangroves. Some of these could well have been brought in by wave action but it also appears likely that a few of such sites were in fact dumping sites (Sugau *et al.* 1998).

It will be important to continue to monitor water quality in the proposed park, and to introduce schemes to deal with sewage and rubbish.

5.6. POVERTY AND LACK OF JOB OPPORTUNITIES

Potential and existing management issues include socio-economic as well as environmental ones. For example, one of the main reasons why marine resources are at a low level is that fishing has been the one of the few options open to people who need to feed their families and make a living. Introduction of seaweed farming has made a difference, but even so, currently more than 50% of the residents of the Semporna Islands are living below or just above Malaysia's poverty line (see Figure 59, taken from Komilus *et al.* 1999).

Figure 68. Income per family in the Semporna Islands



There has been a perception in the past that creation of a State Park incorporating the Semporna Islands and reefs would not bring any benefits to local people, but instead would deprive them of their current livelihoods. Alleviation of poverty and provision of alternative jobs will play as big a part in the success of the park as bringing in measures to conserve resources.