

Economic Activities

Fishing

The Malay economy revolves entirely around fishing, which is the major source of protein and provides most of the Malay family income. When water levels are high, fishing activity is at ebb and carried out for subsistence only. During the onset of the dry season (usually June), as water levels drop, fishing activity picks up, and when the lakes have almost dried out, fishing activity peaks and almost everyone is involved. Fishing practices include the use of a wide range of cast nets, gill nets, fixed nets, funnel nets, lift nets, traps, barriers, hooks-and-lines, and even excavated pits. Most fish are sun-dried and salted, as the remote location excludes the possibility of marketing fresh fish, with the exception of several high-value species. The latter include ornamentals, such as the Clown Loach and the Asian Arowana, but also highly prized food fish such as the Marbled Goby *Oxyeleotris marmorata* or ikan lemas, Sultan Fish *Leptobarbus hoevenii* or jelawat, Featherback *Chitala lopis* or belida and Giant Snakehead *Channa micropeltes* or toman. The latter three also form the basis for floating cage culture, whereby fish are fattened in captivity before being shipped to market. Certain catfish are processed as smoked fish, and these are mainly *Kryptopterus apogon*, known locally as *lais bemban*. Other fish products include fermented fish or buduk, fish crackers or kerupuk (for which mainly *C. lopis* is used), and fish eggs (mainly of Kissing Gouramy, *Helostoma temminckii* or biawan). The estimated total annual catch ranges from 7,800-13,000 tons, which is about 97.5-162.5 kg/ha, which is similar to that of the Mahakam Lakes in East Kalimantan (139 kg/ha) and that of Lake Tonle Sap in Cambodia (147 kg/ha). Each village has a head fisherman or ketua nelayan, who presides over fishing activities and assures that proper practices are adhered to in the villages' fishing area. Certain techniques are prohibited, such as the use of fixed bag nets (*jermal*) in certain areas, the use of fish poisons, and - strangely enough - the use of earthworms as bait.

The fishing industry is a valuable one. A large (50-60cm), reddish-golden colored Asian Arowana can sell for as much as several hundred US dollars in the lake area, and be worth more than US\$1,000.- (or even US\$ 5,000.-) by the time it is sold in Jakarta. Marbled Goby, valued locally at about US\$10 per kilogram, are shipped live, in oxygenated plastic bags, to markets in Singapore and Japan. Clown Loach are shipped the world over, as they are not bred successfully in captivity. The total value of the market is currently valued at about US\$ 2.2 million, but it should be noted that the Asian Arowana is now very scarce and barely contributes to the local economy.

Farming

Dayaks practice extensive shifting cultivation of dryland hill rice in swiddens called ladang. Rice is also the most important staple of the Malay, but most of this is obtained by purchase, as suitable areas in which to cultivate rice are very scarce in the Park area. The Malays practice some swidden agriculture, but this is limited to the upper levees of the main rivers in the basin, and crops other than rice are generally grown, such as cassava, maize, eggplant, cucumbers, beans and chili's. Increasingly, black or white pepper is becoming a widely cultivated crop, which is traded in Sarawak as an important source of cash income. About 4,500 hectares have been cleared altogether for ladang, which is about 3.5 percent of the Park.

Honey Harvesting

Honey is an important product at DSNP, and the honey industry dates back to at least the early 1800s. The industry is well-described by de Mol (1933), who reported that at that time, about 500 families collected honey and wax in the area, each family operating 40-150 tikung. Harvesting occurred mainly at the end of the wet season, or early dry season, by smoking the bees - migratory Asian Giant Bee *Apis dorsata* - out by means of a torch. Bees also make use of large boughs of trees, and such a natural honey tree is called lalau - which are also marked and 'owned' for a season by the person discovering the combs. The industry had withered somewhat over the past decades due to dwindling honey prices, but has picked up again due to promotion by UK-ITFMP. The total honey yield of the Park was estimated to be 20-25 tons in 1993, with almost one third of all families participating, having 10-500 tikung each. In 1993, the value of the industry was about US\$ 7000.- locally, but almost ten times this in Pontianak, the provincial capital. In villages where honey is collected in reasonably large amounts, regulations have existed for a long time, and in some villages a person specifically responsible for the honey (the ketua madu or ketua priyau) is appointed. Honey production declined dramatically again between 1997 and 2000 as migratory bees were driven away by smoke from the 1997 El Niño fires.

Timber Harvesting

Timber is in high demand in the Malay villages, for a wide range of uses, including housing, boat and canoe (*sampan*) construction, simple furniture, tikung, walkways, and floating cages. Although a wide range of timber species may be used, including a range of dipterocarp (*meranti*) species, the most desired timber species is *Fagraea fragrans* (*Loganiaceae*), known locally as *tembesu*, which produces a very durable, high quality timber that is very resistant to rot and termites. Harvesting is restricted to periods of high water, to facilitate transport of the timber, and usually carried out

in October-December, in the lull period following the fishing season. As a general rule, the intensity of logging is inversely proportional to the intensity of fishing. Generally, harvesting of timber in the area governed by a particular village (i.e. the wilayah kerja, or utilization area) is controlled by the village head or head fisherman ketua nelayan. Villagers may harvest freely for themselves, provided that it is for their own use, while permission is granted to outsiders, provided that they follow protocol (i.e. ask permission), and harvest for their own use rather than for commercial purposes.

Non-Timber Forest Product Harvesting

Malays harvest a wide variety of non-timber forest products in the Park's swamp forests, and in addition to honey, the most important are three species of rattan (cane): duri antu (*Calamus schistoacanthus*), duri tapah (*Calamus tapa*) and duri pelanduk (*Ceratolobus hallierianus*). One person can harvest up to 150 canes on a good day, and from 3,000 - 5,000 per year, depending on market conditions and the flooding cycle. Locally, rattan is used for tying and bundling, and most importantly, for the construction of fish traps and barriers. Commercially, rattan is usually sold in bundles of 50 canes, sold for about US\$ 1.00 (1994 rate). Women and children are generally the most important rattan collectors in a community.

The Malays extract many other products from the swamp forests and lakes of the Park, including many fruit, vegetables, timber, herbal medicines and plant dyes. Over the years the inhabitants of the lake area have discovered uses for such a variety of plants, that there are few species that are not found to be useful in one form or other. Giesen (1987) recorded that, for a total of 207 plant species, 81 percent were put to use by local communities, being either consumed directly as fruit or vegetable (30%), used for construction (27%), medicine (6%) or other household uses such as dyes, rope, weaving, household appliances, glues and insect repellent (18%). Plants used as firewood only totaled a mere three percent, and numerous plants have multiple uses. Malays hunt Sambar Deer *Cervus unicolor*, but are restricted by religious beliefs from hunting other wildlife.

Percentage*	Use of plants at DSNP				Type of use		Number of plant species	
	Eaten by wildlife	Human consumption (fruit, vegetable)	Medicine	Firewood only	Construction	No known		
(household use, glues, rope, weaving, dyes)	106	51	27	18	62	30	6	3

Adapted from Giesen (1987), who listed 207 plant species in his inventory of DSNP.

* More than 100% because one species may have more than one use.

Hunting

Iban Dayak hunt a variety of wildlife within and near the Park, including turtles and tortoises, Reticulated Python *Python reticulatus*, Bearded Pig *Sus barbatus*, Sambar Deer, Malayan Sun Bear *Helarctos malayanus*, Orangutan, and numerous bird species. Turtles and tortoises are generally hunted in the dry season, and a large proportion of the catch - an estimated 50 tons - is traded live in Sarawak. Crocodiles - especially *Crocodylus porosus* - were formerly hunted as well, but populations are now so low that they are rarely hunted nowadays. Nests of the Edible-nest Swiftlet *Collocalia fuciphaga* and Black-nest Swiftlet *Collocalia maxima* are harvested from a number of caves located in the sandstone ridges in the southeastern part of the Park. These are marketed in Chinese communities in West Kalimantan and in Sarawak.

Economic Benefits

Many of the benefits derived from the DSNP cannot be directly expressed in monetary terms. The lake basin plays several very important functions, such as buffering Kapuas River waters (flood prevention, maintenance of river transport and water supplies), and providing a habitat for many species of fish, reptiles and other wildlife. The lakes of the Park have a strong effect on the flow of the Kapuas River. In the dry season, up to 50 percent of upper Kapuas River discharge may consist of lake water, while in the wet season, up to 25 percent of peak flow is absorbed by the lakes. Also, most of the extracted resources are for local subsistence, and do not enter the market economy. Extracted resources that do enter the market economy were valued at about US\$ 2.6 million in 1996, while direct (unmarketed) domestic benefits were estimated to be about US\$ 16 million.

Natural Resource				Monetary benefits derived from extracted resources				
Rupiah	US \$	Lake and river fishing						
796,460	Ornamental fish	505,000,000	223,451	Wood	356,085,000	157,560	Fish cages	1,800,000
60,575	Turtles and tortoises	56,000,000	24,779	Rattan	54,800,000	24,248	Edible swiftlet nests	
22,124	TOTAL	5,864,585,000	2,594,949				Honey and beeswax	

Adapted from Aglionby (1997)