Chiew Larn Dam Wildlife Rescue Operation

Seub Nakhasathien

The Chiew Larn Dam, Thailand's thirteenth, was completed in 1986 and the resulting flooding will destroy 165 sq km of the country's largest remaining area of lowland evergreen rain forest. For the first time ever in Thailand a rescue operation was carried out to try to save some of the wildlife, which includes threatened and endangered species, stranded on islands as the waters rose. In 18 months 1364 animals of 116 species were captured, but 44 died soon after. The survivors were released into protected areas nearby. The operation can be judged successful in some ways, but there were many shortcomings. The author, who was Field Director of the rescue operation, argues that even if these could be remedied in future similar projects, a wildlife rescue operation cannot compensate in any way for the loss of important wildlife habitat.

The Chiew Larn Dam was the thirteenth hydroelectric dam to be built in Thailand and the fifth largest such project undertaken to date by the Electricity Generating Authority of Thailand (EGAT). Construction of the dam was approved by the Cabinet in February 1981 with the proviso that plans should first be drawn up to mitigate its most serious environmental impacts (as required by a Cabinet ruling, 18 April 1978). Eleven such plans were submitted, incorporating fisheries, wildlife rescue, commercial logging, forest clearance, forest and watershed protection, village resettlement, archaeological sites, salinity control, soil quality control, prevention of waterborne diseases and monitoring environmental changes. In October 1981 the project was given the final go-ahead.

The Chiew Larn Dam is located in Surat Thani province, southern Thailand (Figure 1). The dam blocks the Khlong Saeng River and has so far inundated 130 sq km of lowland rain forest, thereby bisecting the largest remaining area of this type of forest in Thailand (Conservation Monitoring Centre for Thailand, pers. comm.). It will eventually inundate 165 sq km.

An environmental impact assessment survey was carried out for EGAT in 1979 by Team Consulting Engineers Co. Ltd. The report (EGAT, 1980) maintains that 122 animal species (38 mammals, 69 birds, 11 reptiles, 4 amphibians) occurred within and around the reservoir area. However, a Royal Forest Department survey of the same area, carried out in 1984 (Nakhasathien, 1984), found a total of 237 species (47 mammals, 162 birds, 21 reptiles, 7 amphibians). This survey was not primarily concerned with wildlife at all, but with establishing what measures should be taken to protect the surrounding forests following the dam's construction.

The region is very hilly, ranging from below 20 m to over 1300 m. The area is characterized by a north–south belt of near-vertical limestone peaks intersected by steep valleys and small pockets of level land. For this reason, the level of the reservoir rose quickly and the stretches of water separating the islands from the mainland rapidly became too deep for many animals to venture across.

The Chiew Larn Reservoir began to fill in April 1986 and in 9 months the water level had risen from 13.5 m to 77 m above mean sea level (amsl). When the water reached 40 m amsl in mid-May, the first island appeared. By the time it reached 60 m in August, that one submerged and

Islands were searched for animals as they formed, starting with the smallest. Most of the 241 islands created by the Chiew Larn Reservoir were smaller than 200 sq m (*S. Nakhasathien*).

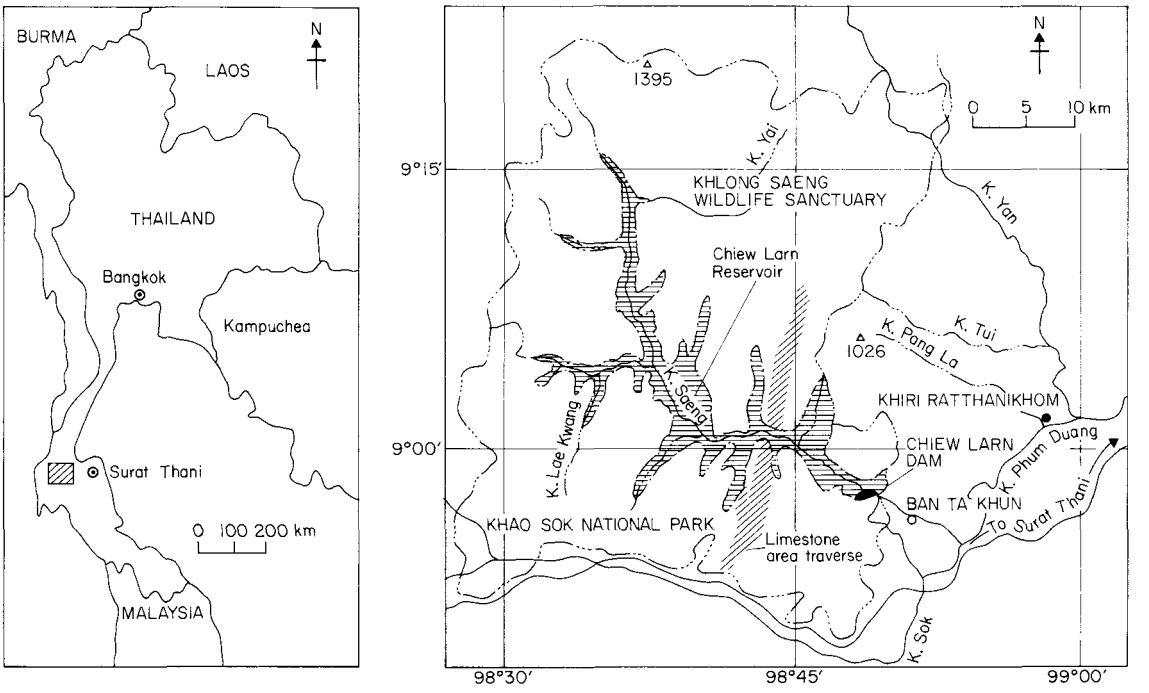


Figure 1. Location map of Chiew Larn Dam Project.

https://doi.org/10.1017/S0030605300022870 Published online by Cambridge University Press

23 more had formed. By December, the end of the rainy season, those too had been replaced by 55 new ones.

The reservoir was planned to rise to a maximum storage level of 95 m amsl and to have an annual draw-down of 33 m. When that happens the present 55 islands will also submerge and 162 permanent ones will be left in their stead, covering an area of 14.06 sq km. The six largest of these will range in size from 0.74 to 1.28 sq km. However, by December 1987 the water had risen no higher than 78.8 m and in September 1988 it had fallen to 73 m.

The purpose of the animal rescue operation was to minimize the most immediate impact of the Chiew Larn Dam on local wildlife. The aim of this paper is to present the results of the project and to discuss whether the operation was successful and whether any wildlife rescue operation has a role to play in nature conservation.

The rescue operation: methods

Although planning for the wildlife rescue operation began in January 1985, rescue work did not begin until April 1986 when the author was assigned to the project. Thereafter, it continued without a break until September 1987 when the Chiew Larn Dam Project was formally closed. There were 21 people in the rescue team: 5 officers and 6 staff rangers of the Wildlife Conservation Division (Royal Forest Department) and 10 local workers. None of the team had previous experience of rescuing wildlife and none was a veterinarian.

As islands formed they were searched for stranded animals, starting with the smallest because these would be submerged or run out of food first. Rescue work was carried out both by day and night using two motor boats (11m × 1.7 m).

The species rescued included mammals, birds and reptiles. Amphibians were rescued only when encountered by chance, because systematically searching for them would have taken up too much time. Nocturnal animals (including serow,* slow loris, lemurs and civets) were sought at night using a spotlight and light-intensifying binoculars, but when possible were not captured until the following day. Animals were released as quickly as possible after capture into Khlong Saeng Wildlife Sanctuary or Khao Sok National Park, which surround the reservoir, but if any appeared weak or sickly they were put under supervision at the project's raft headquarters. Rare species (specifically serow, clouded leopard, greater mouse deer and binturong) that survived were appropriated by the Wildlife Conservation Division for its captive-breeding programme (Nakhasathien, 1987a).

Several methods were used to catch the animals, depending on the species. They included using hands, box traps, live snares, loop nets, drop nets, mist nets and snake sticks. The larger mammals (serow, clouded leopard, barking deer), whether caught by box trap, net or snare, were given a moderate dose (about 0.08 ml per kg body weight) of Vetranquil (acepromazine maleate) tranquillizer immediately following capture and given an amphetamine antidote just before release.

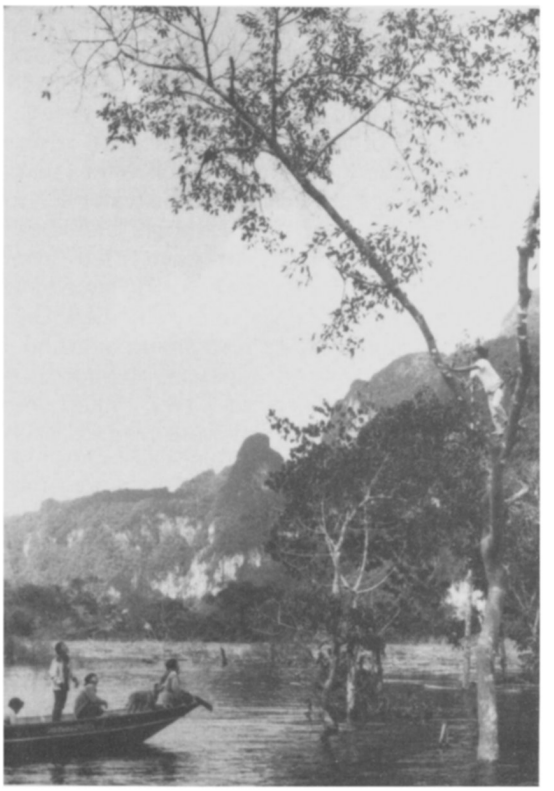
The time needed to catch each animal or clear one island varied greatly and depended on the size, topography and vegetation of the island, the species and the nutritional status of the animal and the weather. Quite often it took several days to catch a single individual, particularly with the larger mammals.

The outcome

Over a period of 18 months, from April 1986 to September 1987, 1364 animals of 116 species (37 mammals, 30 birds and 49 reptiles) were rescued (Table 1) from 79 islands covering a total area of 2.55 sq km, which formed as the water level rose from 13.5 m to 77 m amsl. Of the 1364 animals rescued, 44 (3.2 per cent), of 12 species, died following capture and a further 40, of 13 species, were found already dead (Tables 1 and 2). Deaths occurred in 19 species altogether; all but two of the deaths were of mammals, including 100 per cent mortality for serow and greater mouse deer, two of Thailand's rarest species.

Twenty-three of the 116 species rescued are classified as endangered or threatened (Table 3). Storm's stork *Ciconia stormi* was found for the

*Scientific names are give in Table 3.



The rescue team prepares to catch a black giant squirrel *Ratufa bicolor* stranded in the top of a water-bound tree. Many arboreal animals were found in a similar predicament (*S. Nakhasathien*).

first time in Thailand (Nakhasathien, 1987b) but its only known habitat has now disappeared under the Chiew Larn Reservoir. It should be noted, also, that although the greater mouse deer is not officially classified as a threatened species, it is nonetheless extremely rare in Thailand, both in the wild and in captivity.

Table 1. Number of species and individuals captured and number of deaths during the Chiew Larn Wildlife Rescue Operation

	No. species	No. individuals	Deaths 1*	2	3
Mammals	37	586	42	10	30
Birds	30	58	2	—	—
Reptiles	49	720	—	—	
Totals	116	1364	44†	10‡	30‡

*(1) Died following capture and before being released. Causes: stress, injury, fever, malnutrition, blocked gut, exhaustion or caught in trap. (2) Found dead from starvation or wounds, or killed by predators or poachers. (3) Found drowned.
†Figure included in total number of animals captured.
‡Figure not included in total number of animals captured.

In the course of 18 months, the Wildlife Rescue Operation came across a total of 316 species of mammals, birds and reptiles (61, 193 and 62, respectively) in the reservoir area. Thus the survey for EGAT (1980), which listed 122 species, was found to be 64 per cent deficient and the Royal Forest Department survey, which listed 237 species, was 30 per cent deficient. Furthermore, in capturing animals from 116 out of 316 species, the Wildlife Rescue Operation helped only 36.7 per cent of the mammal, bird and reptile species known to occur in the reservoir area (61 per cent of mammals, 16 per cent of birds and 79 per cent of reptiles).

Causes of death

Most animals were released soon after capture, but some were judged too weak or sickly to release straightaway. These were cared for as long

Table 2. Animals that died after capture, or were found dead, compared with the total number of animals caught for each of those species

English name	No. caught	Deaths after capture	Found dead
Serow*	7	7	—
Sambar deer	1	1	—
Barking deer	4	2	1
Greater mouse deer	6	6	—
Lesser mouse deer†	172	13	7
Tapir*	—	—	1
Common palm civet	9	1	2
Dusky langur	115	8	10
Banded langur	7	—	3
Pig-tailed macaque†	4	—	1
White-handed gibbon	17	—	2
Slow loris	9	—	5
Malayan pangolin†	10	—	1
Malayan porcupine	14	1	2
Ground squirrel	1	—	1
Red-cheeked flying squirrel	1	1	—
Grey-bellied flying squirrel	115	2	4
Chestnut-breasted malkoha	1	1	—
Green broadbill	1	1	—
Total	494	44	40

(Bain and Humphrey, 1982; IUCN, 1974).
*Endangered; †threatened.

as seemed necessary, but most were released within the next few days. Nevertheless, 41 mammals and 2 birds died in care. One porcupine died after being caught in a snare set for a serow.

The Wildlife Rescue Project had no veterinarian on the team, but the local provincial vet carried out a few post-mortems when time permitted. Even so, the direct cause of death often remained a mystery. All seven serow appeared to die from the combined effects of stress, exhaustion and malnutrition. One was pregnant. A pregnant greater mouse deer died from shock within 15 minutes of capture, but the other five died after 5–15 days for no apparent reason. The same was true of all the lesser mouse deer; they all ate well and appeared healthy except for a few minor wounds, but post-mortems revealed that 4 had bled internally and the others were thought to have died of tetanus. The sambar deer was found floundering in the reservoir after falling from a ledge about 70 m above the water. It had multiple fractures and died 12 hours later. Both barking deer appeared to have died from wounds incurred during capture; one gave birth to a still-born fawn 2 days before she died. One of the dusky langurs died from pneumonia and a congested gut. The rest appeared to have died from combined effects of stress, injury and malnutrition. Most of them were rescued from

Table 3. Numbers of endangered and threatened species caught during the Chiew Larn Wildlife Rescue Operation

English name	Status	Scientific name	No.
Pig-tailed macaque	T	*Macaca nemestrina*	4
Stump-tailed macaque	T	*M. arctoides*	1
Crab-eating macaque	T	*M. fascicularis*	8
Banded langur	T	*Presbytis melalophos*	7
Dusky langur	T	*P. obscura*	115
White-handed gibbon	E	*Hylobates lar*	17
Malayan pangolin	T	*Manis javanicus*	10
Black giant squirrel	T	*Ratufa bicolor*	5
Lesser giant flying squirrel*	T	*Petaurista elegans*	1
Large black flying squirrel*	T	*Aeromys tephromelas*	1
Asiatic black bear	T	*Selenarctos tibetanus*	1
Binturong*	T	*Arctictis binturong*	1
Clouded leopard*	E	*Neofelis nebulosa*	1
Serow*	E	*Capricornis sumatraensis*	7
		Total rare mammals =	179
		Total mammals caught =	586
		Per cent =	31
Storm's stork*	T	*Ciconia stormi*	2
Rail-babbler*	T	*Eupetes macrocerus*	1
		Total rare birds =	3
		Total birds caught =	58
		Per cent =	5
Spiny hill turtle*	T	*Heosemys spinosa*	32
Common flying gecko*	T	*Ptychozoon lionatum*	18
Brown spiny lizard*	T	*Acanthosaura armata*	8
Black jungle monitor*	T	*Varanus rudicollis*	3
Yellow tree monitor	T	*V. bengalensis*	18
Blood python*	T	*Python curtus*	1
Rat snake*	T	*Ptyas korros*	2
		Total rare reptiles	82
		Total caught	720
		Per cent	11

T = Threatened; E = Endangered (Bain and Humphrey, 1982; IUCN 1974, 1979a, 1979b).
*Species not included in EGAT (1980).

the bare branches of stranded trees after several days without food or protection from the sun and rain.

Of the 40 animals found dead, most of the primates were hanging from the branches of leafless, drowning trees. Others were found to have bullet wounds or were floating in the water. The tapir was killed by poachers and the barking deer by the clouded leopard that was subsequently captured. Most of the lesser mouse deer drowned, the rest were killed by predators. The civets, porcupines and a pangolin were all found dead on the islands from unknown causes. It is certain that the rescue team came across only a fraction of the total number of animals that died from starvation, drowning, poaching and associated causes.

Practical problems

The Wildlife Rescue Operation was hampered by a number of factors. Some of these were unavoidable, such as the steep and rugged terrain of some of the islands, the dense vegetation, the 9 months of rain and the leeches and mosquitoes. Others could have been avoided and mention of them here may help the planning of future rescue operations.

1. Because the two preliminary surveys had not identified all the species occurring, the rescue team was inadequately prepared for dealing with some of the species encountered. Altogether, 101 species were encountered unexpectedly, including the clouded leopard.
2. The rescue team did not include a veterinarian or anyone who had worked before on a rescue operation. Inevitably, mistakes were made, which might have been avoided had there been someone with previous experience of the problems encountered.
3. There were no proper facilities for keeping any of the animals in captivity, either in the short or long term. The small animals kept for only a day or two were held in make-shift cages on the project raft. The rest were taken on a half-day journey by boat and truck to the local wildlife centre. It is probable that some animals died unnecessarily because of this.
4. By February 1987 almost 300 villagers had settled in the reservoir. The frequent sound of chain-saws, motor boats, firearms and voices made the stranded animals increasingly wary and rescue work more and more difficult.
5. The rescue project had no communication equipment and this was often a problem when two teams were working an island simultaneously and needed to co-ordinate their movements.
6. The field operation might have been better prepared had a senior member of the rescue team been able to take part in the early decision-making process. As it was, the rescue team was assigned to the task well after the plans had been fixed by people not required to execute them. Many of these plans had not been well thought out.

Seven serow *Capricornis sumatraensis* were found trapped on small cliff faces and were in poor physical condition when caught. All seven died (*S. Nakhasathien*).

Conclusion

Do the results of this operation — 1364 animals rescued, 96.8 per cent of these being released on

A dusky langur *Presbytis obscura* clings to bamboo only inches above the water as rescuers try to prize it free (*S. Nakhasthien*).

land on either side of the reservoir, and one clouded leopard and one binturong being taken into captivity for breeding programmes — mean that it could be labelled an unqualified success? The answer must be 'no', for several reasons.

More than three-quarters of the 44 animals that died as a direct result of the rescue operation were of threatened or endangered species — animals that Thailand can least afford to lose. The rarest of these, serow and greater mouse deer, suffered 100 per cent mortality.

Neither of the two surveys carried out in the area attempted to discover the population densities of the species occurring there. As a result, it is impossible to estimate what proportion of the animals affected by the reservoir were helped by the rescue operation. It is possible that the teams encountered only a fraction of the total number of animals disrupted by the flooding and that a far larger number either escaped the rising water unaided or died undetected.

Animals were not monitored in any way after being released, so it is not known how many survived the relocation. It is probable, however, that mortality rates were high for most species involved because of the following factors. The habitat into which the animals were released — hilly, dissected by a range of limestone peaks interspersed with isolated pockets of level land — differs from that in the river valley, which was a single large area of level, lowland evergreen forest. This habitat is likely to have been either unsuitable or at least sub-optimal for many of the animals released there. Although the habitat may have been suitable for others, it may have been already occupied by individuals of the same species. In competition for food or territory, the arrivals would have been at a disadvantage, being in unfamiliar territory and already weakened by hunger and stress. Many will have died from injury or infections exacerbated by malnutrition.

Only a fraction (15.4 per cent or 2.55 sq km) of the total island area (16.61 sq km) could be worked in the 18 months allocated. This is partly because it takes time to catch frightened wild animals and partly because some of the islands were still too large to cover effectively. When the water level rises to the planned maximum level, these islands will become smaller and a rescue operation would then be feasible. By October 1988

A dusky langur *Presbytis obscura* and a pig-tailed macaque *Macaca nemestrina* share a cage on the raft headquarters of the Wildlife Rescue Operation. Many animals were kept in care for a few days to allow superficial injuries to heal (*S. Nakhasathien*).

plans were under way to monitor and, if necessary, rescue animals found on these islands. Some of the animals released will be fitted with radio-collars to enable their movements to be monitored.

The operation was undertaken in an attempt to mitigate the damage the dam would do to the wildlife living in the flood zone. The most serious consequence of the dam, however, was the loss of the largest remaining area of lowland, evergreen forest in Thailand. No rescue operation could compensate for the long-term impact of such a loss. Wildlife rescue operations, therefore, cannot be considered as strategy for nature conservation. They can only attempt to alleviate the most immediate and, from a conservation point of view, the most minor consequence of a hydro-electric project.

Even recognizing its limited scope, the Chiew Larn Rescue Operation was too incomplete to be considered a truly successful project. The preparatory surveys were inadequate, the time allowed for rescuing animals was too short and there was no provision for monitoring animals after they had been released. If future wildlife rescues were to correct these failings they could make some contribution to nature conservation by providing information on the adaptability and ecological requirements of some of the affected area's native species.

Recommendations

It is felt that future wildlife rescue operations that are carried out as part of a hydro-electric project should include the following elements:

1. A comprehensive survey of the area to be inundated and the area into which animals will be

The raft headquarters of the Wildlife Rescue Operation, including the cages for housing sick or injured animals (*S. Nakhasathien*).

released. This survey should not only establish what species occur in the two areas, but should also attempt to estimate the population density and distribution of each. This data would enable adequate preparations to be made to catch and, if necessary, accommodate animals of each species. It would also help determine whether the proposed release site is the right habitat or has sufficient space for extra animals of any given species — the large mammals in particular. It would also help in estimating what proportion of animals occurring in the flood zone were helped, or encountered by, the rescue team.

2. Sufficient time to complete the rescue work, or a larger team, whichever is the more feasible. More time may be more important than a larger team if, as in the Chiew Larn case, the reservoir fails to rise to the maximum predicted level for a year or more and some of the islands remain too large to work effectively in the first year of flooding.

3. A radio-communication system to link the two rescue teams, which have to work in collaboration on either side of an island, with each other and with their field base.

4. A full-time veterinarian with experience of wild species.

5. A simultaneous project to monitor, by radio-tracking and tagging, the survival rates of the released animals. This should be continued for at least a year, or for as long as is useful or feasible. Animals that do not survive are likely to die within days or weeks rather than months, but others may fail to adjust well enough to breed.

6. A follow-up project to monitor the animals remaining on islands too large to clear. In the short term these may run out of food, especially in the dry season, but even if this does not happen the animals may over-exploit the resources in the long term if numbers increase. The populations may also suffer from inbreeding.

In addition it is strongly recommended that all logging work be completed by the time the reservoir begins to fill. Officially, in Thailand, this should happen in any case. In practice it seldom does. At Chiew Larn logging will continue well into 1989 even though the reservoir began to fill in April 1986. This not only makes it impossible to prevent illegal logging and poaching, but it is also very disruptive to a wildlife rescue operation. It is also recommended, for the same reasons, that if villagers are to be allowed to move into the reservoir to live by fishing, they should be required to settle in one or two restricted areas only. At Chiew Larn house-rafts are tucked away all round the several-hundred-km perimeter of the reservoir and it is proving impossible to stop the settlers poaching in the adjacent forest.

Acknowledgments

I would like to thank Belinda Stewart Cox for helping me with the presentation of this manuscript and Dr Alan Rabinowitz for reviewing it and suggesting improvements.

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Postscript

In January 1989 the Electricity Generating Authority of Thailand gave the Forestry Department 2.4 million baht for a second wildlife rescue operation in Chiew Larn Dam. Seub Nakhasathien is leading five wildlife officials in an 18-month operation covering 16.61 sq km of 162 islands in the 165-sq km reservoir. Some animals will be left on the islands, providing adequate habitat is available. There are plans for further evaluation of the impact of the dam on forestry and wildlife, and for developing the area for tourism.