Fish Kills at Khone Falls in the Dry Season of 2016

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Contents

Figures

Tables

Appendices

Abbreviations and Acronyms

DAFO	District Agriculture and Forestry Office
DSFMC	Don Sahong Fisheries Management Committee; the organisation charged with implementing the Fisheries Law of 2009 in the Don Sahong project area; it comprises provincial and district representatives of the responsible government agencies, as well as village-level representatives, with some funding support provided by DSPC.
DSFMP	Don Sahong Fisheries Management Plan
DSHP	Don Sahong Hydropower Project
DSPC	Don Sahong Power Company Ltd
GOL	Government of Lao PDR
ESMO	Environmental and Social Management Office
ESMMP	Environmental and Social Management and Monitoring Plan
FishMAP	Fisheries Monitoring and Action Plan (of DSPC)
GOL	Government of Lao People's Democratic Republic
IRN	International Rivers Network
MFCB	Mega First Corporation Berhad
MONRE	Ministry of Natural Resources and Environment of Lao PDR
MRC	Mekong River Commission
PAFO	Provincial Agriculture and Forestry Office
UXO	Unexploded Ordinance

Glossary of some Lao words for geographical features

Ban	Village
Don	Island
Haew	Large falls where it is too fast and dangerous to go fishing
Hang	Tail or downstream tip of an island
Hou	River Channel
Hua	Head or upstream tip of an island
Khone	A waterfall of cascade where it is possible to go fishing and where fish may pass upstream at times
Taat	Rapids

1. Summary

An investigation by staff of Don Sahong Power Company (DSPC) during May and June of 2016 was prompted by reports of dead fish downstream of Khone Falls near the border with Cambodia, and suggestions that the fish deaths were caused by the Don Sahong Hydropower Project (DSHP). The investigation aimed to determine the extent of the problem and its likely cause(s) and to recommend follow-up actions, and included interviews of fishermen, village chiefs and government staff, and some follow-up inspection in the field.

The investigation confirmed that many dead fish were seen in the river at several places at Khone Falls during the 2016 dry season (January to June) in much larger numbers than in any previous year. All people who were interviewed believe the fish to have been killed by destructive fishing, including use of explosives, poisons and electrofishers. These methods are used in the dry season when the water is clear enough to see fish. The three main destructive fishing areas are (1) along the border with Cambodia in the main Mekong channel opposite the DSHP from the dolphin pool up to Tam Eedeng Falls; (2) Phapheng Channel between the new access bridge and the falls; (3) near Don Tan, an island upstream of Khone Falls. There are no DSPC project activities that could directly result in dead fish at these locations, and no likely natural causes for such fish kills, whereas destructive fishing is an entirely plausible explanation for the fish kills.

Destructive fishing is increasing mainly because of strong demand in the dry season from fish traders, who finance and provide people with the equipment to kill fish. Most of the large high-value fish are trucked to Pakse and many are sold in Vientiane and in Thailand. Destructive fishing is relatively quick and efficient compared to legal methods, so once some people start to do it others tend to join in as they feel disadvantaged. According to interviewed fishers, the apparent increase in destructive fishing in the 2016 dry season is not directly related to the dam construction, but increased road access for outsiders may have exacerbated the increasing trend.

Destructive fishing kills or injures many fish which are not collected and which may then float downstream. Most of the dead fish seen in 2016 appeared to originate from use of rice laced with insecticide, which is fed to fish where they can be seen feeding, primarily targeting medium-sized cyprinids (carps). This is a relatively new method that is dangerous to the users and anybody eating the fish. Some people have reportedly become sick or died in Cambodia after eating poisoned fish. The main poisons are highly toxic carbamate insecticides, which are openly and illegally sold in local villages. Fishing with explosives is indiscriminate, but mainly targets large valuable fish in deep water and is believed by Lao fishermen at Khone Falls to be only or mainly carried out by Cambodians who have particular expertise. One expert Lao fisherman believed that most of the fish sold at Khone Falls in 2016 were illegally caught, and 70% of those were from explosive fishing. It was rumoured that some of the explosives used in 2016 may have been stolen from the DSHP, but investigation has found no evidence. It should be noted that storage, handling and control of explosives at the project are subject to stringent controls. It is possible that the perpetrators may have created false stories to hide the actual sources, as there are other sources of explosives in Laos and many people know how to make them. For example, some Laotians were reportedly killed or injured recently while using explosives for fishing near Pakse. Electrofishers are made and sold locally in Nakasang, and many fishermen have used them, although in 2016 there was little specific information on their use.

Destructive fishing is carried out by Lao and Cambodian fishermen on both sides of the border and sometimes acting collaboratively in Laos. Fishermen from each country have been arrested and fined and their gear confiscated on both sides of the border for using these methods, but in Laos most of the perpetrators caught recently have been upstream of the falls, where they are more likely to be seen and reported.

To reduce the use of destructive methods, we recommend improved education, inspection and enforcement by the Don Sahong Fisheries Management Committee (DSFMC) to begin well before the 2017 dry season, when these activities are likely to recur. The committee during 2016 demonstrated its ability to act effectively by destroying large illegal gears, so with ongoing support it should also be able to reduce the incidence of destructive fishing. Inspection and enforcement should focus on the three main fishing areas identified, especially the two areas downstream of the falls. The committee also needs to work with the agencies responsible for controlling the sale of explosives, electrical equipment and poisons, and should inform the Ministry of Health to educate people on health risks, and should provide materials to schools and temples so they can educate people not to use these methods and not to buy fish caught using these methods.

Aside from its ongoing support to the DSFMC, the company also needs to communicate clearly with its staff and contractors on their obligations to restrict access to explosives and to not engage in or abet other illegal activities including destructive fishing, and to report any offenders to the police.

The company also needs to improve its communications with local people and internal reporting of significant issues as they arise so they can be addressed effectively.

2. Introduction

The Don Sahong Hydropower Project (DSHP) is being constructed from 2016 to 2019 by the Don Sahong Hydropower Company (DSPC) at Khone Falls in southern Lao PDR, as indicated in Figure 1. The project entails damming the Sahong Channel, which is one of seven main anabranches of the Mekong River (Figure 2). Fisheries monitoring has been carried out by the (DSPC) since 2009, and further background information on the project and fisheries can be found in reports on dshpp.com.

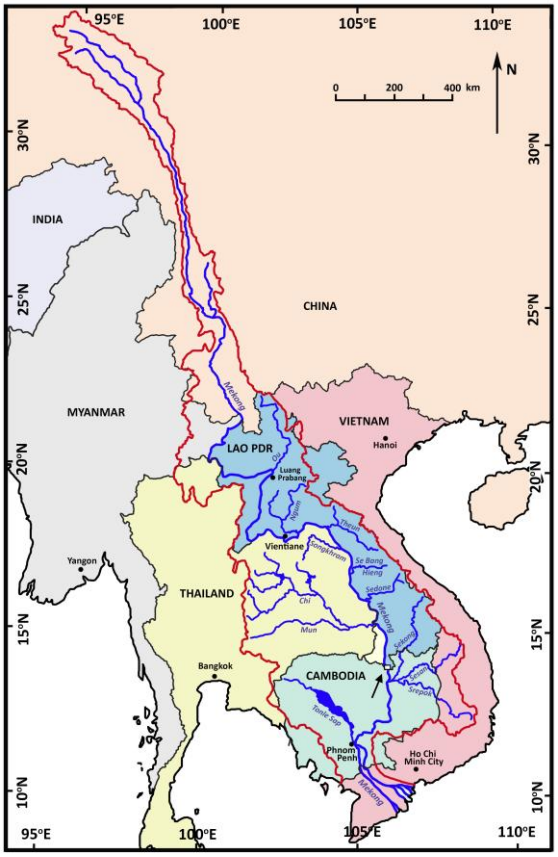

Figure 1 **Location of the Don Sahong Hydropower Project, indicated by the arrow**

This report briefly summarises observations of dead fish and destructive fishing at Khone Falls in the 2016 dry season, examines the likely cause(s) and recommends follow-up actions. It is based on interviews of fishermen, village chiefs and government staff, some follow-up inspection in the field, and review of some published information.

An investigation by DSPC began after receipt on 29 April 2016 of a report by IRN (International Rivers Network) which stated that dead fish had been observed near 'Preah Romkel village[1]' in Cambodia (Appendix 1), which is the main village where tourists go to observe dolphins from the Cambodian side; it is located on the west bank of the dolphin pool (Anlung Cheuteal[2]) opposite the DSHP dam site (Map 1). In Cambodia, tourists usually go to Ou Svay Village on the east bank of the Mekong, from where they can take a boat across several Mekong channels to get to Preah Rumkel village (see maps in Appendix 1).

[1] Preah Rumkel is actually a commune, with one main village.
[2] Anlung means deep pool.

The fish deaths are mentioned in the IRN article in the first two paragraphs and then the third paragraph asserts that the villagers face the threat of the Don Sahong dam. The article does not state there is any direct link between the dead fish and the dam construction, but conflating the two items is effective in creating an association in the minds of readers. The date of the fish deaths is not mentioned, but as the article notes the dam-site work began in January 2016, it seems that the fish deaths refer to the period January to April 2016.

The issue of fish deaths was covered in several later regional news items (e.g. Appendix 2) that also mention the Don Sahong dam, but some also mention poisoning as a possible cause. Some of these items mention people and even cattle dying downstream in Cambodia, again conflating these reports with the coincident construction of the Don Sahong Dam upstream. It has reportedly been a very hot dry season in 2016 in most of the Mekong basin including Cambodia, and as well as weather conditions and low river levels, various other developments such as logging, sawmills, plantations, and construction of other dams (including the lower Sesan 2 dam) could be having various effects which might cause sickness or death to people and animals.

At the time of the IRN report there had been no verbal advice about significant numbers of dead fish to DSPC site staff, despite holding weekly meetings with 15 fishers. However use of destructive fishing methods (explosives, electrofishing, and poisoning) is well-known from the Mekong system (Roberts, 1993; Deap et al., 2003), and anywhere these methods are used there is a likelihood of dead fish being seen downstream of where the fishing occurred. Destructive fishing refers to illegal methods that kill non-target species and may otherwise damage the environment. Although other 'conventional' methods may also be illegal (for example use of lee traps and luang khang), the indiscriminate and wasteful nature of destructive fishing is of particular concern for sustainable fisheries management. People generally know that destructive fishing methods are illegal and disapproved of by many people in all Mekong basin countries, so they tend to use them in places which are not highly accessible where they will not be easily discovered. They may also operate at night (especially when electrofishing) and they may involve rich people, police, military or other government officials, so that other people are afraid to interfere or report on the activities. Hence, although widespread, illegal fishing methods are not well-documented and enforcement is poor.

The Deputy Minister of the Lao Ministry of Agriculture and Forestry (MAF), Dr Bounkhuang Khambounheuang, while referring to the Fisheries Law of 2009 recently stated: "*I acknowledge that the enforcement of our law is weak, causing people to carry out destructive forms of catching aquatic life, notably fish by using explosives and electric shocks."* (Vientiane Times, 17 June 2016). An anonymous official of the Lao Dept of Livestock and Fisheries noted there had been *"a rapid decline in fish stocks throughout the country with overfishing, especially through the use of explosives and electrofishing, considered to be the major cause".* (Vientiane Times, 23 June 2016).

After publication of the IRN story, a report was received from the Fisheries Administration of Cambodia which detailed the results of an investigation into fish deaths near the Lao-Cambodia border just downstream of Khone Falls (Phay et al., 2016). That study's team collected 17 species of fish which were found dead or dying, floating in the river along the Lao-Cambodia border (Map 1) over the period 3 to 6 May 2016, and they noted that some Lao fishers had been arrested as they

were fishing with poisoned rice, and they were sent to the Cambodian Stung Treng Provincial Court on 22 April 2016.

Phay et al. (2016) also interviewed 42 villagers (34 men and 8 women, of whom 39 regularly go fishing). Some of the survey's questions are leading, inviting people to speculate on causes of low water or algal growth) or the stage of the DSPC project completion or its secondary effects so cannot be considered reliable. But questions regarding fishing and observations of fish should elicit more reliable opinions based on actual field observations, given that most of the respondents were fishers.

Among those 'worthwhile' responses:

- 42 people (100%) reported that use of poisonous bait by Lao fishers was the main cause of the recent observations of dead fish in large quantities in the transboundary area; the fish were reported to be killed by poisoned rice or a poisonous local fruit;
- 35 people (83%) felt that destructive and illegal fishing practices were increasing;
- 38 people (90%) reported electroshock, 'grenade', and poisonous fishing bait and gillnet use in the dolphin's core zones.

These reports of destructive fishing are consistent with those from Lao fishermen interviewed later by DSPC staff, so while the details may vary there is general agreement on the timing of fish deaths, the general transboundary area where dead fish were observed, as well as the belief that many more fish have been observed dead this year than in prior years.

In May and June 2016 DSPC staff investigated as follows.

1. The leaders of the six main project area villages were interviewed during weekly meetings on the occurrence of dead fish and the possible causes; and the 15 fishermen who work regularly for DSPC were interviewed in May or June 2016 regarding observations of dead fish and illegal fishing.
2. Company staff followed up on the possible causes of the dead fish and sources of illegal fishing materials with other local people and made some more field observations.
3. News reports were briefly reviewed for information on fish kills in the region.
4. Possible DSPC actions that might be killing fish were assessed.

This brief and unofficial investigation was carried out systematically, with DSPC staff briefed that it is in the company's interest to objectively assess and mitigate the project's impacts, and to provide information to the DSFMC or GOL agencies for them to take the appropriate action.

3. Observations on dead fish

3.1 Observations of dead fish and destructive fishing

Specific observations

General observations of dead fish based on recall during interviews are discussed below. Specific observations of dead fish include the following.

On 28 April 2016 one of the DSPC fishermen (Mr Khamkheng) saw Cambodian fishermen pick up one dead *Cirrhinus microlepis* of 6.5 kg floating in the dolphin pool (Figure 2) and he sold the fish for Kip40,000/kg to Miss Muan a fish trader in Ban Hang Sadam.

On 29 April 2016 Mr Kuang (a labourer from Thakho who was with Mr Nakhone) picked up one large *Chitala ornata* upstream of Phapheng near Thakho. Mr Kuang and his family later ate the fish.

On 14 May 2016 Kent saw one dead *Hypsibarbus* at Hou Wai in Xang Pheuak Channel, but it had been dead for a few days.

On 18 May 2016 two people from Hang Sadam, including Mr Than (owner of the small restaurant at the new bridge the shop owner at Phapheng Bridge) and his son-in-law Mr Seum (DSPC fisher) collected 5 kg and 2 kg each of dead fish (all small or medium-sized Cyprinids) at Phapheng Bridge and ate them later.

On 19 May 2016 two DSPC fishermen Mr Suoi and Mr Lai (from Hang Sadam) were fishing for shrimps just downstream of the Phapheng bridge where they collected about 2 kg of small or medium-sized Cyprinids, which they barbecued and ate, despite previous advice not to eat such fish. Later that day, Somphone checked near the bridge and observed between 10 and 20 dead small carps (most or all were *Hypsibarbus pierrei*)*;* two fish seen close to bridge were already not fresh (Figure 3).

Mr Than reported that many dead fish had floated downstream earlier on 19 May 2016 and several times before that during May, and he believed that they were a result of poisoning by two Cambodians who came in a boat past Veunkham and then directly up into Phapheng Channel upstream of the access bridge. Mr Khamkheng also saw the boat with two Cambodian fishers going upstream under the bridge on 19 May 2016.

On 17-19 May 2016 Mr Kuang and Mr Lee from Thakho saw some dead fish in Phapheng Channel near Veun Beuk (Figure 2); which is consistent with the observations at the bridge (above) (see more details below).

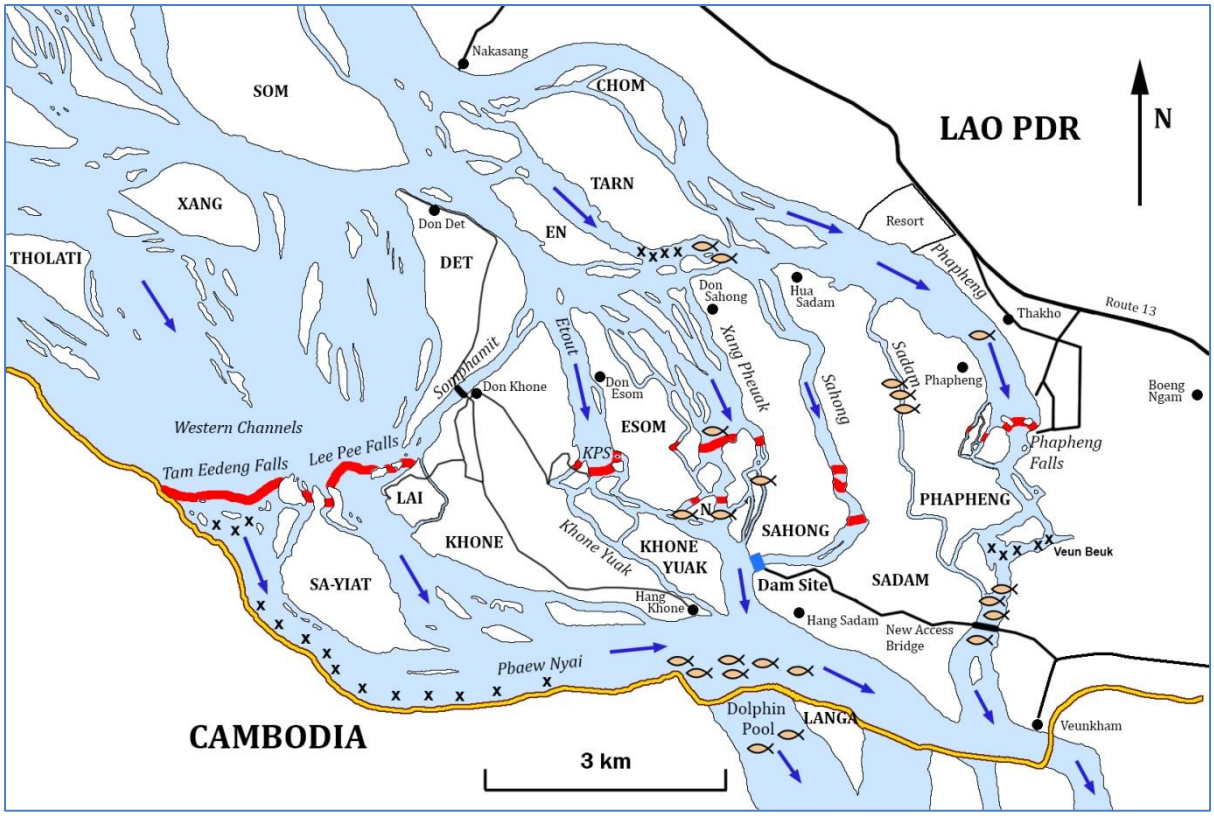

Figure 2 **Locations of fish kills and main areas for destructive fishing at Khone Falls in 2016**
Islands are capitalised, river channels are italicised.

Dead fish observations. Single fish indicate low numbers.

X – Areas where illegal fishing was reported to be carried out in 2016.

Main waterfall, cascade or rapids on each channel.

Direction of river flow.

Figure 3 **Two of the dead fish observed at Phapheng Bridge by Somphone on 19 May 2016**

General observations and interview results

The observations of the fifteen expert fishermen from four villages who work regularly for DSPC are summarised in Appendix 3. Each of the 15 fishermen had seen dead fish in the river in 2016 and in 2015, and they all reported that there were more dead fish in 2016 than in 2015 and in any prior years. The main areas where the fishermen know about destructive fishing and the places where dead fish were seen are shown in Figure 2. The 15 fishers recalled seeing a combined total of over 1,000 dead fish in at least 12 species, mainly medium-sized or large cyprinids, with some fishers also seeing dead catfish (3 species) or featherbacks (*Chitala blanci*) (Appendix 3).

All of the 15 DSPC fishermen said that destructive fishing is commonplace at Khone Falls. All or most of them have probably used electrofishers at some time (which some of them freely admit), although all of them claimed not to have used poisoned rice or explosives. They all believe that many Lao fishermen use or have used electrofishers at some time, while some use poison, and poisoned rice is a new method. They also believe that at Khone Falls explosives are used only by Cambodian fishermen; this would be consistent with Roberts (1993) observations that at or near Khone Falls 'explosives are used only by Cambodian fishermen and soldiers', with many being made from landmines left over from the Cambodian civil war, for which the supply would have reduced greatly since the 1990s.

According to the 15 DSPC fishermen, in the 2016 dry season the largest numbers of dead fish were seen in the main channel of the Mekong, Pbaew Nyai, upstream of or in the dolphin pool, because they had drifted down from destructive fishing areas along the border further upstream as far as Tam Eedeng Falls, where there are very few people and no road access (Figure 2). During the dry season of 2016 one fishermen from Ban Hang Khone and all village chiefs reported that this area was bombed regularly (perhaps daily) by about 10-15 people (Lao and Cambodians) who collaborate on the effort as discussed below. The explosives were supplied by fish traders; at least one trader in Hang Khone Village and one in Don Sahong Village reportedly supplied explosives in 2016. The bombers in this area caught large numbers of fish each day in early 2016 – at least 100 kg per day, which were mainly sold to traders. Poisoned rice was also commonly used in this section of the river as discussed below. Electrofishing is also reported to be regularly used in the dolphin pool at night by about 7-8 people. These observations generally accord with the report by Phay et al. (2016) from the Cambodian side.

Large numbers of dead fish were also observed in Phapheng Channel near the new access bridge (see specific observations above), and these were believed by the fishers to originate from poisoning and electrofishing in the channel upstream, where there is very limited bank access. As mentioned above, on 19 May 2016 some of the fishers employed by DSPC collected and ate dead fish near the bridge, despite being told it could be dangerous.

Nakhone and Yupapon (DSPC staff) on 21 May 2016 interviewed in Thakho Village two fishermen - Mr Kuang, labourer and Mr Lee, village policeman - who said that 3 or 4 Cambodian fishermen for several years have been using explosives and electrofishers in Phapheng Channel between the bridge and Phapheng Falls. The Cambodians work together with some Lao people who are from Thakho, Veunkham and Hang Sadam villages, who act as sentinels and help them to collect and sell the fish in Veunkham. Their main fishing area is Veun Beuk, which is a deep pool about half way

between the bridge and the falls (Figure 2). Lao people do not go to that area at night because they believe they believe it is a holy place. In 2016 that gang began using a new method of killing fish with rice poisoned by insecticide (methomyl) supplied from Thakho. The two interviewees both saw some dead fish in Phapheng Channel near Veun Beuk on 17-19 May 2016, as mentioned above).

Nakhone and Yupapon also went to Nakasang and Don Tan but could not get any accurate information on destructive fishing from people there.

Village chiefs from the six project area villages were well aware of the use of explosives, electrofishing and poisoning at Khone Falls. They confirmed the report above that two people from Hang Sadam had collected 5 kg and 2 kg each of dead fish at Phapheng Bridge on 18 May 2016. They also confirmed that two fishers from Hang Khone village had been recently charged in Cambodia for using poison to catch fish.

An experienced fisher Mr Kamkhing, the DSPC coordinator from Hang Khone village, was interviewed on 17 June 2016 by Somphone. He said that most of the fish which were sold in the 2016 dry season at Khone Falls were obtained by destructive fishing methods, among which he believed that explosives provided 70% of the catch, followed by electrofishing (20%) and then poisons (10%). The bombers target certain species whose habits they know well. Large predators like *Bagariu*s and *Wallago* follow the small fish like Henicorhynchus spp. (*pa soi*) as they migrate and the bombers target those large fish which fetch a high price.

According to Mr Nakhone (DSPC staff), Mr Lee, a local police officer in Thakho saw some Cambodians electrofishing in Phapheng Channel during the night in March 2016, (he used a torch) so he shot their boat with a gun to scare them away. All villages have local police guards who patrol at night at certain times.

Mr Chaloeun (DSPC staff) reported to Mr Kongher on 20 May 2016 that he interviewed Mr Noumai (chief of Hang Khone village) who informed him that Mr Tong from Khone Tai Village got arrested by Cambodian police when he was using poison in Cambodia during May 2016 and he was fined 2 million Kip and sent back to Laos. Mr Noumai also heard that one family of army people from Cambodia bought poisoned fish and made koi pa (half raw fish), then two people and their dog died. Mr Noumai also reported that Mr Tou from Khone Tai was recently caught and fined by Cambodian guards for using a gill net in the dolphin pool Fish Conservation Zone shared between Cambodia and Lao. He was fined 1 million kip and released.

Hang Sadam village head (Mr Khamphing) told Somphone that on 17/3/14 they organised a team of 5 Cambodian river guards and 11 Lao people to catch Cambodians who had been reported at Nokkasum Noi in Xang Pheuak channel. They found three Cambodians in a boat at Nokkasum Noi who they tried to arrest, but the Cambodians escaped into the forest and their boat was confiscated, along with one electrofisher and two bombs. The boat is 8 m x 3.5 and is now at Hang Sadam, and the equipment is at Khong District police office.

The DSPC fishers were asked their opinions about why destructive fishing is increasing. Destructive fishing is relatively quick and efficient compared to legal methods, so once some people start to do it

others tend to join in as they are disadvantaged, despite any concerns about the adverse consequences. They cited that there is strong demand in the dry season from fish traders, who finance and provide people with the equipment to efficiently kill fish. In the early wet season the price of large fish falls when many fish are caught during their upstream migrations. During the dry season, fish attempt to rest in deep pools, where they are particularly targeted. Most of the large high-value fish are sold to traders and then they are trucked to Pakse and then many are transported to Vientiane and to Thailand to meet the demand from urban consumers. Commercial pressure on wild fish from Siphandone has been increasing for many years as discussed in detail by Bush (2004). According to fishers interviewed at DSPC, the apparent increase in destructive fishing in the 2016 dry season is not directly related to the dam construction, but increased road access for outsiders may have exacerbated the increasing trend.

3.2 The main destructive fishing areas

Summarising from the above observations, there are three main areas where destructive fishing is commonly practised and known about by people at Khone Falls.

1. Near Don Tarn, the island upstream of the falls and downstream of Nakasang – that is by Lao people only.
2. Upstream of the dolphin pool near Tam Ee Deng falls is a favoured location where there are deep pools in which fish accumulate in the dry season. People from both Laos and Cambodia go fishing with destructive methods there, including people from Preah Romkel village mentioned in the IRN article. In 2016 some had bought carbofuran poison from a trader in Hang Sadam Village in Laos.
3. In Phapheng Channel downstream of Phapheng Falls. This area is mainly fished by Cambodian people working with local Lao people in a gang as mentioned above.

It can be assumed that destructive fishing occurs regularly in many places further upstream of the falls, from where dead fish might drift downstream.

3.3 Overview of each destructive fishing method

Explosives

Explosives are used in deep pools where fish accumulate during the dry season. The two main areas are along the Lao-Cambodian border upstream of the dolphin pool, and upstream of the new bridge in Phapheng Channel up as far as Phapheng Falls (see Figure 2). Many or most of the fish which are killed or injured by an underwater blast sink to the bottom of the river and are not retrieved, along with other non-target animals, so this is one of the most wasteful and destructive methods of fishing.

As mentioned above, the Lao fishers say that Cambodian fishers are the explosives experts. However, Cambodians often work together with Lao fishers to avoid detection. The Cambodians take explosives to the target pools and detonate them, after which they return home without any fish. Then their Lao collaborators (with normal fishing gear in their boats) go to the area downstream of the blast site and ‘discover’ the dead fish, which they can recover, claiming innocence of any

blasting. So it is difficult to prove any wrongdoing, because uninvolved people have also picked up dead fish.

Most of the DSPC fishermen believed that there had been a big increase in explosive fishing in 2016 and some thought that the explosives may have been stolen from the contractors involved in the DSPC project. The explosive used is Emulite®, which is an emulsion of small droplets of ammonium nitrate solution packed in a mixture of oil and wax, which enhances rapid and complete combustion and protects the ammonium nitrate, making Emulite highly water-resistant and an ideal underwater explosive.

Some of the fishermen relayed stories of how explosives, cable and detonators might have been stolen from the contractor. It should be noted that contractors for the project follow stringent procedures to ensure safety and to prevent theft. Explosives used in the DSPC project are stored in a secure warehouse where access is limited to authorized personnel and all materials are recorded entering and leaving, with a daily balance kept and physically confirmed against stock in the warehouse. Blasting is managed by certified blasting operators, and any remaining materials each day are returned to the warehouse and recorded immediately. Therefore it is very unlikely that there could have been any significant theft of explosives and certainly not enough to account for the apparent extent of the explosive fishing in 2016.

To verify the rumours reported by fishermen and attempt to check on the type and source of explosives, some of the DSPC fishers were asked to buy explosives during late June, but they could not locate any. While it is possible that some of the explosives may have been stolen from the contractor, it's also possible that perpetrators might have spread the rumour of the explosive origin to divert attention from the actual sources. It is quite easy to make explosives, for example, many people make gunpowder and fuses for the popular *'bang fai'* rockets which are set off in many parts of Laos during the Lao New Year (pi mai) in April. There are also many other development projects that use explosives, and UXOs are a common source of explosives in some parts of Laos. The apparent coincidence of the increasing use of explosives for fishing with the start of the DSPC dam construction in early 2016 might also be a result of increased road access and the influx of outsiders, including traders.

Exemplifying the availability of explosives and the dangers of their use, a recent news item in a Lao online magazine reported that the village chief of Hua Pa Koh village on Pa Koh Island near Pakse reported on 26/7/2016 that three labourers went fishing with explosives at 03:00 am in the Mekong River (Figure 4). They had an accident with the explosive and two of the people were killed (both men aged 36 and 31) and one boy aged 16 was injured. This media report was confirmed on 4 August 2016 by Somphone in discussion with Mr Bounkert, official of the Pakse branch of the Provincial Agriculture and Forestry Office (PAFO) and member of the DSFMC. He said that the fishers were checking a bomb that had failed to detonate in the water, which then exploded.

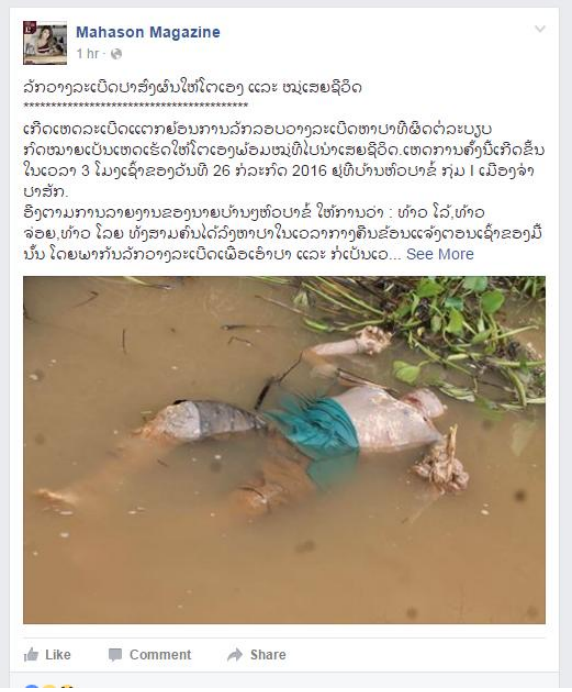

Figure 4 **News item in Lao Mahason magazine downloaded on 3 August 2016**
See text above for approximate translation.

Poisons

Both Lao and Cambodia people traditionally used various plants to poison fish, and the practice has evolved to the use of highly toxic and dangerous insecticides, which are now freely sold by unlicensed traders in Hang Sadam, Thakho and Nakasang villages. Poisons are also provided by some of the fish traders who give them to people to go and get fish for them; traders from Hang Sadam and Thakho are well-known to supply poison for fishing. Some teams of Lao and Cambodian fishermen collaborate in poisoning; one group poisons the fish and another picks up the poisoned fish, to avoid detection in the same way as reported for explosives fishing. It seems that genuine full-time and skilful fishermen appear to frown on poisoning, which is reported to be more commonly used by people out to make a quick catch when fish are abundant and visible, or by occasional fishers. Insecticides have been used in the region for many years, e.g. Deap et al., (2003) reported that poisons are used in the upper Mekong in Stung Treng and showed a container of Thiodan, a trade name for endosulfan, a highly toxic Category 1 organochlorine pesticide that is being phased out in most developed countries; it is relatively persistent and disperses and bioaccumulates.

With increasing infrastructure and trade, the availability and use of insecticides appear to be increasing. DSPC employees were able to buy insecticides used for poisoning fish at a store in Hang Sadam and at another store in Thakho (Figure 5). Mr Kian (driver in Nakasang) advised that many stores in Nakasang had also been selling poisons for catching fish in 2016. The two chemicals bought by DSPC staff are both Carbamate insecticides, which are highly toxic to fish and to people, as well as to insects and other animals. These insecticides are made in Thailand. Sale and use of these chemicals is in theory heavily regulated in Laos under the MAF regulation (2010); the responsible agency now is the Department of Pollution Control within MONRE, but at a local level enforcement is the responsibility of DAFO, but up to now there appears to be little if any enforcement in practise.

Carbamate insecticides are acetylcholinesterase inhibitors; their main effect is to cause continuous firing of motor neurones so that the muscles of affected animals contract continuously. Consequently the bodies of affected fish are stiff and hard for some time after they have been poisoned. Worldwide, many people have been poisoned accidentally or deliberately by suicide using carbamates, and they are also widely reported to be used in various ways to illegally poison animals.

Poisoning is commonly practised in the dry season when fish are visible in clear water. The main fish targeted are cyprinids – especially the medium-sized or large omnivorous species that will eat rice; these include *Hypsibarbus* spp., *Scaphognathops* spp., *Poropuntius* spp., *Labeo* spp. and *Cirrhinus microlepis*. The usual method is to mix some rice with insecticide so that the poison penetrates the rice. The users search for fish and throw the rice to them. Fish that eat the rice begin to convulse and eventually die; they float downstream where they are collected by the waiting poisoners.

Poison is also used in the same general areas as explosives (above), but usually where fish can be seen and often in more shallow waters where fish are feeding.

Figure 5 **Carbofuran (left) from a trader in Hang Sadam and methomyl from a trader in Thakho** Supplier details are on www.pruksakornkset.com

The poisoned fish may be sold mixed together with fish that have been caught by normal gears, so that any ill effects from eating the poisoned fish may not be attributed to poisoning. The fishermen who use these insecticides also place themselves and their families at considerable risk by not taking any of the recommended precautions to prevent contact or inhalation or handling by others. The symptoms of poisoning (including nausea, dizziness and vomiting) are similar to those of many diseases, and chronic long-term effects may take time to manifest, so that people may become sick or die without identifying the cause. DSPC staffs have heard rumours of unexplained deaths in 2015 of apparently healthy people in Thakho Village; these might be associated with pesticide poisoning.

During the meeting on 18 May 16 it was explained to the DSPC fishermen that handling poisons or eating fish which have been poisoned could be dangerous and they were advised against using poison or eating poisoned fish. The DSPC fishermen erroneously believed that as long as poisoned rice is removed from a fish's digestive tract, it will be safe to eat; later it was explained to them that the poisons are absorbed into a fish's bloodstream, so they will be present in the flesh of the poisoned fish. As mentioned above, it has been reported that two people and their dog died in Cambodia after eating raw poisoned fish, and media reports are that many people have become sick in Cambodia after eating poisoned fish (e.g. Appendix 2).

On 26 May 2016 some DSPC fishermen purchased seven poisoned fish from a trader in Hang Sadam; all were common medium-sized cyprinid species (Table 1). The fish were dissected at the DSPC camp (see cover photo) to discover whether poisoned rice would still be in the fish. None of the fish had rice in their stomachs, three fish had grains of rice in their gills and mouth, and the other four fish had detritus or aquatic insects in their gills and/or mouths (Table 1, and Figures 6 to 9). The rice was frozen and retained for possible analysis, but there are no capable laboratories in Laos.

These observations suggest that after eating poisoned rice, fish vomit to expel their stomach contents. In some fish, rice remains in the mouth and gills, whereas others completely expel the rice and also the contents from deeper in their stomachs. Rice would rarely if ever be eaten by wild Mekong fish, especially during May, so the presence of rice in fish is a reliable indicator that the fish have been poisoned. However the absence of rice does not guarantee that fish have not been poisoned, but stomach contents in the mouth and gills indicate that a fish has vomited, which may be a result of poisoning.

No.	Species	Length	Weight	Grains of rice	Note
1	*Hypsibarbus pierrei*	270	409	18	Rice in mouth and gills
2	*Hypsibarbus pierrei*	290	569	10	Rice in mouth and gills
3	*Hypsibarbus pierrei*	235	271	0	Detritus in mouth and gills
4	*Hypsibarbus pierrei*	190	140	0	Detritus in mouth and gills
5	*Poropuntius normani*	210	223	8	Rice in mouth and gills, insect pupae in mouth
6	*Poropuntius normani*	195	179	0	Detritus in mouth and gills
7	*Barbonymus gonionotus*	210	245	0	Detritus in mouth and gills

Table 1 **Summary of observations on fish bought on 25 May 2016 at Hang Sadam village**

Figure 6 **Fish from Hang Sadam village which were dissected at the DSPC camp on 26 May 2016**


Figure 7 **Grains of rice in the mouth of a *Hypsibarbus pierrei***

Figure 8 **Grains of rice in the gills of a *Hypsibarbus pierrei***

Figure 9 **Stomach contents (aquatic insect pupae) in the mouth of a *Poropuntius normani***

Electrofishing

Both Lao and Cambodian fishermen use electrofishers, which are of three main types, each suitable for particular conditions. Small battery-powered units are most common and are generally used to catch small fish or other animals in shallow water or along the edges of larger channels. These small units have been made and openly sold in Nakasang, but the Lao retailer was fined and the units confiscated by officials from the District Agriculture and Forestry Office (DAFO) and police during 2014 (Figure 10 and Appendix 4). Details of the larger more powerful units are lacking, but they are operated from car batteries and are effective in deeper water. Electrofishing is often done at night, and aided by LED lights. Fish that are not caught may recover from electrofishing, depending upon the method used and the degree of exposure, so it may be less damaging than bombing and poisoning.

Figure 10 **Two battery-powered electrofishers held at Khong District office of PAFO**

3.3 Enforcement and education

Enforcement of the Fisheries Law at local level is the responsibility of DAFO (District Agriculture and Forestry Office) of Khong District office, which provided DSPC with a list of 19 people who had been convicted of destructive fishing offences since 2011 (Appendix 4). Those people included 14 Laotians who were arrested upstream of Khone Falls for electrofishing, three Cambodians arrested downstream of the falls for electrofishing, one Laotian arrested downstream of the falls for poisoning, and one Laotian arrested in Nakasang for selling electrofishing gear. Each of the offenders was fined 1-1.5 million kip and jailed for one week. Most of the arrests have been upstream of Khone Falls in more populated and accessible areas, where offenders are more likely to be seen, reported and arrested and where it's less likely that offenders will be close relatives of local police officers. Relatively few people have been penalised for using destructive methods downstream of the falls near the Cambodian border, and none have been apprehended in Phapheng Channel downstream of the falls, which are two of the main areas where destructive fishing is practised, as discussed above. While access would have limited detection in the past, since completion of the new road bridge in August 2015 the possibility of enforcement has been improved for these areas.

4. Other possible causes of dead fish

4.1 Introduction

This section briefly considers whether the observations of dead fish at Khone Falls might be related to some other cause(s) than the destructive fishing methods discussed above.

Fish deaths can be caused by various factors singly or in combination.

- Natural causes, including pathogens or parasites, by consuming naturally poisonous or injurious organisms (e.g. some types of algae), being attacked by predators (fish or birds) then dying later from injuries, or being stranded in shallow areas when water levels recede.
- Direct anthropogenic causes include fishing injuries (e.g. dying after escape from nets or hooks, or being struck by spears, or the result of indiscriminate methods such as explosives, electrofishing or poisons), or being struck by boat propellers.
- Environmental changes which kill fish may be anthropogenic or natural, or some combination; these typically include water level changes which leave fish stranded in shallow waters, changes in water quality, especially low oxygen, high or low temperatures, and the effects of pollutants, such as agricultural or industrial chemicals.

The mortality rates of most wild riverine fish species are very high; of the many thousands of fish which may hatch from the eggs of one spawning female, on average only a few will survive to adulthood. So occasionally individual dead fish are seen either in the water or on banks or sandbars. Nevertheless, in a healthy river system, to see even one or a few dead fish is rather unusual, because such fish will usually be eaten by fish or other animals. Observation of many dead fish at one time usually indicates a significant environmental event that simultaneously affects many fish, including the predators that might clean up the dead fish. The term “fish kill” is usually applied to any event involving many fish.

Fish kills typically involve some natural process that is exacerbated by anthropogenic factors. For example recent fish kills worldwide are commonly blamed on depletion of oxygen caused by decomposing algae, which have grown rapidly (a bloom) as a result of high nutrient levels and weather conditions. High nutrient levels are usually from fertilisers, sewage or animal wastes. Near many river mouths in several countries there are now vast “dead zones” where there are few fish and where fish kills occur regularly; these include the Yangtze and Pearl River estuaries in China.

A website which provides links to all news articles on fish kills and mass animal deaths worldwide lists 261 reported events during 2016 up to 12 June (http://www.end-times-prophecy.org/animal-deaths-birds-fish-end-times.html). Although it is a religious website, the links are to a wide range of media articles. In 2016 the most widely publicised fish kill occurred along the coast of Chile, where millions of fish died. In the Mekong region several fish kills have been recorded by the media in 2016 in April or May from ponds or lakes in Thailand where all were attributed to hot weather and lack of oxygen. A fish kill in the Nam Wang (in the Chao Phraya system) at Lampang in northern Thailand was attributed to abstraction of irrigation water in combination with high temperatures, although one fish kill in Thailand was associated with unusually cold weather in February (http://www.thairath.co.th/content/567941). Some fish kills in 2016 in Viet Nam (a Hanoi canal and on the central coast) were attributed to pollution by industries.

In the Mekong basin 65 tonnes of fish reportedly died in the Tonle Sap Lake's Boeng Tonle Chhmar conservation area on 25 April 2016 because of low water levels and high temperatures, and fish kills have occurred there before (http://www.phnompenhpost.com/national/tonnes-fish-killed-heat-kampong-thom). Other reports of fish kills in the Mekong include in the upper Mekong delta in Viet Nam (http://news.zing.vn/hon-1000-tan-ca-chet-tren-song-o-mien-tay-post626809.html, possibly caused by pollution. Fish kills caused by discharges from cassava processing plants have been reported many times in Laos Thailand and Cambodia. Fish kills are a seasonal occurrence associated with cold weather in elevated regions and in the northern provinces of Laos; the cold weather stresses fish which then succumb to bacterial infections (Hortle, 2009).

While 2016 appears to have been a year of temperature extremes and low water levels in the dry season, these are probably not significant factors in any fish kills at Khone Falls, where even at the driest time of year there is still a very large flow of fast water, which moderates temperatures and maintains oxygen levels. There are no large industries discharging wastes at Khone Falls so pollution can be ruled out as a probable cause of fish kills. Similarly there are no major discharges of sewage or animal wastes in the district. In general, it can be concluded that the fish kills are very unlikely to have been caused by any other factors than the illegal fishing methods discussed in Section 1.

4.2 Could DSPC activities have been responsible for the reported fish kills?

The three main locations where the dead fish were observed are not consistent with any direct impacts of the DSPC project. There are no DSPC project activities that might kill fish upstream of the access bridge or upstream of Phapheng Falls where dead fish were observed. At the dam site blasting is confined on dry land behind coffer dams (Figure 11), and there are no significant wastes disposed of in the nearby river that would seriously affect water quality. Blasting at the dam site is unlikely to cause any injury to fish, which is substantiated by the following observations.

- Since construction began in January 2016, fish have continued to live and are caught regularly by fishermen immediately adjacent to and downstream of the dam site.
- No dead fish have been reported near the dam site, and if fish had been killed or injured near the dam site it is difficult to imagine how they could then end up floating down the river on the opposite side of the main channel in the dolphin pool (i.e. they would have to float down about 800 m from the dam site to the main Mekong channel, and then cross about 800 m of fast flowing river without being swept downstream.
- Some fish were caught and held alive in a cage in the river adjacent to the dam site for three entire days (20-23/6/16) when blasting was carried out; they remained active and in good condition.
- During 2016 many fish have been caught about 500 m from the DSPC dam site in Xang Pheuak channel at the CPUE monitoring site, which is monitored every 3 days by a 24-hour fishing effort.
- During blasting on 18 May 2016 a dolphin-ear hydrophone was used to record underwater sound in the dolphin pool near the border. The sound of a blast was barely audible under water and was insignificant in comparison to the noise from the engine and propeller of a passing

boat. There were no apparent responses to the blast from any fish or any other animals in the vicinity.

- Destructive fishing is well-known to all fishers and village chiefs interviewed, and it seems entirely plausible to explain the observations of dead fish at all the places they have been reported.

It should be noted that during closure of the Sahong Channel from 5 to 15 January 2015, many local people and others from outside the area fished the channel heavily, and many gill nets were set in the channel as water levels fell. Many fish were caught by divers using spears or small nets. Some fish and aquatic invertebrates could be found dead in residual or dried up pools of water along the Sahong Channel in the subsequent weeks; these dead fish are an inevitable consequence of desiccating a larger river channel, but are not related to the observations later in the dry season either in time or space, when in any case Sahong Channel was isolated by coffer dams.

Figure 11 **DSPC dam site in Sahong Channel on 25 May 2016**
Blasting is isolated by the coffer dams. The closest dead fish were found about 1.5 km away.

5. Discussion and Recommendations

Destructive fishing with explosives and electrofishing is well-known at Khone Falls and apparently became much more common in the 2016 dry season from March to May. Use of insecticide-poisoned rice to catch fish is a relatively new method that became common in 2016. Many of the fish and other organisms that are killed by destructive fishing are not recovered, so these methods are far more damaging than conventional fishing methods. Destructive fishing is also hazardous to the perpetrators; and fish that have been poisoned are a danger to anybody who eats them.

Destructive fishing appears to be practised regularly by relatively few people, who thereby impact many others who fish legally for food and livelihood. Many fishers are opposed to the use of these methods, especially explosives and poisons, but they cannot directly confront the perpetrators who may be armed and/or supported by some fish traders and local officials. Enforcement must be done by officials from DAFO and by the police.

The practise of destructive fishing may affect the DSPC project in several ways.

- The project may be blamed in the media for the death of fish, as already evident in 2016.
- The success of DSPC's fisheries mitigation, including fish passage improvements, will be compromised by the loss of fish.
- Villagers in the area will suffer losses of livelihood and food, which will exacerbate any project impacts.
- Local people and DSPC staff or contractors may buy and eat the poisoned fish.

Enforcement of the Fisheries Law of 2009 is the responsibility of Government of Lao (GOL) agencies. The company has a strong incentive to work with the DSFMC to control destructive fishing. The committee can be very effective, as it demonstrated in May and June of 2016 when it took concerted action to destroy illegal gears (lee and luang khang traps). This was done to allow more fish to migrate upstream to breed during the early flood. Overfishing of spawning fish is believed to be a major factor in fisheries decline in the region (Cacot, 2007), and although eliminating the large illegal gears at Khone Falls has been a priority for many years there has only now been strong action as a result of direct support to the Committee by DSPC.

This brief investigation indicates that the company should continue discussions with GOL agencies and especially the DSFMC and should support the following measures.

Education and Communication

Educating people at all levels of the harmful effects and dangers of destructive fishing could be effective in reducing the use of these methods. DSPC staff should assist the DSFMC to prepare educational posters on these methods, including their illegality, their destructive effects and the hazards to people. In particular, the risk of eating poisoned fish needs to be highlighted and consumers need to be educated to look for poisoned rice or evidence of vomiting in any fish they buy from markets in the dry season.

The committee should also consult with and inform the Ministry of Health on health risks, and provide materials to schools and temples to educate people to not use these methods and not to buy fish caught using these methods.

The company also needs to communicate clearly with its staff and contractors on their obligations to restrict access to explosives and to not engage in or abet other illegal activities including destructive fishing, and report any offenders to the police.

Inspection and Enforcement

The DSFMC is already planning enforcement of the provisions of the Fisheries Law, and should now work towards eliminating use of these destructive methods during the 2017 dry season, focusing on the three main fishing areas identified, especially the two areas downstream of the falls. As planned under the DSFMC, the main fishing areas will be regularly patrolled to detect and apprehend any people fishing illegally. The committee also needs to check on traders and fish being sold by them, as fish caught using these methods are generally distinguishable from fish caught using legal means.

As well as preventing illegal fishing, various laws cover the sale and use of explosives, electrofishers and poisons, so it is possible to reduce access given the will and resources to do so. The DSFMC should inform and consult with relevant officials and the local police on this issue.

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Appendix 1

Article from International Rivers on dead fish and location maps

https://www.internationalrivers.org/blogs/721/when-the-fish-stop-swimming-%E2%80%93-the-fight-against-the-don-sahong-dam. Accessed on 29 April 2016

When the Fish Stop Swimming – the Fight against the Don Sahong Dam

Khone Phapheng Falls near the Don Sahong Dam site

In Preah Romkel, a Cambodian village situated on the banks of the Mekong River close to the Lao border, people are noticing dead fish in the waters that run past their home – lots of them. And their numbers are increasing.

Each day, children from both sides of the border row their boats out to collect fish with local names such as *Pava* and *Trey Pruol* found floating lifeless in the river. Recent reports claim that up to seven, or even ten kilograms of fish carcasses can be gathered in one day – a phenomena unprecedented in local memory.

While Cambodian news is saturated with stories of drought and plunging water levels, these villagers face an additional, more tangible threat: the construction of the Don Sahong Dam, currently under construction two kilometres upstream on the Hou Sahong channel of the Mekong River in Laos.

Work on the dam commenced in January. The locals hear the daily sound of trucks, bulldozers and the explosives used to widen the river's channels. The Hou Sahong, the major channel enabling year-round fish migration, is now dry, its water diverted through a coffer dam. The blocked channel leaves many fish species with no effective passage to customary spawning and feeding grounds, and no place for fish larvae to drift downstream.

The children's recent windfall likely signals a larger and imminent disaster for fish, biodiversity and food security. Experts predict that further development of the Don Sahong Dam will widely deplete Mekong fish stocks, affecting hundreds of thousands of people across the Lower Mekong Basin. For rural Cambodians, inland fish are the primary dietary source of protein, fat, and iron, and are crucial to local livelihoods. The dam also threatens to destroy the local population of critically endangered

Irrawaddy dolphins, creatures of cultural significance in the area and a foundation of the local tourism industry.

Despite the threat to riparian communities, the dam continues to rise, with little means of recourse for those affected. Last week, the Malaysian Human Rights Commission (SUHAKAM) publicized the outcome of a groundbreaking complaint against the project developer, Malaysian company Mega First Corporation Berhad. The first of its kind concerning the human rights impacts of a Malaysian company's operations abroad, this document was filed by representatives of Preah Romkel and other Cambodian and Thai communities, together with International Rivers and a coalition of national and international NGOs.

The complaint centred on the project's dire implications for human rights to food, health, culture, life and livelihoods, and the rights of indigenous people.

SUHAKAM initially accepted the complaint, and held separate meetings with Mega First and the complainants, but ultimately concluded that they were unable to conduct an investigation or proceed further with the inquiry because of the extraterritorial nature of the issues.

SUHAKAM did, however, issue recommendations. They exhorted Mega First to ensure that its business operations and activities are "conducted in a manner which respects the human rights of the people living in the affected areas, besides generating profit out of the project" and to adhere to the *United Nations Guiding Principles on Business and Human Rights* in their overseas operations.

They also recommended that the Malaysian government develop policies to monitor Malaysian companies operating outside of the country and ensure their compliance with human rights principles. This includes signing on to the Organisation for Economic Co-operation and Development (OECD) *Guidelines for Multinational Enterprises* and establishing a National Contact Point to receive and address complaints regarding corporate abuses outside of Malaysia.

Fish floating near Preah Romkel village
Social and Environmental Protection Youth (SEPY), Cambodia

In their response to the complaint, Mega First argued that consultation requirements were satisfied through the regional deliberations of the Mekong River Commission (MRC) and consultation meetings held under the 1995 Mekong Agreement's Procedures for Notification, Prior Consultation and Agreement (PNPCA).

They failed to note that during Prior Consultation, the governments of Cambodia, Thailand and Vietnam each expressed serious concerns over the project, and requested an extension to the

consultation process, along with further studies in order to understand the transboundary impacts. Because no consensus was reached between the Mekong governments, the issue was elevated for resolution through diplomatic channels, the outcome of which has not been made public, despite specific requests from development partners to the MRC. The Prior Consultation procedure itself is flawed. In fact, it contains no specific obligation to consult with affected communities, and participants heavily criticized the national and regional consultation meetings as weak on community involvement and information disclosure and lacking in meaningful opportunities to provide input.

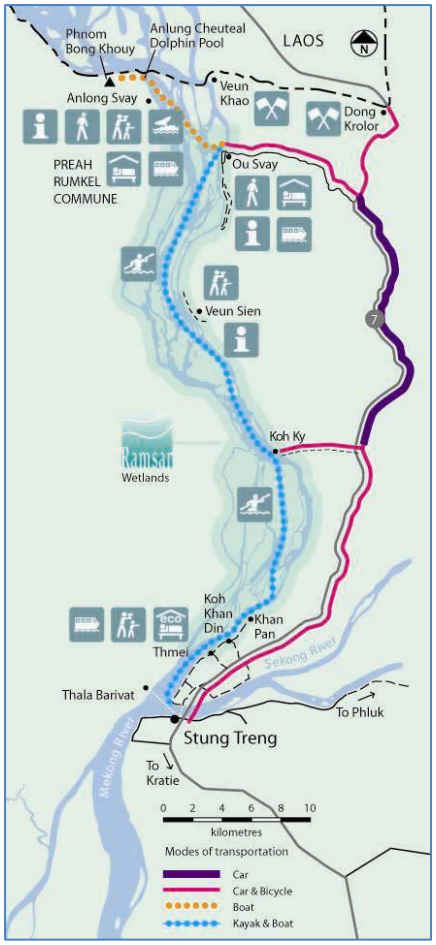
Mega First also responded to the claims by referring to their Corporate Social Responsibility (CSR) initiatives, including building access roads, schools, supermarkets and other facilities in the vicinity of the project and committing funds to enhance local livelihoods. While they may be positive, such measures do not dispense with separate obligations, articulated in the *UN Guiding Principles on Business and Human Rights*: to conduct due diligence; avoid infringing fundamental rights to food, health and livelihoods; and to ensure access to remedy for those adversely affected by the company's business operations.

SUHAKAM's recommendations offer little comfort to the people of Preah Romkel and similarly positioned communities across the Mekong Basin. Nor do they address the highly problematic planning and decision-making process of a project that is now under construction and proceeding rapidly. In developing the project, Mega First failed to inform or consult with those affected across the border in Cambodia, or in Thailand and Vietnam. They did not conduct or make public adequate baseline studies or a transboundary environmental impact assessment (EIA). While the developers have put forward design plans for fish passage and other mitigation measures, they have not provided evidence to demonstrate the efficacy of these in the specific conditions at the project site at Khone Falls or with respect to the diversity of fish species in the Mekong River.

The recommendations highlight the urgent need for an accountability mechanism to address the current impunity surrounding developers and investors involved in extraterritorial projects such as the Don Sahong Dam. Laos' laws are weakly enforced, and its courts are inaccessible to communities in Cambodia. Despite the dam's proximity to their villages, other avenues of recourse are not readily available.

Similar concerns around extraterritorial investments can be seen in the struggle for justice by Thai communities affected by the development of the Xayaburi Dam, also on the Mekong River in Laos. The communities have been locked in a legal battle with the Thai state agencies involved in the project since 2012; claiming that despite serious harm to their livelihoods, they were not sufficiently informed or consulted about the project's impacts. Such complaints are likely to continue, and should be given serious consideration in assessments of project risks by developers and investors who fail to operate in accordance with best practice.

In Southeast Asia, intra-regional investment in projects such as the Don Sahong and Xayaburi Dams is only increasing. There is an urgent need to strengthen the mandate of SUHAKAM and similar national and regional bodies, to address the accountability gap. Fish and ecosystems are much more than unfortunate casualties of infrastructure development and investment. Beyond their own intrinsic value, they are also pressing human rights concerns.



Tourist trail from Stung Treng to the dolphin pool.

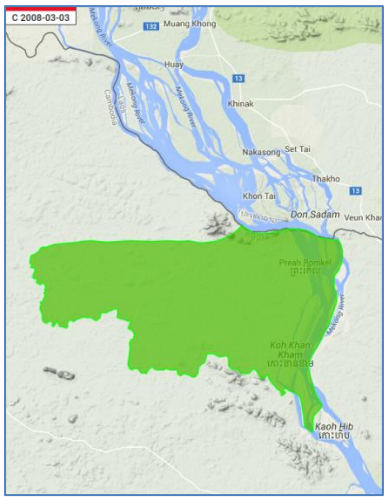
http://angkorlink.com/Photo/PDF_Files/Mekong_Cambodia/8_Stung%20Treng%20North%20to%20Lao%20Border%20.pdf

Ou Svay Commune is to the east and includes villages on the east bank of the Mekong.

http://www.stat.go.jp/info/meetings/cambodia/pdf/19com_m2.pdf

Both Ou Svay and Preah Rumkel are in Stung Treng Province. North of Preah Rumkel is Preah Vihear Province which also borders the Mekong and Laos.

https://www.google.la/imgres?imgurl=https://upload.wikimedia.org/wikipedia/commons/thumb/4/47/Cambodia_provinces_en.svg



Preah Rumkel Commune in Cambodia

http://www.citypopulation.de/php/cambodia-admin.php?adm2id=190508

Appendix 2

Media articles about fish kills at Khone Falls in 2016

http://www.phnompenhpost.com/national/laos-dam-poison-blamed-stung-treng-fish-deaths

Laos dam, poison blamed in Stung Treng fish deaths

Wed, 1 June 2016
Phak Seangly

Hundreds of kilograms of dead fish have washed up on the shores of the Mekong in Stung Treng's Thala Barivat district in the past month, and while environmental activists blame construction of the controversial Don Sahong dam upstream, officials yesterday said the fish are being "poisoned" by Lao fishermen.

"We saw that a lot of dead fish flowed from the upper Mekong in Lao," said O'Svay commune chief Roth Sun, who believes the fish were poisoned near the border.

Villagers have collected some 400 to 500 kilograms of fish, and several fell ill from eating them, Sun said, adding that commune authorities found cooked rice with a "blue substance" inside the fish bodies, prompting them to warn villagers against eating the fish.

Sim Kosal, 23, from nearby Preah Romkil commune suspects the Don Sahong construction is to blame, a viewed shared by activists.

"Fish have died since the construction started . . . [and] the water quality is worse than last year," he said.

Pen Chhundy, provincial Fishery Administration director, yesterday was unaware of the deaths but said that an inspection following fish deaths in the district last month found that illegal poison-based fishing practices by Laotians were to blame.

NGO Forum executive director Tek Vannara said the dam construction's impact on water quality is likely the cause of not just the fish deaths but also the death of two Irrawaddy dolphins this year and possibly the deaths of some 355 cattle in Stung Treng since April. "We must investigate," he said.
Additional reporting by Alessandro Marazzi Sassoon

Appendix 3

Summary of dead fish observations by 15 DSPC fishermen

Locations and timing of dead fish observations

Date	Fisherman	Age	Village	No. of fish seen		Month seen		Place where dead fish seen	
				2015	2016	2015	2016	Channel	Location
26/05/2016	Mr Sing	55	Hua Sadam	1	2	April	April	Sadam, middle part	Downstream of Vang Muang Yai
26/05/2016	Mr Viengxay	34	Don Sahong	1	3	Mar	March	Xang Pheuak	Xang Pheuak Yai
26/05/2016	Mr Kien	45	Don Sahong	2	5	April	April	Xang Pheuak	Xang Pheuak Yai
26/05/2016	Mr Somsavhin	24	Hua Sadam	0	10		March	Mekong upstream	Downstream of Don Tarn
26/05/2016	Mr Vanhsay	45	Hua Sadam	3	30	April	March	Sadam, middle part	Downstream of Vang Muang Yai
26/05/2016	Mr Seum	54	Hang Sadam	2	> 500	March	March	Mekong downstream	Boong Hang Khone, Boong Pa Khuang, upstream of dolphin pool
26/05/2016	Mr Kene	30	Hang Sadam	2	>10	Mar-April	Mar-May	Mekong downstream	Tha Naa Ban Kao
26/05/2016	Mr Lay	38	Hang Sadam	2	>100	Mar-April	Mar-May	Mekong downstream	Next to dolphin pool
26/05/2016	Mr Dteum	45	Hua Sadam	1	>20	Mar-April	Mar-May	Mekong upstream	Downstream of Don Tarn
5/06/2016	Mr Khamkheng	23	Hang Sadam	5	>300	Mar-April	Mar-May	Mekong downstream	Next to dolphin pool
5/06/2016	Mr Zui	31	Hang Sadam	3	>200	Mar-April	Mar-May	Mekong downstream	Next to dolphin pool
								Phapheng downstream	Under DSPC bridge
5/06/2016	Mr Daoheuang	25	Don Sahong	1	4	Mar-April	Mar-May	Xang Pheuak	Xang Pheuak Yai
5/06/2016	Mr Khambai	43	Exom	6	15	Mar-April	Mar-May	Xang Pheuak, Etoud	Nokkasum Noi, Xang Pheuak
5/06/2016	Mr Dton	35	Exom	3	8	Mar-April	Mar-May	Xang Pheuak, Etoud	Nokkasum Noi, KhoneLan
5/06/2016	Mr Kham	41	Hua Sadam	1	16	Mar-April	Mar-May	Phapheng	Lard Yai

Species observed by each fisherman

Fisherman	*Species 1*	*Species 2*	*Species 3*	*Species 4*	*Species 5*	*Species 6*
Mr Sing	*Hypsibarbus pierrei*					
Mr Viengxay	*Hypsibarbus pierrei*	*Poropuntius normani*				
Mr Kien	*Hypsibarbus pierrei*	*Poropuntius normani*				
Mr Somsavhin	*Labeo chrysophekadion*					
Mr Vanhsay	*Poropuntius normani*	*Hypsibarbus pierrei*	*Pangasius macronema*			
Mr Seum	*Hypsibarbus pierrei*	*Poropuntius normani*	*Labeo chrysophekadion*	*Scaphognathops spp.*	*Cirrhinus microlepis*	*Sikkukia gudgeri*
Mr Kene	*Hypsibarbus pierrei*	*Cosmochilus harmandi*	*Labeo chrysophekadion*	*Bagarius* spp.		
Mr Lay	*Hypsibarbus pierrei*	*Labeo chrysophekadion*	*Cirrhinus microlepis*	*Bagarius* spp.		
Mr Dteum	*Chitala blanci*	*Labeo chrysophekadion*	*Hypsibarbus pierrei*	*Poropuntius normani*	*Bagarius* spp.	
Mr Khamkheng	*Hypsibarbus pierrei*	*Labeo chrysophekadion*	*Cirrhinus microlepis*	*Poropuntius normani*		
Mr Zui	*Hypsibarbus pierrei*	*Labeo chrysophekadion*	*Cirrhinus microlepis*	*Poropuntius normani*		
Mr Daoheuang	*Hypsibarbus pierrei*	*Poropuntius normani*				
Mr Khambai	*Poropuntius normani*	*Hemibagrus spiloterus*	*Probarbus jullieni*			
Mr Dton	*Hypsibarbus pierrei*	*Poropuntius normani*				
Mr Kham	*Hypsibarbus pierrei*	*Labeo chrysophekadion*				

Appendix 4

People penalised for destructive fishing offences in Khong District since 2011

Name	Age	Nationality	Village	District	Province	Date	Activity	Location	Penalty	Jail
Mr Loy	33	Laotian	Kangkong	Khong	Champasak	29/11/2011	Electrofishing	Mekong upstream	1,525,000	1 week
Mr Bounchan	47	Laotian	Kangkong	Khong	Champasak	29/11/2011	Electrofishing	Mekong upstream	1,525,000	1 week
Mr Xeuan	39	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Keo	30	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Bounhieng	55	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Oung	24	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Vanh	26	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Phai	30	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Vong	38	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Aenoy	28	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Thongkhoon	19	Laotian	Nakasang	Khong	Champasak	10/03/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Khian	31	Laotian	Veunsom	Khong	Champasak	22/12/2015	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Noi	29	Laotian	Phiengdee	Khong	Champasak	9/06/2016	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Sai	30	Laotian	Lek Fai	Khong	Champasak	13/06/2016	Electrofishing	Mekong upstream	1,000,000	1 week
Mr Sikod	44	Laotian	Nakasang	Khong	Champasak	13/06/2016	Selling Electrofishers	Nakasang	1,000,000	1 week
Mr Mai	23	Laotian	Hang Khone	Khong	Champasak	18/04/2016	Poisoning	Hang Khone to Tam Eedeng	1,400,000	1 week
Mr Khoy	35	Cambodian	Phalakhan	Thala Barivat	Stung Treng	17/12/2014	Electrofishing	Hang Khone to Tam Eedeng	1,000,000	1 week
Mr Rhoy	40	Cambodian	Phalakhan	Thala Barivat	Stung Treng	17/12/2014	Electrofishing	Hang Khone to Tam Eedeng	1,000,000	1 week
Mr Rhon	36	Cambodian	Phalakhan	Thala Barivat	Stung Treng	17/12/2014	Electrofishing	Hang Khone to Tam Eedeng	1,000,000	1 week