

# **Sesan River Fisheries Monitoring in Ratanakiri Province, Northeast Cambodia:**

**Before and After the Construction of the Yali Falls Dam  
in the Central Highlands of Viet Nam**



**Compiled by**

**Ian G. Baird and Meach Mean**

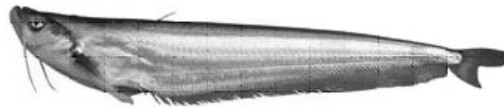
**December 2005**



**This report was published by the 3S Rivers Protection Network (3SPN) in cooperation with  
the Global Association for People and the Environment (GAPE)  
Ban Lung, Ratanakiri Province, Northeast Cambodia**

# **Sesan River Fisheries Monitoring in Ratanakiri Province, Northeast Cambodia:**

**Before and After the Construction of the Yali Falls Dam  
in the Central Highlands of Viet Nam**



**Compiled by**

**Ian G. Baird and Meach Mean**

**December 2005**

The authors can be contacted at:

Ian Baird  
Global Association for People and the Environment (GAPE),  
P.O. Box 860,  
Pakse, Lao PDR  
e-mail: [ianbaird@shaw.ca](mailto:ianbaird@shaw.ca)

and

Meach Mean  
3S Rivers Protection Network (3SPN),  
P.O. Box #9,  
Ban Lung, Ratanakiri Province, Cambodia  
e-mail: [sesan@camintel.com](mailto:sesan@camintel.com)

□ 3S Rivers Protection Network

This research was initiated by the 3S Rivers Protection Network (3SPN) (formerly the Sesan Protection Network) and local people living along the Sesan River in Ratanakiri province, northeast Cambodia. Therefore, 3SPN and its local members remain the owners of the rights to the information included in this report. The Global Association for People and the Environment (GAPE) has provided some financial support to have the report laid out and published.

Suggested Citation:

Baird, Ian G. and Meach Mean 2005. *Sesan River fisheries monitoring in Ratanakiri province, northeast Cambodia: Before and after the construction of the Yali Falls dam in the Central Highlands of Viet Nam*. 3S Rivers Protection Network and the Global Association for People and the Environment. Ban Lung, Ratanakiri, Cambodia, 92 pp.

Cover photo, right: Man living along the Sesan River in Andong Meas district, Ratanakiri province, northeast Cambodia with a new nylon mono-filament gillnet.

Cover photo, left: A nylon mono-filament gillnet being checked by fishers along the Sesan River, Ratanakiri province, northeast Cambodia.

# Table of Contents

<b>Executive Summary Khmer</b>	<b>5</b>
<b>Executive Summary English</b>	<b>11</b>
<b>Acknowledgements</b>	<b>15</b>
<b>Introduction</b>	<b>17</b>
<b>Methodology</b>	<b>19</b>
<b>Quantitative Fisheries Data Collection from the Sesan River in Ratanakiri Province</b>	<b>19</b>
<b>Qualitative Fisheries Data Collection from the Sesan River in Ratanakiri Province</b>	<b>25</b>
<b>Results</b>	<b>26</b>
<b>Quantitative Fisheries Data</b>	<b>26</b>
<b>Local Ecological Knowledge and Sesan Fish and Fisheries</b>	<b>32</b>
<b>Water Quality</b>	<b>32</b>
<b>Hydrology</b>	<b>33</b>
<b>Species</b>	<b>34</b>
<b>Discussion</b>	<b>37</b>
<b>Conclusions</b>	<b>38</b>
<b>References Cited</b>	<b>39</b>
<b>Table 1. Summary of fishers and fisheries monitored during the study</b>	<b>27</b>
<b>Table 2. Summary of Sesan fisheries by fisher and fishery</b>	<b>28</b>
<b>Table 3. Summary of Sesan fisheries by village and fishery</b>	<b>30</b>
<b>Table 4. Depth reductions in Sesan River deep-water pools</b>	<b>33</b>
<b>Table 5. Estimations of earthworm declines near Sesan villages</b>	<b>34</b>
<b>Table 6. Species of fish reported by fishers to have largely disappeared from the Sesan since the Yali Falls dam was built</b>	<b>35</b>
<b>Table 7. Estimations of fisheries declines near Sesan villages</b>	<b>37</b>

<b>Figure 1. The Sekong, Sesan and Srepok Basins in Viet Nam, Cambodia and Laos</b>	<b>17</b>
<b>Figure 2. Sesan River in Ratanakiri Province, Northeast Cambodia, with the seven villages represented in the study</b>	<b>19</b>
<b>Figure 3. Most of the village researchers together with Meach Mean and Kim Sangha of 3SPN, Ban Lung, Ratanakiri Province, northeastern Cambodia</b>	<b>22</b>
<b>Appendix 1 Fish species identified as being caught from the Sesan River during the study</b>	<b>42</b>
<b>Appendix 2 Individual fishers catch data: Records of fish monitoring study</b>	<b>46</b>
<b>Mr. Cham Phuweng (Tiem Leu village) (#1)</b>	<b>46</b>
<b>Mr. Chea Sok (Phnom Kok village) (#2)</b>	<b>48</b>
<b>Mr. Di Deuang (Taveng village) (#3)</b>	<b>54</b>
<b>Mr. Du Wet (Taveng village) (#4)</b>	<b>58</b>
<b>Mr. Kalan Dun (Bokham village) (#5)</b>	<b>63</b>
<b>Mr. Kalan Hin (Bokham village) (#6)</b>	<b>66</b>
<b>Mr. Kong Chan Nara (Tiem Leu village) (#7)</b>	<b>69</b>
<b>Mr. Pang Khan (Talao village) (#8)</b>	<b>72</b>
<b>Mr. Thao Thuy (Talao village) (#9)</b>	<b>74</b>
<b>Mr. Sut Sao (Phnom Kok village) (#10)</b>	<b>77</b>
<b>Mr. Sol Hyak (Kanat Toich village) and So Pheun (Kak village) (#11)</b>	<b>80</b>
<b>Mr. Sol Teuy (Kanat Toich village) (#12)</b>	<b>82</b>
<b>Mr. Phan Thong Lien and Mr. Theuk Nut (Tiem Leu village) (#13)</b>	<b>84</b>
<b>Mr. Tung Son (Taveng village) (#14)</b>	<b>89</b>

## **ខ្លឹមសារសង្ខេប**

តើមានអ្វីដែលអាចធ្វើបាន ពេលគេសាងសង់ទំនប់ធំមួយនៅតាមខ្សែទឹកខាងលើក្នុងប្រទេសមួយ ហើយយើងដឹងច្បាស់ថា ឥទ្ធិពលពីទំនប់នោះអាចបង្កឱ្យបញ្ហាជាច្រើនមកលើមច្ឆា និងជលផល? ប៉ុន្តែ មិនទាន់មានអ្នកណាបានធ្វើការប្រមូលទិន្នន័យជាបរិមាណអំពីទន្លេពីមុនមកទេ ហើយក៏មិនមានការពិចារណាអំពីផលប៉ះពាល់នៅតំបន់ខ្សែទឹកខាងក្រោមសំរាប់ប្រទេសជិតខាងឬនៅក្នុងតំបន់ដែលត្រូវធ្វើការវាយតម្លៃហេតុនៃផលប៉ះពាល់បរិស្ថានរបស់គំរោងសាងសង់ទំនប់ដែរ ។ តើគ្មានអ្នកណាបានប្រមូលទិន្នន័យមូលដ្ឋានអំពីជលផលមុននឹងចាប់ផ្តើមអនុវត្តគំរោងសាងសង់ទំនប់ឬ? សំនួរទាំងនេះគឺជាចំណុចចាប់ផ្តើមនៃការសិក្សានេះ ដែលមានការពាក់ព័ន្ធយ៉ាងខ្លាំងជាមួយទំនប់កំលាំង ៧២០មេហ្គាវ៉ាត **យ៉ាលី** ។ គេសាងសង់ទំនប់**យ៉ាលី** នៅតំបន់ខ្ពង់រាបកណ្តាលនៃប្រទេសវៀតណាម ។ ទំនប់នេះចាប់ផ្តើមបង្កផលប៉ះពាល់មកលើតំបន់ខ្សែទឹកខាងក្រោមក្នុងពេលកំពុងសាងសង់នៅឆ្នាំ១៩៩៦ ហើយផលប៉ះពាល់បានបន្តនិងកាន់តែធ្ងន់ធ្ងរចាប់តាំងពីឆ្នាំ២០០១ នៅពេលដែលទំនប់នេះធ្វើប្រតិបត្តិការពេញលេញ ។

ដើម្បីធ្វើការវាយតម្លៃទៅលើផលប៉ះពាល់មកលើសង្គម និងបរិស្ថានពីទំនប់ផ្សេងៗទៀតនៅតាមតំបន់ខ្សែទឹកខាងលើនៅពេលអនាគត យើងចាំបាច់ត្រូវយល់ដឹងអោយបានច្រើនបន្ថែមទៀតអំពីមច្ឆា និងជលផល ព្រមទាំងពិចារណាទៅលើផលប៉ះពាល់របស់**យ៉ាលី** ពីមុនក៏ដូចជាផលប៉ះពាល់ទៅថ្ងៃអនាគតពីទំនប់ផ្សេងៗ ដែលគេមានផែនការសាងសង់នៅក្នុងអាងទន្លេសេសានក្នុងប្រទេសវៀតណាម ។ របាយការណ៍នេះមានគោលបំណងបង្ហាញជូនអំពីលទ្ធផលនៃការសិក្សាមួយទាក់ទងនឹងជលផលនៃទន្លេសេសានក្នុងខេត្តរតនគិរី ។ ការស្រាវជ្រាវនេះសិក្សាពីជលផលនៃទន្លេសេសានក្នុងខេត្តរតនគិរីនាពេលបច្ចុប្បន្ន និងវាយតម្លៃផងដែរទៅលើផលប៉ះពាល់មកលើមច្ឆានិងជលផលនៅតំបន់ខ្សែទឹកខាងក្រោមនៃទំនប់**យ៉ាលី** និងទំនប់ផ្សេងៗទៀត ។

ការសិក្សាស្រាវជ្រាវនេះមានពីរផ្នែកធំៗ ។ ផ្នែកទីមួយប្រមូលទិន្នន័យជាបរិមាណទាក់ទងនឹងការនេសាទត្រី ដើម្បីវាយតម្លៃអំពីស្ថានភាពត្រីនិងជលផលបច្ចុប្បន្ននៅតាមដងទន្លេសេសានក្នុងខេត្តរតនគិរី ។ ចំណែកឯផ្នែកទីពីរ ការសិក្សាធ្វើការវាយតម្លៃអំពីផលប៉ះពាល់របស់ទំនប់**យ៉ាលី**មកលើត្រី និង ជលផលនៅតំបន់ខ្សែទឹកខាងក្រោមដោយប្រើប្រាស់ចំណេះដឹងស្តីពីអេកូឡូស៊ីទាំងបច្ចុប្បន្ននិងអតីតកាលរបស់ប្រជាជនក្នុងសហគមន៍ ។

ផ្នែកទីមួយគឺចងក្រងទិន្នន័យជាបរិមាណពីការសិក្សាពេញមួយឆ្នាំអំពីជលផលនិងការនេសាទត្រីដែលធ្វើឡើងដោយអ្នកនេសាទចំនួនប្រាំពីភូមិតាមដងទន្លេសេសានក្នុងខេត្តរតនគិរី ។ អ្នកនេសាទទាំងនោះរស់នៅតាមតំបន់ភាគខាងលិចដល់ភាគខាងកើត ឬ ពីតំបន់ខ្សែទឹកខាងក្រោមទៅតំបន់ខ្សែទឹកខាងលើ ។

ភូមិទាំងប្រាំពីរនោះគឺ ភូមិភ្នំកុកនិងភូមិទាមលើ ស្រុករ៉ានសែ ភូមិតារាំង ស្រុកតារាំង និងភូមិតាឡាវ ភូមិ កាណាតតូច ភូមិកាក់ និងភូមិបខាំ ស្រុកអណ្តូងមាស ។ អ្នកនេសាទជាបុរសចំនួន២២នាក់បានចូលរួមក្នុង ដំណើរការប្រមូលទិន្នន័យជាបរិមាណអំពីការនេសាទត្រីនេះ ហើយក្រុមសិក្សាប្រមូលបានទិន្នន័យ២០ ប្រភេទអំពីការនេសាទត្រីចាប់តាំងពីខែមេសា ឆ្នាំ២០០៣ ដល់ ខែមេសា ឆ្នាំ២០០៤ ។ ទិន្នន័យ១៤ប្រភេទ ក្នុងចំណោមទិន្នន័យទាំង២០ប្រភេទនោះអាចយកមកប្រើប្រាស់សំរាប់ការវិភាគចុងក្រោយ ។

ផ្នែកទីពីរបានប្រើប្រាស់ចំនេះដឹងអំពីអេកូឡូស៊ីរបស់អ្នកនេសាទក្នុងសហគមន៍ដែលចូលរួមក្នុងការ សិក្សាស្រាវជ្រាវនេះ ។ ចំណេះដឹងនោះបានមកពីការសំភាសន៍ក្រុមអ្នកនេសាទជាលក្ខណៈបុគ្គលនិងការ សំភាសន៍ជាក្រុមធំរួមគ្នាដើម្បីកត់ត្រាព័ត៌មានដែលបានមកពីការអង្កេតនិងបទពិសោធន៍របស់ពួកគេទាក់ ទងនិងការនេសាទក្នុងទន្លេសេសាន ជាពិសេសពូជត្រីនិងប្រភេទសត្វរស់នៅក្នុងទឹកផ្សេងៗទៀតនៅមុន ពេលសាងសង់ អំឡុងពេលកំពុងសាងសង់ទំនប់យ៉ាលី និងក្រោយពេលទំនប់នេះចាប់ផ្តើមប្រតិបត្តិការ ។ វាមានសារៈសំខាន់ខ្លាំងណាស់ ដែលយើងប្រើប្រាស់ចំណេះដឹងរបស់ពួកគេ ដើម្បីធ្វើការប្រៀបធៀប ទិន្នន័យជលផលជាបរិមាណចេញពីសកម្មភាពនេសាទនៅតាមដងទន្លេសេសានដោយផ្ទាល់ជាមួយនិងទិន្ន ន័យទាក់ទងនិងត្រីនិងជលផលនៅក្នុងទន្លេសេសានចាប់តាំងពីមុនពេលទំនប់យ៉ាលីបានបង្កផលប៉ះពាល់មក លើផ្នែកខាងក្រោមនៃទន្លេសេសានក្នុងខេត្តរតនគិរីឆ្នាំ១៩៩៦ ។

ការសិក្សាស្រាវជ្រាវបានពិនិត្យមើលឧបករណ៍នេសាទ១៦ប្រភេទដូចជា មងលីឡុង ទំហំក្រឡា ២,៥ សង់ទីម៉ែត្រ ៣សង់ទីម៉ែត្រ ៤សង់ទីម៉ែត្រ ៥សង់ទីម៉ែត្រ ៦សង់ទីម៉ែត្រ ៧សង់ទីម៉ែត្រ ៨សង់ទីម៉ែត្រ ១០សង់ទីម៉ែត្រ ១២សង់ទីម៉ែត្រ និង១៣សង់ទីម៉ែត្រ សំណាញ់ទំហំក្រឡា ៣សង់ទីម៉ែត្រ សន្ទូចរនង និង សន្ទូចបង្កែមានផ្នែកតូចនិងធំ ព្រមទាំងការបំពុលត្រីតាមធម្មជាតិដោយប្រើផ្លែឈើព្រៃ ។

ការចងក្រងទិន្នន័យបរិមាណអំពីការនេសាទត្រី ដែលធ្វើឡើងដោយអ្នកនេសាទបានមកពីការត្រួត ពិនិត្យមើលសកម្មភាពនេសាទចំនួន១៩៦៩ ក្នុងរយៈពេលនេសាទ ២៧៣៦២,៧ ម៉ោង ។ ក្នុងរយៈពេល សិក្សា ត្រីចំនួន ១៤៨៤៧ក្បាលដែលបានចាប់មានទំងន់ ២២៥០,៣៦ គីឡូក្រាម ។ មានត្រីចំនួន ១១១ ប្រភេទត្រូវបានចាប់ និងបានកត់ត្រាក្នុងកំឡុងពេលនេសាទ ហើយពូជត្រីទាំងនេះហាក់ដូចជាអាចតំណាង អោយពូជត្រីធម្មជាតិជាង១២០ប្រភេទផ្សេងទៀត ។

វាមិនគួរអោយភ្ញាក់ផ្អើលទេ ដែលពេលនេសាទក្រុមសិក្សាបានរកឃើញប្រភេទត្រីមានស្រកាជា ពូជត្រីសំខាន់ជាងគេ ដែលអ្នកនេសាទចាប់បានក្នុងចំណោមពូជត្រីផ្សេងៗច្រើនទៀត ។ ចំពោះការនេសាទ ទាំងអស់ បរិមាណត្រីចាប់បានជាមធ្យម គឺ ០,០៨២គីឡូក្រាមក្នុងមួយម៉ោង ។ ជាទូទៅ បរិមាណត្រី នេសាទបានជាមធ្យមនៅភូមិតាឡាវ ភូមិកាណាតតូច គឺខ្ពស់ជាងភូមិផ្សេងៗទៀត ។ មានភាពខុសគ្នាជា

ច្រើនគួរអោយពិចារណាផងដែរ ចំពោះភាពខុសគ្នាដាច់ស្រឡះនៃបរិមាណពូជត្រី ដែលចាប់បាននៅតំបន់ ជួរថ្ម និងតំបន់ដីខ្សាច់ ។ ទីជំរកត្រូចៗនៅតាមដងទន្លេសេសានពិតជាមានសារៈសំខាន់ណាស់សំរាប់ការរស់ នៅរបស់ពូជត្រីជាច្រើនប្រភេទ ។

អ្នកនេសាទដែលចូលរួមក្នុងការសិក្សាបានបង្ហាញអោយឃើញអំពីការប្រែប្រួលរបស់ទន្លេសេសាន ចាប់តាំងពីទំនប់យ៉ាលីចាប់ផ្តើមបង្កផលប៉ះពាល់មកលើតំបន់ខ្សែទឹកខាងក្រោម ។ ពួកគាត់ជឿថា ការកើន ឡើងនូវកំទិចកំណនៅក្នុងទន្លេសេសានគឺជាឥទ្ធិពលមួយដ៏ធ្ងន់ធ្ងរដែលបណ្តាលមកពីការសាងសង់ទំនប់នៅ ក្នុងអាងទន្លេសេសាន ។ ការបាក់ច្រាំងទន្លេដែលបណ្តាលមកពីការបើកទឹកដោយតំបុក និងកំលាំងទឹកហូរ ខ្ពស់ខ្ពាញ់ពីទំនប់យ៉ាលី បង្ហាញច្បាស់ថា ជាមូលហេតុដែលបង្កើតអោយមានកំទិចកំណក្នុងទន្លេ ។ អ្នក នេសាទនៅភូមិកាណាតតូច ភូមិតាឡារនិងភូមិបខាំបានប្រាប់អោយអោយដឹងថា ការបាត់បង់ត្រីប៉ាមុខ មួយ ត្រីប៉ាសេអ៊ី ត្រីស្តុក ត្រីក្អែកនិងពូជត្រីជាច្រើនទៀត គឺបណ្តាលមកពីដីខ្សាច់ ល្បប់និងភក់ហូរមក កកលប់លើពពួកសារាយ ស្នែតាមជួរថ្មក្នុងទន្លេ ។ ពួកសារាយ និងស្នែត ទាំងនេះគឺជាប្រភពចំណីអាហារដ៏ សំខាន់បំផុតសំរាប់ពូជត្រីទាំងនេះ និងពូជត្រីផ្សេងៗទៀត ។

ការបាក់ច្រាំងទន្លេបានជះឥទ្ធិពលយ៉ាងធ្ងន់ធ្ងរមកលើត្រីនិងជលផលពីព្រោះកំទិចថ្ម ដីខ្សាច់និង ល្បប់ហូរកប់អន្លង់ជ្រៅៗក្នុងទន្លេនឹងធ្វើអោយបាត់បង់ទីជំរកដ៏សំខាន់ ដែលពូជត្រីច្រើនប្រភេទមកលាក់ ខ្លួននៅរដូវប្រាំង ។ បញ្ហាម្យ៉ាងទៀត ភក់ ល្បប់ ខ្សាច់និងកំទិចថ្មទាំងនេះហូរកប់រុន្តថ្មនៅក្នុងទន្លេ ។

អ្នកនេសាទជឿថា បញ្ហាគុណភាពទឹកបានធ្ងន់ស្រាលជាងពីរបីឆ្នាំមុនបន្តិច ប៉ុន្តែបញ្ហានេះនៅតែ មាន ជាពិសេសពេលកំរិតទឹកទន្លេរាក់នៅចុងរដូវប្រាំង ។

អ្នកនេសាទបានអង្កេតមើលបញ្ហាជាច្រើនទាក់ទងនឹងជលវិទ្យា ។ ឧទាហរណ៍ ជាទូទៅត្រីធ្វើ ដំណើរមកពងតាមអូរជាប់ទន្លេនៅដើមរដូវវស្សាគឺនៅពេលកំរិតទឹកចាប់ផ្តើមឡើងដំបូង ។ អ្នកនេសាទ ទាំងនោះអង្កេតឃើញទៀតថា កំរិតទឹកជាញឹកញាប់ស្រកចុះវិញយ៉ាងលឿនក្រោយពេលហូរខ្លាំងពីដើមរដូវ វស្សា ។ ការហូរទឹកខ្លាំងនៅដើមរដូវវស្សានេះធ្វើអោយកំរិតទឹកនៅតំបន់ខ្សែទឹកខាងលើនៅសល់តិចតួច ឬ គ្មានទឹកសោះតែម្តង ដែលបង្ខំអោយត្រីធ្វើដំណើរយ៉ាងពិបាកតាមច្រាំងទន្លេ និងបង្កលក្ខណៈពិបាកសំរាប់ ការរស់រានមានជីវិត ។

ស្ថានភាពនេះបង្កបរិយាកាសល្អសំរាប់ការនេសាទក្នុងរយៈពេលខ្លី ប៉ុន្តែ ជាទូទៅ វាធ្វើអោយប៉ះ ពាល់ដល់ការរស់នៅរបស់ត្រី ។ អ្នកនេសាទទាំងនោះបានបង្ហាញអំពីការលំបាកដែលជួបប្រទះថា ពេលខ្លះ ពួកគាត់យកមងទៅដាក់នៅពេលយប់ លុះព្រឹកឡើងមងដែលពួកគាត់ដាក់ត្រូវទឹកទន្លេដែលឡើងភ្លាមៗ



ក្នុងយប់នោះហូរគូចយកទៅបាត់ ។ ពេលខ្លះទៀត មងពួកគាត់នៅលើគោកខ្ពស់ពីទឹកនៅពេលព្រឹក ហើយគ្មាន ជាប់ត្រីមួយសោះ ដោយសារទឹកទន្លេស្រកខ្លាំងភ្លាមៗនៅពេលយប់ ។

ក្រុមអ្នកនេសាទបានអង្កេតឃើញបន្តទៀតថា វាជាការល្អចំពោះការប្រើសំណាញ់សំរាប់ចាប់ត្រី ប្រសិនបើក្នុងរយៈពេលបីទៅបួនថ្ងៃកំរិតទឹកទន្លេមិនឡើងចុះឡើយ ។ ប៉ុន្តែបើកំរិតទឹកស្រកចុះឡើយវិញ យើងនឹងពិបាករកត្រីដោយប្រើសំណាញ់ ។ ស្ថិតក្នុងស្ថានភាពស្រដៀងគ្នានេះ ប្រជាជនក្នុងសហគមន៍ធ្លាប់ រកត្រីបានផលល្អនៅពេលកំរិតទឹកឡើងដោយសារមានភ្លៀងខ្លាំង ប៉ុន្តែពួកគាត់មិនអាចទទួលបានសំណាង ល្អដូចនេះទៀតទេ ក្រោយពេលកំរិតទឹកទន្លេប្រែប្រួលភ្លាមៗបន្ទាប់ពីភ្លៀងរាំងមួយរយៈខ្លី ។

ស្ថានភាពទឹកទន្លេមិនប្រក្រតីអាចធ្វើអោយចលនាបំណាស់ទីរបស់ត្រីមានការប្រែប្រួល ហើយយើង ជឿថា នេះជាឥទ្ធិពលមួយទៀតដែលមានការពាក់ព័ន្ធនិងការបត់បែនមិនទៀងទាត់របស់ជលវិទ្យា ។ យើង ជឿថា កំរិតទឹកឡើងចុះនៅរយៈពេលមួយនៃឆ្នាំនីមួយៗពិតជាមានការពាក់ព័ន្ធនិងការបំណាស់ទីរបស់ត្រី ។ ការផ្លាស់ប្តូររបស់ជលវិទ្យាអាចជះឥទ្ធិពលយូរអង្វែងមកលើពូជត្រីដែលបំណាស់ទីឡើងចុះក្នុងអាងទន្លេ មេគង្គ ទន្លេសេសាន ទន្លេស្រែពក និងទន្លេសេកុង ។

អ្នកនេសាទមានការជឿជាក់ថា កំរិតទឹកឡើង ស្រកភ្លាមៗនិងការប្រែប្រួលនៃគុណភាពទឹកអាច ប៉ះពាល់យ៉ាងខ្លាំងដល់ពូជត្រីនិងប្រភេទសត្វរស់នៅក្នុងទឹកជាច្រើនទៀត ។ ពពួកសត្វដែលទទួលរង ឥទ្ធិពលនេះមានពពួកខ្លះ ត្រី ខ្មៅនិងជន្លេន ។ ក្រុមអ្នកនេសាទទាំងនោះបានធ្វើការអង្កេតឃើញថា ពូជ ត្រីមួយចំនួនត្រូវបានទទួលរងផលប៉ះពាល់ជាអវិជ្ជមានខ្លាំងជាងពូជត្រីផ្សេងៗទៀត ។ ពូជត្រីខ្លះត្រូវបាន រាយការណ៍ថាបានបាត់បង់ក្នុងពេលនេសាទ ឬ ថយចុះខ្លាំងជាងពូជត្រីផ្សេងៗទៀត ។

ឧទាហរណ៍៖ សំបុកពូជត្រីមួយចំនួនដូចជា ត្រីឆ្មា និងត្រីរមាស ត្រូវរសាត់តាមទឹកក្នុងខ្លាំង ដែល ធ្វើអោយកំរិតជោគជ័យនៃការបង្កាត់ពូជមានការធ្លាក់ចុះ ហើយទីជំរកជ្រៅៗក្នុងទន្លេរបស់ពូជត្រីមួយ ចំនួនត្រូវបានបាត់បង់យ៉ាងច្រើន ។ លើសពីនេះ ពូជកន្ទាយពីរប្រភេទដែលពងនៅលើផ្នែកខ្សាច់ត្រូវបានរង គ្រោះយ៉ាងខ្លាំងដោយសារកំរិតទឹកទន្លេប្រែប្រួល ។ អ្នកនេសាទទាំងនោះមិនជឿថា ការប្រែប្រួលរបស់ជល វិទ្យា និងគុណភាពទឹកក្នុងទន្លេសេសានមិនមានប្រយោជន៍អ្វីសំរាប់ពពួកសត្វទាំងនេះ ។ អ្នកនេសាទយើង បានត្រឹមតែធ្វើការអង្កេតលើការធ្លាក់ចុះនៃផលត្រីប៉ុណ្ណោះ ។

ក្រុមអ្នកនេសាទយើងបានអង្កេតឃើញផងដែរថា ផលប៉ះពាល់ជាអវិជ្ជមានមកលើដើមឈើនិង គុម្ពាតព្រៃលិចទឹកតាមរដូវកាលបានប្រែប្រួលយ៉ាងខ្លាំងទៅតាមលក្ខណៈបាតទន្លេសេសាន និងទន្លេផ្សេង ទៀតនៅក្នុងអាងទន្លេមេគង្គ ។ ការឡើងចុះមិនទៀងទាត់នៃកំរិតទឹកទន្លេសេសានបានធ្វើអោយដំណាំតាម មាត់ទន្លេធ្លាក់ចុះយ៉ាងខ្លាំង ។

ដោយពិចារណាអំពីផលប៉ះពាល់ជាអវិជ្ជមានមកលើទន្លេសេសានដូចបានរៀបរាប់ខាងលើ វាគ្មានអ្វី គួរអោយភ្ញាក់ផ្អើលទេ ដែលអ្នកនេសាទតាមដងទន្លេសេសានរាយការណ៍ថា ផលត្រីដែលចាប់បានធ្លាក់ចុះ ចាប់តាំងពីមានការកត់សំគាល់ដំបូងថា ទំនប់យ៉ាលី បង្កផលប៉ះពាល់មកលើទន្លេសេសាន ។ ពួកគាត់រាយ ការណ៍ថាផលត្រីធ្លាក់ចុះជាមធ្យម ២៦,៧% តិចជាងផលត្រីធ្លាប់រកបាន ។ ចំពោះភូមិភ្នំកុក ភូមិទាមលើ និងភូមិបខារីពួកធ្លាក់ចុះនេះកាន់តែមានសភាពធ្ងន់ធ្ងរជាងគេ ។

មានហេតុផលល្អៗជាច្រើនផ្នែកលើអេកូឡូស៊ី ដែលអាចបកស្រាយបានថាហេតុអ្វីការប្រែប្រួលនៃ កំរិតទឹកនិងជលវិទ្យារបស់ទន្លេធ្វើអោយបរិមាណត្រីធ្លាក់ចុះ និងហេតុអ្វីការប្រែប្រួលនេះមានការពាក់ព័ន្ធ ទៅនឹងជលផលនិងប្រភេទសត្វរស់នៅក្នុងទឹកផ្សេងទៀត ។ ទោះបីជាយ៉ាងណា វាហាក់បីដូចជាមិនត្រឹម ត្រូវទាំងអស់ទេដែលថាការធ្លាក់ចុះនៃបរិមាណត្រីទាំងនេះដោយសារទំនប់ទាំងស្រុង ។ តាមការពិតមាន កត្តាផ្សេងទៀតដែលរួមចំណែកក្នុងរឿងនេះ កត្តាទាំងនោះមានដូចជា ការនេសាទខុសច្បាប់ និងកំណើន ប្រជាជន ។

ដោយធ្វើការប្រៀបធៀបទំនប់និងកត្តាផ្សេងៗទៀត យើងមិនអាចសន្និដ្ឋានបានច្បាស់លាស់អំពី ភាគរយនៃផលត្រីធ្លាក់ចុះដែលបង្កដោយទំនប់យ៉ាលី ។ ប៉ុន្តែអ្នកនេសាទដែលយល់ដឹងច្បាស់លាស់អំពី បញ្ហាអេកូឡូស៊ីនៅក្នុងសហគមន៍អាចសន្និដ្ឋានបានថា ទំនប់យ៉ាលីជះឥទ្ធិពលអាក្រក់យ៉ាងខ្លាំងមកលើការ រស់នៅរបស់ត្រី ជលផលនិងប្រភេទសត្វរស់នៅក្នុងទឹកផ្សេងទៀតនៅក្នុងទន្លេសេសាន ។ ប្រជាជនដែលរស់ នៅតាមដងទន្លេសេសានក្នុងខេត្តរតនគិរីសមនឹងទទួលបាននូវសំណងទាក់ទងនឹងការធ្លាក់ចុះនៃផលត្រី ពី ព្រោះពួកគាត់បានទទួលរងនូវការខូចខាតពីឥទ្ធិពលទំនប់ជាច្រើនឆ្នាំមកហើយ ហើយនៅតែមិនទាន់បាន ទទួលសំណងអ្វីទាំងអស់ ។ ក្នុងករណីនេះដែរ ការសិក្សារាយតម្លៃហេតុផលប៉ះពាល់បរិស្ថានមកលើតំបន់ ខ្សែទឹកខាងក្រោមរបស់ទំនប់យ៉ាលីមិនទាន់បានធ្វើនៅឡើយនៅក្នុងប្រទេសកម្ពុជា វាមិនគួរជាការទទួល ខុសត្រូវរបស់អ្នកនេសាទទេក្នុងការសិក្សាអោយឃើញពីផលប៉ះពាល់របស់ទំនប់មកលើការចិញ្ចឹមជីវិត របស់ពួកគាត់ឡើយ ។ ដូចនេះ វាជាការត្រឹមត្រូវ បើសិនជាអ្នកសាងសង់ទំនប់គួរទទួលបន្ទុកក្នុងការសិក្សា នេះ ដើម្បីបង្ហាញអោយឃើញ ថាផលត្រី និងស្ថានភាពជលផលមិនមានការធ្លាក់ចុះ ពីព្រោះអ្នកសាងសង់ ទំនប់នេះឯងដែលខកខានក្នុងការដោះស្រាយបញ្ហានេះតាំងពីចាប់ផ្តើមដំបូង ។ សំណងគួរតែត្រូវបានសង តាំងពីពេលគំរោងទំនប់ទាំងមូលចាប់ផ្តើម ហើយការបង់សងសំណងត្រូវតែបន្តរហូត ដរាបណាផលប៉ះ ពាល់នៅតែមាន ហើយគួរតែអនុវត្តតាមទស្សនៈលំហូរធម្មជាតិសំរាប់ការប្រតិបត្តិរបស់ទំនប់នានានៅតាម ដងទន្លេ សេសានក្នុងប្រទេសវៀតណាម ។ ដូចនេះ យើងទាមទារអោយមានការពិចារណាអោយម៉ត់ចត់ ក្នុងការជួយស្តារស្ថានភាពបរិស្ថាននៅតំបន់ខ្សែទឹកខាងក្រោមអោយប្រសើរឡើងវិញ ។

លទ្ធផលសិក្សានេះបង្ហាញយ៉ាងច្បាស់លាស់ថា ទំនប់យ៉ាលីបានបង្កផលប៉ះពាល់ជាអវិជ្ជមានយ៉ាងធ្ងន់ធ្ងរមកលើត្រី ជលផលនិងប្រភេទសត្វរស់នៅក្នុងទឹកផ្សេងៗទៀតតាមដងទន្លេសេសានក្នុងខេត្ត រតនគិរីដែលស្ថិតនៅភាគឦសាននៃប្រទេសកម្ពុជា ។ នៅពេលនេះ យើងមិនអាចប៉ាន់ស្មានអោយច្បាស់លាស់អំពីផលប៉ះពាល់ជាអវិជ្ជមានរបស់ទំនប់យ៉ាលីមកលើជលផលទេ ។ ប៉ុន្តែកំណើរការសិក្សាលម្អិតបន្ទាប់ទៀតដែលមានទាំងទិន្នន័យបរិមាណនិងគុណភាពចាប់តាំងពីមុនសាងសង់ទំនប់យ៉ាលីរហូតដល់បច្ចុប្បន្នអាចជួយអោយយើងធ្វើការប៉ាន់ស្មានដ៏សមហេតុផលមួយលើរូបភាពនៃផលប៉ះពាល់ដែលមានមូលហេតុដោយផ្អែកលើគោលការណ៍បរិស្ថាននិងបទពិសោធន៍នានាពីមុនមក ។ សំខាន់បំផុតនោះការវិភាគរបស់អ្នកភូមិដោយផ្អែកលើចំណេះដឹងអំពីបញ្ហាអេកូឡូស៊ីនៅសហគមន៍ហាក់បីដូចជាសមហេតុផលណាស់ ពីព្រោះការវិភាគលើរូបភាពផលប៉ះពាល់ទាំងនេះធ្វើឡើងដោយការពិចារណាដូចនឹងអ្វីដែលអ្នកបរិស្ថាន និងអ្នកជីវសាស្ត្រធ្វើ ។

វាហាក់បីដូចជាសមហេតុផល ដែលការប៉ាន់ស្មានទាំងនេះត្រូវតែប្រើប្រាស់សំរាប់កំណត់អោយចេញនូវរូបភាពសំណងសំរាប់អ្នកភូមិរងគ្រោះ ពីព្រោះពួកគាត់ត្រូវតែទទួលបានសំណងនេះស្របទៅតាមទំហំនៃផលប៉ះពាល់ដ៏អាក្រក់ដែលទំនប់យ៉ាលីបានផ្តល់អោយ ។ ម្យ៉ាងវិញទៀត ការសិក្សានេះអាចប្រើប្រាស់ជាប្រយោជន៍សំរាប់ការវាយតម្លៃផលប៉ះពាល់របស់ទំនប់ផ្សេងៗទៀតមកលើតំបន់ខ្សែទឹកខាងក្រោមនៃអាងទន្លេសេសានក្នុងប្រទេសកម្ពុជា ។ នេះជាទិន្នន័យនៃការសិក្សាដែលប្រមូលបានក្នុងដំណាក់កាលដំបូងតែទោះជាយ៉ាងណាក៏ដោយ អ្នកសិក្សានឹងបន្តប្រមូលទិន្នន័យបន្ថែមទៀតនៅពេលអនាគត ។

# Executive Summary

What can be done when a large dam is built upstream in another country, the resulting downstream impacts are widely believed to have caused serious problems for fish and fisheries, there has never been any quantitative fisheries data collected from the river before, there was absolutely no consideration of downstream impacts in the neighbouring country or within the project's original Environmental Impact Assessment (EIA), and there were not any attempts made to collect baseline fisheries data before proceeding with the project? The above question was essentially the starting point for this study, with special reference to the 720 MW Yali Falls dam, which has been built in the central highlands of Viet Nam. The dam's downstream construction-period impacts on fish and fisheries in the Sesan River in Ratanakiri and Stung Treng provinces, northeastern Cambodia began in 1996, and impacts have continued more recently since the dam became fully operational in 2001.

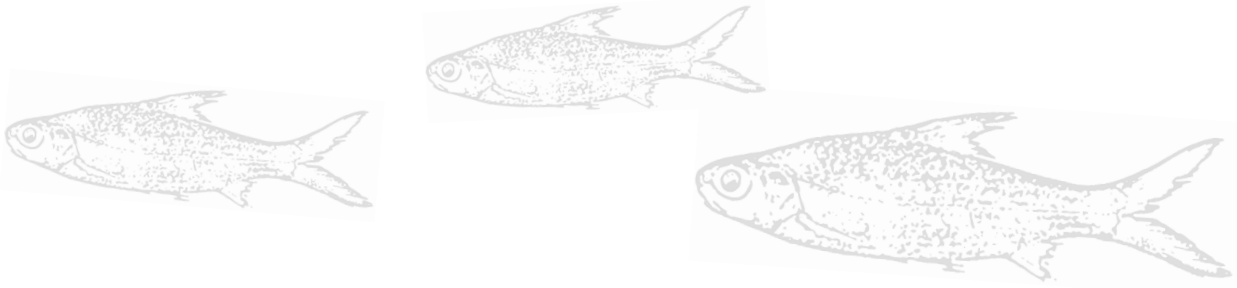
Considering the past downstream impacts of the Yali Falls dam, and the future impacts of other dams planned for the Sesan River basin in Viet Nam, it is necessary to understand more about the fish and fisheries in the basin in order to assess the environmental and social impacts of future dam developments upriver. The purpose of this report is to present the quantitative and qualitative results of a study conducted in Ratanakiri province regarding fisheries in the Sesan River. This study considers both the present status of fisheries in the Sesan River in Ratanakiri province and assesses the downstream impacts of the Yali Falls and other dams on fish and fisheries.

This study includes two main components. The first involves collecting quantitative catch effort fisheries data, in order to assess the present state of fisheries in the Sesan River in Ratanakiri province. The second component involves using local ecological knowledge about the past and present to assess the downstream impacts of the Yali Falls dam on fish and fisheries in Ratanakiri.

The first component involved a full year of quantitative fisheries and fish catch data collection by local fishers living in seven villages along the Sesan River in Ratanakiri province. They are, from west to east (or downstream to upstream), Phnom Kok and Tiem Leu villages in Veun Say district, Taveng village in Taveng district, and Talao, Kanat Toich, Kak and Bokham villages in Andong Meas district. A total of 22 male fishers participated in the quantitative fisheries data collection process of this study, and 20 sets of catch effort fisheries data were collected from April 2003 and April 2004. It was possible to use 14 of the data sets in the final analysis.

The second component utilised the local ecological knowledge of fishers participating in the study. This involved individually and collectively interviewing all the fishers in order





to record information about their observations and experiences regarding Sesan fisheries, particular fish species and other aquatic life before the Yali Falls dam was built, during its construction, and later when the dam started operating. Essentially, their local knowledge was utilised to compare the quantitative fisheries data collected from their own fishing activities on the Sesan River with qualitative data regarding fish and fisheries in the Sesan River before the Yali Falls began causing downstream impacts in the Sesan River in Ratanakiri province in 1996.

There were 16 fishing gears monitored during the research, including nylon mono-filament gillnets with 2.5 cm, 3 cm, 4 cm, 5 cm, 6 cm, 7 cm, 8 cm, 10 cm, 12 cm and 13 cm mesh sizes, 3 cm meshed castnets, longlines and single lines with large and small hooks, and fish poisoning using native fruits.

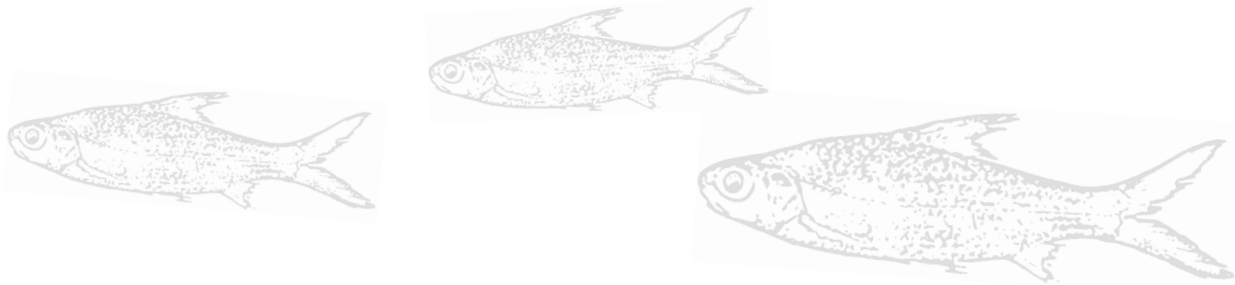
Combining the quantitative catch effort fisheries data collected by the fishers, 1,969 fishing operations were monitored during the study, covering 27,362.7 fishing hours. During this fishing 14,847 fish were caught weighing 2,250.36 kg. There were 111 'species categories' recorded in catches, and it is likely that these categories actually represent over 120 biological species. Not surprisingly, cyprinid carps were found to be the most important fish family in catches, although a number of other families also made up significant portions of catches. The catch-per-unit effort (CPUE) for all fisheries combined was 0.082 kg/hour of fishing. Overall, CPUE levels in Talao and Kanat Toich are higher than for other villages. It was also found that there are considerable differences in the species composition of the catches for fisheries in rocky areas as opposed to sandy areas. Microhabitats in the Sesan River are clearly important for maintaining different communities of fishes.

Fishers involved in the study have made a number of important observations about changes in the Sesan River since the Yali Falls dam started causing downstream impacts. Fishers are convinced that increased turbidity in the Sesan River is one of the most serious impacts of dam building in the Sesan River basin. Erosion resulting from 'hungry water' and water surges released from the Yali Falls dam is widely believed to be the cause of this increased turbidity. Fishers from Kanat Toich, Talao and Bokham reported losses of *Labeo erythropterus*, *Mekongina erythospila*, *Gyrinocheilus pennocki*, *Morulius* spp., and other species as a result of silt and sand being deposited on algae growing on rapids. This alga represents important sources of food for these species and others.

One serious impact of erosion on fish and fisheries has been the filling up of deep-water pools with sand, silt and rocks, damaging these habitats that serve as important dry-season refuges for many species. Another problem has been the silting up of holes in underwater rocks.

Fishers are convinced that while water quality problems are less serious than they were a few years ago, problems remain, especially near the end of the dry season when water levels are low.





Fishers have observed various hydrology problems. For example, fish generally enter streams for spawning at the beginning of the rainy season when water levels initially rise. Fishers have observed that water levels often drop much more rapidly after these initial water surges, leaving many fish stranded upstream with little or no water to survive in. This can result in good fishing for short periods of time, but is generally detrimental for fish populations. Fishers also find fishing difficult when they put out gillnets at night and find that by the next morning water levels have suddenly risen and have washed away their gillnets. Or, they sometimes wake up to find that water levels have declined, leaving their gillnets high and dry, completely out of the water and unable to catch fish.

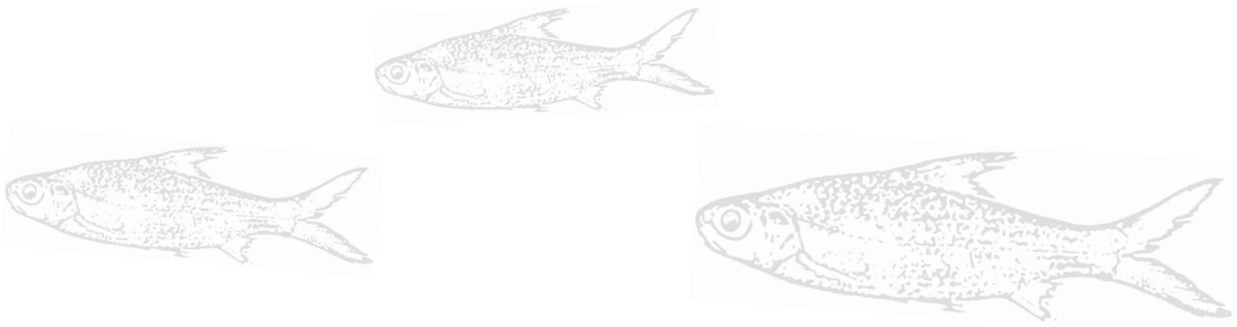
Fishers have observed that if water levels are relatively constant on a daily basis for three or four days castnet fishing is relatively good, but if water levels decline rapidly it is often difficult to catch fish with castnets. In a similar manner, locals used to have a lot of success fishing when water levels first rose after heavy rains, but they have found that the rapidly changing water levels of today no longer bring the same results.

Another important impact associated with unusual hydrological patterns is believed to be changes in fish migration triggers that determine when fish migrations begin. That is, the natural rising and falling of water levels at certain times of the year are thought to be closely associated with particular fish migrations. Changes in hydrology could also be impacting long distance migratory fish species that move up and down the Mekong River and into the Sekong, Sesan and Srepok river basins.

Sesan fishers have also observed that some fish species have been impacted more negatively than others. A few species have reportedly either disappeared entirely from fish catches or have declined more than others. For example, the nests of some fish species, like *Channa micropeltes* and *Osphronemus exodon* have been washed away by water surges, resulting in decreased breeding success, and the deep-water habitat of other species has declined significantly. Fishers are convinced that the rapid increases and declines of river water levels and changes in water quality have had serious impacts on various fish species and other aquatic life. Earthworms and shellfish have also been negatively impacted. In addition, two species of egg laying soft-shell turtles that lay their eggs on sand bars have been negatively impacted due to changes in water levels. No species are believed by fishers to have benefited due to the changes in hydrology and water quality in the Sesan River. Fishers have only observed declines in fish species and in other aquatic life. Fishers have also observed negative impacts to seasonally inundated trees and bushes especially adapted for the riverbed of the Sesan River, and other rivers in the Mekong River basin. Riverside vegetation has also declined due to unusual water fluctuations in the Sesan River.

Considering all the negative impacts on the Sesan River mentioned above, it should come as no surprise that fishers along the Sesan River report serious overall declines in fish catches since the Yali Falls dam impacts were first noticed. The average reported decline is to





just 26.7% of previous catches, with Phnom Kok, Tiem Leu and Bokham reporting the most serious negative impacts.

There are many good ecological reasons why downstream changes in water levels and hydrology have resulted in declines in fish populations and associated fisheries, and other aquatic life. However, it would be incorrect to claim that all these declines are attributable to the dam. Certainly there are other factors, such as destructive illegal fishing and increased human populations harvesting aquatic resources.

While it is impossible to calculate exactly what percentage of fish declines can be attributed to the Yali Falls dam as compared to other factors, it should be clear from the local ecological knowledge provided by fishers that the Yali Falls dam has had a significant negative impact on fish populations, fisheries and other aquatic life in the Sesan River. People living along the Sesan River in Ratanakiri deserve to be compensated for a significant portion of the fish declines, as they have already experienced years of uncompensated impacts. In that there was no EIA conducted regarding the downstream impacts of the Yali Falls dam in Cambodia, it should not be the responsibility of the fishers to prove that their livelihoods have been impacted. Rather, it seems only fair that the burden should be on the dam developers to demonstrate that fish stocks and fisheries have not declined, as they are the ones who failed to consider the potential impacts from the outset. Compensation should be provided for the life of the project, so as to spread out compensation for as long as impacts are being experienced. There also needs to be serious consideration given to improving downstream conditions by adopting an environmental flows perspective to the operation of Sesan dams in Viet Nam, in which water releases from the dam would be timed to replicate natural hydrological patterns as much as possible.

The results of this study clearly indicate that the Yali Falls dam has generally led to serious negative downstream impacts on fish, fisheries and other aquatic life in the Sesan River in Ratanakiri province, northeast Cambodia. While it is not possible to provide a definitive or exact estimate of the negative impacts to fisheries caused by the Yali Falls dam, the relatively detailed research process followed for this study, including the combination of qualitative and quantitative data from now and before the Yali Falls dam was built, has helped to provide at least a reasonable estimate of the types of impacts that are occurring and why, based on the state of knowledge of Mekong River basin riverine ecology. Most importantly, the analysis of villagers, based on local ecological knowledge, seems quite reasonable when considered in the light of what is known about these sorts of impacts by biologists and ecologists.

It seems reasonable to suggest that these estimates could be used to determine the sort of compensation villagers should be provided with as a result of being negatively impacted by the Yali Falls dam. While this study is certainly not fully comprehensive or ideal, it represents a good first step in assessing the future impacts of other Sesan River basin dams on downstream parts of Cambodia.



# Acknowledgements

This study could have never been conducted if it were not for the full participation and great voluntary efforts of the 22 fishers from seven villages (Phnom Kok, Tiem Leu, Taveng, Talao, Kanat Toich, Kak and Bokham) in three districts (Veun Say, Taveng and Andong Meas) in Ratanakiri province, northeast Cambodia who participated in this study. These 22 villagers prepared 20 data sets of quantitative data; of which 14 data sets are included in this report (the other six data sets were unfortunately unusable for various reasons). Those who contributed data sets included in this report are Mr. Cham Phuweng (Tiem Leu village) (#1), Mr. Chea Sok (Phnom Kok village<sup>1</sup>) (#2), Mr. Di Deuang (Taveng village) (#3), Mr. Du Wet (Taveng village) (#4), Mr. Kalan Dun (Bokham village) (#5), Mr. Kalan Hin (Bokham village) (#6), Mr. Kong Chan Nara (Tiem Leu village) (#7), Mr. Pang Khan (Talao village) (#8), Mr. Thao Thuy (Talao village) (#9), Mr. Sut Sao (Phnom Kok village) (#10), Mr. Sol Hyak (Kanat Toich village) and Mr. So Pheun (Kak village) (#11), Mr. Sol Teuy (Kanat Toich village) (#12), Mr. Phan Thong Lien and Mr. Theuk Nut (Tiem Leu village) (#13), and Mr. Tung Son (Taveng village) (#14). The quantitative fisheries data collected by Mr. Roman Heuang (Bokham village), Mr. Na La and Mr. Chu Patek (Phnom Kok village), Mr. Bu Van (Tiem Leu village), Mr. Nyian Non (Taveng village), Mr. Phan Phit (Phnom Kok village), and Mr. Khamle (Phnom Kok village) could not be used, but these fishers still contributed significantly to analysing the Sesan fisheries and downstream impacts to fish and other aquatic life caused by the Yali Falls dam. The 22 people who participated in this research all provided a wealth of local knowledge about changes in the Sesan River's aquatic habitats and resources since the Yali Falls dam was built. They contributed many hours of time to the work and their efforts deserve full acknowledgement.

Thanks also to members of the Indigenous Youth Development Program (IYDP) for helping to support the fish catch monitoring part of the research. Thanks to the Mekong River Commission's fisheries programme for providing support for the initial training workshop and to purchase the various fishing nets and hooks and lines needed to catch fish as part of the study. The 3S (Sesan, Srepok and Sekong) Rivers Protection Network (3SPN) coordinated the study that this report is based upon, with funding support from Oxfam America. Thanks to Ms. Nang Noi, Mr. Kim Sangha, Ms. Ame Tandrem and Ms. Emily Polack from 3SPN, and thanks to Ms. Kate Lazarus and Mr. Peter Chaudhry, both formerly of Oxfam America, for their support, and Mr. Warwick Browne and Ms. Estela Estoria, both presently with Oxfam America, for their support. Thanks also to Mr. Dave Hubbel for helping to edit this report and to Ms. Luntharimar Longcharoen for laying out the report and arranging for its printing. Mr. Dave Hubbel prepared figure 1, and Ms. Georgia van Rooijen prepared Figure 2. Mr. Heang Sarim translated the executive summary into Khmer with editing support from Mr. Kim Sangha.

<sup>1</sup> This village is often known as Phnom Kok Brao, and it is adjacent to another village called Phnom Kok Lao. This study was mainly done in Phnom Kok Brao, but for convenience, the study area is referred to only as Phnom Kok.





# Introduction

The Mekong River basin is rich in fish biodiversity (Kottelat 2000; 2001; Rainboth 1996; Roberts 1993a) and wild capture fisheries are extremely important to the livelihoods of much of the region's population, especially rural people who rely on fish as both a critical part of their diets and as an important source of income (Coates 2002). Cambodia is certainly no exception (Baran 2005; Ahmed *et al.* 1998) and fisheries are also certainly very important in the northeastern part of the country (Baird 1995).

The Sesan River is one of the most important tributaries of the Mekong River, and is the main source of fish utilised by local people living near it (Baird 1995). Originating in the central highlands of Kon Tum and Galai provinces in the Central Highlands of Viet Nam, it flows from east to west through the northern part of Ratanakiri and Stung Treng provinces in northeast Cambodia. In Stung Treng, it is joined by the Srepok River from the southeast, which itself originates in the Central Highlands in Viet Nam, in Dak Lak province. The Srepok River flows northeasterly through northeastern Mondolkiri province and southern Ratanakiri province before entering Stung Treng province and finally flowing into the Sesan. The Sesan, significantly enlarged by the flow of the Srepok, then continues flowing east before entering the Sekong<sup>2</sup> River further west in Stung Treng province. The Sekong River originates in Thua-Thien Hue province in Viet Nam, flowing south easterly through Sekong and Attapeu provinces in southern Laos before entering Stung Treng province and then flowing into the Mekong River at Stung Treng town about ten km after it is joined by the Sesan River (Figure 1). Together, the Sesan, Srepok and Sekong Rivers contribute approximately 19% of the total annual flow of the Mekong at Kratie town (Halcrow 1999).

There is considerable evidence in mainland Southeast Asia that dam and weir projects, whether small or large, or so-called run-of-the-river projects

or large reservoir dams have the potential to cause serious negative impacts to aquatic life and fisheries (Khoa *et al.* 2005; Roberts 2001; Baird 2001b; Dudgeon 2000; Claridge 1996; Roberts 1993b). Over the last decade, there has also been increased recognition of the downstream impacts of dam and other water development projects, be it the Nam Leuk, Nam Song, Theun Hinboun or most recently the Nam Theun 2 dams in Laos (Blake 2005; IRN 2004; Schouten *et al.* 2004; Shoemaker *et al.* 2001; IRN 1999; Roberts 1996), the Chinese dams in the mainstream Mekong River in Yunnan (Daming and Linhui 2002), rapid blasting in the upper Mekong River (Hubbel 2002; SEARIN 2002), or the Yali Falls dam in the Central highlands (Hirsch & Wyatt 2004; Baird & Dearden 2003; Baird *et al.* 2002; Ojendal *et al.* 2002; Fisheries Office & NTFP 2000).

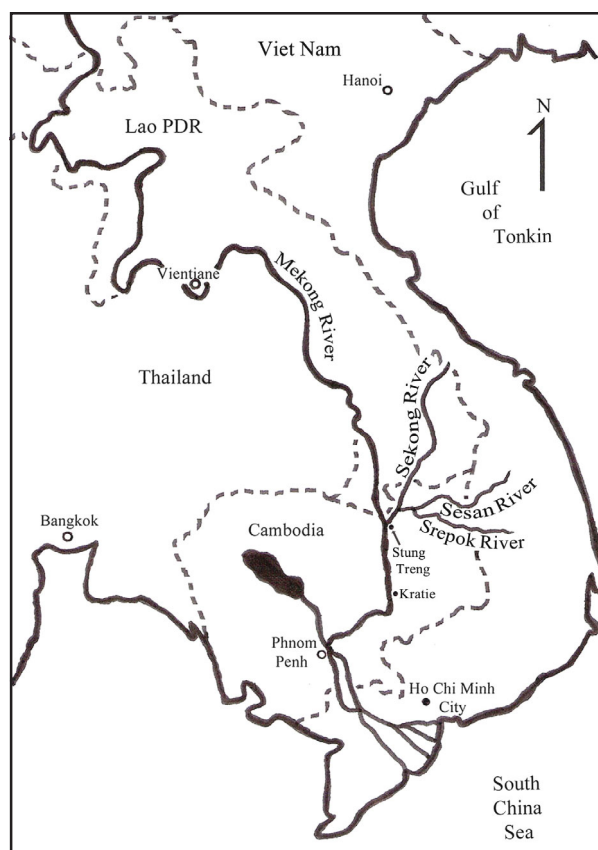


Figure 1. The Sekong, Sesan and Srepok Basins in Viet Nam, Cambodia and Laos

<sup>2</sup> The Sekong River is often spelt Xekong in Laos.

In 1993 the Vietnamese government, with support from the Ukraine, Russia and Sweden, began constructing the 720 MW-capacity Yali Falls dam, which is on the Sesan River about 80 km upstream from the border with Cambodia to the west. All four 180 MW turbines were installed by 2001, when the dam began operating regularly. However, the altered hydrology of the Sesan River due to the construction of a cofferdam began to be noticed downriver in Ratanakiri province, Cambodia, as early as late 1996 (Fisheries Office & NTFP 2000; Baird *et al.* 2002). Since then, over 55,000 people living near the Sesan River in Ratanakiri and Stung Treng provinces have been experiencing serious negative downstream impacts as a result of the construction of the Yali Falls dam between 1996 and 2001, and later due to the operation of the dam between 2001 and the present (Fisheries Office & NTFP 2000; Baird *et al.* 2002; Hirsch & Wyatt 2004). These impacts include over 32 people in Cambodia being drowned as a result of water release surges during the construction period between 1996 and 2000 (Fisheries Office & NTFP 2000; Lerner 2003), and a large number of others becoming ill and dying due to problems resulting from low quality water released downstream from the Yali Falls dam, or low quality water caused specifically by erosion resulting from unusual water releases (Fisheries Office & NTFP 2000; Baird *et al.* 2002). Various other impacts have also been reported. These include large numbers of livestock being washed away, and becoming sick and dying due to water released from the dam; and many fishing gears, boats and engines and other household items being washed away due to water surges and flooding at least partially the result of the dam. In addition, riverside vegetable gardens have been flooded due to water surges, and lowland wet rice paddy fields and swidden fields have been damaged due to rainy season flooding. There have also been various other downstream impacts associated with the Yali Falls dam (Fisheries Office & NTFP 2000; Baird *et al.* 2002; Hirsch & Wyatt 2004). Although the negative impacts of water releases from the Yali Falls dam have been less dramatic since the Yali Falls dam began fully operating in 2001, negative impacts from daily water level fluctuations have continued to result in serious downstream impacts (Baird *et al.* 2002; Hirsch & Wyatt 2004).

Some of the most critical negative impacts associated with changes in hydrology and water quality in the Sesan River in Ratanakiri province – both during construction and since full operation began – are strongly suspected by locals to have been on aquatic

natural resources in and along the Sesan River. For example, riverbank-nesting water birds have been negatively impacted by fluctuating water levels and higher than normal dry season water levels since 1996 (Claasen 2004). There have also been impacts on various species of other river-dependent animals, including shellfish, fresh-water turtles, aquatic insects and even earthworms (Fisheries Office & NTFP 2000; Baird *et al.* 2002).

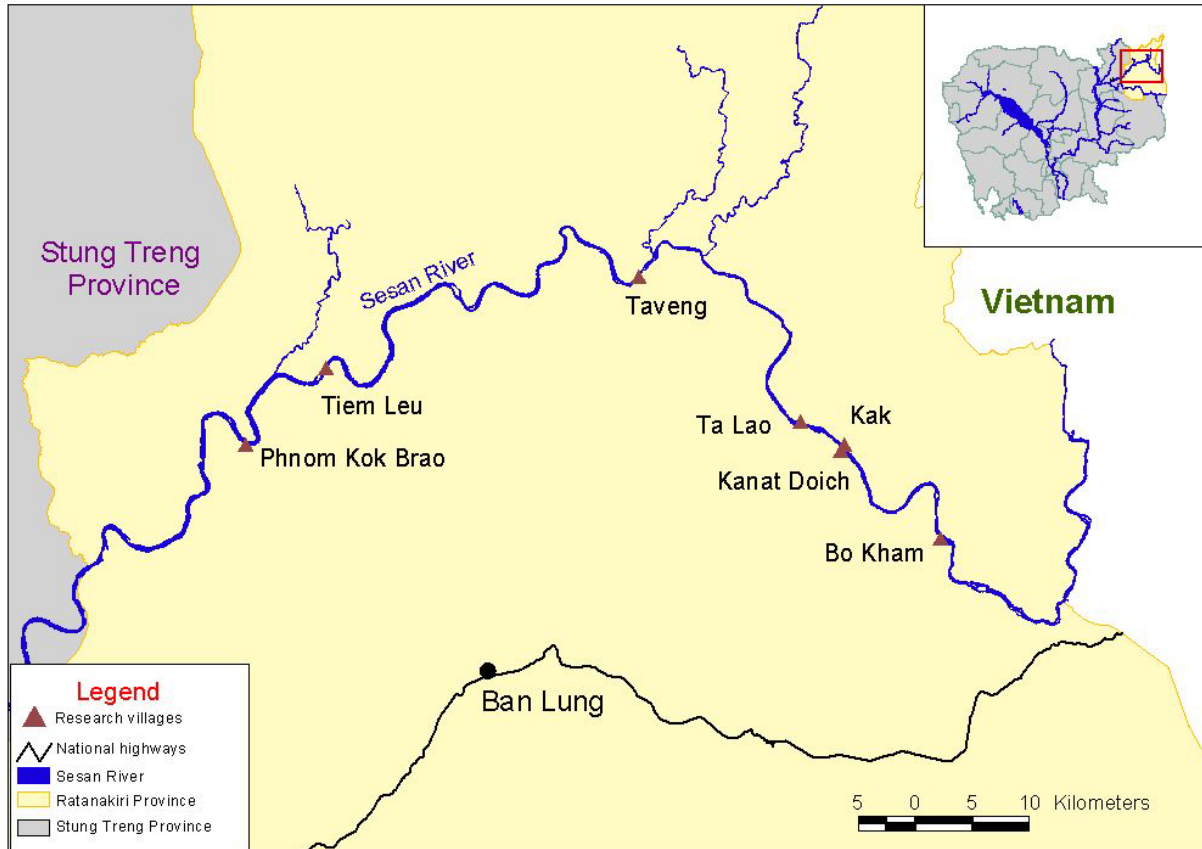
Considering the importance of fisheries to local livelihoods along the Sesan River in Ratanakiri and Stung Treng provinces (Baird 1995), one of the most critical impacts of the Yali Falls dam in Cambodia, as perceived by local people, have been on local fish and fisheries resources in the Sesan River (Fisheries Office & NTFP 2000; Baird *et al.* 2002; Hirsch & Wyatt 2004). However, since there was no environmental and social impact assessment (EIA) conducted in Cambodia prior to the construction or operation of the Yali Falls dam it has been difficult to compare changes in aquatic communities and fisheries. But experienced fishers living near the Sesan River in Cambodia are unanimous in their observations that there have been serious negative impacts due to changes in both hydrology and water quality since 1996 (Baird *et al.* 2002; Fisheries Office & NTFP 2000;).

Apart from the Yali Falls dam, there are also four new large dams under construction in the Sesan River basin in Viet Nam. They are the Sesan 3 dam, which is expected to be completed in 2006/2007; the Prei Krong dam, also expected to be completed in the same year; the Sesan 3A dam; and the Sesan 4 dam, construction of which began in 2005. The Sesan 4 dam is situated just a few km inside Viet Nam on the mainstream Sesan River (EVN 2005). All these dams will certainly accumulatively result in significant and severe negative downstream impacts in Cambodia. Apart from the Yali Falls dam, the two dams with large reservoirs are Plei Krong, upstream from Yali Falls; and the Sesan 4 dam, which will include a regulating dam downstream designed to reduce water level fluctuations in the Sesan River in Cambodia (EVN 2005).

What can be done when a large dam is built upstream in another country, the resulting downstream impacts are widely believed to have caused serious problems for fish and fisheries in a river, there has never been any quantitative fisheries data collected from the river before, and there was absolutely no consideration of downstream impacts in the neighbouring country within the project's original EIA, or attempts made to collect baseline fisheries data



Research villages along Sesan river, Ratanakiri province



**Figure 2. Sesan River in Ratanakiri province, northeast Cambodia, with the seven villages represented in the study**

before proceeding with the project? The above question was essentially the starting point for this study, with particular reference to the 720 MW Yali Falls dam being built in the central highlands of Viet Nam, and considering the dam’s downstream construction-period downstream impacts on fish and fisheries in the Sesan River in Ratanakiri and Stung Treng provinces, northeastern Cambodia since 1996, and its impacts more recently since becoming fully operational in 2001.

Considering the past impacts of the Yali Falls dam, and the future impacts of other dams planned for the Sesan River basin in Viet Nam, it is necessary to understand more about the fisheries of the basin in order to assess the environmental and social impacts of these ongoing dam developments upriver. Therefore, the purpose of this report is to present the quantitative and qualitative results of a study conducted in Ratanakiri province regarding fisheries in the Sesan River. This study both considers the present status of fisheries in the Sesan River in Ratanakiri while also assessing the downstream impacts of the Yali Falls and other dams on fish and fisheries.

**Methodology**

This study includes two main components. The first involved collecting quantitative catch effort data regarding the present state of fisheries in the Sesan River in Ratanakiri province, Cambodia, and the second component involved using local ecological knowledge about the past and present to assess the downstream impacts of the Yali Falls dam on fish and fisheries in Ratanakiri.

***Quantitative Fisheries Data Collection from the Sesan River in Ratanakiri Province***

The first component of this study involved a full year of quantitative fisheries and fish catch data collection by local fishers living in seven villages belonging to three districts along the Sesan River in Ratanakiri province. They are, from west to east (or downstream to upstream), Phnom Kok and Tiem Leu villages in Veun Say district, Taveng village in Taveng district, and Talao, Kanat Toich, Kak and Bokham villages in Andong Meas district (Figure 2).

This component began with a two-day training workshop for the fishers in order to familiarise them



with the objectives of the study – to collect accurate quantitative data regarding the Sesan River fisheries in order to assess the impact of the Yali Falls dam on aquatic resources – and the methods for accurately recording quantitative fishing effort and catch data regarding their own small-scale fisheries operations. This workshop was organised in Ban Lung, the capital of Ratanakiri province, in February 2003, with support from the 3S Rivers Protection Network (3SPN) and the Mekong River Commission’s (MRC) fisheries program in Cambodia. The MRC was approached by 3SPN to participate in the research in order to benefit from their experiences doing similar research in the Mekong River basin, and also to ensure that they were supportive of the research and would accept the research methodology and ultimately the research results. Needless to say, government buy-in and acceptance of the methodology was deemed crucial, so two researchers from the MRC-supported fisheries program at the Department of Fisheries attended the workshop, as well as two staff, including the chief, of the provincial Fisheries Office in Ratanakiri. A representative of the Fisheries Office in Stung Treng was also invited, as was one of the staff of a local NGO and member of the Sesan Rivers Protection Network, the Culture and Environment Protection Association (CEPA). The workshop was officially approved by the Ratanakiri provincial governor’s office.

The main objective of the workshop was to introduce the planned research to a group of villagers living in various communities along the Sesan River who had already been identified by the 3SPN as having the following characteristics essential for participating in this study: 1) They frequently and regularly fish in the Sesan River near their respective villages, and have considerable experience in doing so; 2) They are at least marginally literate, so as to be able to record basic quantitative fisheries data; 3) They have considerable local ecological knowledge about the fish and fisheries of the Sesan River in their respective areas, before and after the Yali Falls dam was built, and; 4) They are willing and able to volunteer time for collecting quantitative fisheries data over a one-year period, and are able to attend periodic meetings associated with the research in Ban Lung.

Although the participants in the initial workshop had already agreed to participate in the project over the coming year, and had been provided with some basic information about the study, it was deemed critical during the first research workshop to ensure that all the local participants fully understood and

agreed with the research objectives and methodology. This was especially important considering that an attempt had been made in 2002-2003 to set up a quantitative hydrology and water quality study at various points along the Sesan River in Ratanakiri and Stung Treng provinces, but that work could not be completed, and failed, largely due to low quality or inaccurate data having been collected at the beginning of the study. Importantly, it is believed that one critical reason that the research was not successful was because the consultants hired to direct the project did not make enough effort to ensure that all those expected to monitor the hydrology and water quality of the Sesan River (the villagers) fully understood and agreed with the research methodology. Essentially, many of those collecting the data only knew, at best, in part what the study was about, and why it was essential for them to ensure that only high quality data be collected as part of it. In addition, the diversity of languages used along the Sesan River in Ratanakiri (with nobody speaking Khmer as their first language) and the generally low level of formal education and literacy levels of the people living along the Sesan River necessitated that in order to conduct this study it would be necessary to carefully consider the strengths and weaknesses of the participants, and make allowances to ensure that their strengths were utilised as much as possible, and that weaknesses were identified and addressed before they could cause any serious problems for the study.

As mentioned above, one problem associated with data collection was that most fishers have only limited literacy skills, and more importantly, the fishers came from various ethnic groups (Brao, Jarai, Kachok, Kreung, Lao and Lun), and use different languages and have different local names for individual fish species. Therefore, it was necessary to develop an easy and transparent method for identifying the fish species caught by local fishers during the study. This involved the use of a set of fish photographs scanned onto the pages of a binder-book. The species included in these books were ones previously identified as occurring in the Sesan River in Ratanakiri province (see Baird 1995), as well as other species that were suspected to occur there, or were at least known from the mainstream Mekong River in southern Laos (Baird *et al.* 1999a).

Using photographs to identify fish collected by villagers in the field is not easy. Therefore, using this method was identified as a potentially serious obstacle for collecting good quality data from the outset of the study. Colour and scale problems associated with



photographs taken of the same species but from other rivers or locations is one serious drawback. Another is that the fishers living along the Sesan River have had little access to photographs or printed material in general, and particularly of fish, and thus are not as familiar with photographs of this type as most people living in industrialised countries or in urban areas. Low literacy levels and a broad array of locally spoken vernacular languages without commonly used written forms in Ratanakiri made it impossible for locals to have written all the local names of fish they had caught. Furthermore, using Khmer names would have been even more problematic, since native Khmer speakers populate none of the villages along the Sesan River in Ratanakiri. Therefore, even if some of the participants were able to write Khmer well, it would still have been highly unlikely that the many local names of fish in the Sesan River could have been translated into Khmer by any of the participants. Therefore, using local names to record fish caught during the study was not possible, as has been the case for other similar studies in the Mekong River basin, such as a quantitative fisheries data study of community-managed fish conservation zones in the mainstream Mekong River in Khong district, Champasak province, southern Laos conducted in the late 1990s (Baird *et al.* 1999b). However, for convenience, a list of local Lao and Brao language names for fishes encountered during the study have been recorded in Appendix 1 with the assistance of fishers involved in the study. An approximate list of Khmer language names has also been included in Appendix 1 based on Rainboth (1996)<sup>3</sup>.

Apart from introducing the study to the participants, most of the workshop involved training the participants how to practically collect high quality fisheries data that could be useful to both establish baseline fisheries data to compare with future dam or other environmental impacts in the Sesan River, and also to help act as a tool for considering the extent of those fish and fisheries impacts that have already occurred since the Yali Falls dam starting causing negative downstream impacts along the Sesan River in northeast Cambodia in 1996. Participants were introduced to the most basic Khmer language data collection sheets that it was possible to create and still collect meaningful and useful data. Special efforts were made to design the data collection forms so that as little writing as possible would be necessary. This was

believed to be important for minimising error and for reducing the amount of effort and time necessary for local fishers to participate in the research. Essentially, fishers were asked to record the code numbers associated with individual fish species or closely related groups of species difficult for fishers to reliably distinguish between (see below) with fish that fishers themselves caught during their regular daily fishing operations. Each of the colour photographs in a handbook given to each of the fishers were of fish known from or reasonably likely to occur in the Sesan River in Ratanakiri province. Apart from identifying fish species caught, it was also important to identify the weights of each individual fish caught, the dates and times of fishing operations, the types of fishing gears used, and the number of individuals of each fish species caught. Researchers were only expected to collect fisheries data from their own individual fishing operations, since it would have generally been both too time consuming and potentially highly disruptive to have expected villagers living along the Sesan in Ratanakiri to have recorded fisheries data from other fishers' catches.

During the training, a number of other potential problems with data collection were considered so as to help ensure that these problems would not occur. For example, from previous experiences in Laos (Baird *et al.* 1999b), it was recognised that it is important to emphasise with villagers that it is not only important for recording fisheries data on days when fish are caught, but also when fishing occurs but nothing is caught. If this is not emphasised villagers will generally only record data about fishing effort when fish are caught, resulting in skewed data with higher than actual catch-per-unit effort (CPUE) levels. In this study, CPUE has been calculated by dividing the weight of all fish caught with the number of hours that fishing occurred, regardless of whether fish were caught or not during any individual fishing operations. Another important point emphasised was the need to record all fish caught, and not just some of the fish or some of the species. Villagers were not requested to collect fisheries data at specific times, but were rather told to just fish following their normal fishing practices, and to record data during those times.

After the written documentation of the data collection process was fully explained and demonstrated, the participants were given chances to test their skills in documenting fish catches during some workshop

<sup>3</sup> It should be noted that this list of names was not collected from fishers involved in the study for reasons already stated earlier.





**Figure 3. Most of the village researchers together with Meach Mean and Kim Sangha of 3SPN, Ban Lung, Ratanakiri Province, northeastern Cambodia**

trials, using actual fish, scales for weighing them, and data sheets for recording the data. This provided the opportunity for the workshop organisers to identify weaknesses or other problems that required particular attention and correction.

Near the end of the first two-day workshop, the participants were given the opportunity to go as a group to the local market to purchase the fishing gears that they wanted to use for collecting fisheries data during the study. The gears purchased were mainly gillnets, longlines and hooks, and single hooks and lines (see Deap *et al.* 2003; Claridge *et al.* 1997). The mesh-sizes of the 100 m long and 50 meshes deep mono-filament nylon gillnets purchased by the research team for each of the fishers were 2.5 cm, 3 cm, 4 cm, 5 cm, 6 cm, 7 cm, 8 cm, 10 cm and 12 cm. The hooks varied from #5 to #14 sizes, and some leader and rope for making longlines were also provided. Each fisher ensured that he was satisfied with the fishing gear purchased by the project at the market.

A total of 22 male fishers from the seven villages participated in the quantitative fisheries data collection process of this study, and 20 sets of catch effort fisheries data<sup>4</sup> was collected from April 2003 and April

2004. Of the 20 data sets collected, it was unfortunately not possible to use six of the data sets (two from Phnom Kok and one each from Tiem Leu, Talao, Taveng and Bokham villages) due to various problems associated with the way the data had been collected and recorded. Although we had originally hoped to be able to utilise all the quantitative fisheries data collected during this study, mistakes made by the data collectors prevented this from being possible. It would have compromised the 14 sets of high quality data that remained, and has been included in this study. The 14 sets of data, were collected by 16 fishers, Mr. Cham Phuweng (Tiem Leu village) (#1), Mr. Chea Sok (Phnom Kok village) (#2), Mr. Di Deuang (Taveng village) (#3), Mr. Du Wet (Taveng village) (#4), Mr. Kalan Dun (Bokham village) (#5), Mr. Kalan Hin (Bokham village) (#6), Mr. Kong Chan Nara (Tiem Leu village) (#7), Mr. Pang Khan (Talao village) (#8), Mr. Thao Thuy (Talao village) (#9), Mr. Sut Sao (Phnom Kok village) (#10), Mr. Sol Hyak (Kanat Toich village) and Mr. So Pheun (Kak village) (#11), Mr. Sol Teuy (Kanat Toich village) (#12), Mr. Phan Thong Lien and Mr. Theuk Nut (Tiem Leu village) (#13) and Mr. Tung Son (Taveng village) (#14).

<sup>4</sup> In two cases, other people (Mr. Theuk Nut, Tiem Leu village and Mr. So Pheun, Kak village) replaced the original data collectors (Mr. Khan Thong Lien, Tiem Leu village and Sol Hyak, Kanat Toich village) part way through the study. Therefore, in both cases two fishers jointly contributed to one data set.

Handbooks with all the required fish photographs were provided to each of the village researchers in March and by April the participants had begun documenting their fish catches on the specified data sheets prepared especially for this research. However, it was recognised that it would not be sufficient to simply provide initial training, fishing gear, scales for weighing fish, and data sheets and pens and expect that the data would be collected. Therefore, staff from 3SPN, and particularly the second author of this report, regularly visited all the fishers in all seven of the villages involved in the project to monitor their work and help them with any problems that they might encounter. Initially, fishers were visited every week or two. During the initial stages of the research, 3SPN also provided support to local indigenous high school students in Ratanakiri province involved with the Indigenous Youth Development Program (IYDP) to assist them with monitoring the quantitative fisheries data collection program. This concerted effort to support the village researchers was deemed essential to ensure that data would be correctly and appropriately collected.

By about halfway through the research year it became evident that many of the fishing gears that had been purchased by 3SPN, with some support from the MRC, had either become damaged or lost during the previous months and required replacement. In some cases, and somewhat ironically, unusual hydrological patterns along the Sesan River were responsible for the washing away and permanent loss of quite a few new gillnets purchased specifically for the research. In other cases, these hydrological patterns caused by the dam were at least partially responsible for causing damage to fishing gear, particularly gillnets and longlines with hooks. Some villagers had also purchased their own fishing gears and were using them to fish for food and income, and were collecting data for this research using them. It was therefore decided to provide the researchers with a second set of fishing gears. Again, gillnets were mainly provided, along with some hooks and longlines. Since the village researchers were contributing all the labour for free, the provision of a few fishing gears for them was the only direct material benefit that they received from the project, apart from transportation, accommodation and food costs for the participants when called in for research workshop or meetings. Essentially, the villagers could use the fish caught in the project-provided fishing gears for whatever purposes they chose. We only required that catches be accurately and regularly recorded, using the scales and data sheets provided.

At the end of the one-year period of collecting quantitative fisheries data from the Sesan River, in April 2004, all the village participants in the project were asked to attend a second project workshop organised in Ban Lung with 3SPN support. This two-day workshop was designed to review the initial findings and impressions of the fishers regarding the research, as well as to collect the quantitative data collected by each fisher so that it could be processed over the next part of the research process. The first author and 3SPN colleagues also conducted an initial review of each fisher's research in order to ensure that the data that would be entered into the computer for analysis were collected using the correct documentation protocol. Unfortunately, it was found at this time that three sets of data were either incomplete or inaccurately recorded and would not be of a high enough standard to be formally used for the quantitative analysis part of the study.

It would not have been possible to have accurately recorded the fish species caught during the study if we had relied only on fish photographs to identify different species. While it was easy for villagers to identify some fish species using photographs, it was found that there was considerable confusion regarding the identification of others. The good news is that this problem was anticipated, as mentioned earlier, and therefore, at this workshop the first author reviewed the fish photographs used during the study with each of the fishers. Each photograph was compared with local Brao and Lao language names for the fish, as well as important biological or ecological characteristics of the species. Using this kind of triangulation, it was possible to identify many of the errors in identification resulting from problems using photographs to identify fish, and to make corrections to the numbers initially recorded by the fishers (see Baird 2003 for more details about this method).

The next labourious part of the study was led by the second author, who facilitated the entering of all the acceptable quantitative fisheries data collected during the study into computers located at the SPN office in Ban Lung, Ratanakiri. At the end of 2004 this work was completed. The data was then provided to the first author for further review and organisation.

The fisheries data used in this study were collected throughout the year based on standard CPUE methods. Certainly there are differences in fish catches during different times of year, based on various biological, ecological and socio-economic factors. In fact, the dates when each fishing operation was conducted were





recorded, and if we had the resources we could have created a database for analysing fish catches based on the times of year. In fact, we still have the raw data that could be used to do this in the future, but due to a lack of resources and time to establish such a database in the context of this study, it was decided to simply provide overall one year profiles of the fisheries rather than try to separate catches by times of year. This is certainly a limitation of this study. In addition, it should be recognised that fishers who participated in this study were not asked to fish at particular times of the year. Instead, we simply asked them to follow their regular fishing patterns and to collect data when they went fishing. Therefore, since more fishing is done at the end of the rainy season, during the dry season, and at the very beginning of the rainy season than at any other times of year, the data included in this study certainly reflect this pattern as well.

In April 2005 a third project workshop involving all the village participants was organised in Ban Lung, and again, this workshop was two days long. One of the purposes of this workshop was to present the initial formatted results of the quantitative fisheries data collected by the villagers during the one-year research period, in table form, to again consider whether the data were all accurate and complete, and how it might be altered so as to better reflect the reality of the fish catches monitored during the study. Once again, the first author sat with each of the fishers and discussed their data. Since the first author is very familiar with the species involved and similar fisheries in southern Laos and northeastern Cambodia, he was able to identify parts of the data that appeared to be either incomplete or inaccurate. For example, if it was found that a 2 kg individual of a certain species known to not exceed 100 grams in weight was recorded, it was quickly realised that this was likely to represent an error in fish identification or in recording the data. Through detailed discussions about these problems it was often possible to correct errors.

It was also found that there were a few species of fish that fishers caught but were not represented in the fish photograph handbook provided to them. These included *Pristolepis fasciata*, *Hypsibarbus wetmorei* and *Pseudomystus siamensis*. In some cases, fishers used codes for other species to identify those fish not

represented by photographs, and in other cases these fish were simply not recorded. Therefore, it was necessary to adjust the data so as to represent actual fish catches as well as possible. Another problem was that while it was generally possible for fishers to identify fish to genus level using photographs, in many cases using photographs to identify fish to the species level was simply unrealistic, although fishers are often able to identify different groups of fish to species level when live fish are involved. Therefore, rather than unrealistically expecting fishers to be able to identify some groups of fish to species level using photographs, it was decided to be conservative and to record some groups only to genus. This was done, for example, for *Probarbus jullieni* and *Probarbus labeamajor*, which have been included in this report as *Probarbus* spp.<sup>5</sup> The same goes for other complicated groups like *Cyclocheilichthys* (except for *C. enoplos*), *Hypsibarbus* (except for *H. wetmorei*), *Mastacemblus*, *Acantopsis* and many others. We felt that presenting accurate data was more important than trying to identify every fish caught to species level. We wanted to represent the fish biodiversity in the Sesan River as much as possible, but not unrealistically, and so we were forced to identify a realistic middle ground for doing this. However, three more sets of data had to be removed at this stage, due to problems with data collection that were deemed too problematic to solve, and this left just 14 for the final analysis.

Ultimately, the quantitative data collected by fishers has been recorded using Latin names, since using the various local names in use along the Sesan would have been unrealistic, and using local names would also have made the data inaccessible internationally, including in neighbouring Viet Nam. The Latin names included represent the most accurate determination of the genera and species of fish caught. Many names have been changed after discussions with fishers. In most cases the original fish species code numbers used during the data collection period are also included next to the Latin names of the fish, but when discussions with villagers have determined major mistakes and changes, or the addition of data not originally recorded on the data sheets, code numbers have sometimes not been recorded (see Appendix 1). A few standard conventions have been applied to the Latin names<sup>6</sup>.

<sup>5</sup> In fact, many fishers are easily able to distinguish these two species (Baird 2005b), but some others had problems doing so from photographs, leading to problems that necessitated a conservative approach to this genus.

<sup>6</sup> When the species was not determinable, but it was believed that only a single species was involved, the genus followed by 'sp.' has been included. When two or more species are believed to be included under the same category, the genus name has been followed by 'spp.' When the species identified was identified as a particular species, but it is believed that it might actually not be that species, the species name is preceded by the term 'cf.'

It is true that the problems associated with recording data were serious, and if we had been unaware of these problems or unwilling to openly recognise them the results of this research certainly would have been subject to potentially serious and legitimate criticisms. But instead, we chose to recognise the problems from the outset and build plans into the study to address these weaknesses, before the study began, during the data collection period, and after the data were collected. It should also be recognised that fisheries data collected by villagers are not the only data subject to errors and other methodological problems. While fisheries researchers often suppress these problems when data are published, giving the appearance of scientific rigour and purity, the reality is that there are many serious problems associated with collecting conventional fisheries data, especially in complex ecosystems like those of the Mekong River basin (Cowx 1995; Baird 2003; Baird *et al.* 2004; Baird 2006b). We believe that it is better to identify and acknowledge potential problems and to address them openly than to try to suppress them and pretend that they do not exist. In this way, we have been able to solve many of problems and help the villagers accurately represent their fisheries here.

The second major purpose of the workshop was to fully engage the fishers in analysing their own fisheries data, including drawing out what meanings they could from the data, and also to consider how the local ecological knowledge of the fishers could help explain the downstream impacts of the Yali Falls dam on fisheries in the Sesan River in Ratanakiri. Essentially, we wanted the villagers to compare the quantitative fisheries data that they had collected over a one-year period with what they remembered the fisheries to have been like prior to experiencing hydrology and water quality changes caused by the construction and operation of the Yali Falls dam. This part of the research requires more explanation.

#### ***Qualitative Fisheries Data Collection from the Sesan River in Ratanakiri Province***

Returning to our initial research problem, we wanted to better understand how fisheries in the Sesan River in Ratanakiri province have changed and are changing as a result of the construction and operation of the Yali Falls dam in Viet Nam. However, there were no quantitative fisheries data from the Sesan River collected before the dam was built to compare with the quantitative

fisheries data collected via this research in 2003-2004.

This leads us to the second component of the study, which involved individually and collectively interviewing all the fishers participating in the study and discussing the data with them. This was done in order to record information about the personal and collective observations and experiences of fishers regarding the state of the Sesan fisheries and particular fish species before the Yali Falls dam was built and since its construction and subsequent operation began. Essentially, they have utilised their local knowledge to compare the quantitative fish data that they collected from their own fishing activities on the Sesan River with qualitative data regarding fish and fisheries in the Sesan River from before the Yali Falls began causing downstream impacts in the Sesan River in Ratanakiri province in 1996. Considering that the Yali Falls dam developers never conducted any EIA on the downstream impacts of the Yali Falls dam in Viet Nam on the Sesan River in Ratanakiri, northeast Cambodia (Fisheries Office & NTFP 2000; Hirsch & Wyatt 2004), let alone collected any baseline fish or fisheries data before the dam was built that could be compared with the situation after the Yali Falls dam was built, one of the key purposes of this study has been to assess impacts on fish and fisheries by comparing quantitative and qualitative fish and fisheries data from the present with qualitative data from before the dam was built. This method is necessary and cannot be reasonably dismissed by the dam developers or their proponents, as every effort has been made to accurately assess changes in fisheries and impacts from the Yali Falls dam using available data, and in any case, the deficiency of quantitative fisheries data from before the dam was constructed cannot be blamed on the villagers, as the responsibility to consider these impacts before the dam was built certainly lies with the developer (Viet Nam) and those who provided financial, material and technical assistance (Russia, Ukraine, Sweden, Switzerland, etc.).

Moreover, some prominent fish biologists, such as the late Dr. Robert E. (Bob) Johannes, have effectively argued that particularly in non-industrialised countries with high levels of aquatic biodiversity and complex ecosystems, there is often no option but to rely on the local ecological knowledge of fishers to fill the gaps where more conventionally derived hard quantitative data is absent. In fact, these data are often the most appropriate considering the



circumstances, and can prove to be very important for management. Johannes has sometimes referred to management that relies on the local ecological knowledge of users as 'dataless management' (Johannes 1998), and he has argued that it would be ridiculous to fail to use this important knowledge in the absence of any quantitative data. In this way he has argued for the 'value of anecdote' (Johannes & Neis 2006).

Therefore, we designed this study to compare quantitative fisheries data collected by villagers over a year with qualitative data about fisheries before the Yali Falls dam was built in order to set basic benchmarks for the extent of fisheries impacts and declines to a large degree attributable to the Yali Falls dam. Most importantly, the study design allowed us to enhance these comparisons with villager observations and local knowledge about fish and fisheries before and since the dam was built, while also making use of relevant scientific fish and fisheries literature where available and the one report written specifically about Sesan fisheries in Ratanakiri before impacts from the Yali Falls dam were noticed downstream in Ratanakiri (Baird 1995). In other words, we have chosen to make use of all the tools available to us in order to try to understand how the Yali Falls dam has and is negatively impacting on fish and fisheries in the Sesan River in Ratanakiri.

We believe that quantitative fish and fisheries data can be extremely useful for examining fisheries issues, and we do not shy away from using it, but we also believe strongly, based on years of experience working on these types of research projects in the region, that local fishers have a huge amount of important local ecological knowledge about fish or fisheries that remains largely unrecognised and unused, and which is certainly undervalued by people other than the fishers and their local compatriots. The challenge has less to do with whether villagers know enough to significantly contribute to understanding the types of biological, ecological, economic, political and socio-cultural issues that are important for better understanding and managing the resources: about this there should be little doubt, based on similar work done in the region (Baird 2006a; Baird & Flaherty 2005; Chan *et al.* 2003; Bao *et al.* 2001; Poulsen & Valbo-Joergensen 2000; Valbo-Joergensen & Poulsen 2000; Baird *et al.* 1999a & b). The bigger challenge relates to the ability, or rather lack of ability, of many researchers to effectively access and assess local ecological knowledge (Baird

2003). We will refrain from going into too much detail on this issue here, but it is necessary to say something about this issue before continuing.

Essentially, one of the most important obstacles to accessing local ecological knowledge is the lack of knowledge of outside researchers about the resources in question and the socio-economic and cultural systems that surround these resources. This has been referred to as the problem of the 'electrical engineer phenomena' (Baird 2003); if someone has intricate knowledge about a particular technical field, like electrical engineering, and another person without a background in the field asks the expert to describe electrical engineering, the response is likely to be incomplete and simplistic, and he or she is unlikely to be very concerned about accurately depicting the field, because the expert would recognise that the person asking the question would not be able to comprehend a detailed explanation anyway. The same is often true when it comes to collecting ecological knowledge about fisheries by people without detailed knowledge about the resource or the skills to communicate this knowledge using local languages and names. Essentially, the involvement of the first author in this study has allowed us to overcome this obstacle, as he was able to talk in detail with the fishers about the fish that they encountered and the fisheries that they were involved with. He has acted as a bridge between the fishers of the Sesan River and the scientific world, but ultimately the fishers deserve the credit for providing the data critical for this study.

## Results

### **Quantitative Fisheries Data**

Sixteen fishers collected the 14 sets (or groups) of data that constitute quantitative catch effort fisheries data used in this study. Fishers from all seven locations monitored during the study have been included in the final results. Table 1 includes a list of the fishers whose data were used, their villages, and the fisheries that were monitored by each. There were 16 fishing gears monitored during the research, including nylon mono-filament gillnets with 2.5 cm, 3 cm, 4 cm, 5 cm, 6 cm, 7 cm, 8 cm, 10 cm, 12 cm and 13 cm mesh sizes, 3 cm meshed castnets, longlines and single lines with large and small hooks, and fish poisoning using native fruits. Of course, fishers in this area use a number of other fishing gears as well, but these were not monitored during this study.



**Table 1. Summary of fishers and fisheries monitored during the study**

No.	Fisher	Village	Fisheries Monitored
1	Mr. Cham Phuweng	Tiem Leu	4 cm and 5 cm meshed gillnets and longline hooks
2	Mr. Chea Sok	Phnom Kok	2.5 cm, 3 cm, 5 cm, 6 cm, 7 cm and 8 cm meshed gillnets and longline hooks
3	Mr. Di Deuang	Taveng	2.5 cm, 3 cm and 5 cm meshed gillnets and large hooks
4	Mr. Du Wet	Taveng	2.5 cm, 3 cm, 4 cm, 5 cm, 6 cm and 12 cm meshed gillnets and longline hooks
5	Mr. Kalan Dun	Bokham	3 cm, 4 cm, 6 cm and 10 cm meshed gillnets and hooks
6	Mr. Kalan Hin	Bokham	2.5 cm, 4 cm and 12 cm gillnets and single hooks and 3 cm castnet
7	Mr. Kong Chan Nara	Tiem Leu	2.5 cm and 5 cm meshed longline hooks
8	Mr. Pang Khan	Talao	3 cm, 4cm and 12 cm meshed gillnets large single hooks
9	Mr. Thao Thuy	Talao	3 cm, 4 cm, 5 cm, 8 cm and 10 cm meshed gillnets and hooks
10	Mr. Sut Sao	Phnom Kok	2.5 cm, 4 cm and 8 cm meshed gillnets and longline hooks
11	Mr. Sol Hyak and Mr. So Pheun	Kanat Toich and Kak	5 cm, 10 cm, 12 cm and 13 cm meshed gillnets and hooks
12	Mr. Sol Teuy	Kanat Toich	5 cm, 8 cm and 12 cm meshed gillnets
13	Mr. Phan Thong Lien and Mr. Theuk Nut	Tiem Leu	2.5 cm, 3 cm, 4 cm, 5 cm and 12 cm meshed gillnets, single hooks and longline hooks and fish poisoning
14	Mr. Tung Son	Taveng	4 cm and 6 cm meshed gillnets and single hooks
<b>Total</b>	<b>16 fishers in 14 groups</b>	<b>7 villages</b>	<b>2.5 cm, 3 cm, 4 cm, 5 cm, 6 cm, 7 cm, 8 cm, 10 cm, 12 cm and 13 cm gillnets, longline hooks and single small and large hooks, 3cm meshed castnets, and fish poisoning (16 fisheries)</b>

Combining the quantitative catch effort fisheries data collected by the fishers, 1,969 fishing operations were monitored during the study, covering 27,362.7 fishing hours. During this fishing 14,847 fish were caught weighing 2,250.36 kg. It is hard to know exactly how many fish species were caught, as some similar species were lumped under single fish 'species categories'. For example, there were two species of *Morulius* in catches, but they were recorded under

the single species category of '*Morulius* spp.' In any case, there were 111 'species categories' recorded in catches, and it is likely that these categories actually represent over 120 biological species. Not surprisingly, cyprinid carps were found to be the most important fish family in catches, although a number of other families also made up significant portions of the catch. The catch-per-unit effort (CPUE) for all fisheries combined was 0.082 kg/hour of fishing<sup>7</sup> (Table 2).

<sup>7</sup> It should, however, be noted that the CPUE calculations for longline hooks and single hooks have not been made on a hook basis. Rather, each set of hooks, regardless of how many hooks were involved, has been considered as a single gear. This has been done for the sake of convenience, and because the hook fisheries monitored mainly involved 40-50 hooks, although in a few cases only 20 were used (see Appendix 2 for details regarding longline and single hook fisheries).

**Table 2. Summary of Sesan fisheries by fisher and fishery**

No.	Fisher	Fishing gear	Times Fished	Hrs Fished	Weight	#Fish	# Spec	CPUE <sup>8</sup>
1	Cham Phuweng	4 cm gillnet	18	252	19.3	268	30	0.077
		5 cm gillnet	25	350	14.45	52	15	0.041
		Longline hooks	2	28	1	3	1	0.036
2	Chea Sok	2.5 cm gillnet	7	98	6.8	167	20	0.069
		3 cm gillnet	3	42	1.15	23	4	0.027
		5 cm gillnet	60	840	35.65	384	69	0.042
		6 cm gillnet	63	882	36.65	332	62	0.042
		7 cm gillnet	7	98	5.3	11	6	0.054
		8 cm gillnet	9	126	4.75	12	7	0.038
		Longline hooks	66	924	93.95	81	19	0.102
3	Di Deuang	2.5 cm gillnet	3	39	4.9	182	15	0.126
		3 cm gillnet	1	13	0.8	12	7	0.062
		5 cm gillnet	161	2093	165.1	1419	69	0.079
		Large hooks	18	234	17.75	69	23	0.076
4	Du Wet	2.5 cm gillnet	35	490	46.6	1030	26	0.095
		3 cm gillnet	12	168	6.3	64	13	0.038
		4 cm gillnet	7	98	11.65	98	17	0.119
5	Kalan Dun	3 cm gillnet	17	225	14.7	65	27	0.065
		4 cm gillnet	15	225	9.95	74	24	0.044
		6 cm gillnet	2	30	1.9	5	5	0.063
		10 cm gillnet	67	1005	110	94	27	0.11
		Hooks	2	30	9.9	11	5	0.33
6	Kalan Hin	2.5 cm gillnet	28	420	39.5	281	39	0.094
		4 cm gillnet	91	1365	30.85	248	41	0.023
		12 cm gillnet	82	1230	29.3	34	12	0.023
		longline hooks	1	15	0.3	2	1	0.02
		Castnet 3 cm	1	1.2	0.8	2	2	0.66
7	Kong Chan Nara	2.5 cm gillnet	74	1036	15.65	1082	32	0.015
		5 cm gillnet	71	994	76	889	54	0.077
		longline hooks	6	84	8.05	10	5	0.096
8	Pang Khan	3 cm gillnet	13	169	9.45	145	15	0.056
		4 cm gillnet	4	52	9.9	64	7	0.19
		12 cm gillnet	275	3510	123.1	86	23	0.035
		large single hooks	6	78	19.4	7	4	0.249

<sup>8</sup> CPUE means catch-per-unit effort, which is recorded here as kilograms of fish per hour of fishing per single fishing gear (i.e. total catch per gear per fishing trip divided by the number of hours fishing).

No.	Fisher	Fishing gear	Times Fished	Hrs Fished	Weight	#Fish	# Spec	CPUE
9	Thao Thuy	3 cm gillnet	3	51	2.2	112	2	0.043
		4 cm gillnet	31	527	43.65	587	35	0.083
		5 cm gillnet	17	289	34.45	205	28	0.119
		8 cm gillnet	17	289	45.5	87	12	0.157
		10 cm gillnet	13	227	40.5	51	13	0.176
		Longline hooks	12	194	39.4	20	7	0.203
10	Sut Sao	2.5 cm gillnet	4	42	1.25	35	6	0.03
		4 cm gillnet	57	798	32.95	615	41	0.041
		8 cm gillnet	13	182	1.6	3	3	0.009
		longline hooks	8	112	2.15	8	6	0.019
11	Sol Hyak and So Pheun	5 cm gillnet	23	345	18.9	75	11	0.05
		10 cm gillnet	4	60	18.4	8	3	0.31
		12 cm gillnet	56	840	356.7	191	25	0.43
		13 cm gillnet	8	120	37.2	19	7	0.31
		Longline hooks	3	45	4.2	1	1	0.09
12	Sol Teuy	5 cm gillnet	19	266	18.45	148	25	0.069
		8 cm gillnet	19	266	5.1	17	9	0.019
		12 cm gillnet	19	266	17.8	14	7	0.067
13	Phan Thong Lien and Theuk Nut	2.5 cm gillnet	33	462	66.06	1826	45	0.143
		3 cm gillnet	23	322	24.3	404	36	0.076
		4 cm gillnet	3	42	0.7	16	8	0.157
		5 cm gillnet	7	98	4.1	35	16	0.042
		6 cm gillnet	9	126	25.95	240	25	0.206
		12 cm gillnet	13	182	6.5	4	4	0.036
		Single hooks	5	70	9.7	21	8	0.143
		fish poisoning	1	14	2.2	115	8	0.157
14	Tung Son	4 cm gillnet	31	318.5	23.45	416	38	0.074
		6 cm gillnet	113	1525.5	97.25	1197	74	0.064
		Single hooks	25	337.5	65.6	65	23	0.194
	<b>Totals</b>		<b>1969</b>	<b>27362.7</b>	<b>2250.36</b>	<b>14847</b>	<b>111<sup>9</sup></b>	<b>0.082</b>

<sup>9</sup> The number of species listed here is only an approximate estimate, as in some cases more than one species is included under the same "species" category. This estimate of 111 species caught represents a minimum number, and there were probably more than 120 species caught during the study.

Table 3 breaks down the quantitative fisheries data by village, and combining data for the same fishing gears used by two or three fishers from the same village. Because So Pheun

(Kak village) and Sol Hyak (Kanat Toich village) contributed data to the same data set, and since the two villages are nearby, data from the two villages have been combined.

**Table 3. Summary of Sesan fisheries by village and fishery**

No.	Village	Fishing gear	Trips	Hrs Fished	Weight	#Fish	# Spec	CPUE
1	Phnom Kok	2.5 cm gillnet	11	140	8.05	202		0.058
		3 cm gillnet	3	42	1.15	23	4	0.027
		4 cm gillnet	57	798	32.95	615	41	0.041
		5 cm gillnet	60	840	35.65	384	68	0.042
		6 cm gillnet	63	882	36.65	332	62	0.042
		7 cm gillnet	7	98	5.3	11	6	0.054
		8 cm gillnet	22	308	6.35	15	10	0.021
		longline hooks	8	112	2.15	8	6	0.019
2		Tiem Leu	2.5 cm gillnet	74	1036	15.65	1082	32
	3 cm gillnet		23	322	24.3	404	36	0.076
	4 cm gillnet		21	294	20	284	33	0.068
	5 cm gillnet		103	1442	99.4	976	62+	0.069
	6 cm gillnet		9	126	25.95	240	25	0.206
	12 cm gillnet		13	182	6.5	4	4	0.036
	Single hooks		5	70	9.7	21	8	0.139
	Longline hooks		8	112	9.05	13	5	0.081
	fish poisoning		1	14	2.2	115	8	0.157
3	Taveng	2.5 cm gillnet	38	529	51.5	1212	26+	0.097
		3 cm gillnet	13	181	7.1	76	13+	0.039
		4 cm gillnet	38	416.5	35.1	514	38+	0.084
		5 cm gillnet	161	2093	165.1	1419	69	0.079
		6 cm gillnet	128	1735.5	139.05	1371	74+	0.053
		12 cm gillnet	25	350	34.7	40	13	0.099
		Large hooks	18	234	17.75	69	23	0.076
		Single hooks	25	337.5	65.6	65	23	0.194
		Longline hooks	36	504	75.25	56	20	0.149





No.	Village	Fishing gear	Trips	Hrs Fished	Weight	#Fish	# Spec	CPUE
4	Talao	3 cm gillnet	16	220	11.65	257	15+	0.053
		4 cm gillnet	35	579	53.55	651	35+	0.093
		5 cm gillnet	17	289	34.45	205	28	0.119
		8 cm gillnet	17	289	45.5	87	12	0.157
		10 cm gillnet	13	227	40.5	51	13	0.176
		12 cm gillnet	275	3510	123.1	86	23	0.035
		large single hooks	6	78	19.4	7	4	0.249
		Longline hooks	12	194	39.4	20	7	0.203
5	Kanat Toich and Kak	5 cm gillnet	42	611	37.35	223	25 +	0.061
		8 cm gillnet	19	266	5.1	17	9	0.019
		10 cm gillnet	4	60	18.4	8	3	0.31
		12 cm gillnet	75	1106	374.5	205	32+	0.339
		13 cm gillnet	8	120	37.2	19	7	0.31
		Longline hooks	3	45	4.2	1	1	0.09
6	Bokham	2.5 cm gillnet	28	420	39.5	281	39	0.094
		3 cm gillnet	17	225	14.7	65	27	0.065
		4 cm gillnet	106	1590	40.8	322	41+	0.026
		6 cm gillnet	2	30	1.9	5	5	0.063
		10 cm gillnet	67	1005	110	94	27	0.11
		12 cm gillnet	82	1230	29.3	34	12	0.023
		Hooks	2	30	9.9	11	5	0.33
		longline hooks	1	15	0.3	2	1	0.02
		Castnet 3 cm	1	1.2	0.8	2	2	0.66

Overall, CPUE levels in Talao and Kanat Toich are higher than for other villages. This may be because there are many rapids habitats near these villages. Bokham also has many good rapids habitats near their village, but because they are the farthest up river, and are closest to the dam, they appear to have been impacted more by water releases from the Yali Falls dam than villages farther downstream. The habitat is much sandier near Phnom Kok, Tiem Leu and Taveng villages, and this type of habitat is generally not as good for fisheries as rocky areas. There are considerable differences in the

species make-up of the catches for fisheries in rocky areas as opposed to sandy areas. For example, *Mekongina erythrospila*, *Labeo erythropterus*, and *Bangana behri*, which all feed on rock algae, made up very significant portions of the catches in Talao, Kanat Toich, Kak and Bokham, in the upper basin, as compared to the sandier downstream villages of Phnom Kok, Tiem Leu and Taveng. Microhabitats within the Sesan are certainly important for determining the species and quantities of fish found, and it would be a mistake to think that data collected from a single location would ever be sufficient to





represent other villages along the same river. That is largely why we chose to locate data from a number of locations along the Sesan River.

### **Local Ecological Knowledge and Sesan Fish and Fisheries**

The fishers from the villages have provided a wealth of information regarding the Yali Falls dam's downstream impacts in Cambodia, largely based on their local ecological knowledge. Local Ecological Knowledge (LEK) is receiving increased attention within fisheries research in the Mekong River basin (see, for example, Baird 2006a & c; Baird & Flaherty 2005; Hirsch 2004; Chan *et al.* 2003; Bao *et al.* 2001; Poulsen & Valbo-Joergensen 2000; Valbo-Joergensen & Poulsen 2000; Baird *et al.* 1999a & b). LEK is based on the individual and collective real-life experiences of fishers and is accumulated from generation to generation. It is not a stagnant form of knowledge based only on the passing on of ancient practices, but is highly adaptable, dynamic and very practical. It is the basis for local livelihoods and is in a constant state of change. Like all forms of knowledge, it can be developed and changed to meet new circumstances.

The fishers working on this study have made a number of important observations about Sesan River fish and fisheries. The study itself has helped them focus their attention on Sesan fish and fisheries issues, including issues related to aquatic ecology and the behaviour of other non-fish aquatic animals, and since all those who participated in the study were fishers before the study began, they held a considerable amount of local ecological knowledge as a basis for understanding and learning more about their changing resources and livelihoods. Their results fit well with known fisheries ecology in the region.

The framing of fisheries decline is not as straightforward as it is often presented, and the interests and positions of different players certainly influence the results. Results can vary considerably from one observer to another, depending on the level that each interacts with a particular fishery. This study is being partially done to help ensure that the perspectives of villagers are presented, as these interpretations of fisheries are the ones that are most frequently omitted when it comes to the development of large-scale projects like large dams and the

associated EIAs for these projects (Bush & Hirsch 2005).

### **Water quality**

Water quality is undoubtedly important when it comes to all kinds of aquatic life. Fishers are convinced that increased turbidity in the Sesan River constitutes one of the most serious impacts of dam building in the Sesan River basin. For example, the fishers who worked on this study have noticed that when water is released from the Yali Falls dam, the river often becomes very turbid and red, unlike anything that was experienced in the past. One fisher commented that if a pail of water is taken from the river at these times, there is generally one finger's width of red silt at the bottom of the pail within ten minutes, which is much more turbid than they ever saw the Sesan River before dam constructing began. They have reported that the water has recently become especially turbid. This is probably due to new dam construction on the Sesan in Viet Nam (Sesan 3, Sesan 3a and Sesan 4 dams).

Fishers from Kanat Toich, Talao and Bokham reported decreased populations of *Labeo erythropterus*, *Mekongina erythospila*, *Gyrinocheilus pennocki*, *Morulus* spp., and other species as a result of silt and sand being deposited on algae growing on rapids. This alga represents an important source of food for these species, and also others like *Henicorhynchus lobatus* and *Labiobarbus* cf. *leptocheilus*. Erosion resulting from 'hungry water'<sup>10</sup> and water surges released from the Yali Falls dam is widely believed to be the cause of this increased turbidity.

One serious impact of erosion on fish and fisheries has been the reported filling up of deep-water pools with sand, silt and rocks, damaging these habitats that serve as important dry-season refuges for many species (Baird 2006a, b & c; Baird & Flaherty 2005; Phounsavath *et al.* 2004; Poulsen *et al.* 2002; Kolding 2002; Baird *et al.* 2001b; Baird 2001a; Bao *et al.* 2001; Poulsen & Valbo-Joergensen 2000; Valbo-Joergensen 2000; Baird *et al.* 1999a & b). Fishers report that the reduction in these habitats has been especially serious for large species such as *Hemibagrus wyckiodes*, *Wallago leeri*, *Chitala blanci*, *Chitala ornata*, *Notopterus notopterus*, *Amphostistus laoensis*, *Tor tambroides*/spp., *Belodontichthys truncatus*, *Probarbus* spp., *Cyclocheilichthys enoplos*, *Labeo erythropterus*,

<sup>10</sup> 'Hungry water' is when relatively clear water is released from a reservoir and then tries to pick up sediment as it flows, leading to the scouring of some areas of riverbeds and erosion of riverbanks downstream.

*Hemibagrus nemurus*, *Bangana behri*, *Hemibagrus wyckii*, *Bagarius yarrelli*, *Kryptopterus* spp., *Micronema* spp., *Hemisilurus mekongensis*, *Pangasius hypophthalmus*, *Pangasius larnaudii*, *Pangasius conchophilus*, *Pangasius macronema*, *Coius undecimradiatus*, *Cirrihnus microlepis*, *Morulius* spp. and *Osphronemus melanopleurus*, to name only a few. However, other smaller species also rely on these habitats as well. Table 4 includes a list of the deep-water pools near six of the villages.

nutrients due to vegetation decay in the reservoir area after it was first filled. Thus, the water released by the dam altered the quality of water downstream, and the increase in filamentous algae was one result caused by the influx of nutrient-rich water from the Yali Falls reservoir. However, as would be expected, years after building the dam, the water quality in the reservoir has probably improved somewhat, resulting in a decline in filamentous algae downstream. Fishers strongly suspect that these changes in water quality

have contributed to fish population declines.

Fishers are also convinced that while water quality problems are less serious than they were in the past, problems remain, especially near the end of the dry season when water levels are low. It is unclear what the water quality is like within the Yali Falls dam reservoir, as we do not have access to data from the dam. While the water quality may have improved somewhat from early years, the quality of the reservoir water will never be as good as it was before the dam was built. Ian Campbell, MRC Senior Environmental Specialist was quoted as saying that, "Water level fluctuations [in the Sesan River] are clearly a problem for the people downstream." (Plaut and Phann

**Table 4. Depth reductions of Sesan River deep-water pools**

Village	Deep-water pool	Previous depth in dry season	Present depth in dry season
Phnom Kok	Kham Haeng	10 m	5 m
	Weun Kong	10 m	5 m
Tiem Leu	Kaleum	15 m	13 m
	Hin Kong	10 m	5 m
Taveng	Glawng Bra	15 m	12 m
	Lo	15 m	10 m
	Kate	13 m	9 m
	Ya Tom	12 m	8 m
	Undrao (N'Chouay village)	15 m	12 m
Talao and Kanat Toich	Weun Hin Ten	10 m	5 m
Bokham	Long Gatom	25 m	12 m

Another problem related to the deep-water pools filling up has been holes in rocks also filling up with silt. For example, fishers from Phnom Kok reported that *Chitala blanci*, *Chitala ornata* and *Notopterus notopterus* used to lay eggs in these holes, but that there is now less habitat for them to do this because the holes are mainly clogged up with silt. In addition, *Gyrinocheilus pennocki* is a species that is commonly found residing in holes in large rocks in the river, and fishers are convinced that the silting up of these holes has negatively impacted this species.

Fishers report that before the Yali Falls dam was built there were very little filamentous algae in the Sesan River. However, the amount increased a great deal after the dam was first built. Now, however, fishers have noticed that the amount of filamentous algae in the river has declined again. This apparently indicates that water initially released from the Yali Falls reservoir after it was first built probably contained excess

2005: 9). Although unable to find evidence of water quality problems, Campbell also pointed out that, "It is possible that rapid rises in water levels are flushing out dead animals or waste near villages and causing problems downstream, but our data did not indicate high bacterial levels in the water", no period. (Plaut and Phann 2005: 9). However, the MRC has apparently not sampled for blue green algae. Also, they did not begin to sample until years after the most serious impacts were reported, and probably after the worst impacts had passed. It is clear that they have failed to respond adequately or in a timely fashion.

**Hydrology**

Fishers have observed various problems when water levels rise quickly due to Yali Falls dam water releases. One relates to fish entering streams for spawning at the beginning of the rainy season when water levels initially rise. Before the dam, water levels rose at the



beginning of the rainy season, but rise are now sometimes much more rapid than before. Fishers have also observed that water levels often drop much more rapidly after these unnatural initial surges, leaving many fish stranded upstream with little or no water to survive. This can result in good fishing for a short period of time, but is generally detrimental for the fish populations. Another important impact associated with unusual hydrological patterns is believed to be changes in fish migration triggers<sup>11</sup>. That is, the rising and falling of water levels at certain times of the year are thought to be closely associated with particular fish migrations. For example, at the beginning of the monsoon rainy season in May there is naturally a rapid increase in water levels, which is frequently followed by fish migrations between the Sesan, Sekong and Mekong Rivers. They have been recorded, for example, with Pangasiidae catfish in the Mekong River in southern Laos (see Baird *et al.* 2004; Hogan *et al.* 2004; 2006). But when large reservoirs alter the natural flows of Mekong tributaries, these initial increases in water can be delayed or altered completely in such ways that migration triggers can be negatively affected. Furthermore, spawning and other important behaviours may also be negatively impacted by changes in rivers that affect triggers (Hogan *et al.* 2004; 2006; Baran *et al.* 2005).

Fishers also find fishing difficult when they put out gillnets at night and find that by the next morning water levels have suddenly risen and have washed away their gillnets. Or they sometimes wake up to find that water levels have dropped, leaving gillnets high and dry, completely out of the water and certainly unable to catch fish. Villagers say that they have little hope of catching more than the occasional bird in these gillnets when they end up out of the water. Fishers have also observed that if water levels are relatively constant on a daily basis for three or four days, castnet fishing is relatively good, but if water levels decline rapidly it is often difficult to catch fish with castnets. In a similar manner, they used to have a lot of success fishing when water levels first rose after heavy rains, but they have found that the rapidly changing water levels of today no longer bring the same results, and have made fishing at these times much less successful than in the past.

### Species

Fishers are convinced that the rapid increases and declines of river water levels and changes in water quality have had serious impacts on various fish species and other aquatic life. For example, the rapid changes in hydrology are believed to have had a serious negative impact on earthworm populations along the edge of the Sesan River. These earthworms are food for many species of fish, including *Hemibagrus wyckiodes*, *Hypsibarbus* spp., *Amphostistus laoensis*, *Pangasius larnaudii*, *Pangasius bocourti*, and other animals and birds. Earthworms are important as bait for longline and single hook fisheries. Table 5 provides estimates by village of the losses since the hydrology of the Sesan River began changing due to water releases from the Yali Falls dam. On average, fishers suspect that only 35% of the previous population of earthworms along the riverbank remains.

**Table 5. Ranked estimations of earthworm declines by Sesan villages**

Village	Previous population (with 10 as the standard)	Present population (as a comparison with 10)
Phnom Kok	10	3
Tiem Leu	10	2
Taveng	10	5
Talao	10	5
Kanat Toich	10	4
Bokham	10	2

Shellfish (including bivalves, like oysters, and gastropods) have also been negatively impacted by rapidly and frequently fluctuating water levels along with water surges from the Yali Falls dam, in a similar way to what is described for earthworms above. Fishers estimate that only about 30% of the previous populations remain. While the most severe impacts on shellfish are believed to have been experienced during the construction of the Yali Falls dam, when water levels fluctuated the most, the frequent daily fluctuations being noticed now have made it very difficult for populations to recover, and many have not. Also, since shellfish are filter feeders, increased turbidity may be negatively affecting their ability to feed. This reduces food for people, and also for some

<sup>11</sup> Fish migration triggers are generally changes in conditions, including water quality and hydrology, which cause fish migrations to begin.

fish species, including *Helicophagus waandersii*, *Pangasius larnaudii*, *Pangasius conchophilus*, *Notopterus notopterus*, *Chitala* spp., and *Hypsibarbus* spp. (see Baird & Phylavanh 1999 for more information

about the feeding habits of these species). Fishers also recognise that crabs and shrimps in the Sesan River have been negatively impacted in similar ways by changes caused by the Yali Falls dam.

It also seems certain that changes in the hydrology and water quality in the Sesan River have resulted in negative impacts on aquatic larvae, including fish eggs and fry and insects, in the river, but fishers have not taken as much notice of these small animals.

Sesan fishers have observed that some fish species have been more seriously impacted since the construction of the Yali Falls dam than others. Table 6 lists the fish species that fishers report having suffered the

most serious impacts. They have observed that these species have virtually disappeared from the Sesan River near their villages since the Yali Falls dam was built. Two species were reported to have disappeared completely from all of the villages. One is an unidentified cyprinid species and the other is *Thynnichthys thynnoides*, a small migratory cyprinid fish. Apart from those, some villagers reported other species as disappearing, although these species are

still occasionally encountered in some other villages along the Sesan River. They are *Leptobarbus hoeveni*, *Channa* cf. *marulius*, *Luciosoma bleekeri*, and *Macrochirichthys macrochirus*.

**Table 6. Species of fish reported by fishers to have largely disappeared from the Sesan since the Yali Falls dam was built**

Village	Species	Local Brao Name	Local Lao Name
Phnom Kok	<i>Macrochirichthys macrochirus</i>		<i>Pa hang pha</i>
	<i>Cyprinidae</i> sp. ? <sup>12</sup>		<i>Pa kai na</i>
	<i>Luciosoma bleekeri</i>		<i>Pa mak wai</i>
	<i>Thynnichthys thynnoides</i>		<i>Pa koum</i>
	<i>Leptobarbus hoeveni</i>		<i>Pa phong</i>
Tiem Leu	<i>Channa</i> cf. <i>marulius</i>		<i>Pa kouan</i>
	<i>Macrochirichthys macrochirus</i>		<i>Pa hang pha</i>
	<i>Cyprinidae</i> sp. ?		<i>Pa kai na</i>
	<i>Luciosoma bleekeri</i>		<i>Pa mak wai</i>
	<i>Thynnichthys thynnoides</i>		<i>Pa koum</i>
Taveng	<i>Channa</i> cf. <i>marulius</i>		<i>Pa kouan</i>
	<i>Cyprinidae</i> sp. ?	<i>Kaboung grung</i>	<i>Pa kai na</i>
	<i>Thynnichthys thynnoides</i>	<i>Kouk kaleng</i>	<i>Pa koum</i>
Talao	<i>Cyprinidae</i> sp. ?		<i>Pa kai na</i>
	<i>Macrochirichthys macrochirus</i>		<i>Pa hang pha</i>
	<i>Thynnichthys thynnoides</i>		<i>Pa koum</i>
Kanat Toich	<i>Thynnichthys thynnoides</i>		<i>Pa koum</i>
	<i>Macrochirichthys macrochirus</i>		<i>Pa hang pha</i>
	<i>Cyprinidae</i> sp. ?		<i>Pa kai na</i>
Bokham	<i>Cyprinidae</i> sp. ?		<i>Pa kai na</i>
	<i>Thynnichthys thynnoides</i>		<i>Pa koum</i>

Apart from the fish species listed above, a number of species were reported to have declined significantly, although some individuals remain. For example, fishers from Taveng reported that only about 20% of the previous population of *Coius undecimradiatus* remains. Fishers from both Taveng and Kanat Toich villages also reported that *Hypsibarbus* spp. and *Barbodes* spp. have declined to about 30% of previous population levels.

<sup>12</sup> It is uncertain what this species is, as there was no photograph of this species in the handbook provided to the fishers, and fishers report that none were caught during the study. The species is reportedly a cyprinid with black and white tail (maybe *Discherodontus ashmeadi*?).

Fishers from Phnom Kok and all other villagers reported drastic declines of *Osphronemus exodon* (to 20% of previous population), *Channa cf. marulius* and *Channa micropeltes* (to 10% of previous populations). The declines in these species are attributed to the habit of these species to make nests near the edges of the river. Unfortunately, these nests have been repeatedly washed away by surges of water released from the dam, resulting in decreased breeding success. In addition, two species of egg laying softshell turtles have also reportedly been negatively impacted due to changes in water levels. Much like sandbar egg-laying birds along the Sesan River have been impacted by water fluctuations along the Sesan River (Claasen 2004), nests of these turtles have often been flooded after water levels unusually increased due to water releases upstream.

No species are believed by fishers to have benefited due to the changes in hydrology and water quality in the Sesan River. Fishers have observed declines in aquatic life only.

Another impact has been on seasonally inundated trees and bushes especially adapted for the riverbed of the Sesan River, and other rivers in the Mekong River basin. These are especially common in rocky habitats, like those near Talao, Kanat Toich, Kak and Bokham villages. One species that has been badly impacted by rapidly fluctuating river levels and general changes in hydrology in the river since the Yali Falls dam was built, including increased water levels in the dry season, is *Telectadium edule* H. Baill. (Asclepiadaceae)<sup>13</sup>. People eat the flowers of this important riverine bush species, which, unlike many other species in this monsoon climate, drops its leaves in the rainy season when inundated by the Sesan River, and grows new leaves and flourishes in the dry season when water levels decline. Fish also eat the flowers, especially *Hypsibarbus* spp., *Osphronemus exodon*, *Pangasius macronema* and *Pangasius pleurotaenia* (see Baird & Phylavanh 1999 for detailed information about the diets of these species). Fishers report that changes in hydrology and water surges from the Yali Falls dam have decreased the number of these bushes by about 50%. In the Phnom Kok area there were never a lot of these bushes, but some of the few that previous existed have died in recent years due to changes in water level fluctuations.

Riverside vegetation has also declined due to unusual water fluctuations in the Sesan River. For

example, one riverside plant species called '*bai nyang hang*' in Lao is believed by fishers to have declined about 50%. Another species of riverside plant, called '*ya pong*' in Lao, is believed to have declined to 30% of previous numbers. Fish species are known to eat these plants, including *Osphronemus exodon* and *Hypsibarbus* spp. Another tree along the river, called the '*mak kabao*' tree in Lao (*Hydnocarpus anthelminthica* [Flacourtiaceae]), also produces a fruit eaten by the large cyprinid fish *Leptobarbus hoeveni* (Baird *et al.* 1999a; Roberts 1993a). Riverbank erosion has caused many of these trees to fall into the water, leaving very few remaining. Some riverside fig trees called '*mak deua*' in Lao and '*lawng lawa*' in Brao (*Ficus racemosa* L. var. *racemosa* [Moraceae]) have also been lost due to erosion. The fruits of these trees are a popular fish food (Baird *et al.* 1999a; Baird & Phylavanh 1999; Roberts & Baird 1995; Roberts 1993a), and many of the fishers who participated in this study bait hooks with them (see Appendix 2).

Fishers reported that the fish *Oxyeleotris marmorata* is found in the lower Sesan River near Phnom Kok and Tiem Leu villages, but is absent or very rare in the upper Sesan from Taveng district upstream. However, one large individual was recorded in fish catches during this study in Kanat Toich village (see Appendix 2). There have also reportedly never been any *Boesemania microlepis*, *Arius* spp., *Polynemus longipectoralis* in the Sesan River in Ratanakiri, although all those species are known from the Mekong River in the mainstream Mekong River at Stung Treng and in southern Laos (Baird *et al.* 1999a).

One of the interesting results of the study relates to the species of fish caught in fisheries near different villages along the Sesan River. The quantitative catch effort fisheries data clearly indicates microhabitats in the Sesan River are important for maintaining different communities of fishes. For example, in sandy areas like those near Tiem Leu and Phnom Kok villages a number of species were either totally absent or quite rare in catches. They included *Mekongina erythrospila* (the highly renowned *trey pa sa-ee*), *Gyrinocheilus pennocki*, *Bangara behri* and *Labeo erythropterus*. However, these species were caught quite frequently in areas with more rapids and rocky areas, such as the areas around Talao, Kanat Toich, Kak and Bokham. This is not particularly surprising considering the

<sup>13</sup> This plant is called "*kok khai khi lao*" or "*kok khai kin mak*" in Lao language.



importance of microhabitats in the mainstream Mekong River in southern Laos, which Baird & Flaherty (2005) have recently demonstrated.

Considering all the negative impacts on the Sesan River mentioned above, it should come as no surprise that fishers along the Sesan River all report serious overall declines in fish catches since the Yali Falls dam impacts were first noticed. Table 7 provides an estimation of the levels of declines that fishers working on this research project reported. Before they provided this information, it was emphasised that it is important that they provide carefully considered and realistic estimates of actual declines. After more than two years of workshops, discussions, data gathering, and collaborative analysis and evaluation, the authors of this report are confident that the fishers involved in this study have provided their carefully considered and realistic estimates of actual declines in the fisheries of the Sesan River. The average reported decline is to just 26.7% of previous catches, with Phnom Kok, Tiem Leu and Bokham reporting the most serious negative impacts.

**Table 7. Estimations of fisheries declines by Sesan villages**

Village	Previous catch (with 10 as the standard)	Present catch (as a comparison with 10)	Notes
Phnom Kok	10	2	
Tiem Leu	10	1	
Taveng	10	3	Villagers now purchase fish paste. Before they caught their own fish to make fish paste.
Kanat Toich	10	3	
Talao	10	5	
Bokham	10	2	

**Discussion**

There is compelling evidence to indicate that downstream changes in water levels and hydrology caused by the Yali Falls dam in Viet Nam have resulted in declines in fish populations and associated fisheries, and other aquatic life in the Sesan River in Cambodia. However, it would be incorrect to claim that all these declines are attributable to the dam. Certainly there

are other factors. These include impacts from illegal fishing, such as electric shock fishing. However, it is unclear how these increases in electric shock fish have been compensated for by observed declines in explosives fishing (see Baird 1995 for information about explosives fishing in the Sesan River at that time). There are probably more market-based pressures on fisheries, and fishing gears have also become more modern and effective in recent years. It is also true that human populations have increased. Nevertheless, there is increasing evidence indicating that fisheries are in decline throughout the Sesan basin for dam-related reasons and, indeed, throughout the Mekong basin. Fish migrate to and from the Sesan River and the Tonlesap Lake in central Cambodia and the South China Sea in Viet Nam (Baird 1995; Baird *et al.* 2003; Hogan *et al.* 2004; 2006), and to and from Laos and Thailand (Baird 1995; Baird *et al.* 2003; Baird & Flaherty 2004 ). Clearly, the fisheries of the Sesan River are not isolated from the rest of the Mekong River basin, nor are the impacts of the Yali Falls dam on the fisheries of the Sesan unrelated to the overall

decline in fisheries in the Mekong basin. Although not all species in the river are highly migratory, some certainly are, including small cyprinids like *Henicorhynchus* spp., *Paralubuca typus*, *Labiobarbus* cf. *leptocheilus*, etc., which are believed to migrate upstream from the Tonlesap Lake and Mekong River (Baird *et al.* 2003).

While it is impossible to say exactly what percentage of fish declines can be attributed to the Yali Falls dam as compared to other factors, it should be clear from the local ecological knowledge provided by fishers that the dam has had a significant negative impact on fish populations and fisheries in the Sesan River. It is clear that the people living along the Sesan River in Ratanakiri deserve to be compensated for a significant portion of the fish declines, as they have already experienced years of uncompensated

impacts. In that there was no EIA conducted regarding the downstream impacts of the Yali Falls dam in Cambodia, it should not be the responsibility of the fishers to prove that their livelihoods have been impacted. Rather, it seems only fair that that the burden should be on the dam developers to demonstrate that fish stocks and fisheries have not declined, as they are the ones who have failed to address the problems. It was not the impacted people



who asked for the dam to be built. In fact, they were not even told about plans to build the Yali Falls dam, let alone consulted regarding whether they wanted the dam to be built or not. They certainly have not received access to electricity as a result of the dam.

It is also certainly important for Sesan villagers to establish community fisheries organisations at the village and commune levels for controlling illegal and destructive fishing practices, as these efforts can lead to good results (Baird & Flaherty 2005; Baird 2006a; 2001a; Baird *et al.* 2001b), but since the subject of this report are the downstream impacts of the Yali Falls dam on fisheries, we have chosen not to discuss this issue here.

While villagers living along the Sesan River certainly deserve substantial compensation for fisheries and other aquatic life losses associated with the construction and operation of the Yali Falls dam, villagers frequently claim that providing compensation, while welcomed, is not sufficient for solving their problems. That is because they have the long-term livelihood interests of themselves and their children and grandchildren in mind. Secondly, they think that cash compensation would not last long, and then when the compensation is all gone they would still be burdened by the continuing impacts of the dam. Therefore, compensation should be provided for the life of the project, and for as long as impacts are being experienced. Secondly, there needs to be serious consideration given to improving downstream conditions by adopting an environmental flows perspective to the operation of Sesan dams in Viet Nam. This would require some sacrifices in electricity generation revenue on behalf of Viet Nam, but these losses could result in considerable improvements downstream if the dams were operated more to time water releases so as to avoid rapid daily fluctuations and also to ensure that the seasonal natural flow downstream is more closely replicated.

## Conclusions

The results of this study clearly indicate that the Yali Falls dam has generally led to serious negative downstream impacts on fish and fisheries in the Sesan River in Ratanakiri province, northeast Cambodia. While it is not possible to provide a definitive or exact estimate of the negative impacts to fisheries caused by the Yali Falls dam, the relatively detailed research process followed for this study, including the combination of qualitative and quantitative data from

now and before the Yali Falls dam was built, has helped to provide at least a reasonable estimate, based on sound ecological principles and previous experiences, of the types of impacts that are occurring and why. Most importantly, the analysis of villagers, based on their ecological knowledge, seems quite reasonable when considered in the light of what is known about these sorts of impacts by biologists and ecologists.

In that this study has helped clarify many of the downstream impacts of the Yali Falls dam on fish and fisheries, as well as other associated livelihood activities, it seems reasonable to suggest at this point that these estimates could be used to determine what sort of compensation villagers should be provided with as a result of the Yali Falls dam. This research is certainly not fully comprehensive or ideal at all times, but considering the historical and present circumstances of the situation, it represents a good assessment of the negative downstream impacts of the Yali Falls dam on fisheries. Moreover, this study should also be quite useful in assessing the future impacts of other Sesan River basin dams on downstream parts of Cambodia.



## References Cited

- Ahmed, M., H. Navy, L. Vuthy and M. Tiongco 1998. Socioeconomic assessment of freshwater capture fisheries in Cambodia: report on a household survey. Mekong River Commission, Phnom Penh, Cambodia, 186 pp.
- Baird, I.G. 2006a. Strength in diversity: fish sanctuaries and deep-water pools in Laos. *Fisheries Management and Ecology* 13: 1-8.
- Baird, I.G. 2006b (In Press). *Probarbus jullieni* and *Probarbus labeamajor*: the management and conservation of two of the largest fish species in the Mekong River in southern Laos. *Aquatic Conservation: Freshwater and Marine Ecosystems*.
- Baird, I.G. 2006c (In Press). Local ecological knowledge and small-scale freshwater fisheries management in the Mekong River in southern Laos. In: Haggan, N., B. Neis and I.G. Baird (Eds.), *Fishers' Knowledge, the Changing Face of Fisheries Science and Management*. UNESCO, Paris.
- Baird, I.G. 2003. Local ecological knowledge and small-scale freshwater fisheries management in the Mekong River in southern Laos. Pages 87-99 In: Haggan, N., C. Brignall, and L. Wood (eds.), *Putting Fishers' Knowledge to Work, Conference Proceedings, 27-30 August, 2001*, The Fisheries Centre, The University of British Columbia, Vancouver, B.C., Canada.
- Baird, I.G. 2001a. Towards sustainable co-management of Mekong River aquatic resources: the experience in Siphandone wetlands. Pages 89-111 in Daconto, G. (ed.), *Siphandone Wetlands*. Environmental Protection and Community Development in Siphandone Wetland Project, CESVI, Bergamo, Italy.
- Baird, I. 2001b. A catchment approach to small-scale irrigation schemes in Lao PDR. *Watershed* 6(3): 36-41.
- Baird, I.G., 1995. A rapid study of fish and fisheries; and livelihoods and natural resources along the Sesan River, Ratanakiri, Cambodia. Unpublished Livelihoods and Natural Resources Study report, Oxfam (UK and Ireland) and Novib, Ban Lung, Ratanakiri, Cambodia, 54 pp.
- Baird, I.G. & P. Dearden 2003. Biodiversity conservation and resource tenure regimes – A case study from northeast Cambodia. *Environmental Management* 32(5): 541-550.
- Baird, I.G. & M.S. Flaherty 2005. Mekong River fish conservation zones in southern Laos: assessing effectiveness using local ecological knowledge. *Environmental Management* 36(3): 439-454.
- Baird, I.G. & M.S. Flaherty 2004. Beyond national borders: important Mekong River medium sized migratory carps (Cyprinidae) and fisheries in Laos and Cambodia. *Asian Fisheries Science* 17(3-4): 279-298.
- Baird, I.G. & B. Phylavanh 1999. Fishes and forests: fish foods and the importance of seasonally flooded riverine habitat for Mekong River fish. Technical report prepared for the Environmental Protection and Community Development in Siphandone Wetland Project, CESVI, Pakse, Lao PDR, 46 pp.
- Baird, I.G., M.S. Flaherty & B. Phylavanh 2003. Rhythms of the river: lunar phases and migrations of small carps (Cyprinidae) in the Mekong River. *Nat. Hist. Bull. Siam Soc.* 51(1): 5-36.
- Baird, I.G., M.S. Flaherty & B. Phylavanh 2004. Mekong River Pangasiidae catfish migrations and the Khone Falls wing trap fishery in southern Laos, *Nat. Hist. Bull. Siam Soc.* 52(1): 81-109.
- Baird, I.G., M. Baird, Chum Moni Cheath, Kim Sangha, Nuon Mekradee, Phat Sounith, Phouy Bun Nyok, Prom Sarim, Ros Savdee (Phiap), H. Rushton & Sia Phen 2002. A community-based study of the downstream impacts of the Yali Falls dam along the Se San, Sre Pok and Sekong Rivers in Stung Treng province, northeast Cambodia, Se San Protection Network Project, Partners For Development (PFD), Non Timber Forest Products Project (NTFP), Se San District Agriculture, Fisheries and Forestry Office, and Stung Treng District Office, Stung Treng, Cambodia.
- Baird, I.G., Z. Hogan, B. Phylavanh & P. Moyle 2001a. A communal fishery for the migratory catfish *Pangasius macronema* in the Mekong River. *Asian Fisheries Science* 14: 25-41.
- Baird, I.G., B. Phylavanh, B. Vongsenesouk & K. Xaiyamanivong 2001b. The ecology and conservation of the Smallscale Croaker *Boesemania microlepis* (Bleeker 1858-59) in the mainstream Mekong River, southern Laos. *Nat. Hist. Bull. Siam Soc.* 49: 161-176.
- Baird, I.G., V. Inthaphaisy, P. Kisouvannalath, B. Phylavanh & B. Mounsouphom 1999a. *The Fishes of Southern Lao* (In Lao). Lao Community Fisheries and Dolphin Protection Project, Ministry of Agriculture and Forestry, Pakse, Lao PDR, 162 pp.
- Baird, I.G., V. Inthaphaisy, P. Kisouvannalath, B. Vongsenesouk & B. Phylavanh 1999b. The setting up and the initial results of a villager based system for monitoring fish conservation zones in the Mekong River, Khong district, Champasak province, southern Lao PDR. Technical report prepared for the Environmental Protection and Community Development in Siphandone Wetland Project, CESVI, Pakse, Lao PDR, 41 pp.



- Baird, I.G. K. Tubtim & M. Baird 1996. The Kavet and the Kreung: observations of livelihoods and natural resources in two highlander villages in the districts of Veun Say and Ta Veng Ratanakiri province, Cambodia, August 1996. Livelihoods and Natural Resources Study Report, Oxfam (UK and Ireland) and Novib, Ban Lung, Ratanakiri, Cambodia, 99 pp.
- Baran, E. 2005. *Cambodian Inland Fisheries. Facts, Figures and Context*. Worldfish Center and Inland Fisheries Research and Development Center, Phnom Penh, 49 pp.
- Baran, E., I.G. Baird & G. Cans 2005. *Fisheries bioecology at the Khone Falls (Mekong River, Southern Laos)*. Worldfish Center, Penang, Malaysia, 84 pp.
- Blake D.J.H. 2005. A Review of the Adequacy of Compensation Measures for Communities Living Along the Xe Bang Fai River, Nam Theun 2 Hydropower Project, Lao PDR. January 2005. (Available at: [www.irmn.org/programs/mekong/namtheun.html](http://www.irmn.org/programs/mekong/namtheun.html))
- Bush, S.H. & P. Hirsch. 2005. Framing fishery decline. *Water Resources, Culture and Development* 1(2): 79-90.
- Chan S., S. Putrea, K. Sean & K.G. Hurtle 2003. Using local knowledge to inventory deep pools, important fish habitats in Cambodia. Assessment of Mekong Capture Fisheries Component, Department of Fisheries, Phnom Penh, 16 pp.
- Claasen, A.H. 2004. Abundance, distribution, and reproductive success of sandbar nesting birds below the Yali Falls hydropower dam on the Sesan River, northeastern Cambodia, WWF-World Wide Fund for Nature/Danida/WCS/BirdLife International Phnom Penh, 43 pp.
- Claridge G.F. (compiler) (1996) *An Inventory of wetlands in the Lao PDR*. Wetlands Programme, IUCN – The World Conservation Union, Vientiane.
- Claridge, G.F., T. Sorangkhou & I.G. Baird 1997. *Community Fisheries in Lao PDR: A Survey of Techniques and Issues*. IUCN - The World Conservation Union, Vientiane.
- Coates, D. 2002. Inland capture fishery statistics of Southeast Asia: Current status and information needs. Asia-Pacific Fishery Commission, Food and Agriculture Organisation of the United Nations, Regional Office for Asia and the Pacific, Bangkok.
- Cowx, I.G. 1995. Fish stock assessment—a biological basis for sound ecological management. In: D.M. Harper and A.J.D. Ferguson (eds.), *The Ecological Basis for River Management*, John Wiley & Sons Ltd., Chichester, pp. 375-388.
- Deap L., P. Degen & N. van Zalinge. 2003. Fishing gears of the Cambodian Mekong. Inland Fisheries Research and Development Institute of Cambodia (IFReDI), Phnom Penh, Cambodia Fisheries Technical Paper Series, Volume IV (2003), 269 pp.
- Dudgeon D. 2000. Large-Scale Hydrological Changes in Tropical Asia: Prospects for Riverine Biodiversity. *BioScience* 50(9): 793-806.
- Electricity of Vietnam [EVN] 2005. Feasibility study report of the Sesan 4 hydropower project (Translation version for notification in MRC). Ministry of Industry, Hanoi, 66 pp. +
- Fisheries Office, Ratanakiri Province & NTFP Project 2000. A study of the downstream impacts of the Yali Falls dam in the Se San River basin in Ratanakiri province, northeast Cambodia. Ban Lung, Ratanakiri Province, Cambodia, 66 pp.
- Sir William Halcrow & Partners [Halcrow]. 1999. Se Kong, Se San and Nam Theun River basins hydropower study. Final report. Asian Development Bank, Manila.
- Daming, He & Chen Linhui. 2002. The impact of hydropower cascade development in the Lancang-Mekong Basin, Yunnan. *Mekong Update and Dialogue* 53: 2-4.
- Hirsch, P. 2004. The politics of fisheries knowledge in the Mekong River Basin. In: R.L. Welcomme and T. Petr (Eds.), *Proceedings of the Second International Symposium on the Management of Large Rivers for Fisheries*. Vol. 2. *Sustaining Livelihoods and Biodiversity in the New Millennium*. 11-14 February, 2003. Phnom Penh, Kingdom of Cambodia. FAO, Bangkok.
- Hirsch, P. & A. Wyatt 2004. Negotiating local livelihoods: scales of conflict in the Se San River basin. *Asia Pacific Viewpoint* 45(1): 51-68.
- Hogan, Z., I. G. Baird, J. Vander Zanden & R. Radtke 2006 (In Preparation). New evidence for long distance migration and marine habitation in the Asian catfish *Pangasius krempfi*. Submitted to *Journal of Fish Biology*.
- Hogan, Z.S., P.B. Moyle, B. May, M.J. Vander Zanden & I.G. Baird 2004. The Imperiled giants of the Mekong. Ecologists struggle to understand – and protect – Southeast Asia's large migratory catfish. *American Scientist* 92 (May-June): 228-237.
- Hubbel D. 2002. 'Mekong: wrong blasted way'. Bangkok: *The Nation*, November 28, 2002.
- International Rivers Network [IRN] 1999. *Power struggle. The Impacts of Hydro-Development in Laos*. International Rivers Network, Berkeley, CA, USA, 68 pp.
- International Rivers Network [IRN]. 2004. The legacy of hydro in Laos. International Rivers Network, Berkeley, CA, USA, 4 pp.

- Ironside, J. & I.G. Baird 2003. Wilderness and cultural landscape: settlement, agriculture, and land and resource tenure in and adjacent to Virachey National Park, Northeast Cambodia. Biodiversity and Protection Area Management Project, Ministry of Environment, Ban Lung, Ratanakiri, Cambodia.
- Johannes, R.E. 1998. Dataless Management. *Trends in Ecology and Evolution* 13(6): 243-246.
- Johannes, R.E. & B. Neis 2006. The value of anecdote. In: Haggan, N., B. Neis and I.G. Baird (Eds.), *Fishers' Knowledge in Fisheries Science and Management*. Blackwell Sciences and UNESCO, Oxford.
- Khoa, S.N., K. Lorenzen, C. Garaway, B. Chamsinhg, D. Siebert & M. Randone. 2005. Impacts of irrigation on fisheries in rain-fed rice farming landscapes. *Journal of Applied Ecology* 42: 892-900.
- Kolding J. 2002. The use of hydro-acoustic surveys for the monitoring of fish abundance in the deep pools and Fish Conservation Zones in the Mekong River, Siphandone area, Champassak Province, Lao PDR. *Technical report*, LARReC, Vientiane, 32 pp.
- Kottelat, M. 2000. Diagnoses of a new genus and 64 new species of fishes of Laos (Teleostei: Cyprinidae, Balitoridae, Bagridae, Syngnathidae, Chaudhuriidae and Tetraodontidae). *J. South Asian Nat. Hist.* 5: 37-82.
- Kottelat, M. 2001. *The Fishes of Laos*. WHT Publications (Pte) Ltd., Colombo, Sri Lanka.
- Lerner, M. 2003. Dangerous Waters: Violations of International Law and Hydropower Development along the Sesan River. Oxfam America, Phnom Penh.
- Ojendal, J., V. Mathur & Mak Sithirith 2002. *Environmental Governance in the Mekong. Hydropower Site Selection Processes in the Se San and Sre Pok Basins*. SEI/RESPI Report Series No. 4, Stockholm Environment Institute, Stockholm, 84 pp.
- Phounsavath, S., C. Photitay & J. Valbo-Jorgensen 2004. Deep pools survey in Stung Treng and Siphandone area 2003-2004. Progress Report. LaRREC, Vientiane, 13 pp.
- Plaut, E. & Phann Ana. 2005. Village all but washed away. Ratanakiri villagers believe an upstream dam is responsible for a host of losses. *Cambodia Daily*, 399, 5-6 November 2005: 7-9.
- Poulsen, A.F., P. Ouch, S. Viravong, U. Suntornratana & N.T. Tung. 2002. Deep pools as dry season fish habitats in the Mekong River Basin. Phnom Penh: Mekong River Commission, *MRC Technical Paper* No. 4, Phnom Penh, 24 pp.
- Poulsen, A.F. & J.Valbo-Joergensen (eds.) 2000. Fish migrations and spawning habits in the Mekong Mainstream – a survey using local knowledge (basin wide). Assessment of Mekong Fisheries: Fish Migrations and Spawning and the Impact of Water Management Component. Mekong River Commission, Vientiane.
- Rainboth, W.J. 1996. *Field Guide to Fishes of the Cambodian Mekong*. Food and Agriculture Organization of the United Nations, Rome.
- Roberts, T.R. 1993a. Artisanal (sic) fisheries and fish ecology below the great waterfalls of the Mekong River in southern Laos. *Nat. Hist. Bull. Siam Soc.* 41: 31-62.
- Roberts, T.R. 1993b. Just another dammed river? Negative impacts of Pak Mun dam on fishes of the Mekong basin. *Nat. Hist. Bull. Siam Soc.* 41: 105-133.
- Roberts, T.R. 1994. *Osphronemus exodon*, a new species of giant gouramy with extraordinary dentition from the Mekong. *Nat. Hist. Bull. Siam Soc.* 42: 67-77.
- Roberts T.R. 1996. Fluvicide: an independent environmental assessment of Nam Theun 2 Hydropower Project in Laos, with particular reference to aquatic biology and fishes. (Unpublished report, January 1996 and reissued at World Bank's Technical Workshop on NT2 Project at AIT, Bangkok in August, 2004).
- Roberts T.R. 2001. On the river of no returns: Thailand's Pak Mun Dam and its fish ladder. *Nat. Hist. Bull. Siam Soc.* 49: 189-230.
- Roberts, T.R. & I.G. Baird 1995. Traditional fisheries and fish ecology on the Mekong River at Khone Waterfalls in Southern Laos. *Nat. Hist. Bull. Siam Soc.* 43: 219-262.
- Schouten, R., V. Visounnarath, B. Souvannalath & K. Volakummane 2004. Evaluation of Environmental and Social Impacts by Theun-Hinboun Hydropower Plant on Aquatic Life and Fisheries. Unpublished report for Theun-Hinboun Power Company Limited, September 2004. Vientiane.
- SEARIN. 2002. *Mekong rapids under fire*. Bangkok Project Rivers and Communities and Love Chiang Khong Group, Southeast Asia Rivers International Network and Oxfam America, Bangkok.
- Shoemaker, B., I.G. Baird & M. Baird 2001. *The People and Their River: A Survey of River-Based Livelihoods in the Xe Bang Fai River Basin in Central Lao PDR*. Lao PDR/Canada Fund for Local Initiatives, Vientiane.
- Valbo-Jorgensen J. & A. Poulsen 2000. Using local knowledge as a research tool in the study of river fish biology: Experiences from the Mekong. *Environment, Development and Sustainability* 2: 253-276.

# Appendix 1

## Fish species identified as being caught from the Sesan River during the study<sup>14</sup>

Number	Latin Name	Khmer <sup>15</sup>	Brao	Lao
001	<i>Amphostistus laoensis</i>	Trey bawbel	Treu ga heulmai	Pa hang lai
003	<i>Chitala ornata</i>	Trey krai	Treu ga gadoong	Pa tong khouay
004	<i>Chitala blanci</i>	Tray krai	Treu gao prawla	Pa tong kai
005	<i>Notopterus notopterus</i>	Trey slat	Treu galung yap	Pa tong na
007	<i>Tenualosa thibaudeaui</i>	Trey kbork	Treu mut dar	Pa mak phang
10a and b	<i>Raiamas guttatus</i>	Trey sawka keo	Treu ga wak	Pa sanak
011	<i>Paralaubucus typus</i>	Trey slak russey	Treu blang	Pa tep
013	<i>Macrochirichthys macrochirus</i>	Trey dangkleng	Treu ga umbeuk	Pa hang pha
017	<i>Luciosoma bleekeri</i>	Trey dawng dao or Trey bang kouy	Treu jeu ling or Treu jeu loin	Pa mak wai, Pa pome
020	<i>Aaptosyax grypus</i>			Pa sanak nyai
021	<i>Tor tambriodes</i> or spp.	Trey khaor	Treu ha mol (small) and Treu gring	Pa koua
022	<i>Hypsibarbus</i> spp.	Trey chhpin	Treu gachik	Pa pak
023	<i>Probarbus jullieni</i>	Trey trawsak	Treu hundom	Pa eun deng
024	<i>Probarbus labeamajor</i>	Trey trawsak sor	Treu hundom	Pa eun khao
026	<i>Amblyrhynchichthys truncates/Cyclocheilichthys</i> spp.	Trey kambot chramos	Treu ga jakook	Pa ta po
028	<i>Cyclocheilichthys</i> spp.	Trey sawka kdam	Treu ga pool	Pa doke ngieu
029	<i>Cyclocheilichthys enoplos</i>	Trey chhkok	Treu grung	Pa jok
031	<i>Cyclocheilichthys</i> sp.	Trey sawka kdam	Treu ga pool	Pa doke ngieu
035	<i>Puntioplites falcifer</i>	Trey chrakaing	Treu jarawgang	Pa sakang
038	<i>Barbodes schwanefeldi</i>	Trey kahe, Trey kahe loeung	Treu graw he	Pa wian fai (black)
040	<i>Barbodes altus</i>	Trey kahe krour horm	Treu Taro	Pa wian fai
041	<i>Systemus binotatus</i>		Treu gum pooal ting	Pa ket kheng, Pa pok
043	<i>Poropunitus deauratus</i>	Trey lolok saw	True broon or Treu hala lawng	Pa chat
044	<i>Hypsibarbus</i> spp.	Trey chhpin	Treu gachik	Pa pak (red tail)

<sup>14</sup> When the species was not determinable, but it was believed that only a single species was involved, the genus followed by 'sp.' has been included. When two or more species are believed to be included under the same category, the genus name has been followed by 'spp.' When the species identified was identified as a particular species, but it is believed that it might actually not be that species, the species name is preceded by the term 'cf.'

<sup>15</sup> Based on Khmer names included in Rainboth (1996).

Number	Latin Name	Khmer	Brao	Lao
049	<i>Scaphognathops bandanensis/spp.</i>	<i>Trey chrakaing</i>	<i>Treu gatek tom (small) or Treu gachik gut jeula (large)</i>	<i>Pa pian</i>
050	<i>Hampala dispar</i>	<i>Trey khmann</i>	<i>Treu jumbleu</i>	<i>Pa sout</i>
051	<i>Hampala macrolepidota</i>	<i>Trey khmann</i>	<i>Treu jumbleu</i>	<i>Pa sout</i>
053	<i>Thynnichthys thynnoides</i>	<i>Trey linh</i>	<i>Treu galeng</i>	<i>Pa koum</i>
054	<i>Bangana behri</i>	<i>Trey pawa mook pee</i>	<i>Treu prawgom mouk</i>	<i>Pa va na no</i>
057	<i>Labeo erythropterus</i>	<i>Trey pawa</i>	<i>Treu hun trung</i>	<i>Pa va souang</i>
058	<i>Morulus spp.</i>	<i>Trey kaek</i>	<i>Treu ga ek</i>	<i>Pa phia</i>
059	<i>Cirrhinus microlepis</i>	<i>Trey krawang (sm) or Treu pruol (lg)</i>	<i>Treu brawl</i>	<i>Pa phone</i>
061	<i>Cirrhinus jullieni</i>	<i>Trey phkar cha</i>	<i>Treu heu naw</i>	<i>Pa doke ngieu pha</i>
062, 006	<i>Henicorhynchus lobatus</i>	<i>Trey riel</i>	<i>Treu reeo</i>	<i>Pa soi houa lem</i>
063	<i>Henicorhynchus siamensis</i>	<i>Trey riel thom</i>	<i>Treu reeo dom</i>	<i>Pa soi houa po</i>
064	<i>Lobochilus melanotaenia</i>	<i>Trey changwa ronoung</i>	<i>Treu greu maich</i>	<i>Pa khiang</i>
066	<i>Osteochilus hasselti</i>	<i>Trey kros</i>	<i>Treu jeh</i>	<i>Pa mak bouap, Pa khikapheu</i>
067	<i>Osteochilus sp.</i>	<i>Trey kros</i>	<i>Treu hala lawng?</i>	<i>Pa i-moum</i>
068	<i>Osteochilus melanopleurus</i>	<i>Trey krum</i>		<i>Pa nok khao</i>
069	<i>Osteochilus sp.</i>	<i>Trey kros</i>	<i>Treu genyao hom</i>	<i>Pa i-moum</i>
070	<i>Osteocheilus microcephalus</i>	<i>Trey kros</i>	<i>Treu ga treu yak</i>	<i>Pa khang lai</i>
071	<i>Osteochilus waandersi</i>	<i>Trey kros</i>	<i>Treu ga treu yak</i>	<i>Pa khang lai</i>
072	<i>Crossocheilus siamensis</i>		<i>Treu ga treu yak</i>	<i>Pa khang lai</i>
073	<i>Garra cambodgiensis</i>		<i>Treu moaal or Treu tra oiny</i>	<i>Pa kom</i>
074	<i>Mekongina erythrospila</i>	<i>Trey pasa ee</i>	<i>Treu ga meum</i>	<i>Pa sa-ee</i>
075	<i>Gyrinocheilus pennocki</i>	<i>Trey smok</i>	<i>Treu ga lawm</i>	<i>Pa ko</i>
077	<i>Botia modesta</i>	<i>Trey kanchrouk krawhorn</i>	<i>Treu'ncheeo ganiang or Treu gabiang</i>	<i>Pa mou man</i>
079	<i>Botia helodes</i>	<i>Trey kanchrouk chhnoht</i>	<i>Treu'ncheeo ganiang or Treu gabiang</i>	<i>Pa kheo kai</i>
080	<i>Botia lecontei</i>	<i>Trey kanchrouk</i>	<i>Treu'ncheeo ganiang or Treu gabiang</i>	<i>Pa kheo kai (black caudal peduncle)</i>
081	<i>Botia nigrolineata</i>	<i>Trey kanchrouk</i>	<i>Treu'ncheeo ganiang or Treu gabiang</i>	<i>Pa kheo kai (black and yellow)</i>
082	<i>Bagrichthys macropterus</i>	<i>Trey chek tum</i>	<i>Treu ga haroom</i>	<i>Pa kouay souk</i>
084	<i>Hemibagrus nemurus</i>	<i>Trey chhlang</i>	<i>Treu glung</i>	<i>Pa kot leuang</i>
085	<i>Hemibagrus wyckioides</i>	<i>Trey cheuteeal?</i>	<i>Treu gateeal</i>	<i>Pa kheung</i>

Number	Latin Name	Khmer	Brao	Lao
086	<i>Hemibagrus wyckii</i>	Trey chhlang thmor	Treu glung tamaw	Pa kot mo
088	<i>Mystus spp.</i>	Trey kanchos	Treu haroom heul met	Pa khanyeng kho
089	<i>Bagrichthys macracanthus</i>	Trey chek tum	Treu ga haroom	Pa mak khan mak kheu
090	<i>Bagarius yarrelli</i>	Trey krawbay	Treu gun jee-ew	Pa khe
092	<i>Belodontichthys truncatus</i>	Trey klang hay	Treu ga gup	Pa khop
095	<i>Kryptopterus cryptopterus</i>	Trey prak or Trey kamplieu		Pa doke boua
096	<i>Micronema bleekeri</i>	Trey kes	Treu hala gadao	Pa nang ngeun
097	<i>Micronema micronema</i>	Trey kes	Treu hala gadao	Pa nang khao
097	<i>Micronema sp.</i>	Trey kes	Treu hala gadao	Pa nang
098	<i>Ompok bimaculatus</i>	Trey krormorm	Treu ga bok	Pa seuam
100	<i>Wallago leeri</i>	Trey stuak	Treu ga jawng lawng rung	Pa khoun
101	<i>Helicophagus waandersi</i>	Trey pra kandor	Treu ga ne	Pa nou
102	<i>Pangasius concophilus</i>	Trey ke	Treu ga haloat	Pa pho/pa ke
103	<i>Pangasius bocourti</i>	Trey pra kchau	Treu jar	Pa yang
104	<i>Pangasius hypophthalmus</i>	Trey pra	Treu ga bra	Pa souay kheo
105	<i>Pangasius krempfi</i>	Trey bong lao	Treu ga juntaing	Pa souay hang leuang
106	<i>Pangasius cf. polyuranodon</i>	Trey chhwiet		Pa gnone hang hian
107	<i>Pangasius larnaudii</i>	Trey po	Treu gum ak	Pa peung
110	<i>Pangasius macronema</i>	Trey chhwiet	Treu wai wai	Pa gnone thamada
111	<i>Pangasius pleurotaenia</i>	Trey chhwiet	Treu wai wai	Pa gnone thong khom
113	<i>Laides siamensis</i>	Trey chhwiet prak	Treu wai wai	Pa gnone thong
117	<i>Xenentodon cancila</i>	Trey phtoung	Treu pa tong	Pa kathong
118	<i>Mastacemblus spp.</i>	Trey kchoeung	Treu ha laing	Pa lat
119	<i>Macrogathus spp.</i>	Trey kchoeung	Treu ja lawt	Pa lot
120	<i>Monopterus albus</i>	Antong	doong	lan
123	<i>Anabas testudineus</i>	Trey kranh srai	Treu ga greng	Pa kheng
125	<i>Trichogaster trichopterus</i>	Trey kawmphleanh samrai	Treu graw gawng	Pa kadeut
126	<i>Osphronemus exodon</i>	Trey romeas	Treu ga preuk	Pa men
128	<i>Channa striatus</i>	Trey phtuok (sm) or Trey chhdaur (adult)	Treu pleeo	Pa kho
129	<i>Channa micropeltes</i>	Trey diep (sm) or Trey chhdaur (lg)	Treu gapree	Pa meng phou
130	<i>Channa sp.</i>	Trey om boong	Treu lumphong	Pa kouan

Number	Latin Name	Khmer	Brao	Lao
131	<i>Gobiidae</i> spp./ <i>Oxyeleotris marmorata</i>	Trey ksan/Trey damrey		Pa bou (large)
133	<i>Coius undecimradiatus</i>	Trey khlar	Treu gleu	Pa seua
139	<i>Achiroides</i> sp.	Trey andat chhke	Hapeeat jaw	Pa pan (small)
162	<i>Labiobarbus</i> cf. <i>leptocheilus</i>	Trey khnawng veng	Treu ga pooal janar	Pa lang khon
164	<i>Cirrhinus molitorella</i>	Trey phkar kor	Treu 'ngoiny	Pa keng
169	<i>Acantopsis</i> sp.	Trey ruschek	Treu 'ncheeo phaik	Pa hak kouay
170	<i>Acantopsis</i> sp.	Trey ruschek	Treu 'ncheeo phaik	Pa hak kouay
171	<i>Acantopsis</i> sp.	Trey ruschek	Treu 'ncheeo phaik	Pa hak kouay
173	<i>Mystus</i> spp.	Trey kanchos chhnoht	Treu haroom 'njeek	Pa khanyeng khang lai
175	<i>Kryptopterus</i> spp.	Trey kes prak or Trey kamplieu	Treu moo hadoom	Pa pik kai
179	<i>Pangasius conchophilus</i> / <i>Pangasius bocourti</i>	Trey ke/Trey pra kchau	Treu ga pa-eu?	Pa ke/Pa nyang
180	<i>Clarius batrachus</i>	Trey andaing	Treu 'ntriang	Pa douk
182, 184	<i>Channa gachua</i>	Trey ksan	Treu 'ngo	Pa kang
183	<i>Channa</i> cf. <i>marulius</i>	Trey om boong	Treu lum poong	Pa kouan (red spot)
185	<i>Channa</i> sp.			
189	<i>Parambassis</i> spp.	Trey kanchanh	Treu geu ta jeu	Pa khap khong
191	<i>Tetraodon</i> spp.	Trey kampot	Treu dawk layo	Pa pao
193	<i>Toxotes microlepis</i>	Trey kancheak sla	Treu gleu	Pa mong
	<i>Pseudomystus siamensis</i>	Trey kanchos thmor	Treu ga pet	Pa khi hia
	<i>Hypsibarbus wetmorei</i>	Trey chhpin krahom	Treu gachik heul met	Pa pak thong leuang
	<i>Leptobarbus hoeveni</i>	Trey chrawlang or Trey knuoch	Treu baloong	Pa phong
	<i>Cosmocheilus harmandi</i>	Trey kampoul bay	Treu took rook	Pa mak ban
	<i>Pristolepis fasciata</i>	Trey kantrawb	Treu ga grup	Pa ka
	<i>Rasbora</i> spp.	Trey changwa	Treu gumbi broon	Pa sieu, Pa sieu ao
	<i>Discherodontus ashmeadi</i>	Trey kantoei krahawm	Treu ga blaw	Pa hang deng <sup>16</sup>
	<i>Mystacoleucus</i> spp.	Trey tim proek	Treu ga tayk	Pa lang nam <sup>17</sup>
	<i>Wallago attu</i>	Trey sanday	Treu ga jawng mat	Pa khao <sup>18</sup>

<sup>16</sup> There were a small number of this species was caught, but there was no photograph in the identification book, catches were not recorded. The numbers were generally small, and could not be added later.

<sup>17</sup> There were a small number of this species was caught, but there was no photograph in the identification book, catches were not recorded. The numbers were generally small, and could not be added later.

<sup>18</sup> There were a small number of this species was caught, but there was no photograph in the identification book, catches were not recorded. The numbers were generally small, and could not be added later.

# Appendix 2

## Individual Fishers Catch Data: Records of Fish Monitoring Study

### Daily Record of fish monitoring study

#### Mr. Cham Phuweng - Tiem Leu village (#1)

No	Species	# Fish	Weight kg
1	<i>Osteocheilus hasselti</i> 66 <sup>19</sup>	45	2.5
2	<i>Puntioplites falcifer</i> 35	31	2.5
3	<i>Cyclocheilichthys</i> spp.	37	2.35
4	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	34	2.25
5	<i>Hemibagrus nemurus</i> 84	28	2.05
6	<i>Clarias batrachus</i> 180	15	1
7	<i>Osteocheilus microcephalus</i> 70	10	1
8	<i>Systemus binotatus</i> 41	7	0.8
9	<i>Hypsibarbus</i> spp. 44	6	0.8
10	<i>Barbodes schwanefeldi</i> 38	14	0.5
11	<i>Osphronemus exodon</i> 126	1	0.4
12	<i>Cirrhinus jullieni</i> / spp.	4	0.35
13	<i>Kryptopterus</i> spp. 175	6	0.3
14	<i>Channa striata</i> 128	4	0.3
15	<i>Bagrithys macracanthus</i> 89	3	0.25
16	<i>Mystus</i> spp. 88	2	0.25
17	<i>Micronema bleekeri</i> 96	4	0.2
18	<i>Belondichthys truncatus</i> 92	2	0.2
19	<i>Pristolepis fasciata</i>	2	0.2
20	<i>Botia helodes</i> 79	2	0.15
21	<i>Raiamas guttatus</i> 10b	1	0.15
22	<i>Notopterus notopterus</i> 5	2	0.1
23	Miscellaneous sp.	1	0.1
24	<i>Probarbus</i> spp. 23-24	1	0.1
25	<i>Paralaubuca typus</i> 11	1	0.1
26	<i>Toxotes microlepis</i> 193	1	0.1
27	<i>Gyrinocheilus pennocki</i> 75	1	0.1
28	<i>Chitala blanci</i> 4	1	0.1
29	<i>Osteocheilus</i> sp. 69	1	0.05
30	<i>P. siamensis</i> / <i>B. macropterus</i> 82 <sup>20</sup>	1	0.05
<b>Total</b>		<b>268</b>	<b>19.3</b>

**Total = 30 species**  
**268 fish = 19.3 kg**  
**4 cm gillnet (1 net)**  
**Times fished 18**  
**Hours fished 252**  
**CPUE 0.077 kg/hr**

<sup>19</sup> The numbers listed after species are the code numbers used to identify fishes during the study.

<sup>20</sup> Wherever this notation occurs, it means *Pseudomystus siamensis* and *Bagrithys macropterus*.



No	Species	# Fish	Weight kg
1	<i>Puntioplites falcifer</i> 35	19	4.1
2	<i>Cyclocheilichthys</i> spp.	3	2.9
3	<i>Hypsibarbus</i> spp. 44	8	2.1
4	<i>Bagrichthys macracanthus</i> 89	2	1
5	<i>Cyclocheilichthys enoplos</i> 29	2	1
6	<i>Scaphognathops bandanensis</i> /spp. 49	6	0.95
7	<i>Pangasius</i> sp.	1	0.5
8	<i>Barbodes schwanefeldi</i> 38	2	0.3
9	<i>Cirrhinus julieni</i> /spp.	2	0.3
10	Miscellaneous sp.	1	0.3
11	<i>Cyclocheilichthys</i> sp. 31	1	0.3
12	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	2	0.2
13	<i>Coius undecimradiatus</i> 133	1	0.2
14	<i>Systemus binotatus</i> 41	1	0.2
15	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	1	0.1
<b>Total</b>		<b>52</b>	<b>14.45</b>

**Total = 15 species**  
**52 fish = 14.45 kg**  
**5 cm gillnet (1 net)**  
**Times fished 25**  
**Hours fished 350**  
**CPUE 0.041 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Channa striata</i> 128	3	1
<b>Total</b>		<b>3</b>	<b>1</b>

**Total = 1 species**  
**3 fish = 1 kg**  
**20 longline hooks (fish baited)**  
**Times fished 2**  
**Hours fished 28**  
**CPUE 0.063 kg/hr**



**Daily Record of fish monitoring study  
Mr. Chea Sok - Phnom Kok village (#2)**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	26	3.1
2	<i>Bagarius yarrelli</i> 90	2	2.3
3	<i>Puntioplites falcifer</i> 35	19	1.65
4	<i>Labiobarbus cf. leptocheilus</i> 162	16	1.3
5	<i>Henicorhynchus</i> spp.	14	1.2
6	<i>Hampala macrolepidota/ H. dispar</i> 51-50	10	1.1
7	<i>Osteocheilus hasselti</i> 66	11	1.1
8	<i>Ompok bimaculatus</i> 98	13	1
9	<i>Micronema cf. micronema</i> 97	9	0.9
10	<i>Osteocheilus</i> sp. 69	21	0.9
11	<i>P. siamensis/ B. macropterus</i> 82	12	0.85
12	<i>Mystus</i> spp. 88	12	0.8
13	<i>Cyclocheilichthys</i> spp.	8	0.8
14	<i>Scaphognathops bandanensis/spp.</i> 49	4	0.7
15	<i>Systemus binotatus</i> 41	10	0.7
16	<i>Hemibagrus nemurus</i> 84	6	0.65
17	<i>Hemibagrus wyckioides</i> 85	3	0.65
18	<i>Mastacembelus</i> spp. 118	3	0.65
19	<i>Pangasius bocourti/ Pangasius concophilus</i> 179	8	0.65
20	<i>Belondichthys truncatus</i> 92	5	0.6
21	<i>Botia modesta</i> 77	6	0.55
22	<i>Gyrinocheilus pennocki</i> 75	1	0.5
23	<i>Raiamas guttatus</i> 10b	6	0.5
24	<i>Botia nigrolineata</i> 81	6	0.5
25	<i>Pangasius macronema</i> 110	7	0.45
26	<i>Barbodes altus</i> 40	4	0.45
27	<i>Bagrichthys macracanthus</i> 89	6	0.45
28	<i>Garra cambodgiensis</i> 73	6	0.45
29	<i>Trichogaster trichopterus</i> 125	6	0.45
30	<i>Chitala ornata</i> 3	5	0.4
31	<i>Osteochilus waandersii</i> 71	5	0.4
32	<i>Wallago leeri</i> 100	2	0.4
33	<i>Kryptopterus kryptopterus</i> 95	4	0.4
34	<i>Probarbus</i> spp. 23-24	5	0.4
35	<i>Pangasius pleurotaenia</i> 111	4	0.35

**Total = 69 species  
384 fish = 35.65 kg  
5 cm gillnet  
Times fished 60  
Hours fished 840  
CPUE 0.042 kg/hr**

No	Species	# Fish	Weight kg
36	<i>Micronema bleekeri</i> 96	3	0.35
37	<i>Cyclocheilichthys enoplos</i> 29	4	0.35
38	<i>Osphronemus exodon</i> 126	6	0.3
39	<i>Bagrichthys macropterus</i> 173	4	0.3
40	<i>Barbodes schwanefeldi</i> 38	4	0.3
41	<i>Pangasius bocourti</i> 103	4	0.3
42	<i>Botia lecontei</i> 80	4	0.3
43	<i>Cyclocheilichthys</i> sp. 31	4	0.3
44	<i>Bangara behri</i> 54	1	0.3
45	<i>Morulius</i> spp. 58	2	0.3
46	<i>Luciosoma bleekeri</i> 17	4	0.25
47	<i>Tetraodon</i> spp. 191	3	0.25
48	<i>Osteocheilus</i> sp. 67	3	0.25
49	<i>Xenentodon cancila</i> 117	3	0.25
50	<i>Tor tambroides/</i> spp. 21	3	0.25
51	<i>Kryptopterus</i> spp. 175	3	0.25
52	<i>Henicorhynchus lobatus</i> 62	15	0.2
53	<i>Pangasius cf. polyuranodon</i> 106	3	0.2
54	<i>Toxotes microlepis</i> 193	3	0.2
55	<i>Helicophagus waandersii</i> 101	2	0.2
56	<i>Macrochirichthys macrochirus</i> 13	2	0.2
57	<i>Cyclocheilichthys</i> spp. 28	2	0.2
58	Miscellaneous spp.	2	0.2
59	<i>Hypsibarbus</i> spp. 22	2	0.2
60	<i>Notopterus notopterus</i> 5	2	0.15
61	<i>Lrides siamensis</i> 113	3	0.15
62	<i>Osteocheilus melanopleurus</i> 68	1	0.15
63	<i>Lobocheilus melanotaenia</i> 64	1	0.15
64	<i>Achiroides</i> sp. 139	1	0.1
65	<i>Pangasius</i> sp.	1	0.1
66	<i>Acantopsis</i> sp. 169	1	0.1
67	<i>Cirrhinus molitorella</i> 164	1	0.1
68	<i>Channa striata</i> 128	1	0.1
69	<i>Aaptosyax grypus</i> 20	1	0.1
<b>Total</b>		<b>384</b>	<b>35.65</b>

No	Species	# Fish	Weight kg
1	<i>Pangasius</i> sp.	8	33
2	<i>Hemibagrus wyckioides</i> 85	15	17.95
3	<i>Hemibagrus nemurus</i> 84	12	13.6
4	<i>Bagarius yarrelli</i> 90	3	6.5
5	<i>Wallago leeri</i> 100	2	4.5
6	<i>Hypsibarbus</i> spp. 44	2	4
7	<i>Osphronemus exodon</i> 126	1	3
8	<i>Channa striata</i> 128	12	2.8
9	<i>Pangasius bocourti</i> 103	1	2
10	<i>Pangasius</i> sp.	1	2
11	<i>Scaphognathops bandanensis</i> / spp. 49	6	0.85
12	<i>Mystus wyckii</i> 86	2	0.8
13	<i>Clarias batrachus</i> 180	2	0.55
14	<i>Bangara behri</i> 54	1	0.5
15	<i>Channa gachua</i> 184	5	0.85
16	<i>Channa</i> sp. 130	2	0.4
17	<i>Chitala ornata</i> 3	1	0.3
18	<i>Barbodes schwanefeldi</i> 38	4	0.2
19	<i>Pangasius bocourti</i> / <i>Pangasius concophilus</i> 179	1	0.15
<b>Total</b>		<b>81</b>	<b>93.95</b>

**Total = 19 species**  
**81 fish = 93.95 kg**  
**Longline hooks (worm bait)**  
**Times fished 66**  
**Hours fished 924**  
**CPUE 0.102 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Labiobarbus cf. leptocheilus</i> 162	32	3.45
2	<i>Scaphognathops bandanensis</i> /spp. 49	33	3.35
3	<i>Puntioplites falcifer</i> 35	28	2.9
4	<i>Hypsibarbus</i> spp. 44	11	1.9
5	<i>Barbodes schwanefeldi</i> 38	15	1.8
6	<i>Bangara behri</i> 54	9	1.6
7	<i>Cyclocheilichthys</i> spp. 28	15	1.2
8	<i>Labeo erythropterus</i> 57	2	1.2
9	<i>Gyrinocheilus pennocki</i> 75	6	1.15
10	<i>Cyclocheilichthys</i> sp. 31	9	0.85
11	<i>Micronema cf. micronema</i> 97	10	0.7
12	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	4	0.7
13	<i>Achiroides</i> sp. 139	6	0.7
14	<i>Crossocheilus siamensis</i> 72	8	0.7
15	<i>Henicorhynchus siamensis</i> 63	10	0.65
16	<i>Osteocheilus hasselti</i> 66	3	0.6

**Total = 62 species**  
**332 fish = 36.65 kg**  
**6 cm gillnet (1 net)**  
**Times fished 63**  
**Hours fished 882**  
**CPUE 0.042 kg/hr**

No	Species	# Fish	Weight kg
17	<i>Osteocheilus microcephalus</i> 70	7	0.6
18	<i>Micronema bleekeri</i> 96	5	0.6
19	<i>Chitala blanci</i> 4	5	0.55
20	<i>Mekongina erythrospila</i> 74	4	0.5
21	<i>Botia modesta</i> 77	4	0.5
22	<i>Hemililurus mekongensis</i> 93	4	0.5
23	<i>Barbodes altus</i> 40	7	0.5
24	<i>Oxyeleotris marmorata</i> /Gobiidae spp. 131	4	0.45
25	<i>Luciosoma bleekeri</i> 17	9	0.45
26	<i>Kryptopterus</i> spp. 175	6	0.4
27	<i>Probarbus</i> spp. 23-24	5	0.35
28	<i>Pangasius bocourti</i> 103	5	0.35
29	<i>Raiamas guttatus</i> 10b	3	0.35
30	<i>Channa micropeltes</i> 129	3	0.3
31	<i>Osteochilus waandersii</i> 71	3	0.3
32	<i>Hemibagrus nemurus</i> 84	3	0.3
33	<i>Paralaubuca typus</i> 11	4	0.3
34	<i>Cirrhinus microlepis</i> 59	4	0.3
35	<i>Pristolepis fasciata</i>	4	0.3
36	<i>Pangasius</i> sp.	4	0.3
37	<i>Trichogaster trichopterus</i> 125	3	0.2
38	<i>Hemibagrus nemurus</i> 84	2	0.3
39	<i>Osteocheilus</i> sp. 69	2	0.3
40	<i>Tetraodon</i> spp. 191	2	0.3
41	<i>Osteocheilus melanopleurus</i> 68	2	0.3
42	<i>Hemibagrus wyckioides</i> 85	1	0.3
43	<i>Mystus wyckii</i> 86	1	0.3
44	<i>Channa</i> cf. <i>marulius</i> 183	2	0.25
45	<i>Clarias batrachus</i> 180	2	0.25
46	<i>Belondichthys truncatus</i> 92	1	0.25
47	<i>Catlocarpio siamensis</i> 52	1	0.2
48	<i>Mastacemblus</i> spp. 118	1	0.2
49	<i>Toxotes microlepis</i> 193	1	0.2
50	<i>Channa striata</i> 128	1	0.2
51	<i>Tenualosa thibaudeaui</i> 7	2	0.2
52	<i>Cyclocheilichthys enoplos</i> 29	2	0.15
53	<i>Mystus wyckioides</i> 85	1	0.15
54	<i>Aaptosyax grypus</i> 20	1	0.15
55	<i>Helicophagus waandersii</i> 101	1	0.15

No	Species	# Fish	Weight kg
56	<i>Notopterus notopterus</i> 5	1	0.1
57	Miscellaneous sp.	1	0.1
58	<i>Bagrichthys macropterus</i> 173	1	0.1
59	<i>Poropuntius deauratus</i> 43	2	0.1
60	<i>Tor tambroides</i> /spp. 21	1	0.1
61	<i>Pangasius macronema</i> / spp. 110	1	0.1
62	<i>Hemililurus mekongensis</i> 93	3	0.05
<b>Total</b>		<b>332</b>	<b>36.65</b>

No	Species	# Fish	Weight kg
1	<i>Puntioplites falcifer</i> 35	4	1.7
2	<i>Hypsibarbus</i> spp. 44	2	1.5
3	<i>Micronema bleekeri</i> 96	2	1.4
4	<i>Raiamas guttatus</i> 10a	1	0.35
5	<i>Scaphognathops bandanensis</i> / spp. 49	1	0.3
6	<i>Osteocheilus melanopleurus</i> 68	1	0.05
<b>Total</b>		<b>11</b>	<b>5.3</b>

**Total = 6 species**  
**11 fish = 5.3 kg**  
**7 cm gillnet (1 net)**  
**Times fished 7**  
**Hours fished 98**  
**CPUE 0.054 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Belondichthys truncatus</i> 92	1	2
2	<i>Chitala blanci</i> 4	1	1
3	<i>Pangasius concophilus</i> 102	1	1
4	Miscellaneous spp.	4	0.3
5	<i>Puntioplites falcifer</i> 35	3	0.25
6	<i>Morulius</i> spp. 58	1	0.1
7	<i>Barbodes schwanefeldi</i> 38	1	0.1
<b>Total</b>		<b>12</b>	<b>4.75</b>

**Total = 7 species**  
**12 fish = 4.75 kg**  
**8 cm gillnet (1 net)**  
**Times fished 9**  
**Hours fished 126**  
**CPUE 0.038 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Mystus</i> spp. 88	7	0.6
2	<i>Raiamas guttatus</i> 10b	8	0.2
3	<i>Luciosoma bleekeri</i> 17	5	0.2
4	<i>Cyclocheilichthys enoplos</i> 29	3	0.15
<b>Total</b>		<b>23</b>	<b>1.15</b>

**Total = 4 species**  
**23 fish = 1.15 kg**  
**3 cm gillnet (1 net)**  
**Times fished 3**  
**Hours fished 42**  
**CPUE 0.027 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Henicorhynchus lobatus</i> 62	80	1.75
2	<i>Labiobarbus cf. leptocheilus</i> 162	14	0.5
3	<i>Paralabuca typus</i> 11	9	0.4
4	<i>Hypsibarbus</i> spp. 44-22	8	0.65
5	<i>Cyclocheilichthys</i> spp. 28	7	0.45
6	<i>Osteocheilus hasselti</i> 66	3	0.35
7	<i>Scaphognathops bandanensis</i> / spp. 49	6	0.35
8	<i>Hemibagrus wyckioides</i> 85	1	0.3
9	<i>Systomus binotatus</i> 41	7	0.25
10	Miscellaneous sp.	2	0.2
11	<i>Acantopsis</i> spp. 169	5	0.2
12	<i>Ompok bimaculatus</i> 98	4	0.2
13	<i>Micronema bleekeri</i> 96	6	0.2
14	<i>Barbodes schwanefeldi</i> 38	3	0.2
15	<i>Cyclocheilichthys</i> sp. 31	3	0.2
16	<i>Achiroides</i> sp. 139	3	0.15
17	<i>Cirrhinus molitorella</i> 164	1	0.15
18	<i>Pristolepis fasciata</i>	3	0.15
19	<i>Osteocheilus</i> sp. 67	1	0.1
20	<i>Luciosoma bleekeri</i> 17	1	0.05
<b>Total</b>		<b>167</b>	<b>6.8</b>

**Total = 20 species**  
**167 fish = 6.8 kg**  
**2.5 cm gillnet (1 net)**  
**Times fished 7**  
**Hours fished 98**  
**CPUE 0.069 kg/hr**

**Daily Record of fish monitoring study  
Mr. Di Deuang - Taveng village (#3)**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	115	15.75
2	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	168	12.6
3	<i>Puntioplites falcifer</i> 35	95	9.75
4	<i>Cyclocheilichthys</i> sp. 31	63	7.6
5	<i>Barbodes schwanefeldi</i> 38	52	6.85
6	<i>Channa striata</i> 128	15	6.65
7	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	32	6.4
8	<i>Hemibagrus nemurus</i> 84	54	6.2
9	<i>Bagarius yarrelli</i> 90	12	5.9
10	<i>Pangasius</i> sp.	30	5.1
11	<i>Pristolepis fasciata</i>	15	0.7
12	<i>Lobocheilus melanotaenia</i> 64	38	5
13	<i>Hemibagrus wyckioides</i> 85	14	5
14	<i>Osteocheilus melanopleurus</i> 68	11	4.8
15	<i>Barbodes altus</i> 40	33	4.7
16	<i>Cyclocheilichthys</i> spp. 28	33	4.4
17	<i>Bagrichthys macracanthus</i> 89	61	4.1
18	<i>P. siamensis</i> / <i>B. macropterus</i> 82	43	3.7
19	<i>Osteocheilus hasselti</i> 66	46	3.2
20	<i>Osphronemus exodon</i> 126	8	3.1
21	<i>Mystus wyckii</i> 86	6	3.1
22	<i>Chitala blanci</i> 4	12	2.9
23	<i>Mastacemblus</i> spp. 118	36	2.7
24	<i>Achiroides</i> sp. 139	16	2.65
25	<i>Scaphognathops bandanensis</i> /spp. 49	52	2.5
26	<i>Channa micropeltes</i> 129	1	2.4
27	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	28	2.2
28	<i>Osteochilus waandersii</i> 71	34	2
29	<i>Osteocheilus</i> sp. 69	31	1.9
30	<i>Raiamas guttatus</i> 10b	26	1.8
31	<i>Micronema bleekeri</i> 96	13	1.6
32	<i>Ompok bimaculatus</i> 98	27	1.4
33	<i>Mystus</i> spp. 88	18	1.4
34	<i>Micronema</i> cf. <i>micronema</i> 97	15	1.2
35	<i>Kryptopterus</i> spp. 175	16	1

**Total = 69 species  
1419 fish = 165.1 kg  
5 cm gillnet (1 net)  
Times fished 61  
Hours fished 2093  
CPUE 0.079 kg/hr**

No	Species	# Fish	Weight kg
36	<i>Tetraodon</i> spp. 191	7	0.95
37	<i>Pangasius macronema</i> 110	17	0.95
38	<i>Systemas binotatus</i> 41	15	0.95
39	<i>Luciosoma bleekeri</i> 17	11	0.9
40	<i>Lalates siamensis</i> 113	10	0.5
41	<i>Notopterus notopterus</i> 5	9	0.7
42	<i>Trichogaster trichopterus</i> 125	9	0.55
43	<i>Osteocheilus microcephalus</i> 70	8	0.5
44	<i>Pangasius</i> sp.	1	0.5
45	<i>Cyclocheilichthys enoplos</i> 29	3	0.5
46	<i>Helicophagus waandersii</i> 101	1	0.5
47	<i>Kryptopterus cryptopterus</i> 95	7	0.4
48	<i>Pangasius larnaudii</i> 107	1	0.4
49	<i>Pangasius</i> cf. <i>polyuranodon</i> 106	3	0.4
50	<i>Bagrithys macropterus</i> 173	4	0.4
51	<i>Osteocheilus</i> sp. 67	8	0.35
52	<i>Mystus wyckii</i> 86	1	0.3
53	<i>Hypsibarbus</i> spp. 22	1	0.3
54	<i>Pristolepis fasciata</i>	3	0.3
55	<i>Botia modesta</i> 77	3	0.3
56	<i>Tor tambroides</i> /spp. 21	2	0.3
57	<i>Poropuntius deauratus</i> 43	5	0.3
58	<i>Channa</i> sp. 130	1	0.3
59	Miscellaneous sp.	1	0.2
60	<i>Pristolepis fasciata</i>	5	0.2
61	<i>Achiroides</i> sp. 139	3	0.15
62	<i>Morulius</i> spp. 58	2	0.1
63	<i>Garra cambodgiensis</i> 73	2	0.1
64	<i>Osteocheilus microcephalus</i> 70	2	0.1
65	<i>Helicophagus waandersii</i>	1	0.1
66	<i>Hypsibarbus wetmorei</i>	1	0.1
67	<i>Clarias batrachus</i> 180	1	0.1
68	<i>Channa</i> cf. <i>marulius</i> 183	1	0.1
69	<i>Botia helodes</i> 79	1	0.05
<b>Totals</b>		<b>1419</b>	<b>165.1</b>



No	Species	# Fish	Weight kg
1	<i>Mystus wyckii</i> 86	6	3.4
2	<i>Hemibagrus wyckioides</i> 85	1	2.3
3	<i>Chitala blanci</i> 4	2	2.1
4	<i>Channa micropeltes</i> 129	2	1.1
5	<i>Hemibagrus nemurus</i> 84	6	1
6	<i>Channa striata</i> 128	2	0.95
7	<i>Osteocheilus melanopleurus</i> 68	2	0.7
8	<i>Barbodes schwanefeldi</i> 38	5	0.7
9	<i>Pangasius</i> sp.	4	0.7
10	<i>Osteocheilus hasselti</i> 66	7	0.6
11	<i>Bagarius yarrelli</i> 90	1	0.6
12	<i>Osphronemus exodon</i> 126	1	0.6
13	<i>Hypsibarbus</i> spp. 44	4	0.6
14	<i>Puntioplites falcifer</i> 35	4	0.5
15	<i>Hampala macrolepidota/H. dispar</i> 51-50	3	0.3
16	<i>Cyclocheilichthys</i> sp. 31	2	0.3
17	<i>Barbodes altus</i> 40	2	0.3
18	<i>Mastacemblus</i> spp. 118	3	0.2
19	<i>Bagrichthys macracanthus</i> 89	4	0.2
20	<i>Hampala macrolepidota/ H. dispar</i> 51	2	0.2
21	<i>Cyclocheilichthys</i> spp. 28	4	0.2
22	<i>Poropuntius deauratus</i> 43	1	0.1
23	<i>Clarias batrachus</i> 180	1	0.1
<b>Total</b>		<b>69</b>	<b>17.75</b>

**Total = 23 species**  
**69 fish = 17.75 kg**  
**Hooks (25 worms, 20 fish, frog, mak deua figs)**  
**Times fished 18**  
**Hours fished 234**  
**CPUE 0.076 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hemibagrus nemurus</i> 84	1	0.2
2	<i>Labiobarbus cf. leptocheilus</i> 162	2	0.15
3	<i>Raiamas guttatus</i> 10b	1	0.1
4	<i>Notopterus notopterus</i> 5	1	0.1
5	<i>Tetraodon</i> sp. 191	1	0.1
6	<i>Pristolepis fasciata</i>	5	0.1
7	<i>Trichogaster trichopterus</i> 125	1	0.05
<b>Total</b>		<b>12</b>	<b>0.8</b>

**Total = 7 species**  
**12 fish = 0.8 kg**  
**3 cm gillnet (1 net)**  
**Times fished 1**  
**Hours fished 13**  
**CPUE 0.062 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Labiobarbus cf. leptocheilus</i> 162	20	1.3
2	<i>Puntioplites falcifer</i> 35	3	1.0
3	<i>Henicorhynchus</i> spp.	117	0.8
4	<i>Hypsibarbus</i> spp. 44	3	0.5
5	<i>Cyclocheilichthys</i> spp. 28	3	0.2
6	<i>Pseudomystus siamensis</i>	5	0.2
7	<i>Pristolepis fasciata</i>	10	0.2
8	<i>Xenentodon cancila</i> 117	3	0.1
9	<i>Raiamas guttatus</i> 10b	2	0.1
10	<i>Bagarius yarrelli</i> 90	1	0.1
11	<i>Paralaubuca typus</i> 11	11	0.1
12	<i>Cyclocheilichthys</i> spp.	1	0.1
13	<i>Hampala macrolepidota/H. dispar</i> 51-50	1	0.1
14	<i>Bagrichthys macracanthus</i> 89	1	0.05
15	<i>Acantopsis</i> sp. 170	1	0.05
<b>Total</b>		<b>182</b>	<b>4.9</b>

**Total = 15 species**  
**182 fish = 4.9 kg**  
**2.5 cm gillnet (1 net)**  
**Times fished 3**  
**Hours fished 39**  
**CPUE 0.126 kg/hr**

**Daily Record of fish monitoring study  
Mr. Du Wet - Taveng village (#4)**

No	Species	# Fish	Weight kg
1	<i>Labiobarbus cf. leptocheilus</i> 162	154	15.95
2	<i>Osteochilus waandersii</i> 71	93	8.75
3	<i>Osteocheilus hasselti</i> 66	61	5.6
4	<i>Luciosoma bleekeri</i> 17	22	4.2
5	<i>Hypsibarbus</i> spp. 44	45	3.4
6	<i>Henicorhynchus lobatus</i> 62	9	3
7	<i>Hemibagrus nemurus</i> 84	6	3
8	<i>Barbodes schwanefeldi</i> 38	29	2.2
9	<i>Cirrhinus molitorella</i> 164	7	2
10	<i>Puntioplites falcifer</i> 35	25	1.8
11	<i>P. siamensis</i> / <i>B. macropterus</i> 82	12	1.7
12	<i>Morulius</i> spp. 58	4	1.5
13	<i>Scaphognathops bandanensis</i> /spp. 49	17	1.35
14	<i>Systemus binotatus</i> 41	12	1.35
15	<i>Gyrinocheilus pennocki</i> 75	20	1.35
16	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	11	1.3
17	<i>Pangasius macronema</i> 110	11	1.2
18	<i>Cyclocheilichthys</i> spp. 28	19	1.2
19	<i>Achiroides</i> sp. 139	7	1
20	<i>Cyclocheilichthys enoplos</i> 29	7	0.95
21	<i>Botia modesta</i> 77	11	0.8
22	<i>Mastacemblus</i> spp. 118	7	0.7
23	<i>Kryptopterus</i> spp. 175	12	0.6
24	<i>Cirrhinus microlepis</i> 59	3	0.6
25	<i>Trichogaster trichopterus</i> 125	3	0.55
26	<i>Achiroides</i> sp. 139	3	0.55
27	<i>Belondichthys truncatus</i> 92	4	0.5
28	<i>Raiamas guttatus</i> 10b	8	0.45
29	<i>Bagrichthys macropterus</i> 173	8	0.4
30	<i>Henicorhynchus</i> spp.	10	0.4
31	<i>Pseudomystus siamensis</i>	22	0.4
32	<i>Ompok bimaculatus</i> 98	9	0.4
33	<i>Bagrichthys macracanthus</i> 89	7	0.4
34	<i>Clarias batrachus</i> 180	4	0.3
35	<i>Cyclocheilichthys</i> sp. 31	6	0.25

**Total = 47 species  
716 fish = 71.55 kg  
5 cm gillnet (1 net)  
Times fished 42  
Hours fished 588  
CPUE 0.122 kg/hr**

No	Species	# Fish	Weight kg
36	<i>Botia helodes</i> 79	3	0.2
37	<i>Barbodes altus</i> 40	2	0.2
38	<i>Hemibagrus nemurus</i> 84	2	0.2
39	<i>Lobocheilus melanotaenia</i> 64	5	0.1
40	Miscellaneous	5	0.1
41	<i>Osteocheilus</i> sp. 67	2	0.1
42	<i>Mystus</i> spp. 88	3	0.1
43	Miscellaneous sp.	1	0.1
44	<i>Cyclocheilichthys</i> spp.	1	0.1
45	<i>Garra cambodgiensis</i> 73	1	0.1
46	<i>Osteocheilus</i> sp. 69	1	0.1
47	<i>Tetraodon</i> spp. 191	2	0.05
<b>Total</b>		<b>716</b>	<b>71.55</b>

No	Species	# Fish	Weight kg
1	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	9	8.65
2	<i>Hypsibarbus</i> spp. 44	10	8
3	<i>Morulus</i> spp. 58	3	3.4
4	<i>Hypsibarbus wetmorei</i>	3	4.25
5	Miscellaneous sp.	1	2
6	<i>Tor tambroides</i> /spp. 21	1	2
7	<i>Helicophagus waandersii</i> 101	1	1.3
8	<i>Osphronemus exodon</i> 126	1	1.2
9	<i>Bangara behri</i> 54	1	1.2
10	<i>Hemibagrus wyckioides</i> 85	1	1.1
11	<i>Probarbus</i> spp. 23-24	1	0.8
12	<i>Puntioplites falcifer</i> 35	1	0.4
13	<i>Osteocheilus hasselti</i> 66	7	0.4
<b>Total</b>		<b>40</b>	<b>34.7</b>

**Total = 13 species**  
**40 fish = 34.7 kg**  
**12 cm gillnet (1 net)**  
**Times fished 25**  
**Hours fished 350**  
**CPUE 0.099 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hemibagrus wyckioides</i> 85	8	20.4
2	<i>Hemibagrus nemurus</i> 84	15	12.2
3	<i>Osphronemus exodon</i> 126	3	6.5
4	<i>Probarbus</i> spp. 23-24	3	6
5	<i>Hypsibarbus</i> spp. 44	2	4.2
6	<i>Channa striata</i> 128	4	3.4

**Total = 20 species**  
**56 fish = 75.25 kg**  
**Hook (single hooks)**  
**20 worms (longline)**  
**20 fish**  
**Times fished 36**  
**Hours fished 504**  
**CPUE 0.149 kg/hr**

No	Species	# Fish	Weight kg
7	<i>Chitala blanci</i> 4	2	3.1
8	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	3	2.8
9	<i>Channa gachua</i> 182	2	2.5
10	<i>Pangasius larnaudii</i> 107	2	3.4
11	<i>Mystus wyckii</i> 86	1	2.1
12	<i>Chitala ornata</i> 3	1	2.1
13	<i>Bagarius yarrelli</i> 90	1	1.4
14	<i>Bagrichthys macropterus</i> 173	2	1.2
15	<i>Tor tambroides</i> /spp. 21	1	1.2
16	<i>Channa</i> sp. 185	1	1.2
17	<i>Clarias batrachus</i> 180	2	0.5
18	<i>Monopterus albus</i> 120	1	0.5
19	<i>Puntioplites falcifer</i> 35	1	0.4
20	<i>Mastacemblus</i> spp. 118	1	0.15
<b>Total</b>		<b>56</b>	<b>75.25</b>

No	Species	# Fish	Weight kg
1	<i>Cyclocheilichthys</i> sp. 31	9	2.4
2	<i>Puntioplites falcifer</i> 35	5	1.1
3	<i>Mystus</i> spp. 88	9	0.7
4	<i>Pseudomystus siamensis</i>	1	0.5
5	<i>Osteocheilus microcephalus</i> 70	7	0.4
6	<i>Pristolepis fasciata</i>	12	0.25
7	<i>Cyclocheilichthys</i> spp. 28	4	0.2
8	<i>Labiobarbus cf. leptocheilus</i> 162	5	0.2
9	<i>Botia helodes</i> 79	5	0.2
10	<i>Lobocheilus melanotaenia</i> 64	3	0.1
11	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	2	0.1
12	<i>Paralabuca typus</i> 11	1	0.1
13	<i>Bagrichthys macracanthus</i> 89	1	0.05
<b>Total</b>		<b>64</b>	<b>6.3</b>

**Total = 13 species**  
**64 fish = 6.3 kg**  
**3 cm gillnet (1 net)**  
**Times fished 12**  
**Hours fished 168**  
**CPUE 0.038 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Labiobarbus cf. leptocheilus</i> 162	27	2.55
2	<i>Scaphognathops bandanensis</i> /spp. 49	12	2.1
3	<i>Hemibagrus wyckioides</i> 85	5	2
4	<i>Osteocheilus microcephalus</i> 70	6	1
5	<i>Puntioplites falcifer</i> 35	6	1
6	<i>Mystus</i> spp. 88	3	1
7	<i>Hypsibarbus</i> spp. 44	2	0.4
8	<i>Hampala macrolepidota/H. dispar</i> 51-50	2	0.3
9	<i>Helicophagus waandersii</i> 17	9	0.3
10	<i>Pristolepis fasciata</i>	12	0.25
11	<i>Notopterus notopterus</i> 5	1	0.15
12	<i>Botia helodes</i> 79	1	0.15
13	<i>Barbodes schwanefeldi</i> 38	3	0.1
14	<i>Botia lecontei</i> 80	3	0.1
15	<i>Bagrichthys macropterus</i> 82	3	0.1
16	<i>Osteocheilus hasselti</i> 66	2	0.1
17	<i>Botia modesta</i> 77	1	0.05
<b>Total</b>		<b>98</b>	<b>11.65</b>

**Total = 17 species**  
**98 fish = 11.65 kg**  
**4 cm gillnet (1 net)**  
**Times fished 7**  
**Hours fished 98**  
**CPUE 0.119 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Henicorhynchus siamensis</i> 63	707	21.2
2	<i>Luciosoma bleekeri</i> 17	35	4.85
3	<i>Osteochilus waandersii</i> 71	26	3.05
4	<i>Hypsibarbus</i> spp. 44	8	3
5	<i>Cyclocheilichthys enoplos</i> 29	6	2.3
6	<i>Henicorhynchus</i> spp.	9	2.1
7	<i>Acantopsis</i> spp. 169	36	2.05
8	<i>Cyclocheilichthys</i> sp. 31	29	1.7
9	<i>Ompok bimaculatus</i> 98	8	1
10	<i>Macrogathus</i> sp. 119	4	1
11	<i>Raiamas guttatus</i> 10b	15	0.6
12	<i>Pristolepis fasciata</i>	26	0.5
13	<i>Lobocheilus melanotaenia</i> 64	7	0.5
14	<i>Hampala macrolepidota/H. dispar</i> 51-50	2	0.5
15	<i>Bagrichthys macropterus</i> 82	12	0.3
16	<i>Pseudomystus siamensis</i>	23	0.3
17	<i>Macrochirichthys macrochirus</i> 13	5	0.3
18	<i>Acantopsis</i> spp. 170	23	0.25

**Total = 26 species**  
**1030 fish = 46.6 kg**  
**2.5 cm gillnet (1 net)**  
**Times fished 35**  
**Hours fished 490**  
**CPUE 0.095 kg/hr**

No	Species	# Fish	Weight kg
19	<i>Osteocheilus hasselti</i> 66	4	0.2
20	<i>Acantopsoides</i> spp.. 172	9	0.2
21	<i>Acantopsis</i> spp.171	9	0.2
22	<i>Clarias batrachus</i> 180	5	0.15
23	<i>Cyclocheilichthys</i> spp. 28	9	0.1
24	<i>Belondichthys truncatus</i> 92	8	0.1
25	Miscellaneous sp.	2	0.1
26	<i>Botia lecontei</i> 80	3	0.05
<b>Total</b>		<b>1030</b>	<b>46.6</b>

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	53	17.15
2	<i>Osteocheilus hasselti</i> 66	18	8.55
3	<i>Cyclocheilichthys</i> sp. 31	8	3.55
4	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	10	3.3
5	<i>Morulius</i> spp. 58	4	3.1
6	<i>Helicophagus waandersii</i> 101	5	1.1
7	<i>Hypsibarbus wetmorei</i>	1	0.75
8	<i>Osteocheilus microcephalus</i> 70	13	0.7
9	<i>Puntioplites falcifer</i> 35	12	0.6
10	<i>Scaphognathops bandanensis</i> / spp. 49	4	0.6
11	<i>Barbodes schwanefeldi</i> 38	3	0.5
12	<i>Labiobarbus cf. leptocheilus</i> 162	23	0.4
13	<i>Cyclocheilichthys enoplos</i> 29	6	0.4
14	<i>Trichogaster trichopterus</i> 125	3	0.2
15	<i>Raiamas guttatus</i> 10b	3	0.2
16	<i>Systemus binotatus</i> 41	1	0.2
17	<i>Raiamas guttatus</i> 10	2	0.1
18	<i>Toxotes microlepis</i> 193	1	0.1
19	<i>Barbodes altus</i> 40	1	0.1
20	<i>Micronema bleekeri</i> 96	1	0.1
21	<i>Barbodes altus</i> 40	1	0.05
22	<i>Henicorhynchus siamensis</i> 63	1	0.05
<b>Total</b>		<b>174</b>	<b>41.8</b>

**Total = 22 species**  
**174 fish = 41.8 kg**  
**6 cm gillnet (1 net)**  
**Times fished 15**  
**Hours fished 210**  
**CPUE 0.199 kg/hr**



**Daily Record of fish monitoring study  
Mr. Kalan Dun – Bokham village (#5)**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44-22	8	1.8
2	<i>Helicophagus waandersii</i> 101	1	0.9
3	<i>Lobocheilus melanotaenia</i> 64	5	0.8
4	<i>Probarbus</i> spp. 23-24	2	0.7
5	<i>Scaphognathops bandanensis/</i> spp. 49	6	0.65
6	<i>Labiobarbus cf. leptocheilus</i> 162	3	0.6
7	<i>Poropuntius deauratus</i> 43	6	0.6
8	<i>Osteocheilus</i> sp. 67	4	0.5
9	<i>Hampala macrolepidota/H. dispar</i> 51-50	4	0.4
10	<i>Osteochilus waandersii</i> 71	3	0.4
11	<i>Puntioplites falcifer</i> 35	1	0.3
12	<i>Hemibagrus nemurus</i> 84	2	0.3
13	<i>Gyrinocheilus pennocki</i> 75	2	0.3
14	<i>Mystus</i> spp. 88	2	0.2
15	<i>Cirrhinus microlepis</i> 59	1	0.2
16	<i>Raiamas guttatus</i> 10a	1	0.2
17	<i>Pangasius pleurotaenia</i> 111	1	0.2
18	<i>Barbodes schwanefeldi</i> 38	1	0.2
19	<i>Hemibagrus wyckioides</i> 85	1	0.2
20	<i>Tor tambroides/</i> spp. 21	1	0.1
21	<i>Osteocheilus microcephalus</i> 70	14	0.1
22	<i>Henicorhynchus siamensis</i> 63	1	0.1
23	<i>Osteocheilus</i> sp. 69	1	0.1
24	<i>Osteocheilus hasselti</i> 66	1	0.1
<b>Total</b>		<b>74</b>	<b>9.95</b>

**Total = 24 Species  
74 fish = 9.95 kg  
4 cm gillnet (1 net)  
Times fished 15  
Hours fished 225  
CPUE 0.044 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44-22	25	24
2	<i>Helicophagus waandersii</i> 101	9	17.6
3	<i>Bagarius yarrelli</i> 90	3	15.5
4	<i>Morulius</i> spp. 58	5	8.2
5	<i>Labeo erythropterus</i> 57	5	7.9

**Total = 27 Species  
94 fish = 110 kg  
10 cm gillnet (1 net)  
Times fished 67  
Hours fished 1005  
CPUE 0.11 kg/hr**

No	Species	# Fish	Weight kg
6	<i>Bangara behri</i> 54	4	6.1
7	<i>Hypsibarbus wetmorei</i>	6	6
8	<i>Pangasius cf. polyuranodon</i> 106	3	4.7
9	<i>Hampala macrolepidota/H. dispar</i> 51-50	3	3.4
10	<i>Pangasius lamaudii</i> 107	1	2
11	<i>Pangasius sp.</i>	2	1.8
12	<i>Hemibagrus nemurus</i> 84	1	1.8
13	<i>Puntioplites falcifer</i> 35	4	1.7
14	<i>Probarbus spp.</i> 23-24	2	1.4
15	<i>Achiroides sp.</i> 139	1	1.2
16	<i>Systemus binotatus</i> 41	1	1.1
17	<i>Pangasius macronema</i> 110	1	1
18	<i>Belondichthys truncatus</i> 92	1	1
19	<i>Mystus wyckii</i> 86	1	1
20	<i>Cirrhinus microlepis</i> 59	1	0.5
21	<i>Chitala blanci</i> 4	1	0.5
22	<i>Raiamas guttatus</i> 10	3	0.45
23	<i>Osteocheilus sp.</i> 69	3	0.4
24	<i>Lobocheilus melanotaenia</i> 64	3	0.3
25	<i>Labiobarbus cf. leptocheilus</i> 162	3	0.3
26	<i>Scaphognathops bandanensis/ spp.</i> 49	1	0.1
27	<i>Xenentodon cancila</i> 117	1	0.05
<b>Total</b>		<b>94</b>	<b>110</b>

No	Species	# Fish	Weight kg
1	<i>Pangasius cf. polyuranodon</i> 106	4	3.5
2	<i>Hypsibarbus spp.</i> 44	11	2.9
3	<i>Puntioplites falcifer</i> 35	3	1.1
4	<i>Morulius spp.</i> 58	2	0.7
5	<i>Poropuntius deauratus</i> 43	8	0.7
6	<i>Chitala ornata</i> 3	1	0.6
7	<i>Cyclocheilichthys sp.</i> 31	3	0.6
8	<i>Barbodes altus</i> 40	5	0.5
9	<i>Hampala dispar</i> 50	2	0.4
10	<i>Poropuntius deauratus</i>	1	0.4
11	<i>Barbodes schwanefeldi</i> 38	3	0.4
12	<i>Osteocheilus microcephalus</i> 70	3	0.4

**Total = 27 species  
65 fish = 14.7 kg  
3 cm gillnet (1 net)  
Times fished 17  
Hours fished 225  
CPUE 0.065 kg/hr**

No	Species	# Fish	Weight kg
13	<i>Hampala macrolepidota/H. dispar</i> 51-50	3	0.3
14	<i>Scaphognathops bandanensis/</i> spp. 49	2	0.3
15	<i>Helicophagus waandersii</i> 101	1	0.3
16	<i>Hemibagrus wyckioides</i> 85	1	0.2
17	<i>Bagarius yarrelli</i> 90	2	0.2
18	<i>Catlocarpio siamensis</i> 52	1	0.2
19	<i>Hemibagrus nemurus</i> 84	1	0.2
20	<i>Henicorhynchus siamensis</i> 63	1	0.1
21	<i>Lobocheilus melanotaenia</i> 64	1	0.1
22	<i>Osteocheilus hasselti</i> 66	1	0.1
23	<i>Labiobarbus cf. leptocheilus</i> 162	1	0.1
24	<i>Pangasius/Laides</i> sp. 110-111-113	1	0.1
25	<i>Cyclocheilichthys</i> spp.	1	0.1
26	<i>P. siamensis/B. macropterus</i> 82	1	0.1
27	<i>Probarbus</i> spp. 23-24	1	0.1
<b>Total</b>		<b>65</b>	<b>14.7</b>

No	Species	# Fish	Weight kg
1	<i>Pangasius concophilus</i> 102	1	0.6
2	<i>Bangara behri</i> 54	1	0.5
3	<i>Gyrinocheilus pennocki</i> 75	1	0.4
4	<i>Hypsibarbus</i> spp. 44	1	0.3
5	<i>Barbodes schwanefeldi</i> 38	1	0.1
<b>Total</b>		<b>5</b>	<b>1.9</b>

**Total = 5 species**  
**5 fish = 1.9 kg**  
**6 cm gillnet (1 net)**  
**Times fished 2**  
**Hours fished 30**  
**CPUE 0.063 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Pangasius bocourti/Pangasius concophilus</i> 179	1	5.3
2	<i>Bagarius yarrelli</i> 90	1	1.5
3	<i>Hemibagrus wyckioides</i> 85	1	1.2
4	<i>Hypsibarbus</i> spp. 44	1	1
5	<i>Mastacemblus</i> spp. 118	1	0.3
<b>Total</b>		<b>11</b>	<b>9.9</b>

**Total = 5 species**  
**11 fish = 9.90 kg**  
**Hook (fish bait) 40**  
**Times fished 2**  
**Hours fished 30**  
**CPUE 0.33 kg/hr**

**Daily Record of fish Monitoring study  
Mr. Kalan Hin – Bokham village (#6)**

No	Species	# Fish	Weight kg
1	<i>Bagarius yarrelli</i> 90	2	0.3
<b>Total</b>		<b>2</b>	<b>0.3</b>

**Total = 1 species  
2 fish = 0.3 kg  
Longline (fish baited) 40 hooks  
Times fished 1  
Hours fished 15  
CPUE 0.02 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Bangara behri</i> 54	6	10
2	<i>Hypsibarbus</i> spp. 44-22	11	8.1
3	<i>Morulius</i> spp. 58	4	3
4	<i>Hampala macrolepidota</i> 51	2	1.9
5	<i>Tor tambroides/</i> spp. 21	1	1.5
6	<i>Catlocarpio siamensis</i> 52	1	1
7	<i>Bagarius yarrelli</i> 90	1	1
8	<i>Osteocheilus</i> sp. 69	4	0.9
9	<i>Osteocheilus hasselti</i> 66	1	0.7
10	<i>Osphronemus exodon</i> 126	1	0.5
11	<i>Puntiplites falcifer</i> 35	1	0.5
12	<i>Macrochirichthys macrochirus</i> 13	1	0.2
<b>Total</b>		<b>34</b>	<b>29.3</b>

**Total = 12 species  
34 fish = 29.3 kg  
12 cm gillnet (1 net)  
Times fished 82  
Hours fished 1230  
CPUE 0.023 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Bangara behri</i> 54	6	10
2	<i>Hypsibarbus</i> spp. 44-22	11	8.1
3	<i>Morulius</i> spp. 58	4	3
4	<i>Hampala macrolepidota</i> 51	2	1.9
5	<i>Tor tambroides/</i> spp. 21	1	1.5
6	<i>Catlocarpio siamensis</i> 52	1	1
7	<i>Bagarius yarrelli</i> 90	1	1
8	<i>Osteocheilus</i> sp. 69	4	0.9
9	<i>Osteocheilus hasselti</i> 66	1	0.7
10	<i>Osphronemus exodon</i> 126	1	0.5
11	<i>Puntiplites falcifer</i> 35	1	0.5
12	<i>Macrochirichthys macrochirus</i> 13	1	0.2
<b>Total</b>		<b>34</b>	<b>29.3</b>

**Total = 39 species  
281 fish = 39.5 kg  
2.5 cm gillnet (1 net)  
Times fished 28  
Hours fished 420  
CPUE 0.094 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Labiobarbus cf. leptocheilus</i> 162	36	2.55
2	<i>Hypsibarbus</i> spp. 44	26	4.6
3	<i>Puntioplites falcifer</i> 35	18	1.95
4	<i>Osteocheilus hasselti</i> 66	17	1.35
5	<i>Cyclocheilichthys</i> spp. 28	15	1.65
6	<i>Barbodes schwanefeldi</i> 38	15	1.65
7	<i>Lobocheilus melanotaenia</i> 64	14	1.1
8	<i>Scaphognathops bandanensis/</i> spp. 49	11	1
9	<i>Hampala macrolepidota/H. dispar</i> 51-50	8	1.6
10	<i>Probarbus</i> spp. 23-24	12	2.2
11	<i>Mystus</i> spp. 88	6	0.2
12	<i>Cirrhinus molitorella</i> 164	5	1
13	<i>Osteochilus waandersii</i> 71	5	0.65
14	<i>Tor tambroides/</i> spp. 21	5	0.75
15	<i>Hemibagrus nemurus</i> 84	4	1.1
16	<i>Osteocheilus</i> sp. 69	4	0.85
17	<i>Cyclocheilichthys</i> sp. 31	4	0.45
18	<i>Poropuntius deauratus</i> 43	4	0.3
19	<i>Achiroides</i> sp. 139	4	0.2
20	<i>Osteocheilus</i> sp. 67	4	0.2
21	<i>Pangasius concophilus</i> 102	3	0.5
22	<i>Barbodes altus</i> 40	3	0.3
23	<i>Luciosoma bleekeri</i> 17	3	0.25
24	<i>Helicophagus waandersii</i> 101	2	0.5
25	<i>Hemibagrus nemurus</i> 84	2	0.3
26	<i>Botia modesta</i> 77	2	0.2
27	<i>Raiamas guttatus</i> 10b	2	0.2
28	<i>Bagarius yarrelli</i> 90	1	1
29	<i>Notopterus notopterus</i> 5	1	0.5
30	<i>Channa striata</i> 128	1	0.5
31	<i>Bangara behri</i> 54	1	0.5
32	<i>Bagrichthys macracanthus</i> 89	1	0.1
33	<i>Gyrinocheilus pennocki</i> 75	1	0.1
34	<i>Bagrichthys macropterus</i> 173	1	0.1
35	<i>Toxotes microlepis</i> 193	1	0.1
36	<i>Ompok bimaculatus</i> 98	1	0.05
37	<i>Osteocheilus microcephalus</i> 70	1	0.05
38	<i>Acantopsoides</i> sp. 172	1	0.05
39	<i>Trichogaster trichopterus</i> 125	1	0.05

**Total = 41 Species**  
**248 fish = 30.85 kg**  
**4 cm gillnet (1 net)**  
**Times fished 91**  
**Hours fished 1365**  
**CPUE 0.023 kg/hr**

No	Species	# Fish	Weight kg
40	<i>P. siamensis</i> / <i>B. macropterus</i> 82	1	0.05
41	<i>Macrochirichthys macrochirus</i> 13	1	0.05
<b>Total</b>		<b>248</b>	<b>30.85</b>

No	Species	# Fish	Weight kg
1	<i>Cirrhinus microlepis</i> 59	1	0.5
2	<i>Morulus</i> spp. 58	1	0.3
<b>Total</b>		<b>2</b>	<b>0.8</b>

**Total = 2 species**  
**2 fish = 0.8 kg**  
**3 cm castnet (1 net)**  
**Times fished 1**  
**Hours fished 1.2**  
**CPUE 0.66 kg/hr**

**Daily Record of fish monitoring study  
Mr. Kong Chan Nara – Tiem Leu village (#7)**

No	Species	# Fish	Weight kg
1	<i>Puntioplites falcifer</i> 35	178	11.05
2	<i>Cyclocheilichthys</i> spp. 28	112	10.75
3	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	130	8.15
4	<i>Micronema</i> sp. 75	33	4.7
5	<i>Hemibagrus nemurus</i> 84	29	3.05
6	<i>Kryptopterus</i> spp. 175	20	2.4
7	<i>Hypsibarbus</i> spp. 44	20	2.35
8	<i>Channa striata</i> 128	2	2.1
9	<i>Cyclocheilichthys enoplos</i> 29	24	2.1
10	<i>Barbodes altus/Systemus binotatus</i> 40-41	23	2.05
11	<i>Pseudomystus siamensis</i> 82	20	1.9
12	<i>Scaphognathops bandanensis/</i> spp. 49	21	1.8
13	<i>Amphostistus laoensis</i> 1	1	1.7
14	<i>Osteocheilus hasselti</i> 66	19	1.6
15	<i>Henicorhynchus</i> spp. 63-62	67	2.9
16	<i>Poropuntius deauratus</i> 43	25	1.4
17	<i>Luciosoma bleekeri</i> 17	12	1.35
18	<i>Barbodes schwanefeldi</i> 38	17	1.3
19	<i>Paralaubuca typus</i> 11	23	1.05
20	<i>Botia modesta</i> 77	16	1.05
21	<i>Tenualosa thibaudeaui</i> 7	6	0.95
22	<i>Achrioides</i> sp. 139	5	0.8
23	<i>Hampala macrolepidota/H. dispar</i> 51-50	9	0.75
24	<i>Cyclocheilichthys</i> sp. 31	7	0.7
25	<i>Raiamas guttatus</i> 10b	4	0.65
26	<i>Probarbus</i> spp. 23-24	6	0.65
27	<i>Labeo erythropterus</i> 57	6	0.5
28	Miscellaneous spp.	4	0.5
29	<i>Tetraodon</i> sp. 191	1	0.5
30	<i>Channa micropeltes</i> 129	1	0.5
31	<i>Osteocheilus</i> sp. 67	4	0.35
32	<i>Pangasius pleurotaenia</i> 111	3	0.35
33	<i>Clarias batrachus</i> 180	1	0.35

**Total = 54 species  
889 fish = 76 kg  
5 cm gillnet (1 net)  
Times fished 71  
Hours fished 994  
CPUE 0.077 kg/hr**



No	Species	# Fish	Weight kg
34	<i>Chitala ornata</i> 3	2	0.35
35	<i>Osteocheilus microcephalus</i> 70	4	0.3
36	<i>Morulius</i> spp. 58	3	0.3
37	<i>Kryptopterus kryptopterus</i> 95	4	0.3
38	Miscellaneous	3	0.25
39	<i>Helicophagus waandersii</i> 101	3	0.25
40	<i>Mystus</i> spp. 88	5	0.2
41	<i>Trichogaster trichopterus</i> 125	2	0.2
42	<i>Pangasius concophilus</i> 102	1	0.2
43	<i>Osteochilus waandersii</i> 71	2	0.15
44	<i>Notopterus notopterus</i> 5	1	0.15
45	<i>Cirrhinus microlepis</i> 59	1	0.15
46	<i>Crossocheilus siamensis</i> 72	1	0.1
47	<i>Lobocheilus melanotaenia</i> 64	1	0.1
48	<i>Bagarius yarrelli</i> 90	1	0.1
49	<i>Osphronemus exodon</i> 126	1	0.1
50	<i>Kryptopterus kryptopterus</i> 95	1	0.1
51	<i>Hemililurus mekongensis</i> 93	1	0.1
52	<i>Macrochirichthys macrochirus</i> 13	1	0.1
53	<i>Achiroides</i> sp. 139	1	0.1
54	<i>Osteocheilus</i> sp. 67	1	0.1
<b>Total</b>		<b>889</b>	<b>76</b>

No	Species	# Fish	Weight kg
1	<i>Henicorhynchus lobatus</i> 62	421	3.95
2	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	287	3.35
3	<i>Acantopsis</i> spp. 169	42	2
4	<i>Cyclocheilichthys</i> sp. 31	99	1.4
5	<i>Hemibagrus nemurus</i> 84	11	0.5
6	<i>Mystus</i> spp. 88	19	0.5
7	<i>Paralauca typus</i> 11	40	0.4
8	<i>Lobocheilus melanotaenia</i> 64	17	0.4
9	<i>Pristolepis fasciata</i>	13	0.5
10	<i>Barbodes altus</i> / <i>Systemus binotatus</i> 40-41	12	0.2
11	<i>Systemus binotatus</i> 41	21	0.2
12	<i>Henicorhynchus siamensis</i> 63	14	0.2
13	<i>Rasbora</i> sp.	10	0.2

**Total = 32 species**  
**1082 fish = 15.65 kg**  
**2.5 cm gillnet (1 net)**  
**Times fished 74**  
**Hours fished 1036**  
**CPUE 0.015 kg/hr**

No	Species	# Fish	Weight kg
14	<i>Pangasius macronema</i> 110	6	0.2
15	<i>Hypsibarbus</i> spp. 44	8	0.15
16	<i>Cyclocheilichthys enoplos</i> 29	12	0.15
17	<i>Bagrichthys macracanthus</i> 89	2	0.15
18	<i>Xenentodon cancila</i> 117	3	0.1
19	<i>Probarbus</i> spp. 23-24	3	0.1
20	<i>Botia modesta</i> 77	3	0.1
21	<i>Scaphognathops bandanensis/</i> spp. 49	1	0.1
22	<i>Helicophagus waandersii</i> 101	1	0.1
23	<i>Osteocheilus</i> sp. 69	7	0.05
24	<i>Macrogathus</i> sp. 119	2	0.05
25	<i>Raiamas guttatus</i> 10b	2	0.05
26	<i>Trichogaster trichopterus</i> 125	2	0.05
27	<i>Achiroides</i> sp. 139	2	0.05
28	<i>Osteocheilus hasselti</i> 66	5	0.05
29	<i>Cyclocheilichthys</i> spp. 28	5	0.05
30	<i>Puntioplites falcifer</i> 35	8	0.07
31	<i>Toxotes microlepis</i> 193	3	0.05
32	<i>Ompok bimaculatus</i> 98	1	0.05
<b>Total</b>		<b>1082</b>	<b>15.25</b>

No	Species	# Fish	Weight kg
1	Soft shell turtle (species 2)	1	4
2	<i>Hemibagrus nemurus</i> 84	5	2.7
3	Soft shell turtle (species 1)	1	1
4	<i>Channa striata</i> 128	2	0.25
5	<i>Clarias batrachus</i> 180	1	0.1
<b>Total</b>		<b>10</b>	<b>8.05</b>

**Total = 5 species**  
**10 Fish = 8.05 kg**  
**30 longline hooks**  
**(worm baited)**  
**Times fished 6**  
**Hours fished 84**  
**CPUE 0.096 kg/hr**

**Daily record of fish monitoring study  
Mr. Pang Khan – Talao village (#8)**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	17	22.1
2	<i>Labeo erythropterus</i> 57	11	18.8
3	<i>Bangara behri</i> 54	9	14.5
4	<i>Tor tambroides</i> / spp. 21	5	11.5
5	<i>Hypsibarbus wetmorei</i>	5	10
6	<i>Cosmocheilus harmandi</i>	6	9
7	<i>Cyclocheilichthys enoplos</i> 29	6	7
8	<i>Mekongina erythrospila</i> 74	2	4
9	<i>Morulius</i> spp. 58	2	3.2
10	<i>Catlocarpio siamensis</i> 52	1	3
11	<i>Bagarius yarrelli</i> 90	6	2.6
12	<i>Hemibagrus nemurus</i> 84	5	2.4
13	<i>Chitala ornata</i> 3	1	2.2
14	<i>Pangasius</i> sp. 101	1	2.2
15	<i>Pangasius</i> sp.	1	2
16	<i>Hemibagrus wyckioides</i> 85	1	2
17	<i>Pangasius bocourti</i> 103	1	1.2
18	<i>Osphronemus exodon</i>	1	1.2
19	<i>Pangasius larnaudii</i> 107	1	1
20	<i>Cirrhinus microlepis</i> 59	1	1
21	<i>Belondichthys truncatus</i> 92	1	1
22	<i>Puntioplites falcifer</i> 35	1	0.7
23	<i>Channa</i> sp. 130	1	0.5
<b>Total</b>		<b>86</b>	<b>123.1</b>

**Total = 23 species  
86 fish = 123.1 kg  
12 cm gillnet (5 nets)  
Times fished 55  
Hours fished 702  
CPUE 0.035 kg/hr (per net)**

No	Species	# Fish	Weight kg
1	<i>Osteocheilus</i> sp. 69	10	2.7
2	<i>Hemililurus mekongensis</i> 93	10	1.9
3	<i>Miscellaneous</i> spp.	10	1.8
4	<i>Osteocheilus hasselti</i> 66	10	1.8
5	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	20	1.3
6	<i>Lobocheilus melanotaenia</i> 64	3	0.2
7	<i>Gyrinocheilus pennocki</i> 75	1	0.2
<b>Total</b>		<b>64</b>	<b>9.9</b>

**Total = 7 species  
64 fish = 9.9 kg  
4 cm gillnet (1 net)  
Times fished 4  
Hours fished 52  
CPUE 0.19 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Bagarius yarrelli</i> 90	4	13.5
2	<i>Leptobarbus hoeveni</i>	1	3
3	<i>Hampala macrolepidota/H. dispar</i> 51-50	1	1.6
4	<i>Hypsibarbus</i> spp. 44	1	1.3
<b>Total</b>		<b>7</b>	<b>19.4</b>

**Total = 4 species**  
**7 fish = 19.4 kg**  
**20 single hooks**  
**(*Hemibagrus* and**  
***makdeua* fig baited)**  
**Times fished 6**  
**Hours fished 78**  
**CPUE 0.249 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hampala macrolepidota/H. dispar</i> 51-50	1	2
2	<i>Belondichthys truncatus</i> 92	11	1.5
3	<i>Poropuntius deauratus</i> 43	34	1.3
4	<i>Henicorhynchus siamensis</i> 63	25	1.3
5	<i>Paralaubuca typus</i> 11	50	1
6	Miscellaneous spp.	2	0.3
7	<i>Hemibagrus nemurus</i> 84	1	0.3
8	<i>Acantopsis</i> sp. 170	1	0.3
9	<i>Xenentodon cancila</i> 117	4	0.25
10	<i>Botia helodes</i> 79	9	0.2
11	<i>Osteocheilus microcephalus</i> 70	3	0.2
12	<i>Tetraodon</i> sp. 191	1	0.2
13	<i>Raiamas guttatus</i> 10b	1	0.2
14	<i>Pangasius macronema</i> 110	1	0.2
15	<i>Coius undecimradiatus</i> 133	1	0.2
<b>Total</b>		<b>145</b>	<b>9.45</b>

**Total = 15 species**  
**145 fish = 9.45 kg**  
**3 cm gillnet (1 net)**  
**Times fished 13**  
**Hours fished 169**  
**CPUE 0.056 kg/hr**

**Daily record of fish monitoring study  
Mr. Thao Thuy - Talao village (#9)**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	41	9.9
2	<i>Pangasius larnaudii</i> 107	1	4
3	<i>Luciosoma bleekeri</i> 17	6	2.4
4	<i>Barbodes schwanefeldi</i> 38	6	2.4
5	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	20	2.4
6	<i>Hemibagrus nemurus</i> 84	16	2.35
7	<i>Cyclocheilichthys</i> sp./ <i>Sikukia gudgeri</i> 28-31	22	2
8	<i>Puntioplites falcifer</i> 35	7	1.5
9	<i>Osteocheilus</i> spp. 69-67-66	9	1.1
10	<i>Barbodes altus</i> 40	7	0.7
11	<i>Hemibagrus wyckioides</i> 85	2	0.6
12	<i>Osphronemus exodon</i> 126	5	0.8
13	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	1	0.5
14	<i>Pangasius macronema</i> / <i>P. pleurotaenia</i> 110-111	2	0.9
15	<i>Scaphognathops bandanensis</i> / spp. 49	4	0.4
16	<i>Mystus</i> spp. 88	3	0.4
17	<i>Poropuntius deauratus</i> 43	25	0.4
18	<i>Pseudomystus siamensis</i>	5	0.25
19	<i>Bagrichthys macracanthus</i> 89	9	0.2
20	<i>Gyrinocheilus pennocki</i> 75	2	0.2
21	<i>Channa</i> sp.	1	0.2
22	<i>Channa</i> cf. <i>marulius</i> 130-183	1	0.2
23	<i>Cirrhinus microlepis</i> 59	3	0.1
24	<i>Lobocheilus melanotaenia</i> 64	1	0.1
25	<i>Cyclocheilichthys</i> spp.	1	0.1
26	<i>Notopterus notopterus</i> 5	1	0.1
27	<i>Xenentodon cancila</i> 117	3	0.15
28	<i>Labeo erythropterus</i> 57	1	0.1
<b>Total</b>		<b>205</b>	<b>34.45</b>

**Total = 28 species  
205 fish = 34.45 kg  
5 cm gillnet (1 net)  
Times fished 17  
Hours fished 289  
CPUE 0.119 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	13	12
2	<i>Pangasius krempfi</i> / <i>P. hypophthalmus</i> 105-104	2	11
3	<i>Osphronemus exodon</i> 126	18	7.5
4	<i>Cyclocheilichthys</i> spp./ <i>Sikukia gudgeri</i> 28-31	4	4.6
5	<i>Cyclocheilichthys enoplos</i> 29	1	1.5
6	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	2	1.2
7	<i>Tor tambroides</i> / spp. 21	1	1
8	<i>Channa micropeltes</i> 129	1	1
9	<i>Barbodes schwanefeldi</i> 38	3	0.2
10	<i>Poropuntius deauratus</i> 43	2	0.1
11	<i>P. siamensis</i> / <i>B. macropterus</i> 82	2	0.1
12	<i>Osteocheilus</i> spp. 69-67-66	1	0.1
13	<i>Hemibagrus nemurus</i> 84	1	0.1
<b>Total</b>		<b>51</b>	<b>40.5</b>

**Total = 13 species**  
**51 fish = 40.5 kg**  
**10 cm gillnet (1 net)**  
**Times fished 13**  
**Hours fished 227**  
**CPUE 0.176 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	38	22.6
2	<i>Morulius</i> spp. 58	3	4.5
3	<i>Bangara behri</i> 54	2	3.5
4	<i>Cyclocheilichthys</i> spp. / <i>Sikukia gudgeri</i> 28-31	15	3.2
5	<i>Scaphognathops bandanensis</i> /spp. 49	2	2.5
6	<i>Channa</i> sp. 130-183	3	2.1
7	<i>Puntioplites falcifer</i> 35	14	2.1
8	<i>Cosmochilus harmandi</i>	2	2
9	<i>Barbodes schwanefeldi</i> 38	8	1.3
10	<i>Osteocheilus</i> spp. 69-67-66	10	1
11	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51	2	1
12	<i>Barbodes altus</i> 40	2	0.2
<b>Total</b>		<b>87</b>	<b>45.5</b>

**Total = 12 species**  
**87 fish = 45.5 kg**  
**8 cm gillnet (1 net)**  
**Times fished 17**  
**Hours fished 289**  
**CPUE 0.157/hr**

No	Species	# Fish	Weight kg
1	<i>Labiobarbus cf. leptocheilus</i> 162	97	6.4
2	<i>Barbodes schwanefeldi</i> 38	30	4.3
3	<i>Cyclocheilichthys</i> spp. 28	49	5.3
4	<i>Osteocheilus</i> spp. 69-67-66	59	4.2
5	<i>Hampala macrolepidota/ H. dispar</i> 51	10	3.5
6	<i>Osteochilus waandersii</i> 71	32	2.4
7	<i>Hypsibarbus</i> spp. 44	8	2.2
8	<i>Henicorhynchus</i> spp.	72	1.7
9	<i>Puntioplites falcifer</i> 35	12	1.6
10	<i>Lobocheilus melanotaenia</i> 64	20	1.5
11	<i>Hemibagrus wyckioides</i> 85	3	1.4
12	<i>Poropuntius deauratus</i> 43	65	1.3
13	<i>Raiamas guttatus</i> 10a	15	1.3
14	<i>Ompok bimaculatus</i> 98	29	0.8
15	<i>Scaphognathops bandanensis/</i> spp. 49	8	0.7
16	<i>Chitala blanci</i> 4	5	0.5
17	<i>Systemus binotatus</i> 41	4	0.5
18	<i>Botia helodes/ B. lecontei</i> 79-80	1	0.5
19	<i>Morulius</i> spp. 58	1	0.5
20	<i>Bagrichthys macropterus</i> 82	10	0.4
21	<i>Luciosoma bleekeri</i> 17	8	0.4
22	<i>Labeo erythropterus</i> 57	1	0.3
23	<i>Bagarius yarrelli</i> 90	1	0.3
24	<i>Pseudomystus siamensis</i>	5	0.25
25	<i>Mekongina erythrospila</i> 74	6	0.25
26	<i>Bagrichthys macracanthus</i> 89	10	0.2
27	<i>Osteocheilus microcephalus</i> 70	8	0.2
28	<i>Cyclocheilichthys enoplos</i> 29	5	0.2
29	<i>Crossocheilus siamensis</i> 72	4	0.1
30	<i>Achiroides</i> sp. 139	3	0.1
31	<i>Toxotes microlepis</i> 193	1	0.1
32	<i>Clarias batrachus</i> 180	1	0.1
33	<i>Acantopsis</i> spp. 170	2	0.05
34	<i>Pangasius macronema/ P. pleurotaenia</i> 110-111	1	0.05
35	<i>Botia modesta</i> 77	1	0.05
<b>Total</b>		<b>587</b>	<b>43.65</b>

**Total = 35 species**  
**587 fish = 43.65 kg**  
**4 cm gillnet (1 net)**  
**Times fished 31**  
**Hours fished 527**  
**CPUE 0.083 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Henicorhynchus</i> spp.	112	2.1
2	<i>Lalates siamensis</i>	5	0.1
<b>Total</b>		<b>117</b>	<b>2.2</b>

**Total = 2 species**  
**112 fish = 2.2 kg**  
**3 cm gillnet (1 net)**  
**Times fished 3**  
**Hours fished 51**  
**CPUE 0.043 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Pangasius larnaudii</i> 107	8	23
2	<i>Cosmochilus harmandi</i>	1	5
3	<i>Hypsibarbus</i> spp. 44	2	4
4	<i>Pangasius</i> sp.	1	3.3
5	<i>Hemibagrus nemurus</i> 84	6	1.6
6	<i>Mystus wyckii</i> 86	1	1.5
7	<i>Osphronemus exodon</i> 126	1	1
<b>Total</b>		<b>20</b>	<b>39.4</b>

**Total = 7 species**  
**20 fish = 39.4 kg**  
**40 longline (worm baited)**  
**Times fished 12**  
**Hours fished 194**  
**CPUE 0.203 kg/hr**



**Daily record of fish monitoring study  
Mr. Sut Sao – Phnom Kok village (#10)**

No	Species	# Fish	Weight kg
1	<i>Puntioplites falcifer</i> 35	82	3.95
2	<i>Cyclocheilichthys</i> spp. 28	65	3.4
3	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	69	2.80
4	<i>Osteocheilus</i> sp. 66	50	2.15
5	<i>Osteocheilus</i> sp. 69	39	2.05
6	<i>Hypsibarbus</i> spp. 44	42	1.95
7	<i>Scaphognathops bandanensis</i> / spp. 49	35	1.75
8	<i>Henicorhynchus</i> spp.	27	1.65
9	<i>Bagrichthys macropterus</i> 173	15	1.45
10	<i>Bangara behri</i> 54	10	1.3
11	<i>Hampala dispar</i> 50	23	1.05
12	<i>Ompok bimaculatus</i> 98	8	1.05
13	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	19	0.95
14	<i>Wallago leeri</i> 100	13	0.95
15	<i>Hemibagrus wyckioides</i> 85	4	0.9
16	<i>Poropuntius deauratus</i> 43	15	0.65
17	<i>Osteochilus waandersii</i> 71	9	0.5
18	<i>Barbodes altus</i> 40	9	0.5
19	<i>Botia modesta</i> 77	9	0.45
20	<i>Probarbus</i> spp. 23-24	9	0.4
21	<i>Cyclocheilichthys enoplos</i> 29	9	0.35
22	<i>Gyrinocheilus pennocki</i> 75	7	0.35
23	<i>Raiamas guttatus</i> 10a	6	0.35
24	Miscellaneous spp.	6	0.3
25	<i>Luciosoma bleekeri</i> 17	4	0.25
26	<i>Achiroides</i> sp. 139	5	0.25
27	<i>Botia helodes</i> / <i>B. lecontei</i> 79-80	5	0.2
28	<i>Barbodes schwanefeldi</i> 38	4	0.2
29	<i>Cosmocheilus harmandi</i>	3	0.15
30	<i>Channa striata</i> 128	3	0.15
31	<i>Tetraodon</i> sp. 191	2	0.1
32	<i>Achiroides</i> sp. 139	2	0.1
33	<i>Hemibagrus nemurus</i> 84	1	0.1

**Total = 41 species  
615 fish = 32.95 kg  
4 cm gillnet (1 net)  
Times fished 57  
Hours fished 798  
CPUE 0.041 kg/hr**

No	Species	# Fish	Weight kg
34	<i>Cirrhinus molitorella</i> 164	1	0.1
35	<i>Tor tambroides</i> / spp. 21	1	0.1
36	<i>Trichogaster trichopterus</i> 125	2	0.05
37	<i>Mystus</i> spp. 88	1	0.05
38	<i>Notopterus notopterus</i> 5	1	0.05
39	<i>P. siamensis</i> / <i>B. macropterus</i> 82	1	0.05
40	<i>Kryptopterus</i> sp. 175	1	0.05
41	<i>Macrogathus</i> sp. 119	1	0.05
<b>Total</b>		<b>615</b>	<b>32.95</b>

No	Species	# Fish	Weight kg
1	<i>Lobocheilus melanotaenia</i> 64	15	0.6
2	<i>Acantopsis</i> spp. 169	10	0.4
3	<i>Osteocheilus</i> sp. 69	2	0.1
4	<i>Puntioplites falcifer</i> 35	4	0.05
5	<i>Luciosoma bleekeri</i> 17	3	0.05
6	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	1	0.05
<b>Total</b>		<b>35</b>	<b>1.25</b>

**Total = 6 species**  
**35 fish = 1.25 kg**  
**2.5 cm gillnet (1 net)**  
**Times fished 4**  
**Hours fished 42**  
**CPUE 0.03 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Bagarius yarrelli</i> 90	1	1
2	<i>Hemibagrus wyckioides</i> 85	1	0.5
3	<i>Puntioplites falcifer</i> 35	2	0.1
<b>Total</b>		<b>4</b>	<b>1.6</b>

**Total = 3 species**  
**3 fish = 1.6 kg**  
**8 cm gillnet (1 net)**  
**Times fished 13**  
**Hours fished 182**  
**CPUE 0.009 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Bagarius yarrelli</i> 90	1	0.9
2	<i>Hemibagrus nemurus</i> 84	1	0.8
3	<i>Hemibagrus wyckioides</i> 85	2	0.15
4	<i>Oxyeleotris marmorata</i> / <i>Gobiidae</i> spp. 131	1	0.15
5	<i>Botia helodes</i> 79	2	0.1
6	<i>Kryptopterus</i> sp. 17	1	0.05
<b>Total</b>		<b>8</b>	<b>2.15</b>

**Total = 6 species**  
**8 fish = 2.15 kg**  
**50 longline (worms)**  
**(lg. and sm. hooks)**  
**Times fished 8**  
**Hours fished 112**  
**CPUE 0.019 kg/hr**

**Daily record of fish monitoring study**

**Mr. Sol Hyak – Kanat Toich village Mr. So Pheun – Kak village (#11)**

No	Species	# Fish	Weight kg
1	<i>Bangara behri</i> 54	33	81.2
2	<i>Morulus</i> spp. 58	30	63.8
3	<i>Hemibagrus wyckioides</i> 85	19	36.2
4	<i>Hypsibarbus</i> spp. 22	18	26.9
5	<i>Cirrhinus microlepis</i> 59	11	25.9
6	<i>Labeo erythropterus</i> 57	3	15
7	<i>Pangasius pleurotaenia</i> 111	20	15
8	<i>Osteocheilus melanopleurus</i> 68	8	14
9	<i>Osphronemus exodon</i> 126	7	11.9
10	<i>Bagarius yarrelli</i> 90	3	10.2
11	<i>Wallago leeri</i> 100	2	8.5
12	<i>Pangasius larnaudii</i> 107	5	8
13	<i>Probarbus</i> spp. 23-24	3	10.7
14	<i>Puntioplites falcifer</i> 35	5	4.9
15	<i>Channa micropeltes</i> 129	2	4.5
16	<i>Toxotes microlepis</i> 193	3	3.5
17	<i>Pangasius bocourti</i> 103	1	3.1
18	<i>Gyrinocheilus pennocki</i> 75	7	2.6
19	<i>Achiroides</i> sp. 139	3	2.3
20	<i>Scaphognathops bandanensis/</i> spp. 49	2	2.2
21	<i>Tor tambroides/</i> spp. 21	2	2
22	<i>Oxyeleotris marmorata</i> 131	1	1.5
23	<i>Coius undecimradiatus</i> 133	1	1.4
24	<i>Chitala blanci</i> 4	1	0.9
25	<i>Pangasius</i> sp.	2	0.5
<b>Total</b>		<b>189</b>	<b>356.2</b>

**Total = 25 species  
191 fish = 356.7 kg  
12 cm gillnet (1 net)  
Times fished 56  
Hours fished 840  
CPUE 0.43 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Pangasius larnaudii</i> 107	2	4.2
<b>Total</b>		<b>2</b>	<b>4.2</b>

**Total = 1 species  
1 fish = 4.2 kg  
Longline hooks (25 #10  
Hooks, 25 #5s)(fish bait)  
Times fished 3  
Hours fished 45  
CPUE 0.09 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Barbodes altus</i> 40	25	8.6
2	<i>Barbodes schwanefeldi</i> 38	14	4.5
3	<i>Notopterus notopterus</i> 5	7	1.2
4	<i>Hypsibarbus</i> spp. 44	3	1
5	<i>Probarbus</i> spp. 23-24	1	1
6	<i>Poropuntius deauratus</i> 43	8	0.9
7	<i>Hampala dispar</i> 50	4	0.7
8	<i>Chitala ornata</i> 3	3	0.4
9	<i>Henicorhynchus</i> spp.	8	0.3
10	<i>Achiroides</i> sp. 139	1	0.2
11	<i>Cyclocheilichthys</i> spp. 28	1	0.1
<b>Total</b>		<b>75</b>	<b>18.9</b>

**Total = 11 species**  
**75 fish = 18.9 kg**  
**5 cm gillnet (1 net)**  
**Times fished 23**  
**Hours fished 345**  
**CPUE 0.05 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Bangara behri</i> 54	7	14.9
2	<i>Wallago leeri</i> 100	1	9.2
3	<i>Hypsibarbus</i> spp. 44	2	4.6
4	<i>Morulius</i> spp. 58	3	3.2
5	<i>Osteocheilus melanopleurus</i> 68	1	2.8
6	<i>Puntioplites falcifer</i> 35	3	1.3
7	<i>Tor tambroides</i> / spp. 21	2	1.2
<b>Total</b>		<b>19</b>	<b>37.2</b>

**Total = 7 species**  
**19 fish = 37.2 kg**  
**13 cm gillnet (1 net)**  
**Times fished 8**  
**Hours fished 120**  
**CPUE 0.31 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Cirrhinus microlepis</i> 59	2	9.8
2	<i>Bagarius yarrelli</i> 90	1	5.3
3	<i>Cyclocheilichthys</i> spp.	5	3.3
<b>Total</b>		<b>8</b>	<b>18.4</b>

**Total = 3 species**  
**8 fish = 18.4 kg**  
**10 cm gillnet (1 net)**  
**Times fished 4**  
**Hours fished 60**  
**CPUE 0.31 kg/hr**

**Daily record of fish monitoring study**  
**Mr. Sol Teuy – Kanat Toich village (#12)**

No	Species	# Fish	Weight kg
1	<i>Barbodes schwanefeldi</i> 38	37	6
2	<i>Hypsibarbus</i> spp. 44-22-148	17	2.55
3	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	26	2
4	<i>Luciosoma bleekeri</i> 17	5	1
5	<i>Scaphognathops bandanensis</i> /spp. 49	14	0.95
6	<i>Puntioplites falcifer</i> 35	5	0.75
7	<i>Hemibagrus nemurus</i> 84	4	0.65
8	<i>Gyrinocheilus pennocki</i> 75	3	0.55
9	<i>Pseudomystus/ Bagrichthys macropterus</i> 82	1	0.5
10	<i>Trichogaster trichopterus</i> 125	1	0.5
11	<i>Cyclocheilichthys</i> sp. 31	4	0.4
12	<i>Osteocheilus hasselti</i> 66	2	0.3
13	<i>Toxotes microlepis</i> 193	3	0.3
14	<i>Hemibagrus nemurus</i> 84	3	0.2
15	<i>Cyclocheilichthys</i> spp. 28	3	0.2
16	Miscellaneous sp.	8	0.2
17	<i>Wallago leeri</i> 100	2	0.2
18	<i>Macrochirichthys macrochirus</i> 13	1	0.2
19	<i>Poropuntius deauratus</i> 43	1	0.2
20	<i>Systemus binotatus</i> 41	1	0.2
21	<i>Hemibagrus wyckioides</i> 85	1	0.2
22	<i>Chitala blanci</i> 4	3	0.1
23	<i>Osphronemus exodon</i> 126	1	0.1
24	<i>Chitala blanci</i> 4	1	0.1
25	<i>Bagarius yarrelli</i> 90	1	0.1
<b>Total</b>		<b>148</b>	<b>18.45</b>

**Total = 25 species**  
**148 fish = 18.45 kg**  
**5 cm gillnet (1 net)**  
**Times fished 19**  
**Hours fished 266**  
**CPUE 0.069 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	6	5.9
2	<i>Chitala blanci</i> 4	2	3
3	<i>Bagarius yarrelli</i> 90	2	2.9
4	<i>Helicophagus waandersii</i> 101	1	2
5	<i>Osphronemus exodon</i> 126	1	1.5
6	<i>Tor tambroides</i> / spp. 21	1	1.5
7	<i>Morulus</i> spp. 58	1	1
<b>Total</b>		<b>14</b>	<b>17.8</b>

**Total = 7 species**  
**14 fish = 17.8 kg**  
**12 cm gillnet (1 net)**  
**Times fished 19**  
**Hours fished 266**  
**CPUE 0.067 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Hemibagrus wyckioides</i> 85	2	1.1
2	<i>Hypsibarbus</i> spp. 44	2	1.1
3	<i>Puntioplites falcifer</i> 35	2	0.9
4	<i>Chitala blanci</i> 4	1	0.7
5	<i>Barbodes schwanefeldi</i> 38	3	0.4
6	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	2	0.4
7	<i>Osteocheilus hasselti</i> 66	2	0.2
8	<i>Hemibagrus nemurus</i> 84	2	0.2
9	<i>Henicorhynchus siamensis</i> 63	1	0.1
<b>Total</b>		<b>17</b>	<b>5.1</b>

**Total = 9 species**  
**17 fish = 5.1 kg**  
**8 cm gillnet (1 net)**  
**Times fished 19**  
**Hours fished 266**  
**CPUE 0.019 kg/hr**

## Daily Record of fish monitoring study

Mr. Phan Thong Lien and Mr. Theuk Nut – Tiem Leu village (#13)

No	Species	# Fish	Weight kg
1	<i>Henicorhynchus lobatus</i> 62	595	12.25
2	<i>Labiobarbus cf. leptocheilus</i> 162	346	10.3
3	<i>Paralabuca typus</i> 11	250	7.1
4	<i>Henicorhynchus siamensis</i> 63	95	5.4
5	<i>Mystus</i> spp. 88	31	4.55
6	<i>Puntioplites falcifer</i> 35	37	3.15
7	<i>Luciosoma bleekeri</i> 17	31	2.65
8	<i>Barbodes schwanefeldi</i> 38	24	2.45
9	<i>Kryptopterus cryptopterus</i> 95	27	2.3
10	<i>Raiamas guttatus</i> 10b	37	2
11	<i>Pangasius macronema</i> 110	37	1.8
12	<i>Acantopsis</i> spp. 169	17	1.5
13	<i>Hemibagrus nemurus</i> 84	15	1.4
14	<i>Cyclocheilichthys</i> spp. 28	53	1.2
15	<i>Scaphognathops bandanensis/</i> spp. 49	19	1.15
16	<i>Cyclocheilichthys</i> sp. 31	10	1.15
17	<i>Acantopsis</i> spp. 170	10	0.75
18	<i>Hypsibarbus</i> spp. 44	23	0.5
19	<i>Channa micropeltes</i> 129	1	0.5
20	<i>Pristolepis fasciata</i>	30	0.4
21	<i>Lobocheilus melanotaenia</i> 64	10	0.3
22	<i>Cyclocheilichthys enoplos</i> 29	6	0.3
23	<i>Ompok bimaculatus</i> 98	17	0.3
24	<i>Osteocheilus hasselti</i> 66	18	0.25
25	<i>Pseudomystus siamensis</i>	10	0.25
26	<i>Osteocheilus</i> sp. 67	13	0.25
27	<i>Botia helodes</i> 79	3	0.2
28	<i>Pristolepis fasciata</i>	7	0.2
29	<i>Pangasius</i> sp.	1	0.2
30	<i>Macrogathus</i> sp. 119	6	0.2
31	<i>Tetraodon</i> spp. 191	2	0.15
32	<i>Cyclocheilichthys</i> spp.	5	0.15
33	<i>Lalates siamensis</i> 113	7	0.1

**Total = 45 species**

**1826 fish = 66.06 kg**

**2.5 cm gillnet (1 net)**

**Times fished 33**

**Hours fished 462**

**CPUE 0.143 kg/hr**

No	Species	# Fish	Weight kg
34	<i>Macrochirichthys macrochirus</i> 13	6	0.1
35	<i>Micronema bleekeri</i> 96	5	0.1
36	<i>Chitala blanci</i> 4	3	0.1
37	<i>Mastacemblus</i> spp. 118	4	0.05
38	<i>Cirrhinus microlepis</i> 59	3	0.05
39	<i>Belondichthys truncatus</i> 92	3	0.05
40	<i>Bagarius yarrelli</i> 90	3	0.05
41	<i>Gyrinocheilus pennocki</i> 75	2	0.05
42	<i>Botia lecontei</i> 80	1	0.05
43	<i>Hampala macrolepidota/ H. dispar</i> 51	1	0.05
44	<i>Kryptopterus</i> sp. 175	1	0.05
45	<i>Notopterus notopterus</i> 5	1	0.01
<b>Total</b>		<b>1826</b>	<b>66.06</b>

No	Species	# Fish	Weight kg
1	<i>Wallago leeri</i> 100	1	3
2	<i>Channa striata</i> 128	3	2.25
3	<i>Hemibagrus nemurus</i> 84	8	1.6
4	<i>Mastacemblus</i> spp. 118	2	1.25
5	<i>Mystus wyckii</i> 86	2	1.1
6	<i>Hemibagrus wyckioides</i> 85	3	0.3
7	<i>Clarias batrachus</i> 180	1	0.1
8	<i>Bagrichthys macracanthus</i> 89	1	0.1
<b>Total</b>		<b>21</b>	<b>9.7</b>

**Total = 8 species**  
**21 fish = 9.7 kg**  
**Single hooks (#10**  
**hooks)50 (worm baited)**  
**Times fished 5**  
**Hours fished 70**  
**CPUE 0.143 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Channa</i> sp.	2	6.05
2	<i>Hypsibarbus</i> spp. 44	40	6.05
3	<i>Puntioplites falcifer</i> 35	42	3.15
4	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	44	3.1
5	<i>Cyclocheilichthys</i> spp. 28	14	1.45
6	<i>Amblyrhynchichthys truncates</i> 26	7	1
7	<i>Barbodes schwanefeldi</i> 38	23	0.9
8	<i>Hemibagrus nemurus</i> 84	5	0.8
9	<i>Barbodes schwanefeldi</i> 38	6	0.5
10	<i>Channa striata</i> 128	3	0.4

**Total = 25 species**  
**240 fish = 25.95 kg**  
**6 cm gillnet (1 net)**  
**Times fished 9**  
**Hours fished 126**  
**CPUE 0.206 kg/hr**



No	Species	# Fish	Weight kg
11	<i>Paralauca typus</i> 11	11	0.3
12	<i>Hampala macrolepidota/H. dispar</i> 51	3	0.3
13	<i>Achiroides</i> sp. 139	5	0.3
14	<i>Henicorhynchus siamensis</i> 63	7	0.25
15	Miscellaneous sp.	10	0.2
16	<i>Scaphognathops bandanensis/</i> spp. 49	1	0.2
17	<i>Hemibagrus nemurus</i> 84	1	0.2
18	<i>Lobocheilus melanotaenia</i> 64	2	0.2
19	<i>Scaphognathops bandanensis/</i> spp. 49	2	0.1
20	<i>Cyclocheilichthys</i> sp. 31	7	0.1
21	<i>Mystus</i> spp. 88	1	0.1
22	<i>Luciosoma bleekeri</i> 17	1	0.1
23	<i>Mystus</i> spp. 88	1	0.1
24	<i>Paralauca typus</i> 11	1	0.05
25	<i>Osteocheilus</i> sp. 69	1	0.05
<b>Total</b>		<b>240</b>	<b>25.95</b>

No	Species	# Fish	Weight kg
1	<i>Raiamas guttatus</i> 10b	6	0.5
2	<i>Systemus binotatus</i> 41	1	0.5
3	<i>Probarbus</i> spp. 23-24	1	0.5
4	<i>Henicorhynchus siamensis</i> 63	4	0.4
5	<i>Labiobarbus cf. leptocheilus</i> 162	4	0.4
6	<i>Hemibagrus nemurus</i> 84	4	0.3
7	<i>Pangasius macronema</i> 110	1	0.3
8	<i>Channa micropeltes</i> 129	1	0.2
9	<i>Channa striata</i> 128	1	0.2
10	<i>Barbodes altus</i> 40	4	0.2
11	<i>Helicophagus waandersii</i> 101	2	0.1
12	Miscellaneous sp.	2	0.1
13	<i>Cyclocheilichthys</i> spp. 28	1	0.1
14	<i>Channa striata</i> 128	1	0.1
15	<i>Cirrhinus microlepis</i> 59	1	0.1
16	<i>Hypsibarbus</i> spp. 44	1	0.1
<b>Total</b>		<b>35</b>	<b>4.1</b>

**Total = 16 species**  
**35 fish = 4.1 kg**  
**5 cm gillnet (1 net)**  
**Times fished 7**  
**Hours fished 98**  
**CPUE 0.042 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Tor tambroides/</i> spp. 21	1	2.5
2	<i>Bangara behri</i> 54	1	1.5
3	<i>Morulus</i> spp. 58	1	1.4
4	<i>Hemibagrus nemurus</i> 84	1	1.1
<b>Total</b>		<b>4</b>	<b>6.5</b>

**Total = 4 species**  
**4 fish = 6.5 kg**  
**12 cm gillnet (1 net)**  
**Times fished 13**  
**Hours fished 182**  
**CPUE 0.036 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Henicorhynchus lobatus</i> 62	43	0.5
2	<i>Labiobarbus cf. leptocheilus</i> 162	30	0.5
3	<i>Henicorhynchus siamensis</i> 63	19	0.5
4	<i>Mastacemblus</i> spp. 118	9	0.2
5	<i>Hemibagrus nemurus</i> 84	5	0.2
6	<i>Botia helodes</i> 79	6	0.1
7	<i>Puntioplites falcifer</i> 35	2	0.1
8	<i>Channa cf. marulius</i> 183	1	0.1
<b>Total</b>		<b>115</b>	<b>2.2</b>

**Total = 8 species**  
**115 fish = 2.2 kg**  
**Ngiang Duk Fruit fish poisoning**  
**Times fished 1**  
**Hours fished 14**  
**CPUE 0.157 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Cyclocheilichthys</i> spp.	2	0.1
2	<i>Poropuntius deauratus</i> 43	2	0.1
3	<i>Labiobarbus cf. leptocheilus</i> 162	2	0.1
4	<i>Pangasius</i> sp.	1	0.1
5	<i>Pristolepis fasciata</i>	2	0.1
6	<i>Pseudomystus siamensis</i>	1	0.1
7	<i>Henicorhynchus siamensis</i> 63	5	0.05
8	<i>Xenentodon cancila</i> 117	1	0.05
<b>Total</b>		<b>16</b>	<b>0.7</b>

**Total = 8 species**  
**16 fish = 0.7 kg**  
**4 cm gillnet (1 net)**  
**Times fished 3**  
**Hours fished 42**  
**CPUE 0.017 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Labiobarbus cf. leptocheilus</i> 162	98	5.1
2	<i>Henicorhynchus siamensis</i> 63	40	2
3	<i>Hemibagrus nemurus</i> 84	19	1.6
4	<i>Puntioplites falcifer</i> 35	16	1.6
5	<i>Bagarius yarrelli</i> 90	1	1.5
6	<i>Cyclocheilichthys</i> sp. 31	21	1.4
7	<i>Henicorhynchus</i> spp.	26	1.35
8	<i>Bangara behri</i> 54	1	1.2
9	<i>Gyrinocheilus pennocki</i> 75	24	1
10	<i>Cyclocheilichthys</i> spp. 28	13	0.85
11	<i>Hypsibarbus</i> spp. 44	9	0.7
12	<i>Barbodes schwanefeldi</i> 38	9	0.6
13	<i>Henicorhynchus lobatus</i> 62	21	0.5
14	<i>Cyclocheilichthys</i> spp.	7	0.5
15	<i>Pseudomystus siamensis</i>	6	0.4
16	<i>Mystus</i> spp. 88	6	0.3
17	<i>Raiamas guttatus</i> 10a	3	0.3
18	<i>Acantopsis</i> spp. 170	30	0.3
19	Miscellaneous sp.	5	0.3
20	<i>Helicophagus waandersii</i> 101	3	0.3
21	<i>Cirrhinus microlepis</i> 59	4	0.3
22	<i>Lobocheilus melanotaenia</i> 64	4	0.25
23	<i>Osteocheilus microcephalus</i> 70	8	0.2
24	<i>Pristolepis fasciata</i>	6	0.2
25	<i>Cyclocheilichthys enoplos</i> 29	1	0.2
26	<i>Botia modesta</i> 77	2	0.2
27	<i>Hampala macrolepidota/ H. dispar</i> 51	2	0.2
28	<i>Paralaubuca typus</i> 11	6	0.2
29	<i>Scaphognathops bandanensis/</i> spp. 49	3	0.15
30	<i>Osteocheilus hasselti</i> 66	2	0.15
31	<i>Notopterus notopterus</i> 5	2	0.1
32	<i>Luciosoma bleekeri</i> 17	3	0.1
33	<i>Pangasius macronema</i> 110	1	0.1
34	<i>Tenualosa thibaudeaui</i> 7	2	0.05
35	<i>Systemus binotatus</i> 41	1	0.05
36	<i>Osteochilus waandersii</i> 71	1	0.05
<b>Total</b>		<b>404</b>	<b>24.3</b>

**Total = 36 species**  
**404 fish = 24.3 kg**  
**3 cm gillnet (1 net)**  
**Times fished 23**  
**Hours fished 322**  
**CPUE 0.076 kg/hr**

**Daily Record of fish monitoring study  
Mr. Tung Son – Taveng village (#14)**

No	Species	# Fish	Weight kg
1	<i>Hypsibarbus</i> spp. 44	118	16.3
2	<i>Chitala blanci</i> 4	11	6.3
3	<i>Osteocheilus hasselti</i> 66	93	5.6
4	<i>Labiobarbus</i> cf. <i>leptocheilus</i> 162	77	5.2
5	<i>Scaphognathops bandanensis</i> / spp. 49	58	4.5
6	<i>Hemibagrus nemurus</i> 84	21	4.4
7	<i>Puntioplites falcifer</i> 35	47	4.3
8	<i>Cyclocheilichthys</i> sp. 31	35	2.5
9	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51	36	2.2
10	<i>Barbodes altus</i> 40	26	2.2
11	<i>Barbodes schwanefeldi</i> 38	38	2.1
12	<i>Achiroides</i> sp. 139	45	2
13	<i>Osteochilus waandersii</i> 71	40	2
14	<i>Henicorhynchus</i> spp.	12	1.7
15	<i>Hemibagrus nemurus</i> 84	28	1.7
16	<i>Systemus binotatus</i> 41	24	1.65
17	<i>Luciosoma bleekeri</i> 17	18	1.6
18	<i>Lobocheilus melanotaenia</i> 64	21	1.5
19	<i>Osteocheilus</i> sp. 69	27	1.4
20	<i>Cyclocheilichthys enoplos</i> 29	21	1.35
21	<i>Notopterus notopterus</i> 5	20	1.2
22	<i>Osteocheilus microcephalus</i> 70	19	1.2
23	<i>Mastacemblus</i> spp. 118	14	1.1
24	<i>Mystus wyckii</i> 86	11	1.05
25	<i>Hypsibarbus wetmorei</i>	3	1
26	<i>Botia helodes</i> 79	17	0.95
27	<i>Osteocheilus</i> sp. 67	17	0.9
28	<i>Pristolepis fasciata</i>	12	0.9
29	<i>Osphronemus exodon</i> 126	2	0.9
30	<i>Tor tambroides</i> / spp. 21	16	0.85
31	<i>P. siamensis</i> / <i>B. macropterus</i>	8	0.8
32	<i>Cyclocheilichthys</i> spp.	16	0.8
33	<i>Bagarius yarrelli</i> 90	6	0.8
34	<i>Kryptopterus</i> spp. 175	15	0.75

**Total = 74 species  
1197 fish = 97.25 kg  
6 cm gillnet (1 net)  
Times fished 113  
Hours fished 1525.5  
CPUE 0.064 kg/hr**

No	Species	# Fish	Weight kg
35	<i>Mystus</i> spp. 88	18	0.75
36	<i>Poropuntius</i> sp.	13	0.7
37	<i>Helicophagus waandersii</i> 101	12	0.7
38	<i>Paralaubuca typus</i> 11	13	0.6
39	<i>Probarbus</i> spp. 23-24	11	0.6
40	<i>Pangasius</i> sp.	3	0.6
41	<i>Clarias batrachus</i> 180	9	0.55
42	<i>Botia modesta</i> 77	7	0.5
43	<i>Ompok bimaculatus</i> 98	7	0.5
44	<i>Bagrichthys macracanthus</i> 89	9	0.5
45	<i>Channa striata</i> 128	4	0.5
46	Miscellaneous spp.	7	0.5
47	<i>Trichogaster trichopterus</i> 125	6	0.5
48	<i>Chitala ornata</i> 3	7	0.4
49	<i>Raiamas guttatus</i> 10b	7	0.4
50	<i>Morulius</i> spp. 58	6	0.4
51	<i>Bangara behri</i> 54	6	0.4
52	<i>Hampala dispar</i> 50	7	0.4
53	<i>Rasbora</i> spp.	8	0.35
54	<i>Henicorhynchus lobatus</i> 62	8	0.3
55	<i>Gyrinocheilus pennocki</i> 75	5	0.3
56	<i>Macrogathus</i> sp. 119	5	0.3
57	<i>Toxotes microlepis</i> 193	4	0.3
58	<i>Crossocheilus siamensis</i> 72	6	0.25
59	<i>Micronema bleekeri</i> 96	4	0.2
60	<i>Henicorhynchus siamensis</i> 63	4	0.2
61	<i>Crossocheilus siamensis</i> 72	4	0.2
62	<i>Tetraodon</i> spp. 191	3	0.2
63	<i>Kryptopterus cryptopterus</i> 95	3	0.2
64	<i>Bagrichthys macropterus</i> 173	5	0.2
67	<i>Macrochirichthys macrochirus</i> 13	2	0.2
68	<i>Channa</i> cf. <i>marulius</i> 183	1	0.2
69	<i>Acantopsis</i> spp. 171	3	0.15
70	<i>Systemus binotatus</i> 41	2	0.1
71	Miscellaneous spp.	2	0.1
72	<i>Lalates siamensis</i> 113	2	0.1
73	<i>Micronema</i> cf. <i>micronema</i> 97	1	0.1
74	<i>Garra cambodgiensis</i> 73	1	0.1
<b>Total</b>		<b>1197</b>	<b>97.25</b>

No	Species	# Fish	Weight kg
1	<i>Bagarius yarrelli</i> 90	6	14
2	<i>Hemibagrus wyckioides</i> 85	4	9.1
3	<i>Pangasius larnaudii</i> 107	3	4.2
4	<i>Hemibagrus nemurus</i> 84	13	3.2
5	<i>Helicophagus waandersii</i> 101	3	3.1
6	<i>Osphronemus exodon</i> 126	3	3
7	<i>Hypsibarbus</i> spp. 44	3	6
8	<i>Pangasius bocourti</i> / <i>Pangasius concophilus</i> 179	1	3
9	<i>Channa striata</i> 128	6	2.1
10	<i>Channa</i> sp. 130	2	2
11	<i>Micronema cf micronema</i> 97	2	2
12	<i>Coius undecimradiatus</i> 133	2	2
13	<i>Hampala macrolepidota</i> / <i>H. dispar</i> 51-50	2	2
14	<i>Wallago leeri</i> 100	1	2
15	<i>Pangasius</i> sp.	1	2
16	<i>Channa</i> sp.	1	2
17	<i>Hemibagrus nemurus</i> 84	3	1.1
18	<i>Mystus wyckii</i> 86	2	1
19	<i>Channa micropeltes</i> 129	1	1
20	<i>Micronema bleekeri</i> 96	1	0.5
21	<i>Kryptopterus</i> sp. 175	1	0.1
22	<i>Trichogaster trichopterus</i> 125	3	0.1
23	<i>Mastacemblus</i> spp. 118	1	0.1
<b>Total</b>		<b>65</b>	<b>65.6</b>

**Total = 23 species**  
**65 fish = 65.6 kg**  
**25 #5 hooks (*mak deua***  
**fig fruits)25 single hooks**  
**(worm bait)**  
**Times fished 25**  
**Hours fished 337.5**  
**CPUE 0.194 kg/hr**

No	Species	# Fish	Weight kg
1	<i>Osteocheilus hasselti</i> 66	52	3.5
2	<i>Osteochilus waandersii</i> 71	44	3.0
3	<i>Labiobarbus cf. leptocheilus</i> 162	38	2.2
4	<i>Systemus binotatus</i> 41	23	1.3
5	<i>Lobocheilus melanotaenia</i> 64	25	1.2
6	<i>Henicorhynchus</i> spp.	26	1.1
7	<i>Poropuntius deauratus</i> 43	21	1.1
8	<i>Osteocheilus</i> sp. 69	21	1.1
9	<i>Osteocheilus microcephalus</i> 70	15	1
10	<i>Osteocheilus</i> sp. 67	11	0.6
11	<i>Mystus</i> spp. 88	16	0.6
12	<i>Cirrhinus molitorella</i> 164	10	0.5
13	<i>Ompok bimaculatus</i> 98	6	0.5
14	<i>Hemibagrus nemurus</i> 84	8	0.5
15	<i>Hampala macrolepidota/ H. dispar</i> 51-50	9	0.5
16	<i>Luciosoma bleekeri</i> 17	9	0.5
17	<i>Notopterus notopterus</i> 5	6	0.4
18	<i>P. siamensis/ B. macropterus</i>	6	0.4
19	<i>Pristolepis fasciata</i>	7	0.35
20	<i>Botia helodes</i> 79	7	0.3
21	<i>Barbodes altus</i> 40	6	0.3
22	<i>Raiamas guttatus</i> 10b	6	0.3
23	<i>Hypsibarbus</i> spp. 44	5	0.3
24	<i>Scaphognathops bandanensis/ spp.</i> 49	4	0.2
25	<i>Micronema bleekeri</i> 96	3	0.2
26	<i>Mekongina erythrospila</i> 74	3	0.2
27	<i>Crossocheilus siamensis</i> 72	4	0.2
28	<i>Macrochirichthys macrochirus</i> 13	2	0.2
29	<i>Rasbora</i> sp.	4	0.1
30	<i>Henicorhynchus siamensis</i> 63	4	0.1
31	<i>Botia modesta</i> 77	2	0.1
32	<i>Labeo erythropterus</i> 57	2	0.1
33	<i>Cyclocheilichthys enoplos</i> 29	1	0.1
34	<i>Botia lecontei</i> 80	2	0.1
35	<i>Cyclocheilichthys</i> sp. 28	2	0.1
36	<i>Clarias batrachus</i> 180	2	0.1
37	<i>Mystus wyckii</i> 86	2	0.1
38	<i>Mastacemblus</i> spp. 118	2	0.1
<b>Total</b>		<b>416</b>	<b>23.45</b>

**Total = 38 species**  
**416 fish = 23.45 kg**  
**4 cm gillnet (1 net)**  
**Times fished 31**  
**Hours fished 318.5**  
**CPUE 0.074 kg/hr**