# 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**

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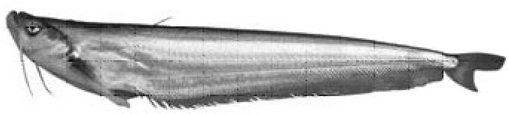


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Cover photo, right: Man living along the Sesan River in Andong Meas district, Ratanakiri province, northeast Cambodia with a new nylon mono-filament gillnet.
Cover photo, left: A nylon mono-filament gillnet being checked by fishers along the Sesan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

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តើមានអ្វីដែលអាចធ្វើបាន  ពេលគេសាងសង់ទំនប់ធំមួយនៅតាមខ្សែទឹកខាងលើក្នុងប្រទេសមួយ ហើយយើងដឹងច្បាស់ថា ឥទ្ធិពលពីទំនប់នោះអាចបង្កើតនូវបញ្ហាជាច្រើនមកលើមច្ឆា និងជលផល?  ប៉ុន្តែ មិនទាន់មានអ្នកណាបានធ្វើការប្រមូលទិន្នន័យជាបរិមាណអំពីទន្លេពីមុនមកទេ  ហើយក៏មិនមានការពិចារណាអំពីផលប៉ះពាល់នៅតំបន់ខ្សែទឹកខាងក្រោមសំរាប់ប្រទេសជិតខាងឬនៅក្នុងតំបន់ដែលត្រូវធ្វើការវាយតំលៃហេតុនៃផលប៉ះពាល់បរិស្ថានរបស់គំរោងសាងសង់ទំនប់ដែរ ។  តើគ្មានអ្នកណាបានប្រមូលទិន្នន័យមូលដ្ឋានអំពីជលផលមុននឹងចាប់ផ្តើមអនុវត្តគំរោងសាងសង់ទំនប់ឬ?  សំនួរទាំងនេះគឺជាចំនុចចាប់ផ្តើមនៃការសិក្សានេះ ដែលមានការពាក់ពន្ធ័យ៉ាងខ្លាំងជាមួយទំនប់កំលាំង ៧២០មេហ្គាវ៉ាត **យ៉ាលី** ។ គេសាងសង់ទំនប់**យ៉ាលី** នៅតំបន់ខ្ពង់រាបកណ្តាលនៃប្រទេសវៀតណាម ។ ទំនប់នេះចាប់ផ្តើមបង្កផលប៉ះពាល់មកលើតំបន់ខ្សែទឹកខាងក្រោមក្នុងពេលកំពុងសាងសង់នៅឆ្នាំ១៩៩៦  ហើយផលប៉ះពាល់បានបន្តនិងកាន់តែធ្ងន់ធ្ងរចាប់តាំងពីឆ្នាំ២០០១ នៅពេលដែលទំនប់នេះធ្វើប្រតិបត្តិការពេញលេញ ។

ដើម្បីធ្វើការវាយតំលៃទៅលើផលប៉ះពាល់មកលើសង្គម  និងបរិស្ថានពីទំនប់ផ្សេងៗទៀតនៅតាមតំបន់ខ្សែទឹកខាងលើនៅពេលអនាគត  យើងចាំបាច់ត្រូវយល់ដឹងអោយបានច្រើនបន្ថែមទៀតអំពីមច្ឆា  និងជលផល  ព្រមទាំងពិចារណាទៅលើផលប៉ះពាល់របស់**យ៉ាលី**  ពីមុនក៏ដូចជាផលប៉ះពាល់ទៅថ្ងៃអនាគតពីទំនប់ផ្សេងៗ ដែលគេមានផែនការសាងសង់នៅក្នុងអាងទន្លេសេសានក្នុងប្រទេសវៀតណាម ។ របាយការណ៍នេះមានគោលបំណងបង្ហាញជូនអំពីលទ្ធផលនៃការសិក្សាមួយទាក់ទងនិងជលផលនៃទន្លេសេសានក្នុងខេត្តរតនគិរី ។ ការស្រាវជ្រាវនេះសិក្សាពីជលផលនៃទន្លេសេសានក្នុងខេត្តរតនគិរីនាពេលបច្ចុប្បន្ន និងវាយតំលៃផងដែរទៅលើផលប៉ះពាល់មកលើមច្ឆានិងជលផលនៅតំបន់ខ្សែទឹកខាងក្រោមនៃទំនប់**យ៉ាលី**  និងទំនប់ផ្សេងៗទៀត ។

ការសិក្សាស្រាវជ្រាវនេះមានពីរផ្នែកធំៗ  ។  ផ្នែកទីមួយប្រមូលផ្តុំទិន្នន័យជាបរិមាណទាក់ទងនិងការនេសាទត្រី  ដើម្បីវាយតំលៃអំពីស្ថានភាពត្រីនិងជលផលបច្ចុប្បន្ននៅតាមដងទន្លេសេសានក្នុងខេត្តរតនគិរី ។ ចំណែកឯផ្នែកទីពីរ ការសិក្សាធ្វើការវាយតំលៃអំពីផលប៉ះពាល់របស់ទំនប់**យ៉ាលី**មកលើត្រី និង ជលផលនៅតំបន់ខ្សែទឹកខាងក្រោមដោយប្រើប្រាស់ចំណេះដឹងស្តីពីអេកូឡូស៊ីទាំងបច្ចុប្បន្ននិងអតីតកាលរបស់ប្រជាជនក្នុងសហគមន៍ ។

ផ្នែកទីមួយគឺចងក្រងទិន្នន័យជាបរិមាណពីការសិក្សាពេញមួយឆ្នាំអំពីជលផលនិងការនេសាទត្រី ដែលធ្វើឡើងដោយអ្នកនេសាទចំនួនប្រាំពីភូមិតាមដងទន្លេសេសានក្នុងខេត្តរតនគិរី ។ អ្នកនេសាទទាំងនោះរស់នៅតាមតំបន់ភាគខាងលិចដល់ភាគខាងកើត  ឬ  ពីតំបន់ខ្សែទឹកខាងក្រោមទៅតំបន់ខ្សែទឹកខាងលើ ។

ភូមិទាំងប្រាំពីនោះគឺ ភូមិភ្នំកុកនិងភូមិទាមលើ ស្រុកវ៉ឺនសៃ ភូមិតាវែង ស្រុកតាវែង និងភូមិតាឡាវ ភូមិកាណាតតូច ភូមិកាក់ និងភូមិបខាំ ស្រុកអណ្តូងមាស ។ អ្នកនេសាទជាបុរសចំនួន២២នាក់បានចូលរួមក្នុងដំណើរការប្រមូលទិន្នន័យជាបរិមាណអំពីការនេសាទត្រីនេះ ហើយក្រុមសិក្សាប្រមូលបានទិន្នន័យ២០ប្រភេទអំពីការនេសាទត្រីចាប់តាំងពីខែមេសា ឆ្នាំ២០០៣ ដល់ ខែមេសា ឆ្នាំ២០០៤ ។ ទិន្នន័យ១៤ប្រភេទក្នុងចំណោមទិន្នន័យទាំង២០ប្រភេទនោះអាចយកមកប្រើប្រាស់សំរាប់ការវិភាគចុងក្រោយ ។

ផ្នែកទីពីរបានប្រើប្រាស់ចំនេះដឹងអំពីអេកូឡូស៊ីរបស់អ្នកនេសាទក្នុងសហគមន៏ដែលចូលរួមក្នុងការសិក្សាស្រាវជ្រាវនេះ ។ ចំណេះដឹងនោះបានមកពីការសំភាសន៏ក្រុមអ្នកនេសាទជាលក្ខណៈបុគ្គលនិងការសំភាសន៏ជាក្រុមធំរួមគ្នាដើម្បីកត់ត្រាព័ត៌មានដែលបានមកពីការអង្កេតនិងបទពិសោធន៏របស់ពួកគេទាក់ទងនិងការនេសាទក្នុងទន្លេសេសាន ជាពិសេសពូជត្រីនិងប្រភេទសត្វរស់នៅក្នុងទឹកផ្សេងៗទៀតនៅមុនពេលសាងសង់ អំឡុងពេលកំពុងសាងសង់ទំនប់យ៉ាលី និងក្រោយពេលទំនប់នេះចាប់ផ្តើមប្រតិបត្តិការ ។ វាមានសារៈសំខាន់ខ្លាំងណាស់ ដែលយើងប្រើប្រាស់ចំណេះដឹងរបស់ពួកគេ ដើម្បីធ្វើការប្រៀបធៀបទិន្នន័យជលផលជាបរិមាណចេញពីសកម្មភាពនេសាទនៅតាមដងទន្លេសេសានដោយផ្ទាល់ជាមួយនិងទិន្នន័យទាក់ទងនិងត្រីនិងជលផលនៅក្នុងទន្លេសេសានចាប់តាំងពីមុនពេលទំនប់**យ៉ាលី**បានបង្កផលប៉ះពាល់មកលើផ្នែកខាងក្រោមនៃទន្លេសេសានក្នុងខេត្តរតនគីរីនាឆ្នាំ១៩៩៦ ។

ការសិក្សាស្រាវជ្រាវបានពិនិត្យមើលឧបករណ៏នេសាទ១៦ប្រភេទដូចជា មងលីឡុង ទំហំក្រឡា ២,៥ សង់ទីម៉ែត្រ ៣សង់ទីម៉ែត្រ ៤សង់ទីម៉ែត្រ ៥សង់ទីម៉ែត្រ ៦សង់ទីម៉ែត្រ ៧សង់ទីម៉ែត្រ ៨សង់ទីម៉ែត្រ ១០សង់ទីម៉ែត្រ ១២សង់ទីម៉ែត្រ និង១៣សង់ទីម៉ែត្រ សំណាញ់ទំហំក្រឡា ៣សង់ទីម៉ែត្រ សន្ទូចរនង និងសន្ទូចបង្កៃមានផ្លែតូចនិងធំ ព្រមទាំងការបំពុលត្រីតាមធម្មជាតិដោយប្រើផ្លែឈើព្រៃ ។

ការចងក្រងទិន្នន័យបរិមាណអំពីការនេសាទត្រី ដែលធ្វើឡើងដោយអ្នកនេសាទបានមកពីការត្រួតពិនិត្យមើលសកម្មភាពនេសាទចំនួន១៩៦៩ ក្នុងរយៈពេលនេសាទ ២៧៣៦២,៧ ម៉ោង ។ ក្នុងរយៈពេលសិក្សា ត្រីចំនួន ១៤៨៤៧ក្បាលដែលបានចាប់មានទំងន់ ២២៥០,៣៦ គីឡូក្រាម ។ មានត្រីចំនួន ១១១ ប្រភេទត្រូវបានចាប់ និងបានកត់ត្រាក្នុងកំឡុងពេលនេសាទ ហើយពូជត្រីទាំងនេះហាក់ដូចជាអាចតំណាងអោយពូជត្រីធម្មជាតិជាង១២០ប្រភេទផ្សេងទៀត ។

វាមិនគួរអោយភ្ញាក់ផ្អើលទេ ដែលពេលនេសាទក្រុមសិក្សាបានរកឃើញប្រភេទត្រីមានស្រកាជាពូជត្រីសំខាន់ជាងគេ ដែលអ្នកនេសាទចាប់បានក្នុងចំណោមពូជត្រីផ្សេងៗច្រើនទៀត ។ ចំពោះការនេសាទទាំងអស់ បរិមាណត្រីចាប់បានជាមធ្យម គឺ ០,០៨២គីឡូក្រាមក្នុងមួយម៉ោង ។ ជាទូទៅ បរិមាណត្រីនេសាទបានជាមធ្យមនៅភូមិតាឡាវ ភូមិកាណាតតូច គឺខ្ពស់ជាងភូមិផ្សេងៗទៀត ។ មានភាពខុសគ្នាជា

ច្រើនគួរអោយពិចារណាផងដែរ ចំពោះភាពខុសគ្នាដាច់ស្រឡះនៃបរិមាណពូជត្រី ដែលចាប់បាននៅតំបន់ជួរថ្ម និងតំបន់ដីខ្សាច់ ។ ទីជំរកត្រួច១នៅតាមដងទន្លេសេសានពិតជាមានសារៈសំខាន់ណាស់សំរាប់ការរស់នៅរបស់ពូជត្រីជាច្រើនប្រភេទ។

អ្នកនេសាទដែលចូលរួមក្នុងការសិក្សាបានបង្ហាញអោយឃើញអំពីការប្រែប្រួលរបស់ទន្លេសេសានចាប់តាំងពីទំនប់**យ៉ាលី**ចាប់ផ្តើមបង្កផលប៉ះពាល់មកលើតំបន់ខ្សែទឹកខាងក្រោម ។ ពួកគាត់ជឿថា ការកើនឡើងនូវកំទិចកំណនៅក្នុងទន្លេសេសានគឺជាឥទ្ធិពលមួយដ៏ធ្ងន់ធ្ងរដែលបណ្តាលមកពីការសាងសង់ទំនប់នៅក្នុងអាងទន្លេសេសាន ។ ការបាក់ច្រាំងទន្លេដែលបណ្តាលមកពីការបើកទឹកដោយគំហុក និងកំលាំងទឹកហូរខ្លួលខ្លាញ់ពីទំនប់**យ៉ាលី** បង្ហាញច្បាស់ថា ជាមូលហេតុដែលបង្កើតអោយមានកំទិចកំណក្នុងទន្លេ ។ អ្នកនេសាទនៅភូមិកាណាតតូច ភូមិតាឡាវនិងភូមិបខាំបានប្រាប់អោយអោយដឹងថា ការបាត់បង់ត្រីប៉ាវាមុខមួយ ត្រីប៉ាសេអ៊ី ត្រីស្លុក ត្រីក្អែកនិងពូជត្រីជាច្រើនទៀត គឺបណ្តាលមកពីដីខ្សាច់ ល្បប់និងភក់ហូរមកកកលប់លើពពួកសារាយ ស្លែតាមជួរថ្មក្នុងទន្លេ ។ ពួកសារាយ និងស្លែ ទាំងនេះគឺជាប្រភពចំណីរអាហារដ៏សំខាន់បំផុតសំរាប់ពូជត្រីទាំងនេះ និងពូជត្រីផ្សេង១ទៀត ។

ការបាក់ច្រាំងទន្លេបានជះឥទ្ធិពលយ៉ាងធ្ងន់ធ្ងរមកលើត្រីនិងជលផលពីព្រោះកំទិចថ្ម ដីខ្សាច់និងល្បប់ហូរកប់អន្លង់ជ្រៅ១ក្នុងទន្លេនឹងធ្វើអោយបាត់បង់ទីជំរកដ៏សំខាន់ ដែលពូជត្រីច្រើនប្រភេទមកលាក់ខ្លួននៅរដូវប្រាំង ។ បញ្ហាម្យ៉ាងទៀត ភក់ ល្បប់ ខ្សាច់និងកំទិចថ្មទាំងនេះហូរកប់រុន្ធថ្មនៅក្នុងទន្លេ ។

អ្នកនេសាទជឿថា បញ្ហាគុណភាពទឹកបានធូរស្រាលជាងពីរបីឆ្នាំមុនបន្តិច ប៉ុន្តែបញ្ហានេះនៅតែមាន ជាពិសេសពេលក៏រិតទឹកទន្លេរាក់នៅចុងរដូវប្រាំង ។

អ្នកនេសាទបានអង្កេតមើលបញ្ហាជាច្រើនទាក់ទងនឹងជលវិទ្យា ។ ឧទាហរណ៍ ជាទូទៅត្រីធ្វើដំណើរមកពងតាមអូរជាប់ទន្លេនៅដើមរដូវវស្សាគឺនៅពេលក៏រិតទឹកចាប់ផ្តើមឡើងដំបូង ។ អ្នកនេសាទទាំងនោះអង្កេតឃើញទៀតថា ក៏រិតទឹកជាញឹកញាប់ស្រកចុះវិញយ៉ាងលឿនក្រោយពេលហូរខ្លាំងពីដើមរដូវវស្សា ។ ការហូរទឹកខ្លាំងនៅដើមរដូវវស្សានេះធ្វើអោយក៏រិតទឹកនៅតំបន់ខ្សែទឹកខាងលើនៅសល់តិចតួច ឬគ្មានទឹកសោះតែម្តង ដែលបង្ខំអោយត្រីធ្វើដំណើរយ៉ាងពិបាកតាមច្រាំងទន្លេ និងបង្កលក្ខណៈពិបាកសំរាប់ការរស់រានមានជីវិត ។

ស្ថានភាពនេះបង្កបរិយាកាសល្អសំរាប់ការនេសាទក្នុងរយៈពេលខ្លី ប៉ុន្តែ ជាទូទៅ វាធ្វើអោយប៉ះពាល់ដល់ការរស់នៅរបស់ត្រី។ អ្នកនេសាទទាំងនោះបានបង្ហាញអំពីការលំបាកដែលជួបប្រទះថា ពេលខ្លះពួកគាត់យកមងទៅដាក់នៅពេលយប់ លុះព្រឹកឡើងមងដែលពួកគាត់ដាក់ត្រូវទឹកទន្លេដែលឡើងភ្លាម១

ក្នុងយប់នោះហូរគួចយកទៅបាត់ ។ ពេលខ្លះទៀត មងពួកគាត់នៅលើគោកខ្ពស់ពីទឹកនៅពេលព្រឹក ហើយគ្មាន ជាប់ត្រីមួយសោះ ដោយសារទឹកទន្លេស្រកខ្លាំងភ្លាមៗនៅពេលយប់ ។

ក្រុមអ្នកនេសាទបានអង្កេតឃើញបន្តទៀតថា វាជាការល្អចំពោះការប្រើសំណាញ់សំរាប់ចាប់ត្រី ប្រសិនបើក្នុងរយៈពេលបីទៅបួនថ្ងៃកំរិតទឹកទន្លេមិនឡើងចុះលឿន ។ ប៉ុន្តែបើកំរិតទឹកស្រកចុះលឿនវិញ យើងនឹងពិបាករកត្រីដោយប្រើសំណាញ់ ។ ស្ថិតក្នុងស្ថានភាពស្រដៀងគ្នានេះ ប្រជាជនក្នុងសហគមន៍ធ្លាប់រកត្រីបានផលល្អនៅពេលកំរិតទឹកឡើងដោយសារមានភ្លៀងខ្លាំង ប៉ុន្តែពួកគាត់មិនអាចទទួលបានសំណាងល្អដូចនេះទៀតទេ ក្រោយពេលកំរិតទឹកទន្លេប្រែប្រួលភ្លាមៗបន្ទាប់ពីភ្លៀងរាំងមួយរយៈខ្លី ។

ស្ថានភាពទឹកទន្លេមិនប្រក្រតីអាចធ្វើអោយចលនាបំលាស់ទីរបស់ត្រីមានការប្រែប្រួល ហើយយើងជឿថា នេះជាឥទ្ធិពលមួយទៀតដែលមានការពាក់ពន្ធ័និងការបត់បែនមិនទៀងទាត់របស់ជលវិទ្យា ។ យើងជឿថា កំរិតទឹកឡើងចុះនៅរយៈពេលមួយនៃឆ្នាំនីមួយៗពិតជាមានការពាក់ពន្ធ័និងការបំលាស់ទីរបស់ត្រី ។ ការផ្លាស់ប្តូររបស់ជលវិទ្យាអាចជះឥទ្ធិពលយូរអង្វែងមកលើពូជត្រីដែលបំលាស់ទីឡើងចុះក្នុងអាងទន្លេមេគង្គ ទន្លេសេសាន ទន្លេស្រែពក និងទន្លេសេកុង ។

អ្នកនេសាទមានការជឿជាក់ថា កំរិតទឹកឡើង ស្រកភ្លាមៗនិងការប្រែប្រួលនៃគុណភាពទឹកអាចប៉ះពាល់យ៉ាងខ្លាំងដល់ពូជត្រីនិងប្រភេទសត្វរស់នៅក្នុងទឹកជាច្រើនទៀត ។ ពពួកសត្វដែលទទួលរងឥទ្ធិពលនេះមានពពួកខ្ចង គ្រុំ ខ្ចៅនិងជន្លេន ។ ក្រុមអ្នកនេសាទទាំងនោះបានធ្វើការអង្កេតឃើញថា ពូជត្រីមួយចំនួនត្រូវបានទទួលរងផលប៉ះពាល់ជាអវិជ្ជមានខ្លាំងជាងពូជត្រីផ្សេងៗទៀត ។ ពូជត្រីខ្លះត្រូវបានរាយការណ៍ថាបានបាត់បង់ក្នុងពេលនេសាទ ឬ ថយចុះខ្លាំងជាងពូជត្រីផ្សេងៗទៀត ។

ឧទាហរណ៍: សំបុកពូជត្រីមួយចំនួនដូចជា ត្រីឆ្តោ និងត្រីរមាស ត្រូវរសាត់តាមទឹកគួចខ្លាំង ដែលធ្វើអោយកំរិតជោគជ័យនៃការបង្កាត់ពូជមានការធ្លាក់ចុះ ហើយទីជំរកជ្រៅៗក្នុងទន្លេរបស់ពូជត្រីមួយចំនួនត្រូវបានបាត់បង់យ៉ាងច្រើន ។ លើសពីនេះ ពូជកន្ធាយពីរប្រភេទដែលពងនៅលើថ្មកខ្សាច់ត្រូវបានរងគ្រោះយ៉ាងខ្លាំងដោយសារកំរិតទឹកទន្លេប្រែប្រួល ។ អ្នកនេសាទទាំងនោះមិនជឿថា ការប្រែប្រួលរបស់ជលវិទ្យា និងគុណភាពទឹកក្នុងទន្លេសេសានមិនមានប្រយោជន៍អ្វីសំរាប់ពពួកសត្វទាំងនេះ។ អ្នកនេសាទយើងបានត្រឹមតែធ្វើការអង្កេតលើការធ្លាក់ចុះនៃផលត្រីប៉ុណ្ណោះ ។

ក្រុមអ្នកនេសាទយើងបានអង្កេតឃើញផងដែរថា ផលប៉ះពាល់ជាអវិជ្ជមានមកលើដើមឈើនិងគុម្ពោតព្រៃលិចទឹកតាមរដូវកាលបានប្រែប្រួលយ៉ាងខ្លាំងទៅតាមលក្ខណៈបាតទន្លេសេសាន និងទន្លេផ្សេងទៀតនៅក្នុងអាងទន្លេមេគង្គ ។ ការឡើងចុះមិនទៀតទាត់នៃកំរិតទឹកទន្លេសេសានបានធ្វើអោយដំណាំតាមមាត់ទន្លេធ្លាក់ចុះយ៉ាងខ្លាំង ។

ដោយពិចារណាអំពីផលប៉ះពាល់ជាអវិជ្ជមានមកលើទន្លេសេសានដូចបានរៀបរាប់ខាងលើ វាគ្មានអ្វីគួរអោយភ្ញាក់ផ្អើលទេ ដែលអ្នកនេសាទតាមដងទន្លេសេសានរាយការណ៍ថា ផលត្រីដែលចាប់បានធ្លាក់ចុះចាប់តាំងពីមានការកត់សំគាល់ដំបូងថា ទំនប់**យ៉ាលី** បង្កផលប៉ះពាល់មកលើទន្លេសេសាន ។ ពួកគាត់រាយការណ៍ថាផលត្រីធ្លាក់ចុះជាមធ្យម ២៦,៧% តិចជាងផលត្រីធ្លាប់រកបាន ។ ចំពោះភូមិភ្នំកុក ភូមិទាមលើ និងភូមិបខាំវិញការធ្លាក់ចុះនេះកាន់តែមានសភាពធ្ងន់ធ្ងរជាងគេ ។

មានហេតុផលល្អៗជាច្រើនផ្អែកលើអេកូឡូស៊ី ដែលអាចបកស្រាយបានថាហេតុអ្វីការប្រែប្រួលនៃកំរិតទឹកនិងជលវិទ្យារបស់ទន្លេធ្វើអោយបរិមាណត្រីធ្លាក់ចុះ និងហេតុអ្វីការប្រែប្រួលនេះមានការពាក់ពន្ធ័ទៅនឹងជលផលនិងប្រភេទសត្វរស់នៅក្នុងទឹកផ្សេងទៀត ។ ទោះបីជាយ៉ាងណា វាហាក់បីដូចជាមិនត្រឹមត្រូវទាំងអស់ទេដែលថាការធ្លាក់ចុះនៃបរិមាណត្រីទាំងនេះដោយសារទំនប់ទាំងស្រុង ។ តាមការពិតមានកត្តាផ្សេងទៀតដែលរួមចំណែកក្នុងរឿងនេះ កត្តាទាំងនោះមានដូចជា ការនេសាទខុសច្បាប់ និងកំណើនប្រជាជន ។

ដោយធ្វើការប្រៀបធៀបទំនប់និងកត្តាផ្សេងៗទៀត យើងមិនអាចសន្និដ្ឋានបានច្បាស់លាស់អំពីភាគរយនៃផលត្រីធ្លាក់ចុះដែលបង្កដោយទំនប់**យ៉ាលី** ។ ប៉ុន្តែអ្នកនេសាទដែលយល់ដឹងច្បាស់លាស់អំពីបញ្ហាអេកូឡូស៊ីនៅក្នុងសហគមន៏អាចសន្និដ្ឋានបានថា ទំនប់**យ៉ាលី**ជះឥទ្ធិពលអាក្រក់យ៉ាងខ្លាំងមកលើការរស់នៅរបស់ត្រី ជលផលនិងប្រភេទសត្វរស់ក្នុងទឹកផ្សេងទៀតនៅក្នុងទន្លេសេសាន ។ ប្រជាជនដែលរស់នៅតាមដងទន្លេសេសានក្នុងខេត្តរតនគីរីសមនឹងទទួលបាននូវសំណងទាក់ទងនឹងការធ្លាក់ចុះនៃផលត្រី ពីព្រោះពួកគាត់បានទទួលរងនូវការខូចខាតពីឥទ្ធិពលទំនប់ជាច្រើនឆ្នាំមកហើយ ហើយនៅតែមិនទាន់បានទទួលសំណងអ្វីទាំងអស់ ។ ក្នុងករណីនេះដែរ ការសិក្សាវាយតំលៃហេតុផលប៉ះពាល់បរិស្ថានមកលើតំបន់ខ្សែទឹកខាងក្រោមរបស់ទំនប់**យ៉ាលី**មិនទាន់បានធ្វើនៅឡើយនៅក្នុងប្រទេសកម្ពុជា វាមិនគួរជាការទទួលខុសត្រូវរបស់អ្នកនេសាទទេក្នុងការសិក្សាអោយឃើញពីផលប៉ះពាល់របស់ទំនប់មកលើការចិញ្ចឹមជីវិតរបស់ពួកគាត់ឡើយ ។ ដូចនេះ វាជាការត្រឹមត្រូវ បើសិនជាអ្នកសាងសង់ទំនប់គួរទទួលបន្ទុកក្នុងការសិក្សានេះ ដើម្បីបង្ហាញអោយឃើញ ថាផលត្រី និងស្ថានភាពជលផលមិនមានការធ្លាក់ចុះ ពីព្រោះអ្នកសាងសង់ទំនប់នេះឯងដែលខកខានក្នុងការដោះស្រាយបញ្ហានេះតាំងពីចាប់ផ្តើមដំបូង ។ សំណងគួរតែត្រូវបានសងតាំងពីពេលគំរោងទំនប់ទាំងមូលចាប់ផ្តើម ហើយការបង់សងសំណងត្រូវតែបន្តរហូត ដរាបណាផលប៉ះពាល់នៅតែមាន ហើយគួរតែអនុវត្តតាមទស្សនៈលំហូរធម្មជាតិសំរាប់ការប្រតិបត្តិរបស់ទំនប់នានានៅតាមដងទន្លេ សេសានក្នុងប្រទេសវៀតណាម ។ ដូចនេះ យើងទាមទារអោយមានការពិចារណាអោយម៉ត់ចត់ក្នុងការជួយស្តារស្ថានភាពបរិស្ថាននៅតំបន់ខ្សែទឹកខាងក្រោមអោយប្រសើរឡើងវិញ ។

លទ្ធផលសិក្សានេះបង្ហាញយ៉ាងច្បាស់លាស់ថា ទំនប់យ៉ាលីបានបង្កផលប៉ះពាល់ជាអវិជ្ជមានយ៉ាងធ្ងន់ធ្ងរមកលើត្រី ជលផលនិងប្រភេទសត្វរស់នៅក្នុងទឹកផ្សេងៗទៀតតាមដងទន្លេសេសានក្នុងខេត្ត រតនគិរីដែលស្ថិតនៅភាគឦសាន្តនៃប្រទេសកម្ពុជា ។ នៅពេលនេះ យើងមិនអាចប៉ាន់ស្មានអោយច្បាស់លាស់អំពីផលប៉ះពាល់ជាអវិជ្ជមានរបស់ទំនប់យ៉ាលីមកលើជលផលទេ ។ ប៉ុន្តែកំណើរការសិក្សាលំអិតបន្ទាប់ទៀតដែលមានទាំងទិន្នន័យបរិមាណនិងគុណភាពចាប់តាំងពីមុនសាងសង់ទំនប់យ៉ាលីរហូតដល់បច្ចុប្បន្នអាចជួយអោយយើងធ្វើការប៉ាន់ស្មានដ៏សមហេតុផលមួយលើរូបភាពនៃផលប៉ះពាល់ដែលមានមូលហេតុដោយផ្អែកលើគោលការណ៍បរិស្ថាននិងបទពិសោធន៏នានាពីមុនមក ។ សំខាន់បំផុតនោះការវិភាគរបស់អ្នកភូមិដោយផ្អែកលើចំណេះដឹងអំពីបញ្ហាអេកូឡូស៊ីនៅសហគមន៏ហាក់បីដូចជាសមហេតុផលណាស់ ពីព្រោះការវិភាគលើរូបភាពផលប៉ះពាល់ទាំងនេះធ្វើឡើងដោយការពិចារណាដូចនឹងអ្វីដែលអ្នកបរិស្ថាន និងអ្នកជីវសាស្ត្រធ្វើ ។

វាហាក់បីដូចជាសមហេតុផល ដែលការប៉ាន់ស្មានទាំងនេះគួរតែប្រើប្រាស់សំរាប់កំណត់អោយចេញនូវរូបភាពសំណងសំរាប់អ្នកភូមិរងគ្រោះ ពីព្រោះពួកគាត់គួរតែទទួលបានសំណងនេះស្របទៅតាមទំហំនៃផលប៉ះពាល់ដ៏អាក្រក់ដែលទំនប់យ៉ាលីបានផ្តល់អោយ ។ ម្យ៉ាងវិញទៀត ការសិក្សានេះអាចប្រើប្រាស់ជាប្រយោជន៏សំរាប់ការវាយតំលៃផលប៉ះពាល់របស់ទំនប់ផ្សេងៗទៀតមកលើតំបន់ខ្សែទឹកខាងក្រោមនៃអាងទន្លេសេសានក្នុងប្រទេសកម្ពុជា ។ នេះជាទិន្នន័យនៃការសិក្សាដែលប្រមូលបានក្នុងដំណាក់ការដំបូង តែទោះជាយ៉ាងណាក៏ដោយ 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 erythopterus*, *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[1]) (#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 Rooijenprepared Figure 2. Mr. Heang Sarim translated the executive summary into Khmer with editing support from Mr. Kim Sangha.

[1] 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[2] 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).

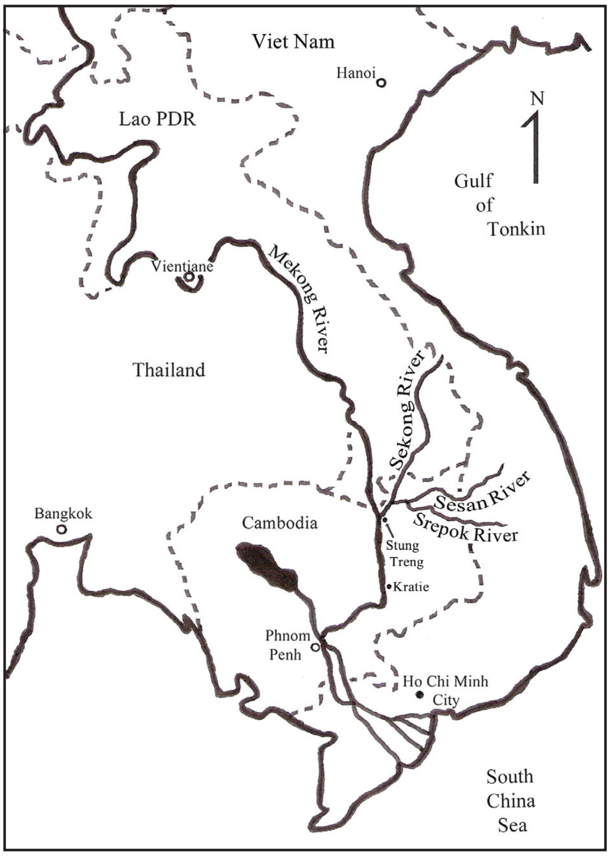


**Figure 1. The Sekong, Sesan and Srepok Basins in Viet Nam, Cambodia and Laos**

[2] 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

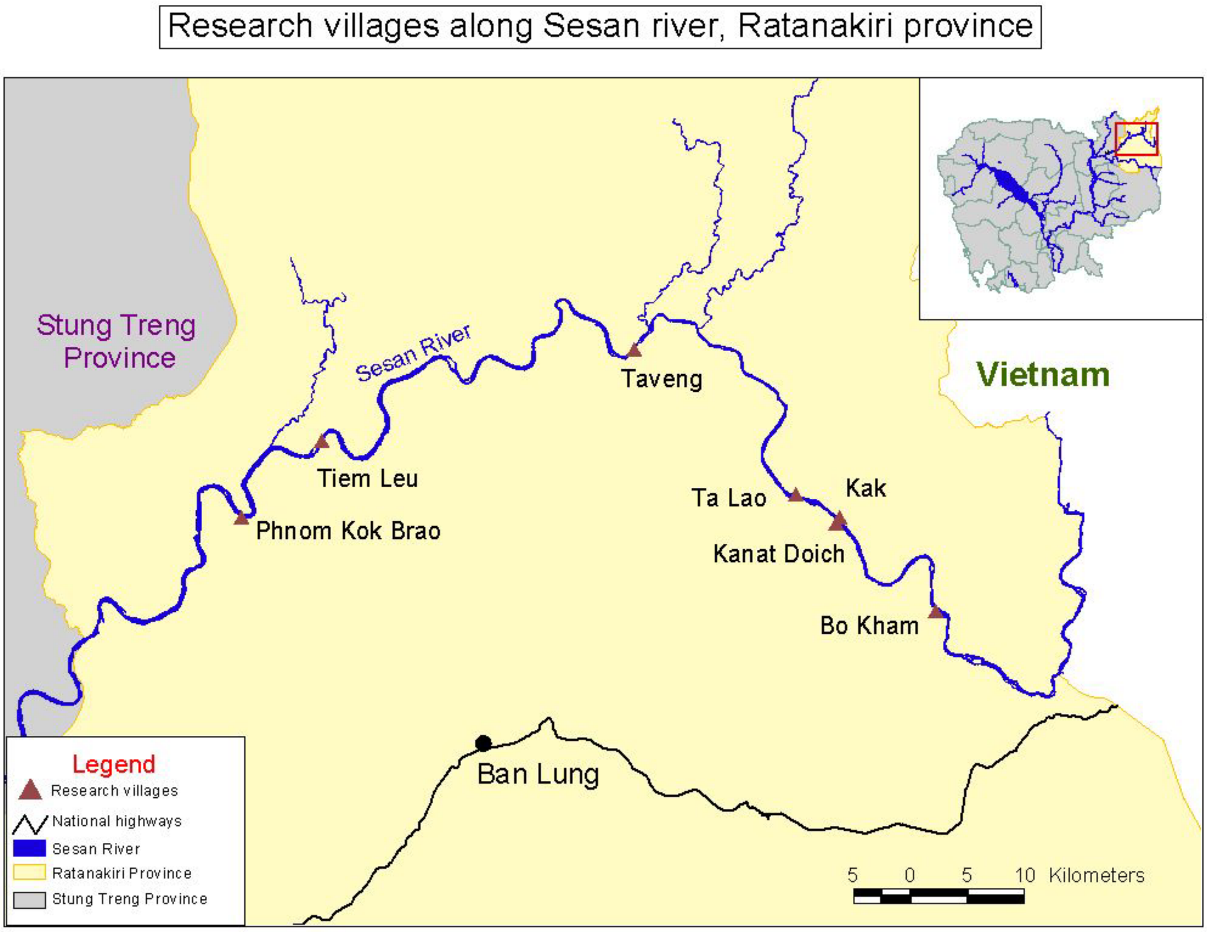


**Figure 2. Sesan River in Ratanakiri province, northeast Cambodia, with the seven villages represented in the study**

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)[3].

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

[3] 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[4] 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).

[4] 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.[5] 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[6].

[5] 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.
[6] 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 |
| **Total** | **16 fishers in 14 groups** | **7 villages** | **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)** |

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[7] (Table 2).

[7] 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[8] |
|---|---|---|---|---|---|---|---|---|
| 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 |

[8] 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 |
| | **Totals** | | **1969** | **27362.7** | **2250.36** | **14847** | **111**[9] | **0.082** |

[9] 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 | 0.015 |
| | | 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 erythopterus*, 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 erythopterus*, *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 an important source of food for these species, and also others like *Henicorhynchus lobatus* and *Labiobarbus* cf. *leptocheilus*. Erosion resulting from 'hungry water'[10] 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 erythopterus*,

[10] '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 riverbes 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.

**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 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 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[11]. 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

[11] 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 | *Macrochirichthys macrochirus* | | *Pa hang pha* |
| | *Cyprinidae* sp. *?*[12] | | *Pa kai na* |
| | *Luciosoma bleekeri* | | *Pa mak wai* |
| | *Thynnichthys thynnoides* | | *Pa koum* |
| | *Leptobarbus hoeveni* | | *Pa phong* |
| | *Channa* cf. *marulius* | | *Pa kouan* |
| Tiem Leu | *Macrochirichthys macrochirus* | | *Pa hang pha* |
| | *Cyprinidae* sp. *?* | | *Pa kai na* |
| | *Luciosoma bleekeri* | | *Pa mak wai* |
| | *Thynnichthys thynnoides* | | *Pa koum* |
| | *Channa* cf. *marulius* | | *Pa kouan* |
| Taveng | *Cyprinidae* sp. *?* | *Kaboung grung* | *Pa kai na* |
| | *Thynnichthys thynnoides* | *Kouk kaleng* | *Pa koum* |
| Talao | *Cyprinidae* sp. *?* | | *Pa kai na* |
| | *Macrochirichthys macrochirus* | | *Pa hang pha* |
| | *Thynnichthys thynnoides* | | *Pa koum* |
| Kanat Toich | *Thynnichthys thynnoides* | | *Pa koum* |
| | *Macrochirichthys macrochirus* | | *Pa hang pha* |
| | *Cyprinidae* sp. *?* | | *Pa kai na* |
| Bokham | *Cyprinidae* sp. *?* | | *Pa kai na* |
| | *Thynnichthys thynnoides* | | *Pa koum* |

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.

[12] 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)[13]. 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

[13] 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.

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# Appendix 1

**Fish species identified as being caught from the Sesan River during the study[14]**

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

[14] 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.'
[15] Based on Khmer names included in Rainboth (1996).

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

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

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

[16] 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.
[17] 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.
[18] 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 | *Osteocheilus hasselti 66* [19] | 45 | 2.5 |
| 2 | *Puntioplites falcifer 35* | 31 | 2.5 |
| 3 | *Cyclocheilichthys* spp. | 37 | 2.35 |
| 4 | *Labiobarbus* cf. *leptocheilus 162* | 34 | 2.25 |
| 5 | *Hemibagrus nemurus 84* | 28 | 2.05 |
| 6 | *Clarias batrachus 180* | 15 | 1 |
| 7 | *Osteocheilus microcephalus 70* | 10 | 1 |
| 8 | *Systomus binotatus 41* | 7 | 0.8 |
| 9 | *Hypsibarbus* spp. *44* | 6 | 0.8 |
| 10 | *Barbodes schwanefeldi 38* | 14 | 0.5 |
| 11 | *Osphronemus exodon 126* | 1 | 0.4 |
| 12 | *Cirrhinus jullieni/* spp. | 4 | 0.35 |
| 13 | *Kryptopterus* spp. *175* | 6 | 0.3 |
| 14 | *Channa striata 128* | 4 | 0.3 |
| 15 | *Bagrichthys macracanthus 89* | 3 | 0.25 |
| 16 | *Mystus* spp. *88* | 2 | 0.25 |
| 17 | *Micronema bleekeri 96* | 4 | 0.2 |
| 18 | *Belondichthys truncatus 92* | 2 | 0.2 |
| 19 | *Pristolepis fasciata* | 2 | 0.2 |
| 20 | *Botia helodes 79* | 2 | 0.15 |
| 21 | *Raiamas guttatus 10b* | 1 | 0.15 |
| 22 | *Notopterus notopterus 5* | 2 | 0.1 |
| 23 | *Miscellaneous* sp. | 1 | 0.1 |
| 24 | *Probarbus* spp. *23-24* | 1 | 0.1 |
| 25 | *Paralaubuca typus 11* | 1 | 0.1 |
| 26 | *Toxotes microlepis 193* | 1 | 0.1 |
| 27 | *Gyrinocheilus pennocki 75* | 1 | 0.1 |
| 28 | *Chitala blanci 4* | 1 | 0.1 |
| 29 | *Osteocheilus* sp. *69* | 1 | 0.05 |
| 30 | *P. siamensis/ B. macropterus 82* [20] | 1 | 0.05 |
| **Total** | | **268** | **19.3** |

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

[19] The numbers listed after species are the code numbers used to identify fishes during the study.
[20] Wherever this notation occurs, it means *Pseudomystus siamensis* and *Bagrichthys macropterus*.

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

**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 | *Channa striata 128* | 3 | 1 |
| **Total** | | **3** | **1** |

**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 | *Hypsibarbus* spp. *44* | 26 | 3.1 |
| 2 | *Bagarius yarrelli 90* | 2 | 2.3 |
| 3 | *Puntioplites falcifer 35* | 19 | 1.65 |
| 4 | *Labiobarbus cf. leptocheilus 162* | 16 | 1.3 |
| 5 | *Henicorhynchus* spp. | 14 | 1.2 |
| 6 | *Hampala macrolepidota/ H. dispar 51-50* | 10 | 1.1 |
| 7 | *Osteocheilus hasselti 66* | 11 | 1.1 |
| 8 | *Ompok bimaculatus 98* | 13 | 1 |
| 9 | *Micronema cf. micronema 97* | 9 | 0.9 |
| 10 | *Osteocheilus* sp. *69* | 21 | 0.9 |
| 11 | *P. siamensis/ B. macropterus 82* | 12 | 0.85 |
| 12 | *Mystus* spp. *88* | 12 | 0.8 |
| 13 | *Cyclocheilichthys* spp. | 8 | 0.8 |
| 14 | *Scaphognathops bandanensis/spp. 49* | 4 | 0.7 |
| 15 | *Systomus binotatus 41* | 10 | 0.7 |
| 16 | *Hemibagrus nemurus 84* | 6 | 0.65 |
| 17 | *Hemibagrus wyckioides 85* | 3 | 0.65 |
| 18 | *Mastacemblus* spp. *118* | 3 | 0.65 |
| 19 | *Pangasius bocourti/ Pangasius concophilus 179* | 8 | 0.65 |
| 20 | *Belondichthys truncatus 92* | 5 | 0.6 |
| 21 | *Botia modesta 77* | 6 | 0.55 |
| 22 | *Gyrinocheilus pennocki 75* | 1 | 0.5 |
| 23 | *Raiamas guttatus 10b* | 6 | 0.5 |
| 24 | *Botia nigrolineata 81* | 6 | 0.5 |
| 25 | *Pangasius macronema 110* | 7 | 0.45 |
| 26 | *Barbodes altus 40* | 4 | 0.45 |
| 27 | *Bagrichthys macracanthus 89* | 6 | 0.45 |
| 28 | *Garra cambodgiensis 73* | 6 | 0.45 |
| 29 | *Trichogaster trichopterus 125* | 6 | 0.45 |
| 30 | *Chitala ornata 3* | 5 | 0.4 |
| 31 | *Osteochilus waandersii 71* | 5 | 0.4 |
| 32 | *Wallago leeri 100* | 2 | 0.4 |
| 33 | *Kryptopterus cryptopterus 95* | 4 | 0.4 |
| 34 | *Probarbus* spp. *23-24* | 5 | 0.4 |
| 35 | *Pangasius pleurotaenia 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 | *Micronema bleekeri 96* | 3 | 0.35 |
| 37 | *Cyclocheilichthys enoplos 29* | 4 | 0.35 |
| 38 | *Osphronemus exodon 126* | 6 | 0.3 |
| 39 | *Bagrichthys macropterus 173* | 4 | 0.3 |
| 40 | *Barbodes schwanefeldi 38* | 4 | 0.3 |
| 41 | *Pangasius bocourti 103* | 4 | 0.3 |
| 42 | *Botia lecontei 80* | 4 | 0.3 |
| 43 | *Cyclocheilichthys* sp. *31* | 4 | 0.3 |
| 44 | *Bangara behri 54* | 1 | 0.3 |
| 45 | *Morulius* spp. *58* | 2 | 0.3 |
| 46 | *Luciosoma bleekeri 17* | 4 | 0.25 |
| 47 | *Tetraodon* spp. *191* | 3 | 0.25 |
| 48 | *Osteocheilus* sp. *67* | 3 | 0.25 |
| 49 | *Xenentodon cancila 117* | 3 | 0.25 |
| 50 | *Tor tambroides/* spp. *21* | 3 | 0.25 |
| 51 | *Kryptopterus* spp. *175* | 3 | 0.25 |
| 52 | *Henicorhynchus lobatus 62* | 15 | 0.2 |
| 53 | *Pangasius cf. polyuranodon 106* | 3 | 0.2 |
| 54 | *Toxotes microlepis 193* | 3 | 0.2 |
| 55 | *Helicophagus waandersii 101* | 2 | 0.2 |
| 56 | *Macrochirichthys macrochirus 13* | 2 | 0.2 |
| 57 | *Cyclocheilicthys* spp. *28* | 2 | 0.2 |
| 58 | *Miscellaneous* spp. | 2 | 0.2 |
| 59 | *Hypsibarbus* spp. 22 | 2 | 0.2 |
| 60 | *Notopterus notopterus 5* | 2 | 0.15 |
| 61 | *Laides siamensis 113* | 3 | 0.15 |
| 62 | *Osteocheilus melanopleurus 68* | 1 | 0.15 |
| 63 | *Lobocheilus melanotaenia 64* | 1 | 0.15 |
| 64 | *Achiroides* sp. *139* | 1 | 0.1 |
| 65 | *Pangasius* sp. | 1 | 0.1 |
| 66 | *Acantopsis* sp. *169* | 1 | 0.1 |
| 67 | *Cirrhinus molitorella 164* | 1 | 0.1 |
| 68 | *Channa striata 128* | 1 | 0.1 |
| 69 | *Aaptosyax grypus 20* | 1 | 0.1 |
| **Total** | | **384** | **35.65** |

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

**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 | *Labiobarbus* cf. *leptocheilus 162* | 32 | 3.45 |
| 2 | *Scaphognathops bandanensis* /spp. *49* | 33 | 3.35 |
| 3 | *Puntioplites falcifer 35* | 28 | 2.9 |
| 4 | *Hypsibarbus* spp. *44* | 11 | 1.9 |
| 5 | *Barbodes schwanefeldi 38* | 15 | 1.8 |
| 6 | *Bangara behri 54* | 9 | 1.6 |
| 7 | *Cyclocheilicthys* spp. *28* | 15 | 1.2 |
| 8 | *Labeo erythropterus 57* | 2 | 1.2 |
| 9 | *Gyrinocheilus pennocki 75* | 6 | 1.15 |
| 10 | *Cyclocheilichthys* sp. *31* | 9 | 0.85 |
| 11 | *Micronema* cf. *micronema 97* | 10 | 0.7 |
| 12 | *Hampala macrolepidota/ H. dispar 51-50* | 4 | 0.7 |
| 13 | *Achiroides* sp. *139* | 6 | 0.7 |
| 14 | *Crossocheilus siamensis 72* | 8 | 0.7 |
| 15 | *Henicorhynchus siamensis 63* | 10 | 0.65 |
| 16 | *Osteocheilus hasselti 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 | *Osteocheilus microcephalus 70* | 7 | 0.6 |
| 18 | *Micronema bleekeri 96* | 5 | 0.6 |
| 19 | *Chitala blanci 4* | 5 | 0.55 |
| 20 | *Mekongina erythrospila 74* | 4 | 0.5 |
| 21 | *Botia modesta 77* | 4 | 0.5 |
| 22 | *Hemililurus mekongensis 93* | 4 | 0.5 |
| 23 | *Barbodes altus 40* | 7 | 0.5 |
| 24 | *Oxyeleotris marmorata/Gobiidae* spp. *131* | 4 | 0.45 |
| 25 | *Luciosoma bleekeri 17* | 9 | 0.45 |
| 26 | *Kryptopterus* spp. *175* | 6 | 0.4 |
| 27 | *Probarbus* spp. *23-24* | 5 | 0.35 |
| 28 | *Pangasius bocourti 103* | 5 | 0.35 |
| 29 | *Raiamas guttatus 10b* | 3 | 0.35 |
| 30 | *Channa micropeltes 129* | 3 | 0.3 |
| 31 | *Osteochilus waandersii 71* | 3 | 0.3 |
| 32 | *Hemibagrus nemurus 84* | 3 | 0.3 |
| 33 | *Paralaubuca typus 11* | 4 | 0.3 |
| 34 | *Cirrhinus microlepis 59* | 4 | 0.3 |
| 35 | *Pristolepis fasciata* | 4 | 0.3 |
| 36 | *Pangasius* sp. | 4 | 0.3 |
| 37 | *Trichogaster trichopterus 125* | 3 | 0.2 |
| 38 | *Hemibagrus nemurus 84* | 2 | 0.3 |
| 39 | *Osteocheilus* sp. *69* | 2 | 0.3 |
| 40 | *Tetraodon* spp. *191* | 2 | 0.3 |
| 41 | *Osteocheilus melanopleurus 68* | 2 | 0.3 |
| 42 | *Hemibagrus wyckioides 85* | 1 | 0.3 |
| 43 | *Mystus wyckii 86* | 1 | 0.3 |
| 44 | *Channa* cf. *marulius 183* | 2 | 0.25 |
| 45 | *Clarias batrachus 180* | 2 | 0.25 |
| 46 | *Belondichthys truncatus 92* | 1 | 0.25 |
| 47 | *Catlocarpio siamensis 52* | 1 | 0.2 |
| 48 | *Mastacemblus* spp. *118* | 1 | 0.2 |
| 49 | *Toxotes microlepis 193* | 1 | 0.2 |
| 50 | *Channa striata 128* | 1 | 0.2 |
| 51 | *Tenualosa thibaudeaui 7* | 2 | 0.2 |
| 52 | *Cyclocheilichthys enoplos 29* | 2 | 0.15 |
| 53 | *Mystus wyckioides 85* | 1 | 0.15 |
| 54 | *Aaptosyax grypus 20* | 1 | 0.15 |
| 55 | *Helicophagus waandersii 101* | 1 | 0.15 |

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

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

**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 | *Belondichthys truncatus 92* | 1 | 2 |
| 2 | *Chitala blanci 4* | 1 | 1 |
| 3 | *Pangasius concophilus 102* | 1 | 1 |
| 4 | *Miscellaneous* spp. | 4 | 0.3 |
| 5 | *Puntioplites falcifer 35* | 3 | 0.25 |
| 6 | *Morulius* spp. *58* | 1 | 0.1 |
| 7 | *Barbodes schwanefeldi 38* | 1 | 0.1 |
| **Total** | | **12** | **4.75** |

**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 | *Mystus* spp. *88* | 7 | 0.6 |
| 2 | *Raiamas guttatus 10b* | 8 | 0.2 |
| 3 | *Luciosoma bleekeri 17* | 5 | 0.2 |
| 4 | *Cyclocheilichthys enoplos 29* | 3 | 0.15 |
| **Total** | | **23** | **1.15** |

**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 | *Henicorhynchus lobatus 62* | 80 | 1.75 |
| 2 | *Labiobarbus cf. leptocheilus 162* | 14 | 0.5 |
| 3 | *Paralaubuca typus 11* | 9 | 0.4 |
| 4 | *Hypsibarbus* spp. *44-22* | 8 | 0.65 |
| 5 | *Cyclocheilicthys* spp. *28* | 7 | 0.45 |
| 6 | *Osteocheilus hasselti 66* | 3 | 0.35 |
| 7 | *Scaphognathops bandanensis /* spp. *49* | 6 | 0.35 |
| 8 | *Hemibagrus wyckioides 85* | 1 | 0.3 |
| 9 | *Systomus binotatus 41* | 7 | 0.25 |
| 10 | *Miscellaneous* sp. | 2 | 0.2 |
| 11 | *Acantopsis* spp. *169* | 5 | 0.2 |
| 12 | *Ompok bimaculatus 98* | 4 | 0.2 |
| 13 | *Micronema bleekeri 96* | 6 | 0.2 |
| 14 | *Barbodes schwanefeldi 38* | 3 | 0.2 |
| 15 | *Cyclocheilichthys* sp. *31* | 3 | 0.2 |
| 16 | *Achiroides* sp. *139* | 3 | 0.15 |
| 17 | *Cirrhinus molitorella 164* | 1 | 0.15 |
| 18 | *Pristolepis fasciata* | 3 | 0.15 |
| 19 | *Osteocheilus* sp. *67* | 1 | 0.1 |
| 20 | *Luciosoma bleekeri 17* | 1 | 0.05 |
| **Total** | | **167** | **6.8** |

**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 | *Hypsibarbus* spp. *44* | 115 | 15.75 |
| 2 | *Labiobarbus* cf. *leptocheilus 162* | 168 | 12.6 |
| 3 | *Puntioplites falcifer 35* | 95 | 9.75 |
| 4 | *Cyclocheilichthys* sp. *31* | 63 | 7.6 |
| 5 | *Barbodes schwanefeldi 38* | 52 | 6.85 |
| 6 | *Channa striata 128* | 15 | 6.65 |
| 7 | *Hampala macrolepidota/ H. dispar 51-50* | 32 | 6.4 |
| 8 | *Hemibagrus nemurus 84* | 54 | 6.2 |
| 9 | *Bagarius yarrelli 90* | 12 | 5.9 |
| 10 | *Pangasius* sp. | 30 | 5.1 |
| 11 | *Pristolepis fasciata* | 15 | 0.7 |
| 12 | *Lobocheilus melanotaenia 64* | 38 | 5 |
| 13 | *Hemibagrus wyckioides 85* | 14 | 5 |
| 14 | *Osteocheilus melanopleurus 68* | 11 | 4.8 |
| 15 | *Barbodes altus 40* | 33 | 4.7 |
| 16 | *Cyclocheilichthys* spp. *28* | 33 | 4.4 |
| 17 | *Bagrichthys macracanthus 89* | 61 | 4.1 |
| 18 | *P. siamensis/ B. macropterus 82* | 43 | 3.7 |
| 19 | *Osteocheilus hasselti 66* | 46 | 3.2 |
| 20 | *Osphronemus exodon 126* | 8 | 3.1 |
| 21 | *Mystus wyckii 86* | 6 | 3.1 |
| 22 | *Chitala blanci 4* | 12 | 2.9 |
| 23 | *Mastacemblus* spp. *118* | 36 | 2.7 |
| 24 | *Achiroides* sp. *139* | 16 | 2.65 |
| 25 | *Scaphognathops bandanensis* /spp. *49* | 52 | 2.5 |
| 26 | *Channa micropeltes 129* | 1 | 2.4 |
| 27 | *Labiobarbus* cf. *leptocheilus 162* | 28 | 2.2 |
| 28 | *Osteochilus waandersii 71* | 34 | 2 |
| 29 | *Osteocheilus* sp. *69* | 31 | 1.9 |
| 30 | *Raiamas guttatus 10b* | 26 | 1.8 |
| 31 | *Micronema bleekeri 96* | 13 | 1.6 |
| 32 | *Ompok bimaculatus 98* | 27 | 1.4 |
| 33 | *Mystus* spp. *88* | 18 | 1.4 |
| 34 | *Micronema* cf. *micronema 97* | 15 | 1.2 |
| 35 | *Kryptopterus* 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 | *Tetraodon* spp. *191* | 7 | 0.95 |
| 37 | *Pangasius macronema 110* | 17 | 0.95 |
| 38 | *Systomas binotatus 41* | 15 | 0.95 |
| 39 | *Luciosoma bleekeri 17* | 11 | 0.9 |
| 40 | *Laides siamensis 113* | 10 | 0.5 |
| 41 | *Notopterus notopterus 5* | 9 | 0.7 |
| 42 | *Trichogaster trichopterus 125* | 9 | 0.55 |
| 43 | *Osteocheilus microcephalus 70* | 8 | 0.5 |
| 44 | *Pangasius* sp. | 1 | 0.5 |
| 45 | *Cyclocheilichthys enoplos 29* | 3 | 0.5 |
| 46 | *Helicophagus waandersii 101* | 1 | 0.5 |
| 47 | *Kryptopterus cryptopterus 95* | 7 | 0.4 |
| 48 | *Pangasius larnaudii 107* | 1 | 0.4 |
| 49 | *Pangasius* cf. *polyuranodon 106* | 3 | 0.4 |
| 50 | *Bagrichthys macropterus 173* | 4 | 0.4 |
| 51 | *Osteocheilus* sp. *67* | 8 | 0.35 |
| 52 | *Mystus wyckii 86* | 1 | 0.3 |
| 53 | *Hypsibarbus* spp. *22* | 1 | 0.3 |
| 54 | *Pristolepis fasciata* | 3 | 0.3 |
| 55 | *Botia modesta 77* | 3 | 0.3 |
| 56 | *Tor tambroides* /spp. *21* | 2 | 0.3 |
| 57 | *Poropuntius deauratus 43* | 5 | 0.3 |
| 58 | *Channa* sp. *130* | 1 | 0.3 |
| 59 | *Miscellaneous* sp. | 1 | 0.2 |
| 60 | *Pristolepis fasciata* | 5 | 0.2 |
| 61 | *Achiroides* sp. *139* | 3 | 0.15 |
| 62 | *Morulius* spp. *58* | 2 | 0.1 |
| 63 | *Garra cambodgiensis 73* | 2 | 0.1 |
| 64 | *Osteocheilus microcephalus 70* | 2 | 0.1 |
| 65 | *Helicophagus waandersii* | 1 | 0.1 |
| 66 | *Hypsibarbus wetmorei* | 1 | 0.1 |
| 67 | *Clarias batrachus 180* | 1 | 0.1 |
| 68 | *Channa* cf. *marulius 183* | 1 | 0.1 |
| 69 | *Botia helodes 79* | 1 | 0.05 |
| **Totals** | | **1419** | **165.1** |

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

**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 | *Hemibagrus nemurus 84* | 1 | 0.2 |
| 2 | *Labiobarbus cf. leptocheilus 162* | 2 | 0.15 |
| 3 | *Raiamas guttatus 10b* | 1 | 0.1 |
| 4 | *Notopterus notopterus 5* | 1 | 0.1 |
| 5 | *Tetraodon* sp. *191* | 1 | 0.1 |
| 6 | *Pristolepis fasciata* | 5 | 0.1 |
| 7 | *Trichogaster trichopterus 125* | 1 | 0.05 |
| **Total** | | **12** | **0.8** |

**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 | *Labiobarbus cf. leptocheilus 162* | 20 | 1.3 |
| 2 | *Puntioplites falcifer 35* | 3 | 1.0 |
| 3 | *Henicorhynchus* spp. | 117 | 0.8 |
| 4 | *Hypsibarbus* spp. *44* | 3 | 0.5 |
| 5 | *Cyclocheilicthys* spp. *28* | 3 | 0.2 |
| 6 | *Pseudomystus siamensis* | 5 | 0.2 |
| 7 | *Pristolepis fasciata* | 10 | 0.2 |
| 8 | *Xenentodon cancila 117* | 3 | 0.1 |
| 9 | *Raiamas guttatus 10b* | 2 | 0.1 |
| 10 | *Bagarius yarrelli 90* | 1 | 0.1 |
| 11 | *Paralaubuca typus 11* | 11 | 0.1 |
| 12 | *Cyclocheilichthys* spp. | 1 | 0.1 |
| 13 | *Hampala macrolepidota/H. dispar 51-50* | 1 | 0.1 |
| 14 | *Bagrichthys macracanthus 89* | 1 | 0.05 |
| 15 | *Acantopsis* sp. *170* | 1 | 0.05 |
| **Total** | | **182** | **4.9** |

**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 | *Labiobarbus cf. leptocheilus 162* | 154 | 15.95 |
| 2 | *Osteochilus waandersii 71* | 93 | 8.75 |
| 3 | *Osteocheilus hasselti 66* | 61 | 5.6 |
| 4 | *Luciosoma bleekeri 17* | 22 | 4.2 |
| 5 | *Hypsibarbus* spp. *44* | 45 | 3.4 |
| 6 | *Henicorhynchus lobatus 62* | 9 | 3 |
| 7 | *Hemibagrus nemurus 84* | 6 | 3 |
| 8 | *Barbodes schwanefeldi 38* | 29 | 2.2 |
| 9 | *Cirrhinus molitorella 164* | 7 | 2 |
| 10 | *Puntioplites falcifer 35* | 25 | 1.8 |
| 11 | *P. siamensis/ B. macropterus 82* | 12 | 1.7 |
| 12 | *Morulius* spp. *58* | 4 | 1.5 |
| 13 | *Scaphognathops bandanensis* /spp. *49* | 17 | 1.35 |
| 14 | *Systomus binotatus 41* | 12 | 1.35 |
| 15 | *Gyrinocheilus pennocki 75* | 20 | 1.35 |
| 16 | *Hampala macrolepidota/ H. dispar 51-50* | 11 | 1.3 |
| 17 | *Pangasius macronema 110* | 11 | 1.2 |
| 18 | *Cyclocheilicthys* spp. *28* | 19 | 1.2 |
| 19 | *Achiroides* sp. *139* | 7 | 1 |
| 20 | *Cyclocheilichthys enoplos 29* | 7 | 0.95 |
| 21 | *Botia modesta 77* | 11 | 0.8 |
| 22 | *Mastacemblus* spp. *118* | 7 | 0.7 |
| 23 | *Kryptopterus spp. 175* | 12 | 0.6 |
| 24 | *Cirrhinus microlepis 59* | 3 | 0.6 |
| 25 | *Trichogaster trichopterus 125* | 3 | 0.55 |
| 26 | *Achiroides* sp. *139* | 3 | 0.55 |
| 27 | *Belondichthys truncatus 92* | 4 | 0.5 |
| 28 | *Raiamas guttatus 10b* | 8 | 0.45 |
| 29 | *Bagrichthys macropterus 173* | 8 | 0.4 |
| 30 | *Henicorhynchus* spp. | 10 | 0.4 |
| 31 | *Pseudomystus siamensis* | 22 | 0.4 |
| 32 | *Ompok bimaculatus 98* | 9 | 0.4 |
| 33 | *Bagrichthys macracanthus 89* | 7 | 0.4 |
| 34 | *Clarias batrachus 180* | 4 | 0.3 |
| 35 | *Cyclocheilichthys* 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 | *Botia helodes 79* | 3 | 0.2 |
| 37 | *Barbodes altus 40* | 2 | 0.2 |
| 38 | *Hemibagrus nemurus 84* | 2 | 0.2 |
| 39 | *Lobocheilus melanotaenia 64* | 5 | 0.1 |
| 40 | *Miscellaneous* | 5 | 0.1 |
| 41 | *Osteocheilus* sp. *67* | 2 | 0.1 |
| 42 | *Mystus* spp. *88* | 3 | 0.1 |
| 43 | *Miscellaneous* sp. | 1 | 0.1 |
| 44 | *Cyclocheilichthys* spp. | 1 | 0.1 |
| 45 | *Garra cambodgiensis 73* | 1 | 0.1 |
| 46 | *Osteocheilus sp. 69* | 1 | 0.1 |
| 47 | *Tetraodon spp. 191* | 2 | 0.05 |
| **Total** | | **716** | **71.55** |

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

**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 | *Hemibagrus wyckioides 85* | 8 | 20.4 |
| 2 | *Hemibagrus nemurus 84* | 15 | 12.2 |
| 3 | *Osphronemus exodon 126* | 3 | 6.5 |
| 4 | *Probarbus* spp. *23-24* | 3 | 6 |
| 5 | *Hypsibarbus* spp. *44* | 2 | 4.2 |
| 6 | *Channa striata 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 | *Chitala blanci 4* | 2 | 3.1 |
| 8 | *Hampala macrolepidota/ H. dispar 51-50* | 3 | 2.8 |
| 9 | *Channa gachua 182* | 2 | 2.5 |
| 10 | *Pangasius larnaudii 107* | 2 | 3.4 |
| 11 | *Mystus wyckii 86* | 1 | 2.1 |
| 12 | *Chitala ornata 3* | 1 | 2.1 |
| 13 | *Bagarius yarrelli 90* | 1 | 1.4 |
| 14 | *Bagrichthys macropterus 173* | 2 | 1.2 |
| 15 | *Tor tambroides* /spp. *21* | 1 | 1.2 |
| 16 | *Channa* sp. *185* | 1 | 1.2 |
| 17 | *Clarias batrachus 180* | 2 | 0.5 |
| 18 | *Monopterus albus 120* | 1 | 0.5 |
| 19 | *Puntioplites falcifer 35* | 1 | 0.4 |
| 20 | *Mastacemblus* spp. *118* | 1 | 0.15 |
| **Total** | | **56** | **75.25** |

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

**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 | *Labiobarbus cf. leptocheilus 162* | 27 | 2.55 |
| 2 | *Scaphognathops bandanensis /spp. 49* | 12 | 2.1 |
| 3 | *Hemibagrus wyckioides 85* | 5 | 2 |
| 4 | *Osteocheilus microcephalus 70* | 6 | 1 |
| 5 | *Puntioplites falcifer 35* | 6 | 1 |
| 6 | *Mystus* spp. *88* | 3 | 1 |
| 7 | *Hypsibarbus* spp. *44* | 2 | 0.4 |
| 8 | *Hampala macrolepidota/ H. dispar 51-50* | 2 | 0.3 |
| 9 | *Helicophagus waandersii 17* | 9 | 0.3 |
| 10 | *Pristolepis fasciata* | 12 | 0.25 |
| 11 | *Notopterus notopterus 5* | 1 | 0.15 |
| 12 | *Botia helodes 79* | 1 | 0.15 |
| 13 | *Barbodes schwanefeldi 38* | 3 | 0.1 |
| 14 | *Botia lecontei 80* | 3 | 0.1 |
| 15 | *Bagrichthys macropterus 82* | 3 | 0.1 |
| 16 | *Osteocheilus hasselti 66* | 2 | 0.1 |
| 17 | *Botia modesta 77* | 1 | 0.05 |
| **Total** | | **98** | **11.65** |

**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 | *Henicorhynchus siamensis 63* | 707 | 21.2 |
| 2 | *Luciosoma bleekeri 17* | 35 | 4.85 |
| 3 | *Osteochilus waandersii 71* | 26 | 3.05 |
| 4 | *Hypsibarbus* spp. *44* | 8 | 3 |
| 5 | *Cyclocheilichthys enoplos 29* | 6 | 2.3 |
| 6 | *Henicorhynchus* spp. | 9 | 2.1 |
| 7 | *Acantopsis* spp. *169* | 36 | 2.05 |
| 8 | *Cyclocheilichthys* sp. *31* | 29 | 1.7 |
| 9 | *Ompok bimaculatus 98* | 8 | 1 |
| 10 | *Macrognathus* sp. *119* | 4 | 1 |
| 11 | *Raiamas guttatus 10b* | 15 | 0.6 |
| 12 | *Pristolepis fasciata* | 26 | 0.5 |
| 13 | *Lobocheilus melanotaenia 64* | 7 | 0.5 |
| 14 | *Hampala macrolepidota/H. dispar 51-50* | 2 | 0.5 |
| 15 | *Bagrichthys macropterus 82* | 12 | 0.3 |
| 16 | *Pseudomystus siamensis* | 23 | 0.3 |
| 17 | *Macrochirichthys macrochirus 13* | 5 | 0.3 |
| 18 | *Acantopsis* 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 | *Osteocheilus hasselti 66* | 4 | 0.2 |
| 20 | *Acantopsoides* spp.. *172* | 9 | 0.2 |
| 21 | *Acantopsis* spp.*171* | 9 | 0.2 |
| 22 | *Clarias batrachus 180* | 5 | 0.15 |
| 23 | *Cyclocheilicthys* spp. *28* | 9 | 0.1 |
| 24 | *Belondichthys truncatus 92* | 8 | 0.1 |
| 25 | *Miscellaneous* sp. | 2 | 0.1 |
| 26 | *Botia lecontei 80* | 3 | 0.05 |
| **Total** | | **1030** | **46.6** |

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

**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 | *Hypsibarbus* spp. *44-22* | 8 | 1.8 |
| 2 | *Helicophagus waandersii 101* | 1 | 0.9 |
| 3 | *Lobocheilus melanotaenia 64* | 5 | 0.8 |
| 4 | *Probarbus* spp. *23-24* | 2 | 0.7 |
| 5 | *Scaphognathops bandanensis/* spp. *49* | 6 | 0.65 |
| 6 | *Labiobarbus* cf. *leptocheilus 162* | 3 | 0.6 |
| 7 | *Poropuntius deauratus 43* | 6 | 0.6 |
| 8 | *Osteocheilus* sp. *67* | 4 | 0.5 |
| 9 | *Hampala macrolepidota/H. dispar 51-50* | 4 | 0.4 |
| 10 | *Osteochilus waandersii 71* | 3 | 0.4 |
| 11 | *Puntioplites falcifer 35* | 1 | 0.3 |
| 12 | *Hemibagrus nemurus 84* | 2 | 0.3 |
| 13 | *Gyrinocheilus pennocki 75* | 2 | 0.3 |
| 14 | *Mystus* spp. *88* | 2 | 0.2 |
| 15 | *Cirrhinus microlepis 59* | 1 | 0.2 |
| 16 | *Raiamas guttatus 10a* | 1 | 0.2 |
| 17 | *Pangasius pleurotaenia 111* | 1 | 0.2 |
| 18 | *Barbodes schwanefeldi 38* | 1 | 0.2 |
| 19 | *Hemibagrus wyckioides 85* | 1 | 0.2 |
| 20 | *Tor tambroides/* spp. *21* | 1 | 0.1 |
| 21 | *Osteocheilus microcephalus 70* | 14 | 0.1 |
| 22 | *Henicorhynchus siamensis 63* | 1 | 0.1 |
| 23 | *Osteocheilus* sp. *69* | 1 | 0.1 |
| 24 | *Osteocheilus hasselti 66* | 1 | 0.1 |
| **Total** | | **74** | **9.95** |

**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 | *Hypsibarbus* spp. *44-22* | 25 | 24 |
| 2 | *Helicophagus waandersii 101* | 9 | 17.6 |
| 3 | *Bagarius yarrelli 90* | 3 | 15.5 |
| 4 | *Morulius* spp. *58* | 5 | 8.2 |
| 5 | *Labeo erythropterus 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 | *Bangara behri 54* | 4 | 6.1 |
| 7 | *Hypsibarbus wetmorei* | 6 | 6 |
| 8 | *Pangasius* cf. *polyuranodon 106* | 3 | 4.7 |
| 9 | *Hampala macrolepidota/H. dispar 51-50* | 3 | 3.4 |
| 10 | *Pangasius larnaudii 107* | 1 | 2 |
| 11 | *Pangasius* sp. | 2 | 1.8 |
| 12 | *Hemibagrus nemurus 84* | 1 | 1.8 |
| 13 | *Puntioplites falcifer 35* | 4 | 1.7 |
| 14 | *Probarbus* spp. *23-24* | 2 | 1.4 |
| 15 | *Achiroides* sp. *139* | 1 | 1.2 |
| 16 | *Systomus binotatus 41* | 1 | 1.1 |
| 17 | *Pangasius macronema 110* | 1 | 1 |
| 18 | *Belondichthys truncatus 92* | 1 | 1 |
| 19 | *Mystus wyckii 86* | 1 | 1 |
| 20 | *Cirrhinus microlepis 59* | 1 | 0.5 |
| 21 | *Chitala blanci 4* | 1 | 0.5 |
| 22 | *Raiamas guttatus 10* | 3 | 0.45 |
| 23 | *Osteocheilus* sp. *69* | 3 | 0.4 |
| 24 | *Lobocheilus melanotaenia 64* | 3 | 0.3 |
| 25 | *Labiobarbus* cf. *leptocheilus 162* | 3 | 0.3 |
| 26 | *Scaphognathops bandanensis/* spp. *49* | 1 | 0.1 |
| 27 | *Xenentodon cancila 117* | 1 | 0.05 |
| **Total** | | **94** | **110** |

**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 |
|---|---|---|---|
| 1 | *Pangasius* cf. *polyuranodon 106* | 4 | 3.5 |
| 2 | *Hypsibarbus* spp. *44* | 11 | 2.9 |
| 3 | *Puntioplites falcifer 35* | 3 | 1.1 |
| 4 | *Morulius* spp. *58* | 2 | 0.7 |
| 5 | *Poropuntius deauratus 43* | 8 | 0.7 |
| 6 | *Chitala ornata 3* | 1 | 0.6 |
| 7 | *Cyclocheilichthys* sp. *31* | 3 | 0.6 |
| 8 | *Barbodes altus 40* | 5 | 0.5 |
| 9 | *Hampala dispar 50* | 2 | 0.4 |
| 10 | *Poropuntius deauratus* | 1 | 0.4 |
| 11 | *Barbodes schwanefeldi 38* | 3 | 0.4 |
| 12 | *Osteocheilus microcephalus 70* | 3 | 0.4 |

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

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

**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 | *Pangasius bocourti/Pangasius concophilus 179* | 1 | 5.3 |
| 2 | *Bagarius yarrelli 90* | 1 | 1.5 |
| 3 | *Hemibagrus wyckioides 85* | 1 | 1.2 |
| 4 | *Hypsibarbus* spp. *44* | 1 | 1 |
| 5 | *Mastacemblus* spp. *118* | 1 | 0.3 |
| **Total** | | **11** | **9.9** |

**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 | *Bagarius yarrelli 90* | 2 | 0.3 |
| **Total** | | **2** | **0.3** |

**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 | *Bangara behri 54* | 6 | 10 |
| 2 | *Hypsibarbus* spp. *44-22* | 11 | 8.1 |
| 3 | *Morulius* spp. *58* | 4 | 3 |
| 4 | *Hampala macrolepidota 51* | 2 | 1.9 |
| 5 | *Tor tambroides/* spp. *21* | 1 | 1.5 |
| 6 | *Catlocarpio siamensis 52* | 1 | 1 |
| 7 | *Bagarius yarrelli 90* | 1 | 1 |
| 8 | *Osteocheilus* sp. *69* | 4 | 0.9 |
| 9 | *Osteocheilus hasselti 66* | 1 | 0.7 |
| 10 | *Osphronemus exodon 126* | 1 | 0.5 |
| 11 | *Puntioplites falcifer 35* | 1 | 0.5 |
| 12 | *Macrochirichthys macrochirus 13* | 1 | 0.2 |
| **Total** | | **34** | **29.3** |

**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 | *Bangara behri 54* | 6 | 10 |
| 2 | *Hypsibarbus* spp. *44-22* | 11 | 8.1 |
| 3 | *Morulius* spp. *58* | 4 | 3 |
| 4 | *Hampala macrolepidota 51* | 2 | 1.9 |
| 5 | *Tor tambroides/* spp. *21* | 1 | 1.5 |
| 6 | *Catlocarpio siamensis 52* | 1 | 1 |
| 7 | *Bagarius yarrelli 90* | 1 | 1 |
| 8 | *Osteocheilus* sp. *69* | 4 | 0.9 |
| 9 | *Osteocheilus hasselti 66* | 1 | 0.7 |
| 10 | *Osphronemus exodon 126* | 1 | 0.5 |
| 11 | *Puntioplites falcifer 35* | 1 | 0.5 |
| 12 | *Macrochirichthys macrochirus 13* | 1 | 0.2 |
| **Total** | | **34** | **29.3** |

**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 | *Labiobarbus cf. leptocheilus 162* | 36 | 2.55 |
| 2 | *Hypsibarbus* spp. *44* | 26 | 4.6 |
| 3 | *Puntioplites falcifer 35* | 18 | 1.95 |
| 4 | *Osteocheilus hasselti 66* | 17 | 1.35 |
| 5 | *Cyclocheilicthys* spp. *28* | 15 | 1.65 |
| 6 | *Barbodes schwanefeldi 38* | 15 | 1.65 |
| 7 | *Lobocheilus melanotaenia 64* | 14 | 1.1 |
| 8 | *Scaphognathops bandanensis/* spp. *49* | 11 | 1 |
| 9 | *Hampala macrolepidota/H. dispar 51-50* | 8 | 1.6 |
| 10 | *Probarbus* spp. *23-24* | 12 | 2.2 |
| 11 | *Mystus* spp. *88* | 6 | 0.2 |
| 12 | *Cirrhinus molitorella 164* | 5 | 1 |
| 13 | *Osteochilus waandersii 71* | 5 | 0.65 |
| 14 | *Tor tambroides/* spp. *21* | 5 | 0.75 |
| 15 | *Hemibagrus nemurus 84* | 4 | 1.1 |
| 16 | *Osteocheilus* sp. *69* | 4 | 0.85 |
| 17 | *Cyclocheilichthys* sp. *31* | 4 | 0.45 |
| 18 | *Poropuntius deauratus 43* | 4 | 0.3 |
| 19 | *Achiroides* sp. *139* | 4 | 0.2 |
| 20 | *Osteocheilus* sp. *67* | 4 | 0.2 |
| 21 | *Pangasius concophilus 102* | 3 | 0.5 |
| 22 | *Barbodes altus 40* | 3 | 0.3 |
| 23 | *Luciosoma bleekeri 17* | 3 | 0.25 |
| 24 | *Helicophagus waandersii 101* | 2 | 0.5 |
| 25 | *Hemibagrus nemurus 84* | 2 | 0.3 |
| 26 | *Botia modesta 77* | 2 | 0.2 |
| 27 | *Raiamas guttatus 10b* | 2 | 0.2 |
| 28 | *Bagarius yarrelli 90* | 1 | 1 |
| 29 | *Notopterus notopterus 5* | 1 | 0.5 |
| 30 | *Channa striata 128* | 1 | 0.5 |
| 31 | *Bangara behri 54* | 1 | 0.5 |
| 32 | *Bagrichthys macracanthus 89* | 1 | 0.1 |
| 33 | *Gyrinocheilus pennocki 75* | 1 | 0.1 |
| 34 | *Bagrichthys macropterus 173* | 1 | 0.1 |
| 35 | *Toxotes microlepis 193* | 1 | 0.1 |
| 36 | *Ompok bimaculatus 98* | 1 | 0.05 |
| 37 | *Osteocheilus microcephalus 70* | 1 | 0.05 |
| 38 | *Acantopsoides* sp. *172* | 1 | 0.05 |
| 39 | *Trichogaster trichopterus 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 | *P. siamensis/ B. macropterus 82* | 1 | 0.05 |
| 41 | *Macrochirichthys macrochirus 13* | 1 | 0.05 |
| **Total** | | **248** | **30.85** |

| No | Species | # Fish | Weight kg |
|---|---|---|---|
| 1 | *Cirrhinus microlepis 59* | 1 | 0.5 |
| 2 | *Morulius* spp. *58* | 1 | 0.3 |
| **Total** | | **2** | **0.8** |

**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 | *Puntioplites falcifer 35* | 178 | 11.05 |
| 2 | *Cyclocheilichthys* spp. *28* | 112 | 10.75 |
| 3 | *Labiobarbus* cf. *leptocheilus 162* | 130 | 8.15 |
| 4 | *Micronema* sp. *75* | 33 | 4.7 |
| 5 | *Hemibagrus nemurus 84* | 29 | 3.05 |
| 6 | *Kryptopterus* spp. *175* | 20 | 2.4 |
| 7 | *Hypsibarbus* spp. *44* | 20 | 2.35 |
| 8 | *Channa striata 128* | 2 | 2.1 |
| 9 | *Cyclocheilichthys enoplos 29* | 24 | 2.1 |
| 10 | *Barbodes altus/Systomus binotatus 40-41* | 23 | 2.05 |
| 11 | *Pseudomystus siamensis 82* | 20 | 1.9 |
| 12 | *Scaphognathops bandanensis/* spp. *49* | 21 | 1.8 |
| 13 | *Amphostistus laoensis 1* | 1 | 1.7 |
| 14 | *Osteocheilus hasselti 66* | 19 | 1.6 |
| 15 | *Henicorhynchus* spp. *63-62* | 67 | 2.9 |
| 16 | *Poropuntius deauratus 43* | 25 | 1.4 |
| 17 | *Luciosoma bleekeri 17* | 12 | 1.35 |
| 18 | *Barbodes schwanefeldi 38* | 17 | 1.3 |
| 19 | *Paralaubuca typus 11* | 23 | 1.05 |
| 20 | *Botia modesta 77* | 16 | 1.05 |
| 21 | *Tenualosa thibaudeaui 7* | 6 | 0.95 |
| 22 | *Achrioides* sp. *139* | 5 | 0.8 |
| 23 | *Hampala macrolepidota/H. dispar 51-50* | 9 | 0.75 |
| 24 | *Cyclocheilichthys* sp. *31* | 7 | 0.7 |
| 25 | *Raiamas guttatus 10b* | 4 | 0.65 |
| 26 | *Probarbus* spp. *23-24* | 6 | 0.65 |
| 27 | *Labeo erythropterus 57* | 6 | 0.5 |
| 28 | *Miscellaneous* spp. | 4 | 0.5 |
| 29 | *Tetraodon* sp. *191* | 1 | 0.5 |
| 30 | *Channa micropeltes 129* | 1 | 0.5 |
| 31 | *Osteocheilus* sp. *67* | 4 | 0.35 |
| 32 | *Pangasius pleurotaenia 111* | 3 | 0.35 |
| 33 | *Clarias batrachus 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 | *Chitala ornata 3* | 2 | 0.35 |
| 35 | *Osteocheilus microcephalus 70* | 4 | 0.3 |
| 36 | *Morulius* spp. *58* | 3 | 0.3 |
| 37 | *Kryptopterus cryptopterus 95* | 4 | 0.3 |
| 38 | *Miscellaneous* | 3 | 0.25 |
| 39 | *Helicophagus waandersii 101* | 3 | 0.25 |
| 40 | *Mystus* spp. *88* | 5 | 0.2 |
| 41 | *Trichogaster trichopterus 125* | 2 | 0.2 |
| 42 | *Pangasius concophilus 102* | 1 | 0.2 |
| 43 | *Osteochilus waandersii 71* | 2 | 0.15 |
| 44 | *Notopterus notopterus 5* | 1 | 0.15 |
| 45 | *Cirrhinus microlepis 59* | 1 | 0.15 |
| 46 | *Crossocheilus siamensis 72* | 1 | 0.1 |
| 47 | *Lobocheilus melanotaenia 64* | 1 | 0.1 |
| 48 | *Bagarius yarrelli 90* | 1 | 0.1 |
| 49 | *Osphronemus exodon 126* | 1 | 0.1 |
| 50 | *Kryptopterus cryptopterus 95* | 1 | 0.1 |
| 51 | *Hemililurus mekongensis 93* | 1 | 0.1 |
| 52 | *Macrochirichthys macochirus 13* | 1 | 0.1 |
| 53 | *Achiroides* sp. *139* | 1 | 0.1 |
| 54 | *Osteocheilus* sp. *67* | 1 | 0.1 |
| **Total** | | **889** | **76** |

| No | Species | # Fish | Weight kg |
|---|---|---|---|
| 1 | *Henicorhynchus lobatus 62* | 421 | 3.95 |
| 2 | *Labiobarbus* cf. *leptocheilus 162* | 287 | 3.35 |
| 3 | *Acantopsis* spp. *169* | 42 | 2 |
| 4 | *Cyclocheilichthys* sp. *31* | 99 | 1.4 |
| 5 | *Hemibagrus nemurus 84* | 11 | 0.5 |
| 6 | *Mystus* spp. *88* | 19 | 0.5 |
| 7 | *Paralaubuca typus 11* | 40 | 0.4 |
| 8 | *Lobocheilus melanotaenia 64* | 17 | 0.4 |
| 9 | *Pristolepis fasciata* | 13 | 0.5 |
| 10 | *Barbodes altus/Systomus binotatus 40-41* | 12 | 0.2 |
| 11 | *Systomus binotatus 41* | 21 | 0.2 |
| 12 | *Henicorhynchus siamensis 63* | 14 | 0.2 |
| 13 | *Rasbora* 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 | *Pangasius macronema 110* | 6 | 0.2 |
| 15 | *Hypsibarbus* spp. *44* | 8 | 0.15 |
| 16 | *Cyclocheilichthys enoplos 29* | 12 | 0.15 |
| 17 | *Bagrichthys macracanthus 89* | 2 | 0.15 |
| 18 | *Xenentodon cancila 117* | 3 | 0.1 |
| 19 | *Probarbus* spp. *23-24* | 3 | 0.1 |
| 20 | *Botia modesta 77* | 3 | 0.1 |
| 21 | *Scaphognathops bandanensis/* spp. *49* | 1 | 0.1 |
| 22 | *Helicophagus waandersii 101* | 1 | 0.1 |
| 23 | *Osteocheilus* sp. *69* | 7 | 0.05 |
| 24 | *Macrognathus* sp. *119* | 2 | 0.05 |
| 25 | *Raiamas guttatus 10b* | 2 | 0.05 |
| 26 | *Trichogaster trichopterus 125* | 2 | 0.05 |
| 27 | *Achiroides* sp. *139* | 2 | 0.05 |
| 28 | *Osteocheilus hasselti 66* | 5 | 0.05 |
| 29 | *Cyclocheilicthys* spp. *28* | 5 | 0.05 |
| 30 | *Puntioplites falcifer 35* | 8 | 0.07 |
| 31 | *Toxotes microlepis 193* | 3 | 0.05 |
| 32 | *Ompok bimaculatus 98* | 1 | 0.05 |
| **Total** | | **1082** | **15.25** |

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

**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 | *Hypsibarbus* spp. *44* | 17 | 22.1 |
| 2 | *Labeo erythropterus 57* | 11 | 18.8 |
| 3 | *Bangara behri 54* | 9 | 14.5 |
| 4 | *Tor tambroides/* spp. *21* | 5 | 11.5 |
| 5 | *Hypsibarbus wetmorei* | 5 | 10 |
| 6 | *Cosmocheilus harmandi* | 6 | 9 |
| 7 | *Cyclocheilichthys enoplos 29* | 6 | 7 |
| 8 | *Mekongina erythrospila 74* | 2 | 4 |
| 9 | *Morulius* spp. *58* | 2 | 3.2 |
| 10 | *Catlocarpio siamensis 52* | 1 | 3 |
| 11 | *Bagarius yarrelli 90* | 6 | 2.6 |
| 12 | *Hemibagrus nemurus 84* | 5 | 2.4 |
| 13 | *Chitala ornata 3* | 1 | 2.2 |
| 14 | *Pangasius* sp. *101* | 1 | 2.2 |
| 15 | *Pangasius* sp. | 1 | 2 |
| 16 | *Hemibagrus wyckioides 85* | 1 | 2 |
| 17 | *Pangasius bocourti 103* | 1 | 1.2 |
| 18 | *Osphronemus exodon* | 1 | 1.2 |
| 19 | *Pangasius larnaudii 107* | 1 | 1 |
| 20 | *Cirrhinus microlepis 59* | 1 | 1 |
| 21 | *Belondichthys truncatus 92* | 1 | 1 |
| 22 | *Puntioplites falcifer 35* | 1 | 0.7 |
| 23 | *Channa* sp. *130* | 1 | 0.5 |
| **Total** | | **86** | **123.1** |

**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 | *Osteocheilus* sp. *69* | 10 | 2.7 |
| 2 | *Hemililurus mekongensis 93* | 10 | 1.9 |
| 3 | *Miscellaneous* spp. | 10 | 1.8 |
| 4 | *Osteocheilus hasselti 66* | 10 | 1.8 |
| 5 | *Labiobarbus* cf. *leptocheilus 162* | 20 | 1.3 |
| 6 | *Lobocheilus melanotaenia 64* | 3 | 0.2 |
| 7 | *Gyrinocheilus pennocki 75* | 1 | 0.2 |
| **Total** | | **64** | **9.9** |

**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 | *Bagarius yarrelli 90* | 4 | 13.5 |
| 2 | *Leptobarbus hoeveni* | 1 | 3 |
| 3 | *Hampala macrolepidota/H. dispar 51-50* | 1 | 1.6 |
| 4 | *Hypsibarbus* spp. *44* | 1 | 1.3 |
| **Total** | | **7** | **19.4** |

**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 | *Hampala macrolepidota/H. dispar 51-50* | 1 | 2 |
| 2 | *Belondichthys truncatus 92* | 11 | 1.5 |
| 3 | *Poropuntius deauratus 43* | 34 | 1.3 |
| 4 | *Henicorhynchus siamensis 63* | 25 | 1.3 |
| 5 | *Paralaubuca typus 11* | 50 | 1 |
| 6 | *Miscellaneous* spp. | 2 | 0.3 |
| 7 | *Hemibagrus nemurus 84* | 1 | 0.3 |
| 8 | *Acantopsis* sp. *170* | 1 | 0.3 |
| 9 | *Xenentodon cancila 117* | 4 | 0.25 |
| 10 | *Botia helodes 79* | 9 | 0.2 |
| 11 | *Osteocheilus microcephalus 70* | 3 | 0.2 |
| 12 | *Tetraodon* sp. *191* | 1 | 0.2 |
| 13 | *Raiamas guttatus 10b* | 1 | 0.2 |
| 14 | *Pangasius macronema 110* | 1 | 0.2 |
| 15 | *Coius undecimradiatus 133* | 1 | 0.2 |
| **Total** | | **145** | **9.45** |

**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 | *Hypsibarbus* spp. *44* | 41 | 9.9 |
| 2 | *Pangasius larnaudii 107* | 1 | 4 |
| 3 | *Luciosoma bleekeri 17* | 6 | 2.4 |
| 4 | *Barbodes schwanefeldi 38* | 6 | 2.4 |
| 5 | *Labiobarbus* cf. *leptocheilus 162* | 20 | 2.4 |
| 6 | *Hemibagrus nemurus 84* | 16 | 2.35 |
| 7 | *Cyclocheilichthys* sp./ *Sikukia gudgeri 28-31* | 22 | 2 |
| 8 | *Puntioplites falcifer 35* | 7 | 1.5 |
| 9 | *Osteocheilus* spp. *69-67-66* | 9 | 1.1 |
| 10 | *Barbodes altus 40* | 7 | 0.7 |
| 11 | *Hemibagrus wyckioides 85* | 2 | 0.6 |
| 12 | *Osphronemus exodon 126* | 5 | 0.8 |
| 13 | *Hampala macrolepidota/ H. dispar 51-50* | 1 | 0.5 |
| 14 | *Pangasius macronema/ P. pleurotaenia 110-111* | 2 | 0.9 |
| 15 | *Scaphognathops bandanensis/* spp. *49* | 4 | 0.4 |
| 16 | *Mystus* spp. *88* | 3 | 0.4 |
| 17 | *Poropuntius deauratus 43* | 25 | 0.4 |
| 18 | *Pseudomystus siamensis* | 5 | 0.25 |
| 19 | *Bagrichthys macracanthus 89* | 9 | 0.2 |
| 20 | *Gyrinocheilus pennocki 75* | 2 | 0.2 |
| 21 | *Channa* sp. | 1 | 0.2 |
| 22 | *Channa cf. marulius 130-183* | 1 | 0.2 |
| 23 | *Cirrhinus microlepis 59* | 3 | 0.1 |
| 24 | *Lobocheilus melanotaenia 64* | 1 | 0.1 |
| 25 | *Cyclocheilichthys* spp. | 1 | 0.1 |
| 26 | *Notopterus notopterus 5* | 1 | 0.1 |
| 27 | *Xenentodon cancila 117* | 3 | 0.15 |
| 28 | *Labeo erythropterus 57* | 1 | 0.1 |
| **Total** | | **205** | **34.45** |

**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 | *Hypsibarbus* spp. *44* | 13 | 12 |
| 2 | *Pangasius krempfi/ P. hypophthalmus 105-104* | 2 | 11 |
| 3 | *Osphronemus exodon 126* | 18 | 7.5 |
| 4 | *Cyclocheilichthys* spp../ *Sikukia gudgeri 28-31* | 4 | 4.6 |
| 5 | *Cyclocheilichthys enoplos 29* | 1 | 1.5 |
| 6 | *Hampala macrolepidota/ H. dispar 51-50* | 2 | 1.2 |
| 7 | *Tor tambroides/* spp. *21* | 1 | 1 |
| 8 | *Channa micropeltes 129* | 1 | 1 |
| 9 | *Barbodes schwanefeldi 38* | 3 | 0.2 |
| 10 | *Poropuntius deauratus 43* | 2 | 0.1 |
| 11 | *P. siamensis/ B. macropterus 82* | 2 | 0.1 |
| 12 | *Osteocheilus* spp. *69-67-66* | 1 | 0.1 |
| 13 | *Hemibagrus nemurus 84* | 1 | 0.1 |
| **Total** | | **51** | **40.5** |

**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 | *Hypsibarbus* spp. *44* | 38 | 22.6 |
| 2 | *Morulius* spp. *58* | 3 | 4.5 |
| 3 | *Bangara behri 54* | 2 | 3.5 |
| 4 | *Cyclocheilicthys* spp. / *Sikukia gudgeri 28-31* | 15 | 3.2 |
| 5 | *Scaphognathops bandanensis/spp. 49* | 2 | 2.5 |
| 6 | *Channa* sp. *130-183* | 3 | 2.1 |
| 7 | *Puntioplites falcifer 35* | 14 | 2.1 |
| 8 | *Cosmochilus harmandi* | 2 | 2 |
| 9 | *Barbodes schwanefeldi 38* | 8 | 1.3 |
| 10 | *Osteocheilus* spp. *69-67-66* | 10 | 1 |
| 11 | *Hampala macrolepidota/ H. dispar 51* | 2 | 1 |
| 12 | *Barbodes altus 40* | 2 | 0.2 |
| **Total** | | **87** | **45.5** |

**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 | *Labiobarbus* cf. *leptocheilus 162* | 97 | 6.4 |
| 2 | *Barbodes schwanefeldi 38* | 30 | 4.3 |
| 3 | *Cyclocheilicthys* spp. *28* | 49 | 5.3 |
| 4 | *Osteocheilus* spp. *69-67-66* | 59 | 4.2 |
| 5 | *Hampala macrolepidota/ H. dispar 51* | 10 | 3.5 |
| 6 | *Osteochilus waandersii 71* | 32 | 2.4 |
| 7 | *Hypsibarbus* spp. *44* | 8 | 2.2 |
| 8 | *Henicorhynchus* spp. | 72 | 1.7 |
| 9 | *Puntioplites falcifer 35* | 12 | 1.6 |
| 10 | *Lobocheilus melanotaenia 64* | 20 | 1.5 |
| 11 | *Hemibagrus wyckioides 85* | 3 | 1.4 |
| 12 | *Poropuntius deauratus 43* | 65 | 1.3 |
| 13 | *Raiamas guttatus 10a* | 15 | 1.3 |
| 14 | *Ompok bimaculatus 98* | 29 | 0.8 |
| 15 | *Scaphognathops bandanensis/* spp. *49* | 8 | 0.7 |
| 16 | *Chitala blanci 4* | 5 | 0.5 |
| 17 | *Systomus binotatus 41* | 4 | 0.5 |
| 18 | *Botia helodes/ B. lecontei 79-80* | 1 | 0.5 |
| 19 | *Morulius* spp. *58* | 1 | 0.5 |
| 20 | *Bagrichthys macropterus 82* | 10 | 0.4 |
| 21 | *Luciosoma bleekeri 17* | 8 | 0.4 |
| 22 | *Labeo erythropterus 57* | 1 | 0.3 |
| 23 | *Bagarius yarrelli 90* | 1 | 0.3 |
| 24 | *Pseudomystus siamensis* | 5 | 0.25 |
| 25 | *Mekongina erythrospila 74* | 6 | 0.25 |
| 26 | *Bagrichthys macracanthus 89* | 10 | 0.2 |
| 27 | *Osteocheilus microcephalus 70* | 8 | 0.2 |
| 28 | *Cyclocheilichthys enoplos 29* | 5 | 0.2 |
| 29 | *Crossocheilus siamensis 72* | 4 | 0.1 |
| 30 | *Achiroides* sp. *139* | 3 | 0.1 |
| 31 | *Toxotes microlepis 193* | 1 | 0.1 |
| 32 | *Clarias batrachus 180* | 1 | 0.1 |
| 33 | *Acantopsis* spp. *170* | 2 | 0.05 |
| 34 | *Pangasius macronema/ P. pleurotaenia 110-111* | 1 | 0.05 |
| 35 | *Botia modesta 77* | 1 | 0.05 |
| **Total** | | **587** | **43.65** |

**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 | *Henicorhynchus* spp. | 112 | 2.1 |
| 2 | *Laides siamensis* | 5 | 0.1 |
| **Total** | | **117** | **2.2** |

**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 | *Pangasius larnaudii 107* | 8 | 23 |
| 2 | *Cosmochilus harmandi* | 1 | 5 |
| 3 | *Hypsibarbus* spp. *44* | 2 | 4 |
| 4 | *Pangasius* sp. | 1 | 3.3 |
| 5 | *Hemibagrus nemurus 84* | 6 | 1.6 |
| 6 | *Mystus wyckii 86* | 1 | 1.5 |
| 7 | *Osphronemus exodon 126* | 1 | 1 |
| **Total** | | **20** | **39.4** |

**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 | *Puntioplites falcifer 35* | 82 | 3.95 |
| 2 | *Cyclocheilicthys* spp. *28* | 65 | 3.4 |
| 3 | *Labiobarbus* cf. *leptocheilus 162* | 69 | 2.80 |
| 4 | *Osteocheilus* sp. *66* | 50 | 2.15 |
| 5 | *Osteocheilus* sp. *69* | 39 | 2.05 |
| 6 | *Hypsibarbus* spp. *44* | 42 | 1.95 |
| 7 | *Scaphognathops bandanensis/* spp. *49* | 35 | 1.75 |
| 8 | *Henicorhynchus* spp. | 27 | 1.65 |
| 9 | *Bagrichthys macropterus 173* | 15 | 1.45 |
| 10 | *Bangara behri 54* | 10 | 1.3 |
| 11 | *Hampala dispar 50* | 23 | 1.05 |
| 12 | *Ompok bimaculatus 98* | 8 | 1.05 |
| 13 | *Hampala macrolepidota/ H. dispar 51-50* | 19 | 0.95 |
| 14 | *Wallago leeri 100* | 13 | 0.95 |
| 15 | *Hemibagrus wyckioides 85* | 4 | 0.9 |
| 16 | *Poropuntius deauratus 43* | 15 | 0.65 |
| 17 | *Osteochilus waandersii 71* | 9 | 0.5 |
| 18 | *Barbodes altus 40* | 9 | 0.5 |
| 19 | *Botia modesta 77* | 9 | 0.45 |
| 20 | *Probarbus* spp. *23-24* | 9 | 0.4 |
| 21 | *Cyclocheilichthys enoplos 29* | 9 | 0.35 |
| 22 | *Gyrinocheilus pennocki 75* | 7 | 0.35 |
| 23 | *Raiamas guttatus 10a* | 6 | 0.35 |
| 24 | *Miscellaneous* spp. | 6 | 0.3 |
| 25 | *Luciosoma bleekeri 17* | 4 | 0.25 |
| 26 | *Achiroides* sp. *139* | 5 | 0.25 |
| 27 | *Botia helodes/ B. lecontei 79-80* | 5 | 0.2 |
| 28 | *Barbodes schwanefeldi 38* | 4 | 0.2 |
| 29 | *Cosmocheilus harmandi* | 3 | 0.15 |
| 30 | *Channa striata 128* | 3 | 0.15 |
| 31 | *Tetraodon* sp. *191* | 2 | 0.1 |
| 32 | *Achiroides* sp. *139* | 2 | 0.1 |
| 33 | *Hemibagrus nemurus 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 | *Cirrhinus molitorella 164* | 1 | 0.1 |
| 35 | *Tor tambroides/* spp. *21* | 1 | 0.1 |
| 36 | *Trichogaster trichopterus 125* | 2 | 0.05 |
| 37 | *Mystus* spp. *88* | 1 | 0.05 |
| 38 | *Notopterus notopterus 5* | 1 | 0.05 |
| 39 | *P. siamensis/ B. macropterus 82* | 1 | 0.05 |
| 40 | *Kryptopterus* sp. *175* | 1 | 0.05 |
| 41 | *Macrognathus* sp. *119* | 1 | 0.05 |
| **Total** | | **615** | **32.95** |

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

**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 | *Bagarius yarrelli 90* | 1 | 1 |
| 2 | *Hemibagrus wyckioides 85* | 1 | 0.5 |
| 3 | *Puntioplites falcifer 35* | 2 | 0.1 |
| **Total** | | **4** | **1.6** |

**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 | *Bagarius yarrelli 90* | 1 | 0.9 |
| 2 | *Hemibagrus nemurus 84* | 1 | 0.8 |
| 3 | *Hemibagrus wyckioides 85* | 2 | 0.15 |
| 4 | *Oxyeleotris marmorata/ Gobiidae* spp. *131* | 1 | 0.15 |
| 5 | *Botia helodes 79* | 2 | 0.1 |
| 6 | *Kryptopterus* sp. *17* | 1 | 0.05 |
| **Total** | | **8** | **2.15** |

**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 | *Bangara behri 54* | 33 | 81.2 |
| 2 | *Morulius* spp. *58* | 30 | 63.8 |
| 3 | *Hemibagrus wyckioides 85* | 19 | 36.2 |
| 4 | *Hypsibarbus* spp. *22* | 18 | 26.9 |
| 5 | *Cirrhinus microlepis 59* | 11 | 25.9 |
| 6 | *Labeo erythropterus 57* | 3 | 15 |
| 7 | *Pangasius pleurotaenia 111* | 20 | 15 |
| 8 | *Osteocheilus melanopleurus 68* | 8 | 14 |
| 9 | *Osphronemus exodon 126* | 7 | 11.9 |
| 10 | *Bagarius yarrelli 90* | 3 | 10.2 |
| 11 | *Wallago leeri 100* | 2 | 8.5 |
| 12 | *Pangasius larnaudii 107* | 5 | 8 |
| 13 | *Probarbus* spp. *23-24* | 3 | 10.7 |
| 14 | *Puntioplites falcifer 35* | 5 | 4.9 |
| 15 | *Channa micropeltes 129* | 2 | 4.5 |
| 16 | *Toxotes microlepis 193* | 3 | 3.5 |
| 17 | *Pangasius bocourti 103* | 1 | 3.1 |
| 18 | *Gyrinocheilus pennocki 75* | 7 | 2.6 |
| 19 | *Achiroides* sp. *139* | 3 | 2.3 |
| 20 | *Scaphognathops bandanensis/* spp. *49* | 2 | 2.2 |
| 21 | *Tor tambroides/* spp. *21* | 2 | 2 |
| 22 | *Oxyeleotris marmorata 131* | 1 | 1.5 |
| 23 | *Coius undecimradiatus 133* | 1 | 1.4 |
| 24 | *Chitala blanci 4* | 1 | 0.9 |
| 25 | *Pangasius* sp. | 2 | 0.5 |
| **Total** | | **189** | **356.2** |

**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 | *Pangasius larnaudii 107* | 2 | 4.2 |
| **Total** | | **2** | **4.2** |

**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 | *Barbodes altus 40* | 25 | 8.6 |
| 2 | *Barbodes schwanefeldi 38* | 14 | 4.5 |
| 3 | *Notopterus notopterus 5* | 7 | 1.2 |
| 4 | *Hypsibarbus* spp. *44* | 3 | 1 |
| 5 | *Probarbus* spp. *23-24* | 1 | 1 |
| 6 | *Poropuntius deauratus 43* | 8 | 0.9 |
| 7 | *Hampala dispar 50* | 4 | 0.7 |
| 8 | *Chitala ornata 3* | 3 | 0.4 |
| 9 | *Henicorhynchus* spp. | 8 | 0.3 |
| 10 | *Achiroides* sp. *139* | 1 | 0.2 |
| 11 | *Cyclocheilicthys* spp. *28* | 1 | 0.1 |
| **Total** | | **75** | **18.9** |

**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 | *Bangara behri 54* | 7 | 14.9 |
| 2 | *Wallago leeri 100* | 1 | 9.2 |
| 3 | *Hypsibarbus* spp. *44* | 2 | 4.6 |
| 4 | *Morulius* spp. *58* | 3 | 3.2 |
| 5 | *Osteocheilus melanopleurus 68* | 1 | 2.8 |
| 6 | *Puntioplites falcifer 35* | 3 | 1.3 |
| 7 | *Tor tambroides/* spp. *21* | 2 | 1.2 |
| **Total** | | **19** | **37.2** |

**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 | *Cirrhinus microlepis 59* | 2 | 9.8 |
| 2 | *Bagarius yarrelli 90* | 1 | 5.3 |
| 3 | *Cyclocheilichthys* spp. | 5 | 3.3 |
| **Total** | | **8** | **18.4** |

**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 | *Barbodes schwanefeldi 38* | 37 | 6 |
| 2 | *Hypsibarbus* spp. *44-22-148* | 17 | 2.55 |
| 3 | *Labiobarbus* cf. *leptocheilus 162* | 26 | 2 |
| 4 | *Luciosoma bleekeri 17* | 5 | 1 |
| 5 | *Scaphognathops bandanensis/spp. 49* | 14 | 0.95 |
| 6 | *Puntioplites falcifer 35* | 5 | 0.75 |
| 7 | *Hemibagrus nemurus 84* | 4 | 0.65 |
| 8 | *Gyrinocheilus pennocki 75* | 3 | 0.55 |
| 9 | *Pseudomystus/ Bagrichthys macropterus 82* | 1 | 0.5 |
| 10 | *Trichogaster trichopterus 125* | 1 | 0.5 |
| 11 | *Cyclocheilichthys* sp. *31* | 4 | 0.4 |
| 12 | *Osteocheilus hasselti 66* | 2 | 0.3 |
| 13 | *Toxotes microlepis 193* | 3 | 0.3 |
| 14 | *Hemibagrus nemurus 84* | 3 | 0.2 |
| 15 | *Cyclocheilicthys* spp. *28* | 3 | 0.2 |
| 16 | *Miscellaneous* sp. | 8 | 0.2 |
| 17 | *Wallago leeri 100* | 2 | 0.2 |
| 18 | *Macrochirichthys macrochirus 13* | 1 | 0.2 |
| 19 | *Poropuntius deauratus 43* | 1 | 0.2 |
| 20 | *Systomus binotatus 41* | 1 | 0.2 |
| 21 | *Hemibagrus wyckioides 85* | 1 | 0.2 |
| 22 | *Chitala blanci 4* | 3 | 0.1 |
| 23 | *Osphronemus exodon 126* | 1 | 0.1 |
| 24 | *Chitala blanci 4* | 1 | 0.1 |
| 25 | *Bagarius yarrelli 90* | 1 | 0.1 |
| **Total** | | **148** | **18.45** |

**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 | *Hypsibarbus* spp. *44* | 6 | 5.9 |
| 2 | *Chitala blanci 4* | 2 | 3 |
| 3 | *Bagarius yarrelli 90* | 2 | 2.9 |
| 4 | *Helicophagus waandersii 101* | 1 | 2 |
| 5 | *Osphronemus exodon 126* | 1 | 1.5 |
| 6 | *Tor tambroides/* spp. *21* | 1 | 1.5 |
| 7 | *Morulius* spp. *58* | 1 | 1 |
| **Total** | | **14** | **17.8** |

**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 | *Hemibagrus wyckioides 85* | 2 | 1.1 |
| 2 | *Hypsibarbus* spp. *44* | 2 | 1.1 |
| 3 | *Puntioplites falcifer 35* | 2 | 0.9 |
| 4 | *Chitala blanci 4* | 1 | 0.7 |
| 5 | *Barbodes schwanefeldi 38* | 3 | 0.4 |
| 6 | *Labiobarbus* cf. l*eptocheilus 162* | 2 | 0.4 |
| 7 | *Osteocheilus hasselti 66* | 2 | 0.2 |
| 8 | *Hemibagrus nemurus 84* | 2 | 0.2 |
| 9 | *Henicorhynchus siamensis 63* | 1 | 0.1 |
| **Total** | | **17** | **5.1** |

**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 | *Henicorhynchus lobatus 62* | 595 | 12.25 |
| 2 | *Labiobarbus cf. leptocheilus 162* | 346 | 10.3 |
| 3 | *Paralaubuca typus 11* | 250 | 7.1 |
| 4 | *Henicorhynchus siamensis 63* | 95 | 5.4 |
| 5 | *Mystus* spp. *88* | 31 | 4.55 |
| 6 | *Puntioplites falcifer 35* | 37 | 3.15 |
| 7 | *Luciosoma bleekeri 17* | 31 | 2.65 |
| 8 | *Barbodes schwanefeldi 38* | 24 | 2.45 |
| 9 | *Kryptopterus cryptopterus 95* | 27 | 2.3 |
| 10 | *Raiamas guttatus 10b* | 37 | 2 |
| 11 | *Pangasius macronema 110* | 37 | 1.8 |
| 12 | *Acantopsis* spp. *169* | 17 | 1.5 |
| 13 | *Hemibagrus nemurus 84* | 15 | 1.4 |
| 14 | *Cyclocheilicthys* spp. *28* | 53 | 1.2 |
| 15 | *Scaphognathops bandanensis/* spp. *49* | 19 | 1.15 |
| 16 | *Cyclocheilichthys* sp. *31* | 10 | 1.15 |
| 17 | *Acantopsis* spp. *170* | 10 | 0.75 |
| 18 | *Hypsibarbus* spp. *44* | 23 | 0.5 |
| 19 | *Channa micropeltes 129* | 1 | 0.5 |
| 20 | *Pristolepis fasciata* | 30 | 0.4 |
| 21 | *Lobocheilus melanotaenia 64* | 10 | 0.3 |
| 22 | *Cyclocheilichthys enoplos 29* | 6 | 0.3 |
| 23 | *Ompok bimaculatus 98* | 17 | 0.3 |
| 24 | *Osteocheilus hasselti 66* | 18 | 0.25 |
| 25 | *Pseudomystus siamensis* | 10 | 0.25 |
| 26 | *Osteocheilus* sp. *67* | 13 | 0.25 |
| 27 | *Botia helodes 79* | 3 | 0.2 |
| 28 | *Pristolepis fasciata* | 7 | 0.2 |
| 29 | *Pangasius* sp. | 1 | 0.2 |
| 30 | *Macrognathus* sp. *119* | 6 | 0.2 |
| 31 | *Tetraodon* spp. *191* | 2 | 0.15 |
| 32 | *Cyclocheilichthys* spp. | 5 | 0.15 |
| 33 | *Laides siamensis 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 | *Macrochirichthys macrochirus 13* | 6 | 0.1 |
| 35 | *Micronema bleekeri 96* | 5 | 0.1 |
| 36 | *Chitala blanci 4* | 3 | 0.1 |
| 37 | *Mastacemblus spp. 118* | 4 | 0.05 |
| 38 | *Cirrhinus microlepis 59* | 3 | 0.05 |
| 39 | *Belondichthys truncatus 92* | 3 | 0.05 |
| 40 | *Bagarius yarrelli 90* | 3 | 0.05 |
| 41 | *Gyrinocheilus pennocki 75* | 2 | 0.05 |
| 42 | *Botia lecontei 80* | 1 | 0.05 |
| 43 | *Hampala macrolepidota/ H. dispar 51* | 1 | 0.05 |
| 44 | *Kryptopterus* sp. *175* | 1 | 0.05 |
| 45 | *Notopterus notopterus 5* | 1 | 0.01 |
| **Total** | | **1826** | **66.06** |

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

**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 | *Channa* sp. | 2 | 6.05 |
| 2 | *Hypsibarbus* spp. *44* | 40 | 6.05 |
| 3 | *Puntioplites falcifer 35* | 42 | 3.15 |
| 4 | *Labiobarbus* cf. *leptocheilus 162* | 44 | 3.1 |
| 5 | *Cyclocheilicthys* spp. *28* | 14 | 1.45 |
| 6 | *Amblyrhychichthys truncates 26* | 7 | 1 |
| 7 | *Barbodes schwanefeldi 38* | 23 | 0.9 |
| 8 | *Hemibagrus nemurus 84* | 5 | 0.8 |
| 9 | *Barbodes schwanefeldi 38* | 6 | 0.5 |
| 10 | *Channa striata 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 | *Paralaubuca typus 11* | 11 | 0.3 |
| 12 | *Hampala macrolepidota/ H. dispar 51* | 3 | 0.3 |
| 13 | *Achiroides* sp. *139* | 5 | 0.3 |
| 14 | *Henicorhynchus siamensis 63* | 7 | 0.25 |
| 15 | *Miscellaneous* sp. | 10 | 0.2 |
| 16 | *Scaphognathops bandanensis/* spp. *49* | 1 | 0.2 |
| 17 | *Hemibagrus nemurus 84* | 1 | 0.2 |
| 18 | *Lobocheilus melanotaenia 64* | 2 | 0.2 |
| 19 | *Scaphognathops bandanensis/* spp. *49* | 2 | 0.1 |
| 20 | *Cyclocheilichthys* sp. *31* | 7 | 0.1 |
| 21 | *Mystus* spp. *88* | 1 | 0.1 |
| 22 | *Luciosoma bleekeri 17* | 1 | 0.1 |
| 23 | *Mystus* spp. *88* | 1 | 0.1 |
| 24 | *Paralaubuca typus 11* | 1 | 0.05 |
| 25 | *Osteocheilus* sp. *69* | 1 | 0.05 |
| **Total** | | **240** | **25.95** |

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

**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 | *Tor tambroides/* spp. *21* | 1 | 2.5 |
| 2 | *Bangara behri 54* | 1 | 1.5 |
| 3 | *Morulius* spp. *58* | 1 | 1.4 |
| 4 | *Hemibagrus nemurus 84* | 1 | 1.1 |
| **Total** | | **4** | **6.5** |

**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 | *Henicorhynchus lobatus 62* | 43 | 0.5 |
| 2 | *Labiobarbus* cf. *leptocheilus 162* | 30 | 0.5 |
| 3 | *Henicorhynchus siamensis 63* | 19 | 0.5 |
| 4 | *Mastacemblus* spp. *118* | 9 | 0.2 |
| 5 | *Hemibagrus nemurus 84* | 5 | 0.2 |
| 6 | *Botia helodes 79* | 6 | 0.1 |
| 7 | *Puntioplites falcifer 35* | 2 | 0.1 |
| 8 | *Channa* cf. *marulius 183* | 1 | 0.1 |
| **Total** | | **115** | **2.2** |

**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 | *Cyclocheilichthys* spp. | 2 | 0.1 |
| 2 | *Poropuntius deauratus 43* | 2 | 0.1 |
| 3 | *Labiobarbus* cf. *leptocheilus 162* | 2 | 0.1 |
| 4 | *Pangasius* sp. | 1 | 0.1 |
| 5 | *Pristolepis fasciata* | 2 | 0.1 |
| 6 | *Pseudomystus siamensis* | 1 | 0.1 |
| 7 | *Henicorhynchus siamensis 63* | 5 | 0.05 |
| 8 | *Xenentodon cancila 117* | 1 | 0.05 |
| **Total** | | **16** | **0.7** |

**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 | *Labiobarbus cf. leptocheilus 162* | 98 | 5.1 |
| 2 | *Henicorhynchus siamensis 63* | 40 | 2 |
| 3 | *Hemibagrus nemurus 84* | 19 | 1.6 |
| 4 | *Puntioplites falcifer 35* | 16 | 1.6 |
| 5 | *Bagarius yarrelli 90* | 1 | 1.5 |
| 6 | *Cyclocheilichthys* sp. *31* | 21 | 1.4 |
| 7 | *Henicorhynchus* spp. | 26 | 1.35 |
| 8 | *Bangara behri 54* | 1 | 1.2 |
| 9 | *Gyrinocheilus pennocki 75* | 24 | 1 |
| 10 | *Cyclocheilicthys* spp. *28* | 13 | 0.85 |
| 11 | *Hypsibarbus* spp. *44* | 9 | 0.7 |
| 12 | *Barbodes schwanefeldi 38* | 9 | 0.6 |
| 13 | *Henicorhynchus lobatus 62* | 21 | 0.5 |
| 14 | *Cyclocheilichthys* spp. | 7 | 0.5 |
| 15 | *Pseudomystus siamensis* | 6 | 0.4 |
| 16 | *Mystus* spp. *88* | 6 | 0.3 |
| 17 | *Raiamas guttatus 10a* | 3 | 0.3 |
| 18 | *Acantopsis* spp. *170* | 30 | 0.3 |
| 19 | *Miscellaneous* sp. | 5 | 0.3 |
| 20 | *Helicophagus waandersii 101* | 3 | 0.3 |
| 21 | *Cirrhinus microlepis 59* | 4 | 0.3 |
| 22 | *Lobocheilus melanotaenia 64* | 4 | 0.25 |
| 23 | *Osteocheilus microcephalus 70* | 8 | 0.2 |
| 24 | *Pristolepis fasciata* | 6 | 0.2 |
| 25 | *Cyclocheilichthys enoplos 29* | 1 | 0.2 |
| 26 | *Botia modesta 77* | 2 | 0.2 |
| 27 | *Hampala macrolepidota/ H. dispar 51* | 2 | 0.2 |
| 28 | *Paralaubuca typus 11* | 6 | 0.2 |
| 29 | *Scaphognathops bandanensis/* spp. *49* | 3 | 0.15 |
| 30 | *Osteocheilus hasselti 66* | 2 | 0.15 |
| 31 | *Notopterus notopterus 5* | 2 | 0.1 |
| 32 | *Luciosoma bleekeri 17* | 3 | 0.1 |
| 33 | *Pangasius macronema 110* | 1 | 0.1 |
| 34 | *Tenualosa thibaudeaui 7* | 2 | 0.05 |
| 35 | *Systomus binotatus 41* | 1 | 0.05 |
| 36 | *Osteochilus waandersii 71* | 1 | 0.05 |
| **Total** | | **404** | **24.3** |

**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 | *Hypsibarbus* spp. *44* | 118 | 16.3 |
| 2 | *Chitala blanci 4* | 11 | 6.3 |
| 3 | *Osteocheilus hasselti 66* | 93 | 5.6 |
| 4 | *Labiobarbus* cf. *leptocheilus 162* | 77 | 5.2 |
| 5 | *Scaphognathops bandanensis/* spp. *49* | 58 | 4.5 |
| 6 | *Hemibagrus nemurus 84* | 21 | 4.4 |
| 7 | *Puntioplites falcifer 35* | 47 | 4.3 |
| 8 | *Cyclocheilichthys* sp. *31* | 35 | 2.5 |
| 9 | *Hampala macrolepidota/ H. dispar 51* | 36 | 2.2 |
| 10 | *Barbodes altus 40* | 26 | 2.2 |
| 11 | *Barbodes schwanefeldi 38* | 38 | 2.1 |
| 12 | *Achiroides* sp. *139* | 45 | 2 |
| 13 | *Osteochilus waandersii 71* | 40 | 2 |
| 14 | *Henicorhynchus* spp. | 12 | 1.7 |
| 15 | *Hemibagrus nemurus 84* | 28 | 1.7 |
| 16 | *Systomus binotatus 41* | 24 | 1.65 |
| 17 | *Luciosoma bleekeri 17* | 18 | 1.6 |
| 18 | *Lobocheilus melanotaenia 64* | 21 | 1.5 |
| 19 | *Osteocheilus* sp. *69* | 27 | 1.4 |
| 20 | *Cyclocheilichthys enoplos 29* | 21 | 1.35 |
| 21 | *Notopterus notopterus 5* | 20 | 1.2 |
| 22 | *Osteocheilus microcephalus 70* | 19 | 1.2 |
| 23 | *Mastacemblus* spp. *118* | 14 | 1.1 |
| 24 | *Mystus wyckii 86* | 11 | 1.05 |
| 25 | *Hypsibarbus wetmorei* | 3 | 1 |
| 26 | *Botia helodes 79* | 17 | 0.95 |
| 27 | *Osteocheilus* sp. *67* | 17 | 0.9 |
| 28 | *Pristolepis fasciata* | 12 | 0.9 |
| 29 | *Osphronemus exodon 126* | 2 | 0.9 |
| 30 | *Tor tambroides/* spp. *21* | 16 | 0.85 |
| 31 | *P. siamensis/ B. macropterus* | 8 | 0.8 |
| 32 | *Cyclocheilichthys* spp. | 16 | 0.8 |
| 33 | *Bagarius yarrelli 90* | 6 | 0.8 |
| 34 | *Kryptopterus* 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 | *Mystus* spp. *88* | 18 | 0.75 |
| 36 | *Poropuntius* sp. | 13 | 0.7 |
| 37 | *Helicophagus waandersii 101* | 12 | 0.7 |
| 38 | *Paralaubuca typus 11* | 13 | 0.6 |
| 39 | *Probarbus* spp. *23-24* | 11 | 0.6 |
| 40 | *Pangasius* sp. | 3 | 0.6 |
| 41 | *Clarias batrachus 180* | 9 | 0.55 |
| 42 | *Botia modesta 77* | 7 | 0.5 |
| 43 | *Ompok bimaculatus 98* | 7 | 0.5 |
| 44 | *Bagrichthys macracanthus 89* | 9 | 0.5 |
| 45 | *Channa striata 128* | 4 | 0.5 |
| 46 | *Miscellaneous* spp. | 7 | 0.5 |
| 47 | *Trichogaster trichopterus 125* | 6 | 0.5 |
| 48 | *Chitala ornata 3* | 7 | 0.4 |
| 49 | *Raiamas guttatus 10b* | 7 | 0.4 |
| 50 | *Morulius* spp. *58* | 6 | 0.4 |
| 51 | *Bangara behri 54* | 6 | 0.4 |
| 52 | *Hampala dispar 50* | 7 | 0.4 |
| 53 | *Rasbora* spp. | 8 | 0.35 |
| 54 | *Henicorhynchus lobatus 62* | 8 | 0.3 |
| 55 | *Gyrinocheilus pennocki 75* | 5 | 0.3 |
| 56 | *Macrognathus* sp. *119* | 5 | 0.3 |
| 57 | *Toxotes microlepis 193* | 4 | 0.3 |
| 58 | *Crossocheilus siamensis 72* | 6 | 0.25 |
| 59 | *Micronema bleekeri 96* | 4 | 0.2 |
| 60 | *Henicorhynchus siamensis 63* | 4 | 0.2 |
| 61 | *Crossocheilus siamensis 72* | 4 | 0.2 |
| 62 | *Tetraodon* spp. *191* | 3 | 0.2 |
| 63 | *Kryptopterus cryptopterus 95* | 3 | 0.2 |
| 64 | *Bagrichthys macropterus 173* | 5 | 0.2 |
| 67 | *Macrochirichthys macrochirus 13* | 2 | 0.2 |
| 68 | *Channa* cf. *marulius 183* | 1 | 0.2 |
| 69 | *Acantopsis spp. 171* | 3 | 0.15 |
| 70 | *Systomus binotatus 41* | 2 | 0.1 |
| 71 | *Miscellaneous* spp. | 2 | 0.1 |
| 72 | *Laides siamensis 113* | 2 | 0.1 |
| 73 | *Micronema* cf. *micronema 97* | 1 | 0.1 |
| 74 | *Garra cambodgiensis 73* | 1 | 0.1 |
| **Total** | | **1197** | **97.25** |

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

**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 | *Osteocheilus hasselti 66* | 52 | 3.5 |
| 2 | *Osteochilus waandersii 71* | 44 | 3.0 |
| 3 | *Labiobarbus* cf. *leptocheilus 162* | 38 | 2.2 |
| 4 | *Systomus binotatus 41* | 23 | 1.3 |
| 5 | *Lobocheilus melanotaenia 64* | 25 | 1.2 |
| 6 | *Henicorhynchus* spp. | 26 | 1.1 |
| 7 | *Poropuntius deauratus 43* | 21 | 1.1 |
| 8 | *Osteocheilus* sp. *69* | 21 | 1.1 |
| 9 | *Osteocheilus microcephalus 70* | 15 | 1 |
| 10 | *Osteocheilus* sp. *67* | 11 | 0.6 |
| 11 | *Mystus* spp. *88* | 16 | 0.6 |
| 12 | *Cirrhinus molitorella 164* | 10 | 0.5 |
| 13 | *Ompok bimaculatus 98* | 6 | 0.5 |
| 14 | *Hemibagrus nemurus 84* | 8 | 0.5 |
| 15 | *Hampala macrolepidota/ H. dispar 51-50* | 9 | 0.5 |
| 16 | *Luciosoma bleekeri 17* | 9 | 0.5 |
| 17 | *Notopterus notopterus 5* | 6 | 0.4 |
| 18 | *P. siamensis/ B. macropterus* | 6 | 0.4 |
| 19 | *Pristolepis fasciata* | 7 | 0.35 |
| 20 | *Botia helodes 79* | 7 | 0.3 |
| 21 | *Barbodes altus 40* | 6 | 0.3 |
| 22 | *Raiamas guttatus 10b* | 6 | 0.3 |
| 23 | *Hypsibarbus* spp. *44* | 5 | 0.3 |
| 24 | *Scaphognathops bandanensis/* spp. *49* | 4 | 0.2 |
| 25 | *Micronema bleekeri 96* | 3 | 0.2 |
| 26 | *Mekongina erythrospila 74* | 3 | 0.2 |
| 27 | *Crossocheilus siamensis 72* | 4 | 0.2 |
| 28 | *Macrochrichthys macrochirus 13* | 2 | 0.2 |
| 29 | *Rasbora* sp. | 4 | 0.1 |
| 30 | *Henicorhynchus siamensis 63* | 4 | 0.1 |
| 31 | *Botia modesta 77* | 2 | 0.1 |
| 32 | *Labeo erythropterus 57* | 2 | 0.1 |
| 33 | *Cyclocheilichthys enoplos 29* | 1 | 0.1 |
| 34 | *Botia lecontei 80* | 2 | 0.1 |
| 35 | *Cyclocheilichthys* sp. *28* | 2 | 0.1 |
| 36 | *Clarias batrachus 180* | 2 | 0.1 |
| 37 | *Mystus wyckii 86* | 2 | 0.1 |
| 38 | *Mastacemblus* spp. *118* | 2 | 0.1 |
| **Total** | | **416** | **23.45** |

**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**