

Today's lecture

# Purpose: understanding what is GAS

## Contents

1. my experience  
in Cambodia



2. exercise

case study

fisheries in Philippines



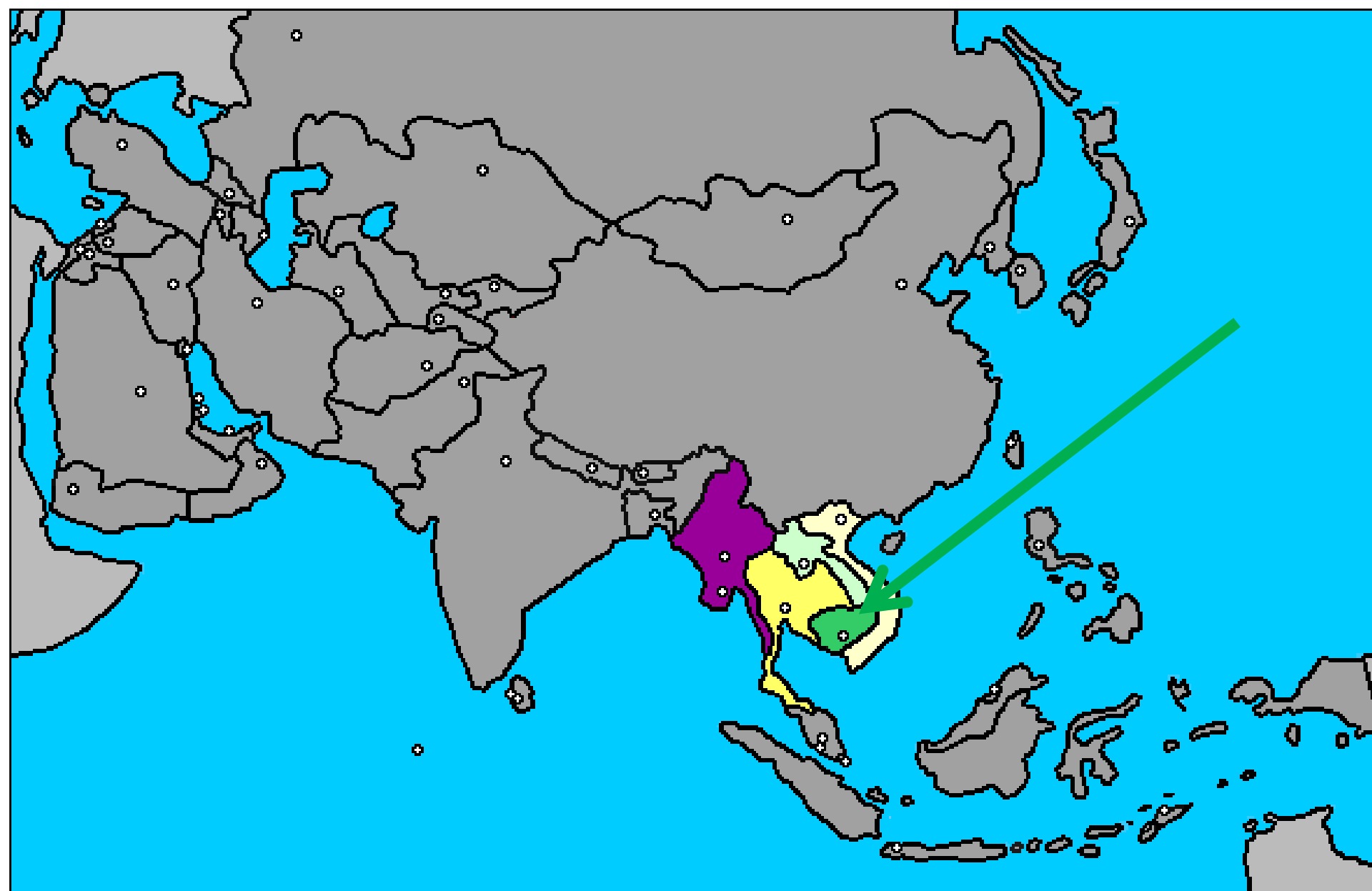
# Objective

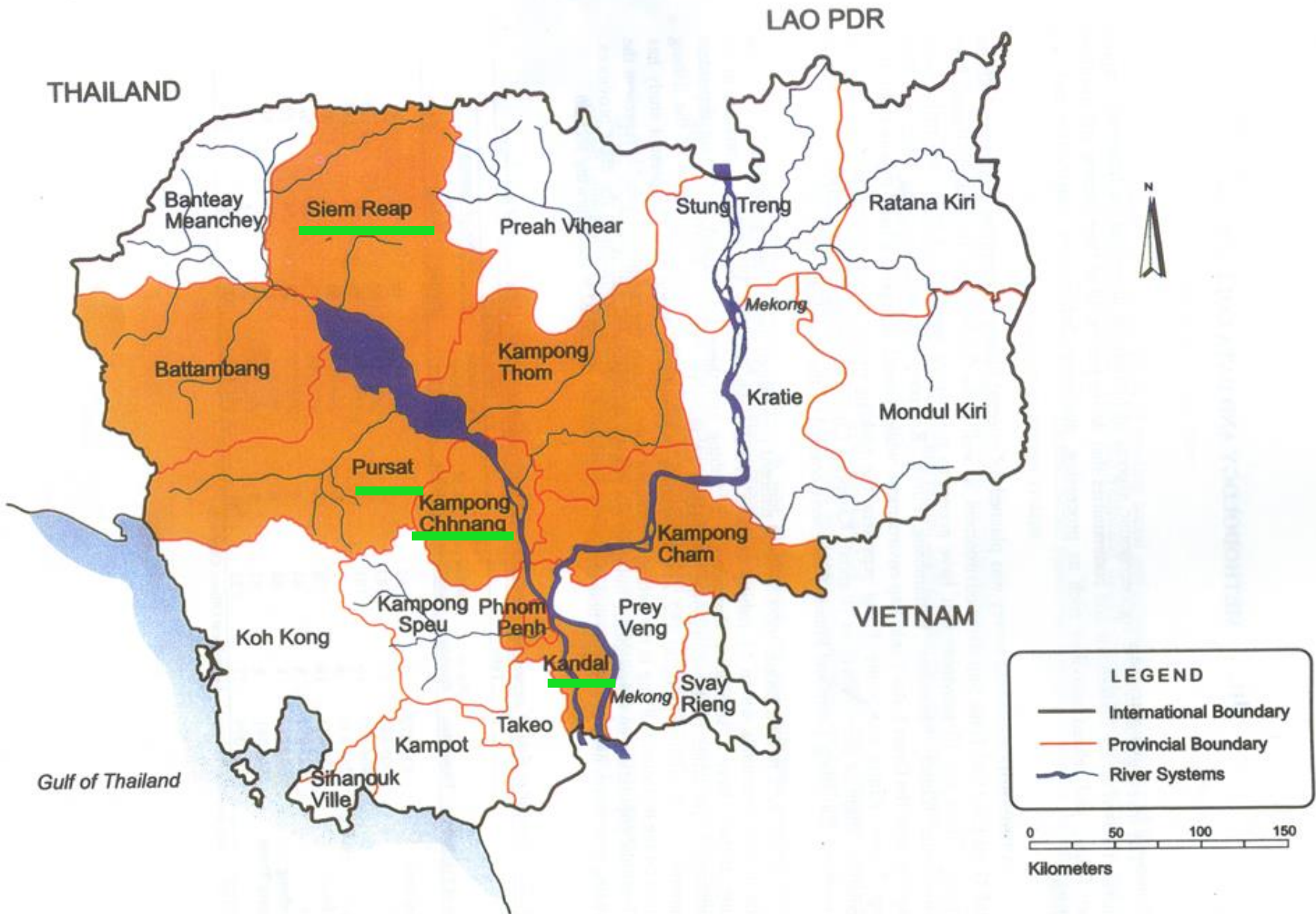
Fishery management system in Cambodia

# Present status

fish catch is decreasing

impacts of flood control on fish resources



















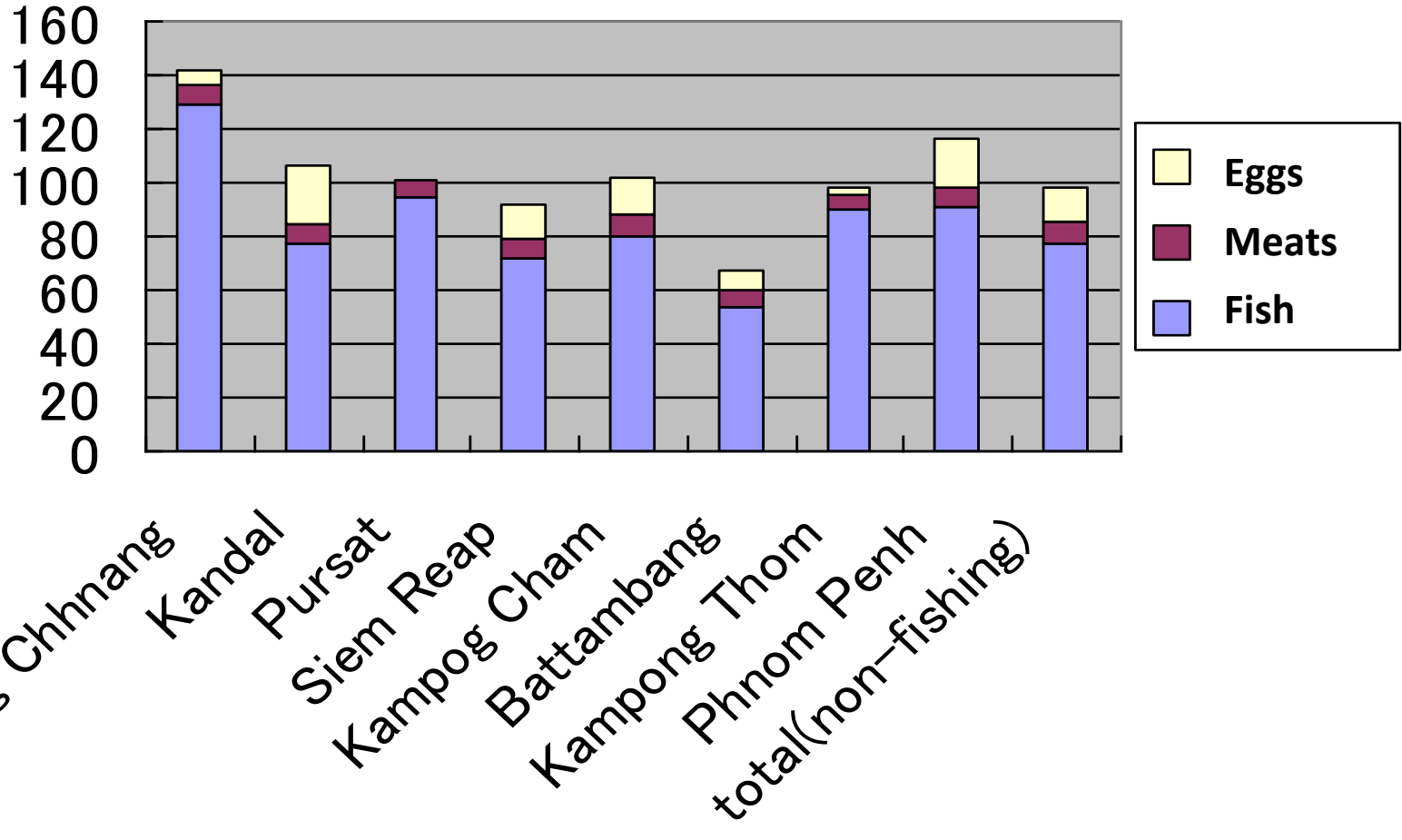
## History of Cambodia

- 1 Century Funan Empire
- 6 Century Khmer Empire (Angkor Wat)
- 15 Century Fall of the Empire
  - Pressure of **Siam (Thailand) and Annam** (south Vietnam)
- 1863 French protectorate
- 1887 A part of the Union of Indochina (governed under **French**)
- 1940 Entry of Japanese troop
- 1941 Sihanouk took throne (Pacific War: (World War II))
- 1945 **Japan** disarmed French army
  - Declaration of **independence by Sihanouk**
- 1945 Japan defeated in the war.
  - French took control of Phnom Penh
  - Recolonization by French**
- 1953 Declaration of complete independence by Sihanouk
  - Non alignment policy**
- 1961 **Vietnam War**
  - Supply base and refuge to North Vietnam and Viet Cong
- 1969 **Aerial attacks by USA** against Viet Cong in Cambodia
- 1970 Right-wing coup by Premier **Lon Nol** (**Supported by USA**)
  - Beijing refugee government** (Sihanouk)
  - United front of Cambodian people (**Khmer rouge** join)

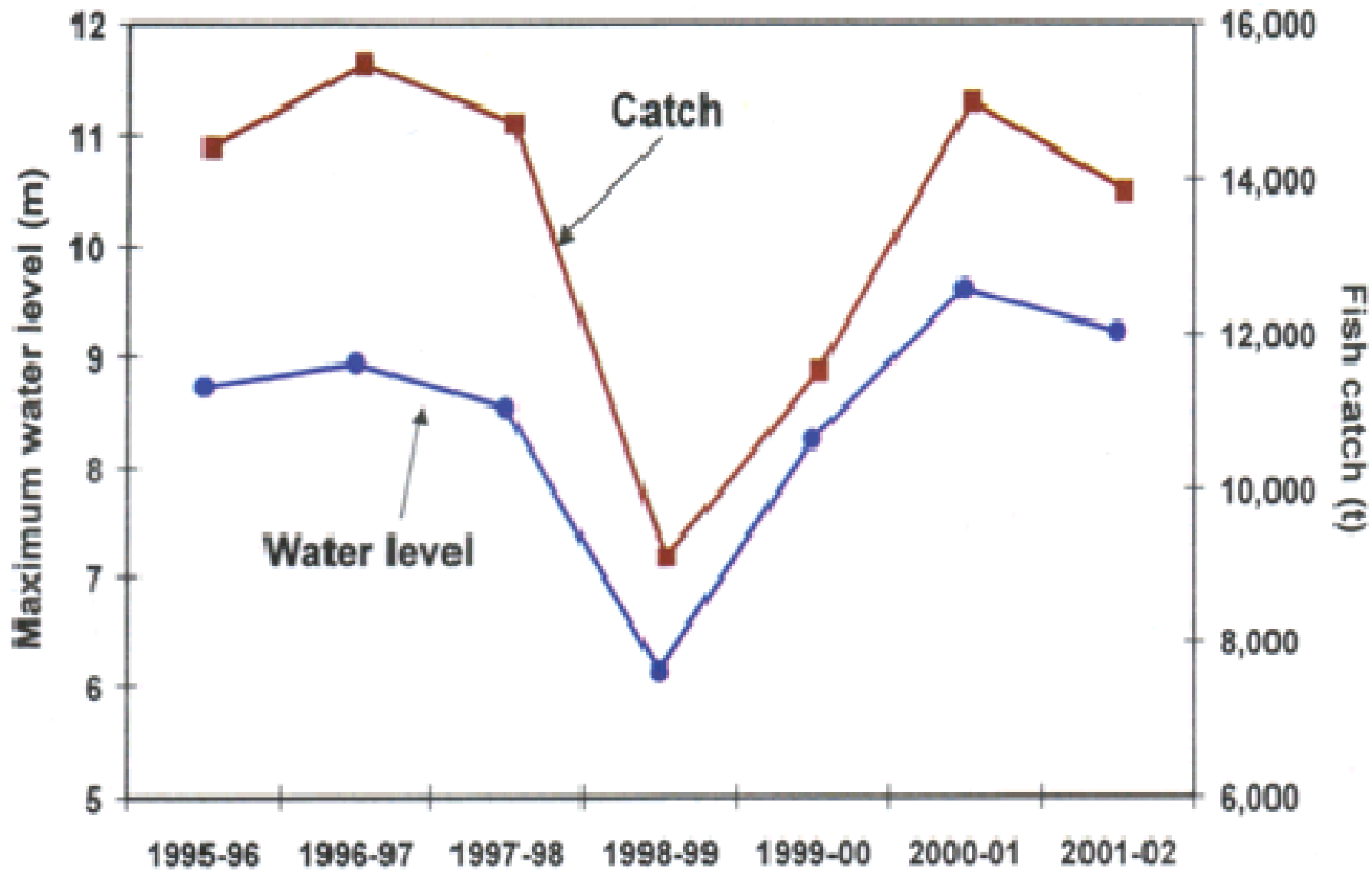
- 1973 **Peace Agreement in Paris (USA-North Vietnam)**
- 1975 **Khumer Rouge took control of Phnon Penh  
and established **Pol pot as the premier**  
Beginning of “**killing field**”  
About **a million and a half people** were executed  
over the next four years.**
- 1975 **Falling of Saigon (The end of Vietnam war)  
Sihanouk return from Beiing**
- 1976 **Sihanouk was confined by Khumer Rouge**
- 1978 **Pol Pot refuge international supervision by UN  
Vietnam made inroad to Cambodia**
- 1978 **Vietnam liberate Phnon Penh  
Phnon Penh Government  
**Civil war** between  
National Government of Cambodia and Phnon Penh Government**
- 1991 **Peace treaty was signed  
Khmer Rouge resumed guerrilla warfare**
- 1993 **First ever democratic election supervised by the UN PKO**

# Importance of fish as protein source

(kg)



Per capita annual consumption of animal protein resource(kg/indiv/year)  
In major fishing province and average non-fishing area



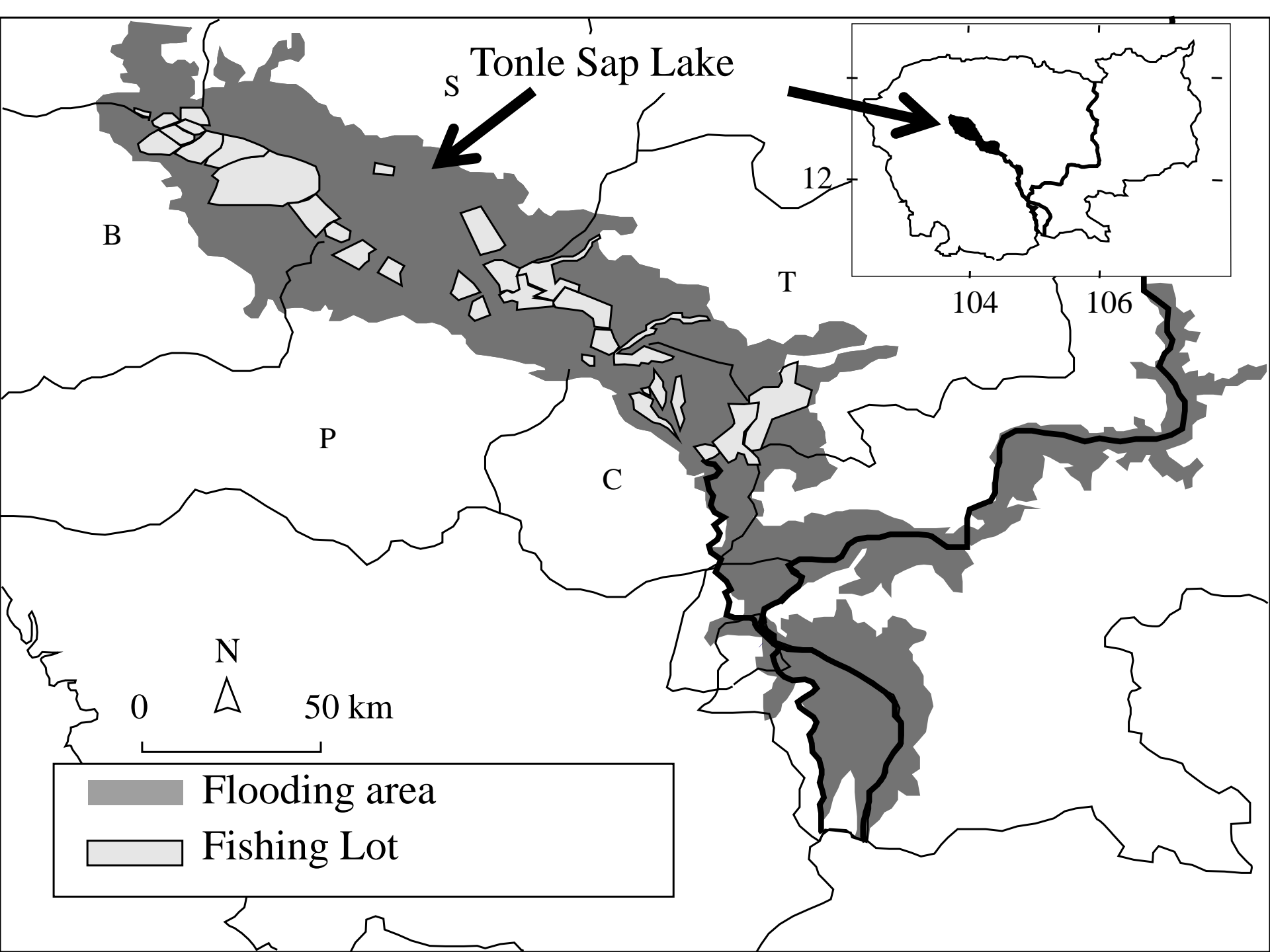
トンレサップ湖の最大水深とdaiの漁獲量

**Stock assessment is base for resource management**

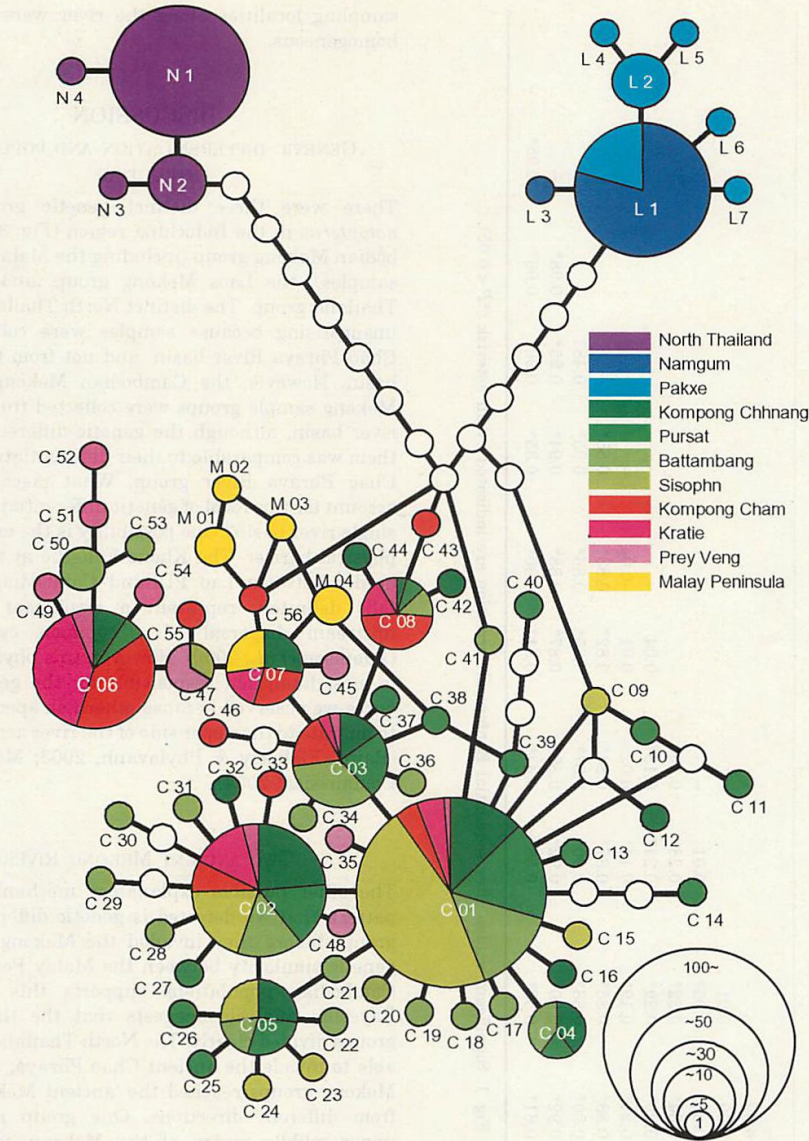
$$\text{Catch} = f(\text{Resource}, \text{Effort})$$

**(We need information of catch and effort for stock assessment)**

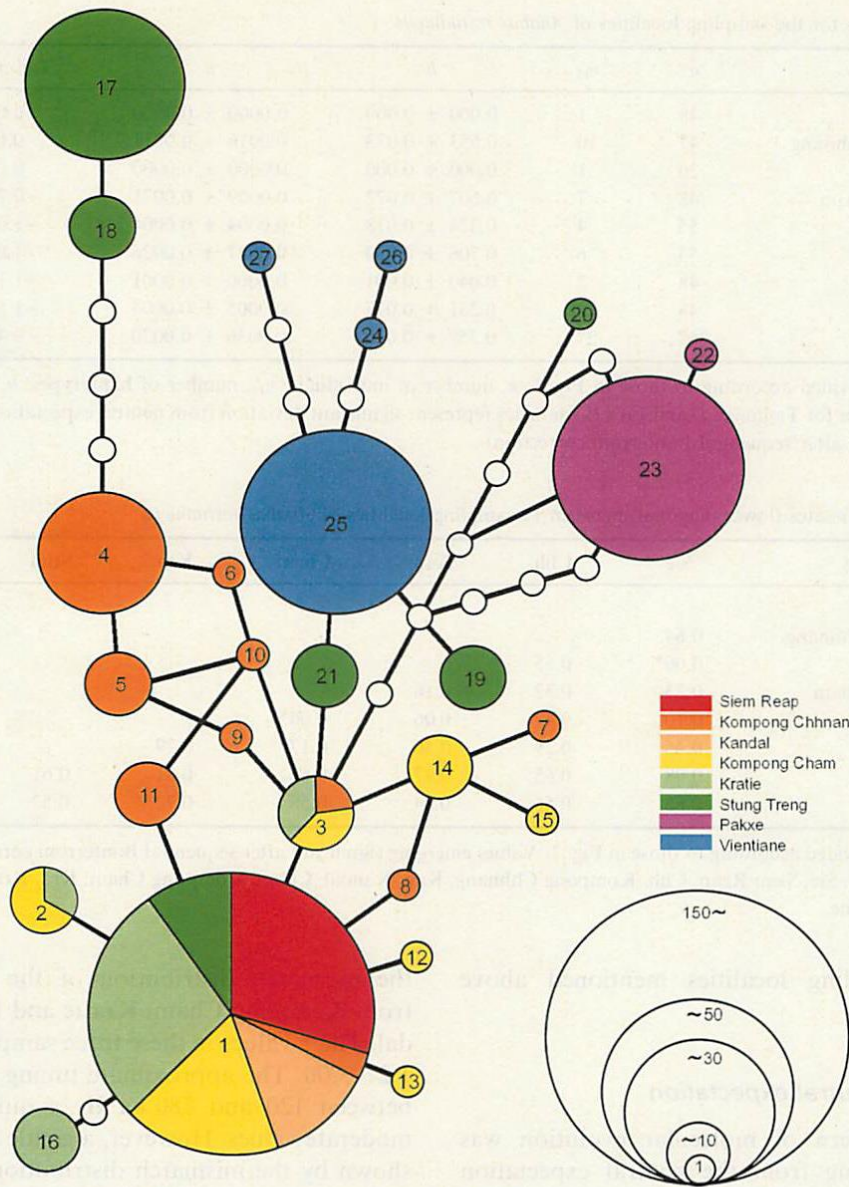
It is difficult to collect records of catch and effort by small scale fisheries.







**Figure 3.** *Notopterus notopterus*: Minimum spanning network of 71 mitochondrial DNA haplotypes. White circles indicate the number of site changes among haplotypes. Red and green circles represent the Cambodia group (Kompong Chhnang, Pursat, Battambang, Sisophon, Kompong Cham, Kratie, and Prey Veng), yellow circles represent the Malay Peninsula group, blue circles represent the Lao group (Namgum and Pakxe), and purple circles represent the North Thailand group.



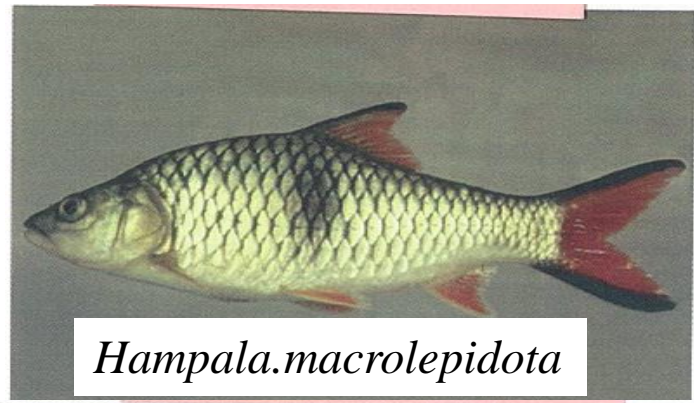
**Figure 3.** Minimum-spanning network of 27 mtDNA haplotypes of *Anabas testudineus*. Different haplotypes are represented by different coloured circles, with the size of the circle representing the number of samples. Single-base mutations are indicated by the solid line between circles. Hypothesised haplotypes absent in the sample are indicated by white circles.

Table 1. Local and scientific names of fish groups

| Khmer name                                                                                | Latin name                                  |
|-------------------------------------------------------------------------------------------|---------------------------------------------|
| Trey Chhipin                                                                              | <i>Barbodes gonionotus</i> ,                |
| Trey Chhdaur (Diep;juvenile)                                                              | <i>Channa micropeltes</i> ,                 |
| Trey Raws (Ptuok;juvenile)                                                                | <i>Channa striata</i> ,                     |
| Trey Pruol (Kralang: Juvenile)                                                            | <i>Cirrhinus microlepis</i> ,               |
| Trey Riel                                                                                 | <i>Cirrhinus</i> spp.                       |
| <i>(Ci. siamensis, other species in Cirrhinus and Henicorhynchus except C.microlepis)</i> |                                             |
| Trey Chhukok                                                                              | <i>Cyclocheilichthys enoplos</i> ,          |
| Trey Khmann                                                                               | <i>Hampala</i> spp.,                        |
|                                                                                           | <i>( H.dispar, H.macrolepidota)</i>         |
| Trey Krum                                                                                 | <i>Osteochilous melanopleurus</i> ,         |
| Trey Pra                                                                                  | <i>Pangasius</i> spp.                       |
|                                                                                           | <i>Pangasianodon hypophthalmus</i>          |
|                                                                                           | <i>(P.hypophthalmus, P.djambal, others)</i> |
| Trey Kamphleanh                                                                           | <i>Trichogaster microlepis</i>              |



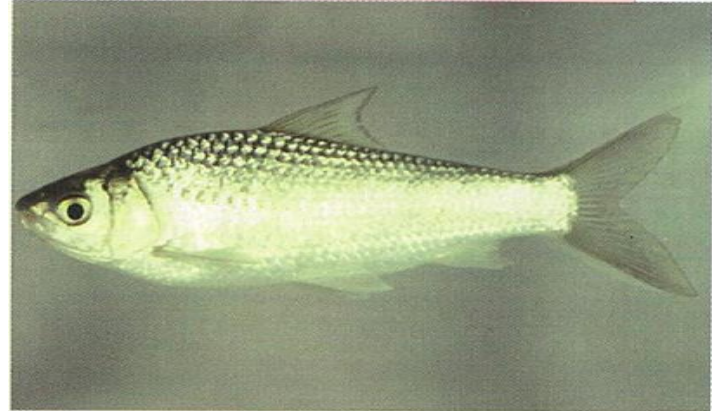
*Barbodes gonionotus,*



*Hampala macrolepidota*



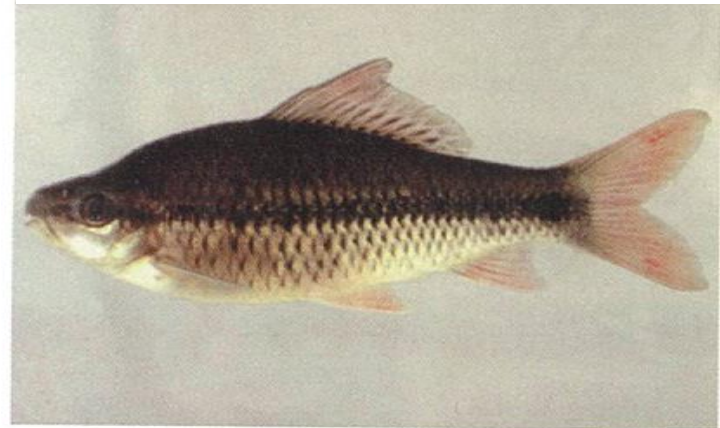
85. CYPRINIDAE: *Cirrhinus microlepis*



91. CYPRINIDAE: *Henicorhynchus siamensis*



54. CYPRINIDAE: *Cyclocheilichthys enoplos*



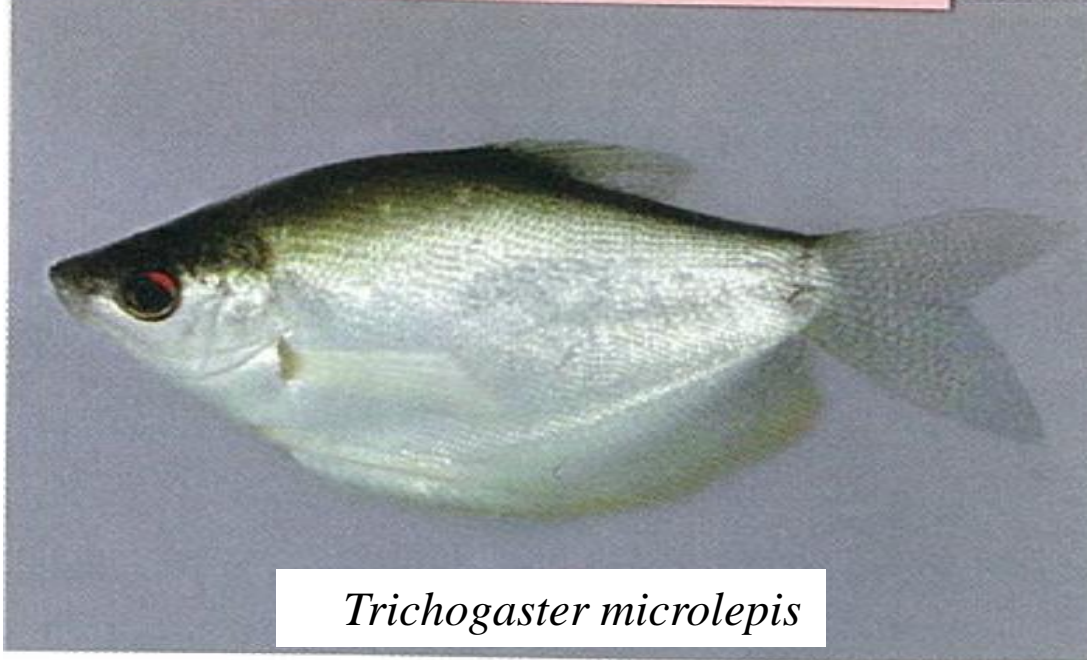
100. CYPRINIDAE: *Osteochilus microcephalus*



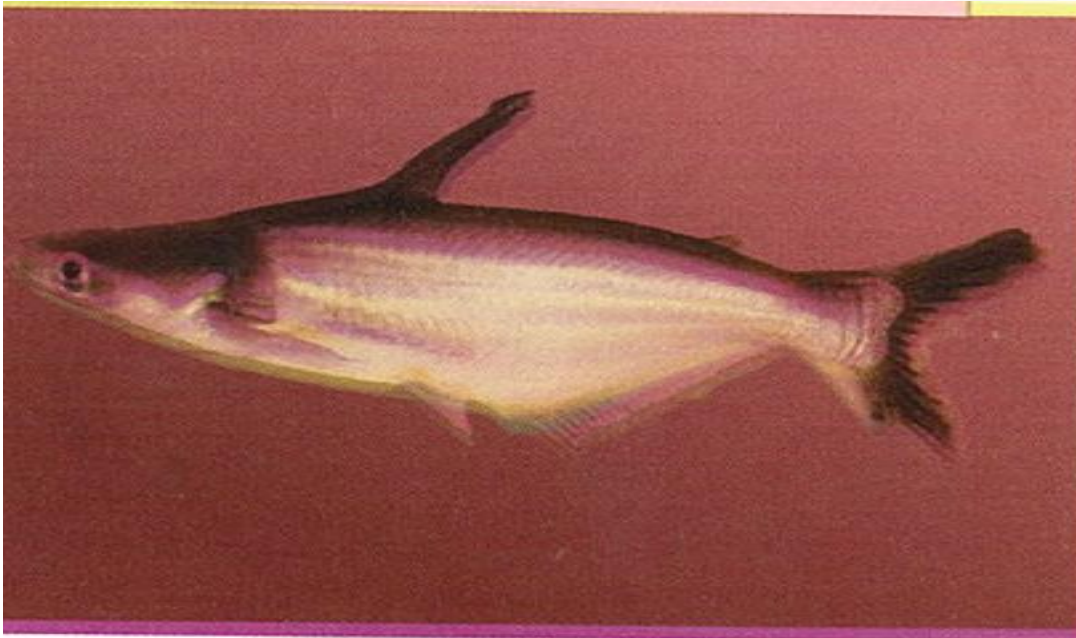
*Channa micropeltes,*



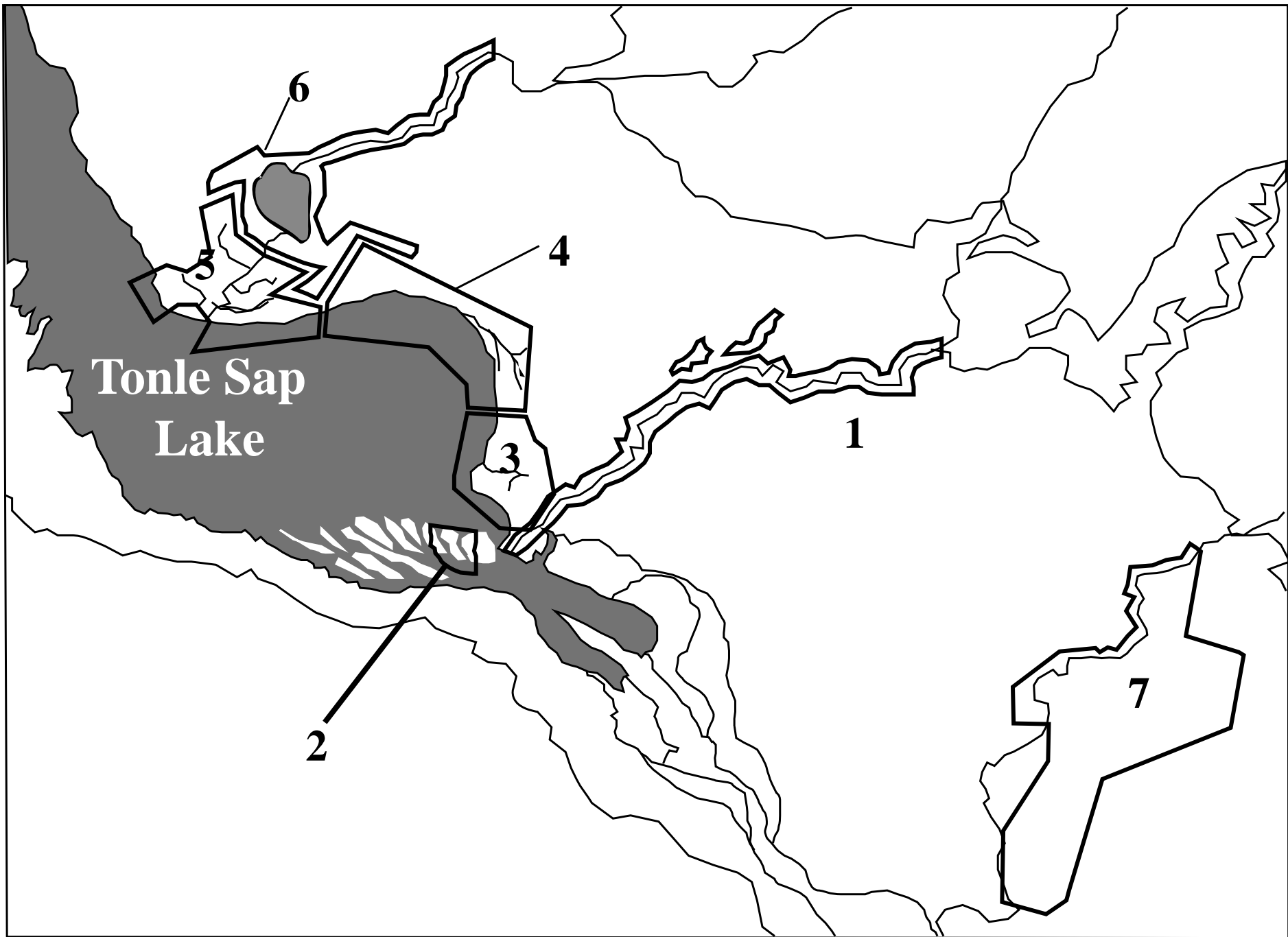
*Channa striata,*



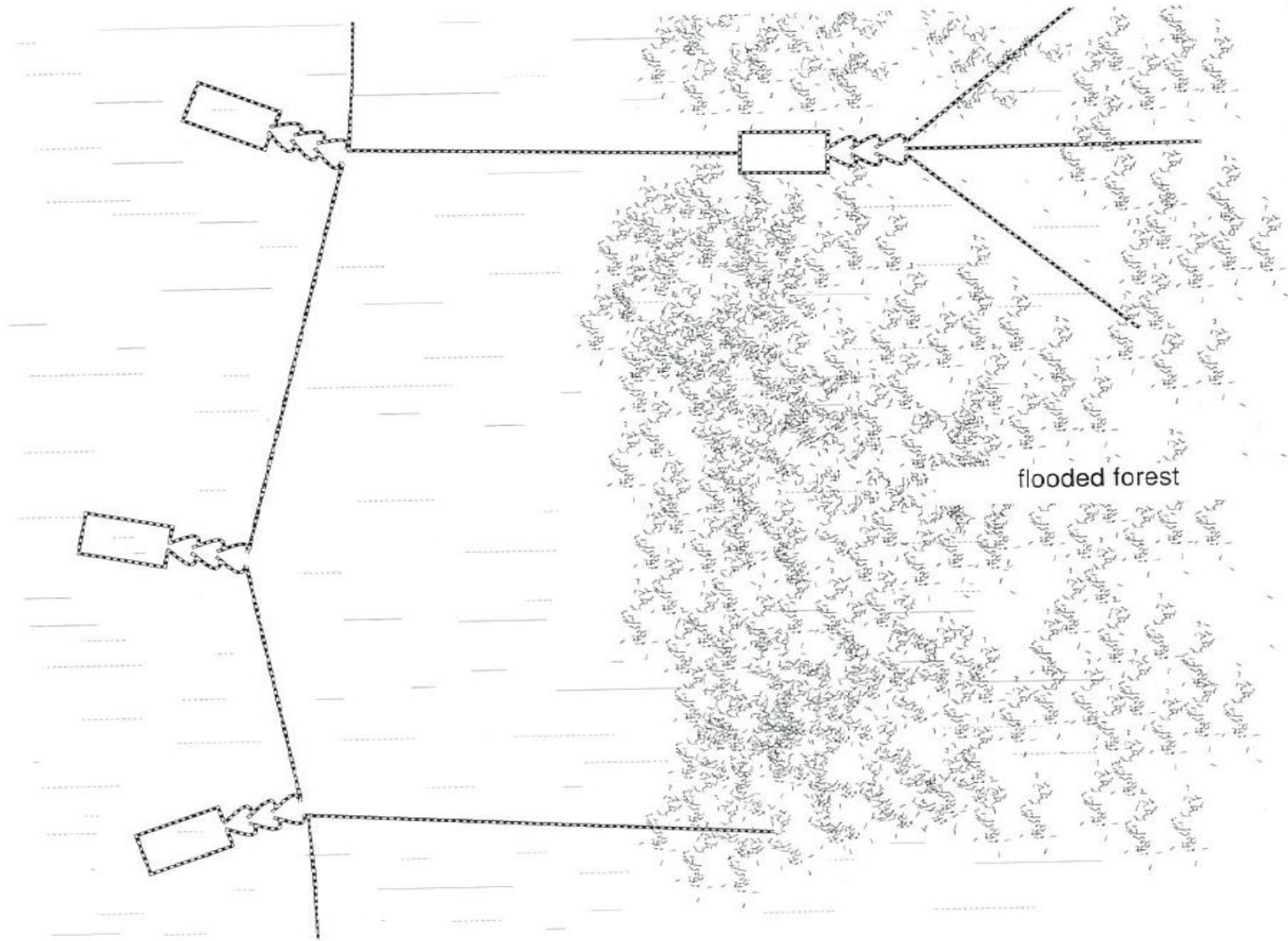
*Trichogaster microlepis*



60. PANGASIIDAE: *Pangasianodon hypophthalmus*



Schematic lay-out of a Great Lake fishing lot with fences, arrow-shaped trap systems and pens

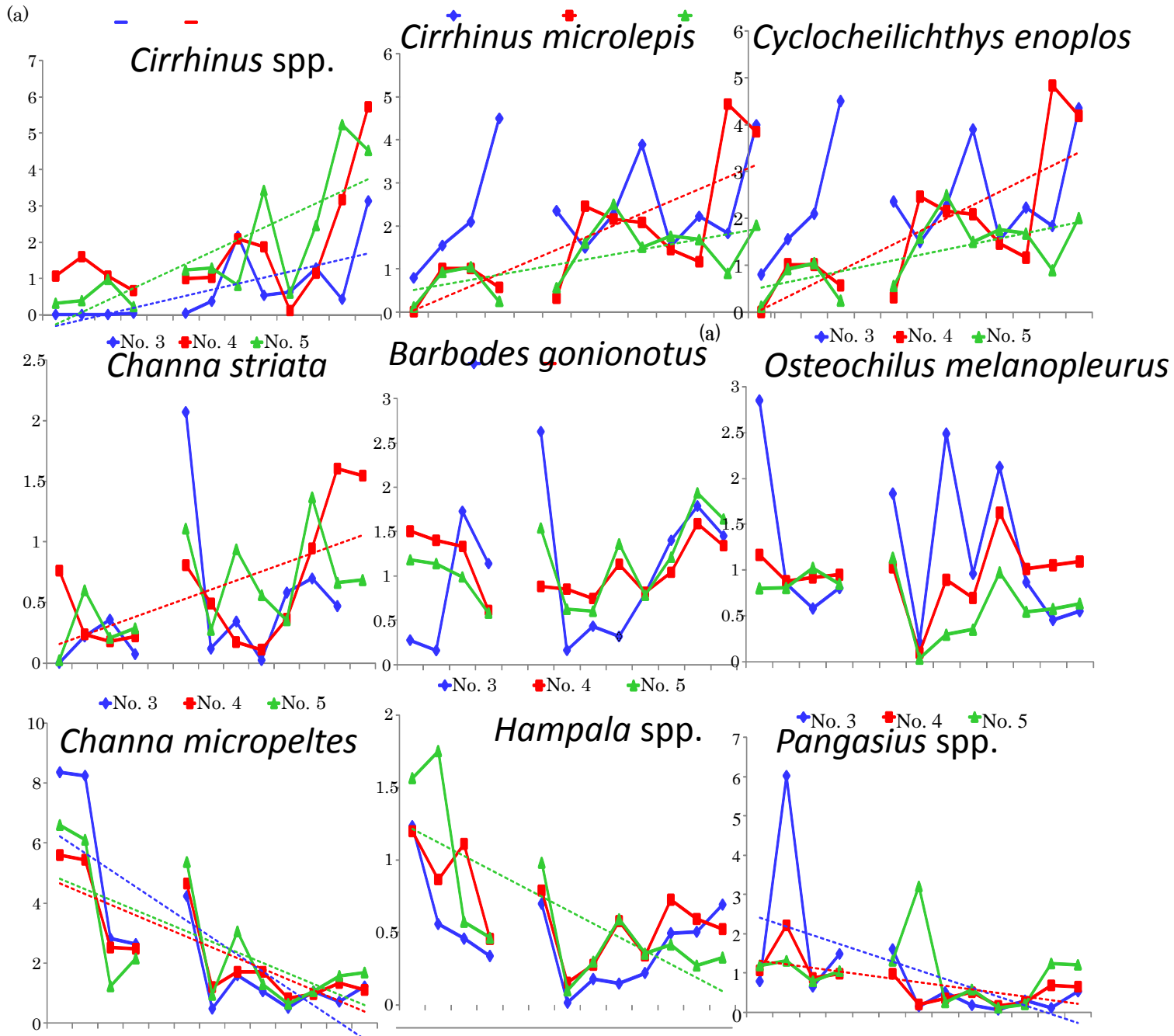




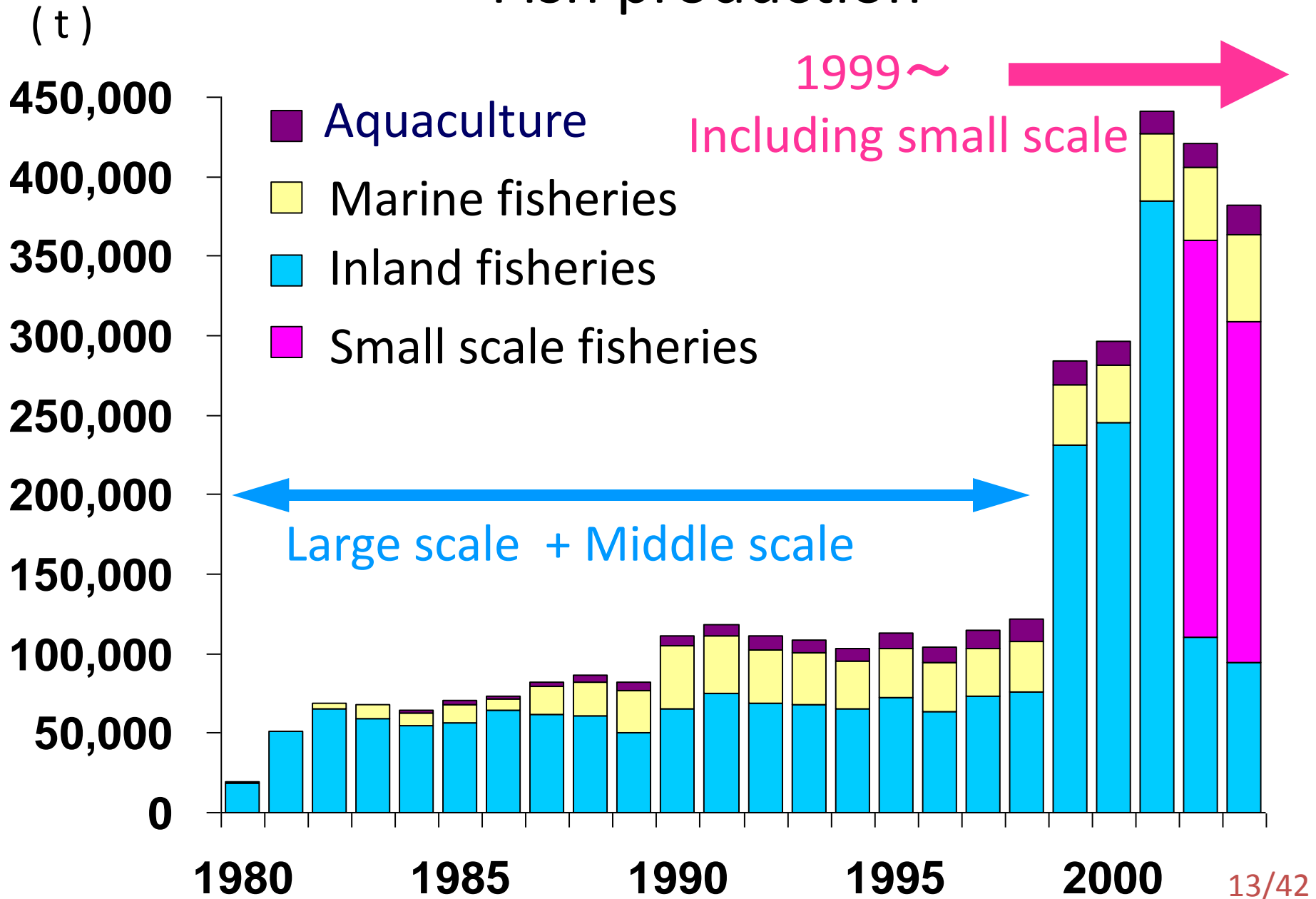
# River Barrage with U-shaped Bagnets

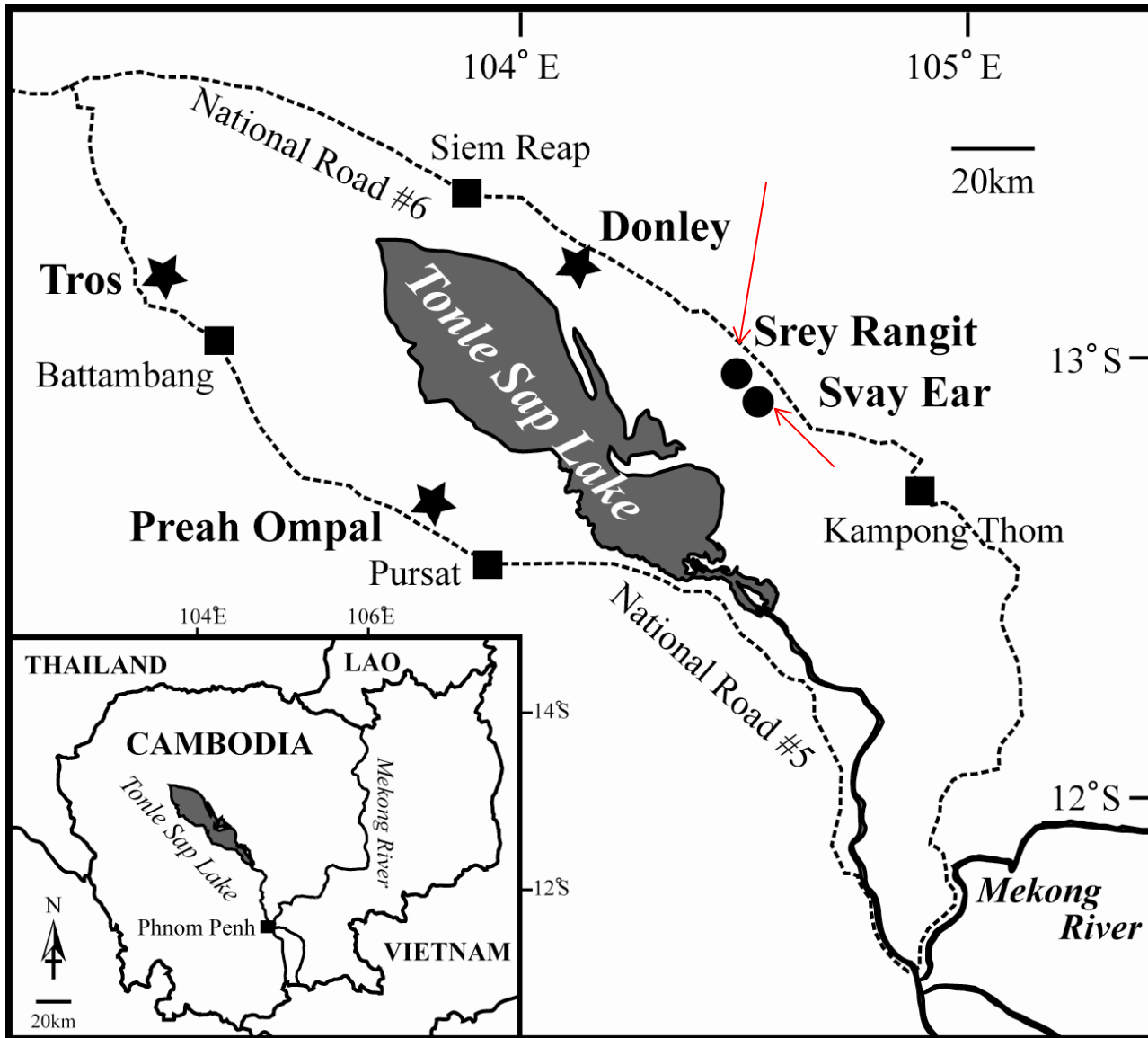


*Fishing Int No. 9 in Kamnong Chhnang Barrage with 3 weir sorting plat*



# Fish production





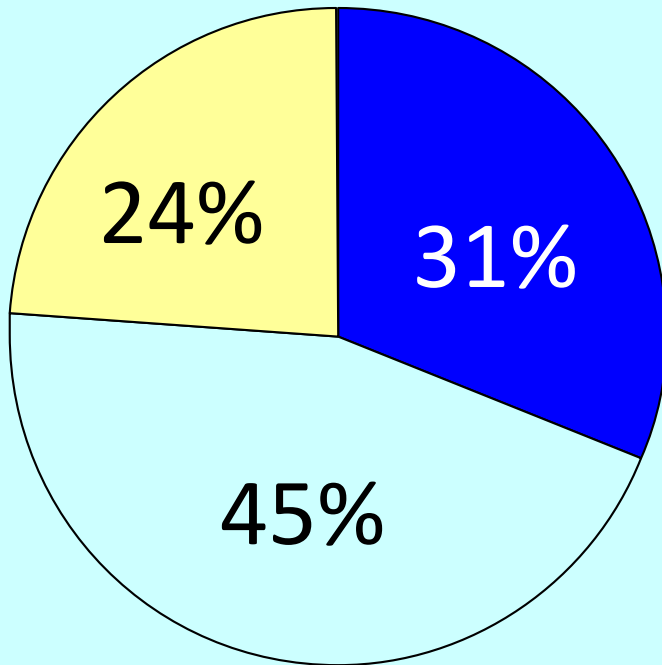
# Outline of the villages: population and household

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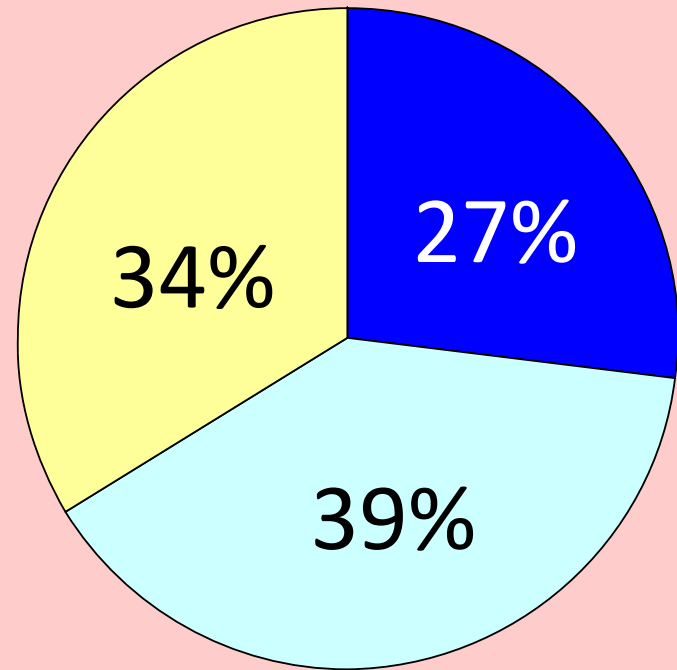
| <b>village</b>     | <b>popul<br/>ation</b> | <b>house<br/>hold</b> | <b>HH.<br/>Surveye<br/>d</b> | <b>Family size</b> |
|--------------------|------------------------|-----------------------|------------------------------|--------------------|
| <b>Svay Ear</b>    | <b>1140</b>            | <b>183</b>            | <b>106</b>                   | <b>6.4</b>         |
| <b>Srey Rangit</b> | <b>844</b>             | <b>140</b>            | <b>106</b>                   | <b>5.9</b>         |

# Fishing ground group(%)

## Svay Ear

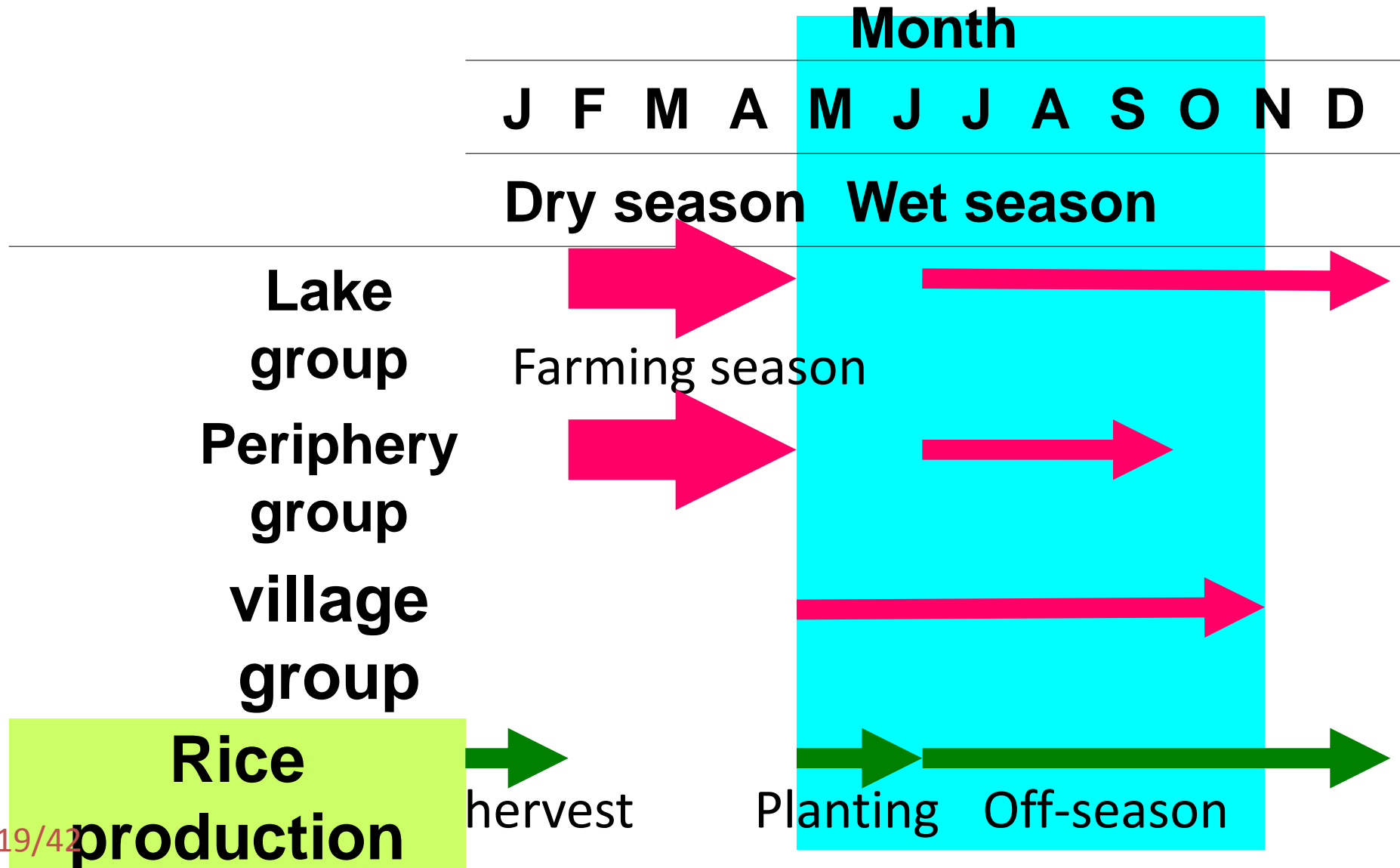


## Srey Rangit



- Tonle Sap lake: 30km far form village
- Periphery of the lake: > 5km form the village
- Periphery of the village: <5km from the village

# Production calendar



# Catch/ household/ year Ratio for sale

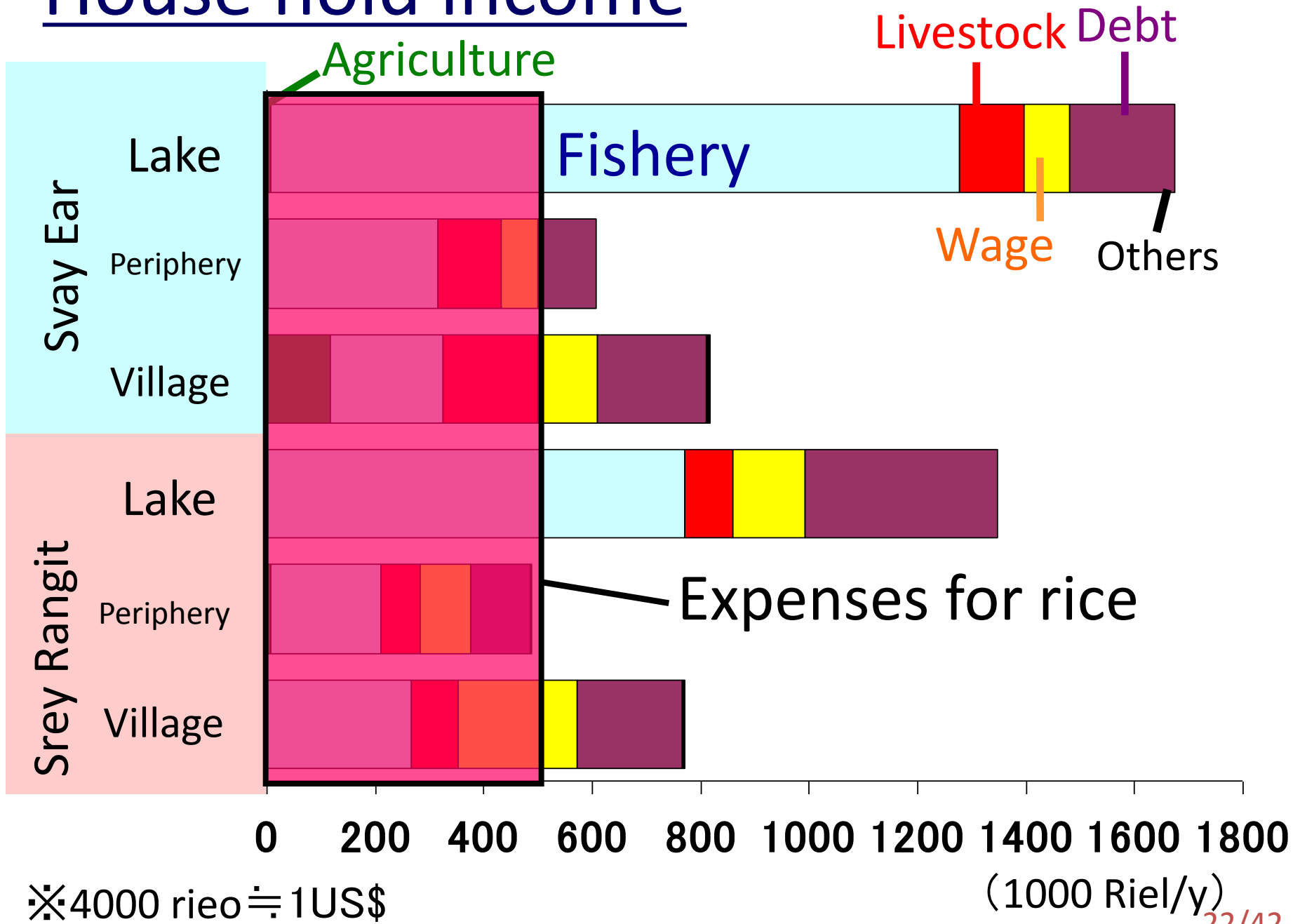
| <b>village</b>     | <b>fishing group</b> | <b>Catch (kg/yr)</b> | <b>% for sale)</b> |
|--------------------|----------------------|----------------------|--------------------|
|                    | <b>Lake</b>          | <b>701</b>           | <b>90.8</b>        |
| <b>Svay Ear</b>    | <b>Periphery</b>     | <b>270</b>           | <b>77.4</b>        |
|                    | <b>Village</b>       | <b>334</b>           | <b>31.6</b>        |
|                    | <b>Lake</b>          | <b>544</b>           | <b>89.1</b>        |
| <b>Srey Rangit</b> | <b>Periphery</b>     | <b>167</b>           | <b>67.7</b>        |
|                    | <b>Village</b>       | <b>260</b>           | <b>53.9</b>        |



# Rice production and shortage of rice

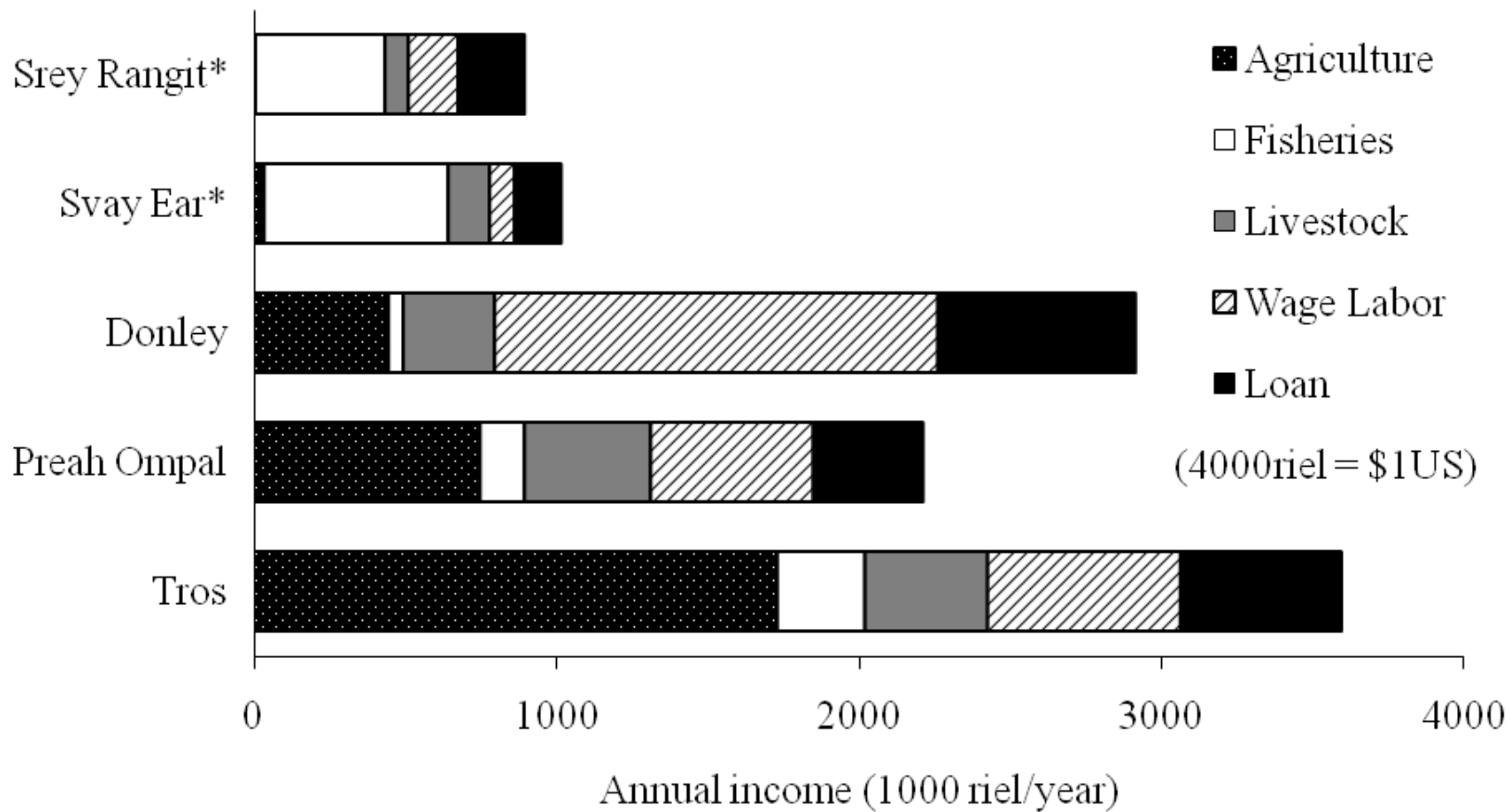
| <b>Village</b>     | <b>Fishery group</b> | <b>Production (kg/y)</b> | <b>consumption (kg/y)</b> | <b>Shortage (kg/y)</b> |
|--------------------|----------------------|--------------------------|---------------------------|------------------------|
| <b>Svay Ear</b>    | <b>Lake</b>          | <b>900</b>               | <b>1620</b>               | <b>516</b>             |
|                    | <b>Periphery</b>     | <b>721</b>               | <b>1216</b>               | <b>495</b>             |
|                    | <b>Village</b>       | <b>1069</b>              | <b>1234</b>               | <b>569</b>             |
| <b>Srey Rangit</b> | <b>Lake</b>          | <b>991</b>               | <b>1134</b>               | <b>463</b>             |
|                    | <b>Periphery</b>     | <b>577</b>               | <b>1108</b>               | <b>549</b>             |
|                    | <b>village</b>       | <b>677</b>               | <b>958</b>                | <b>391</b>             |

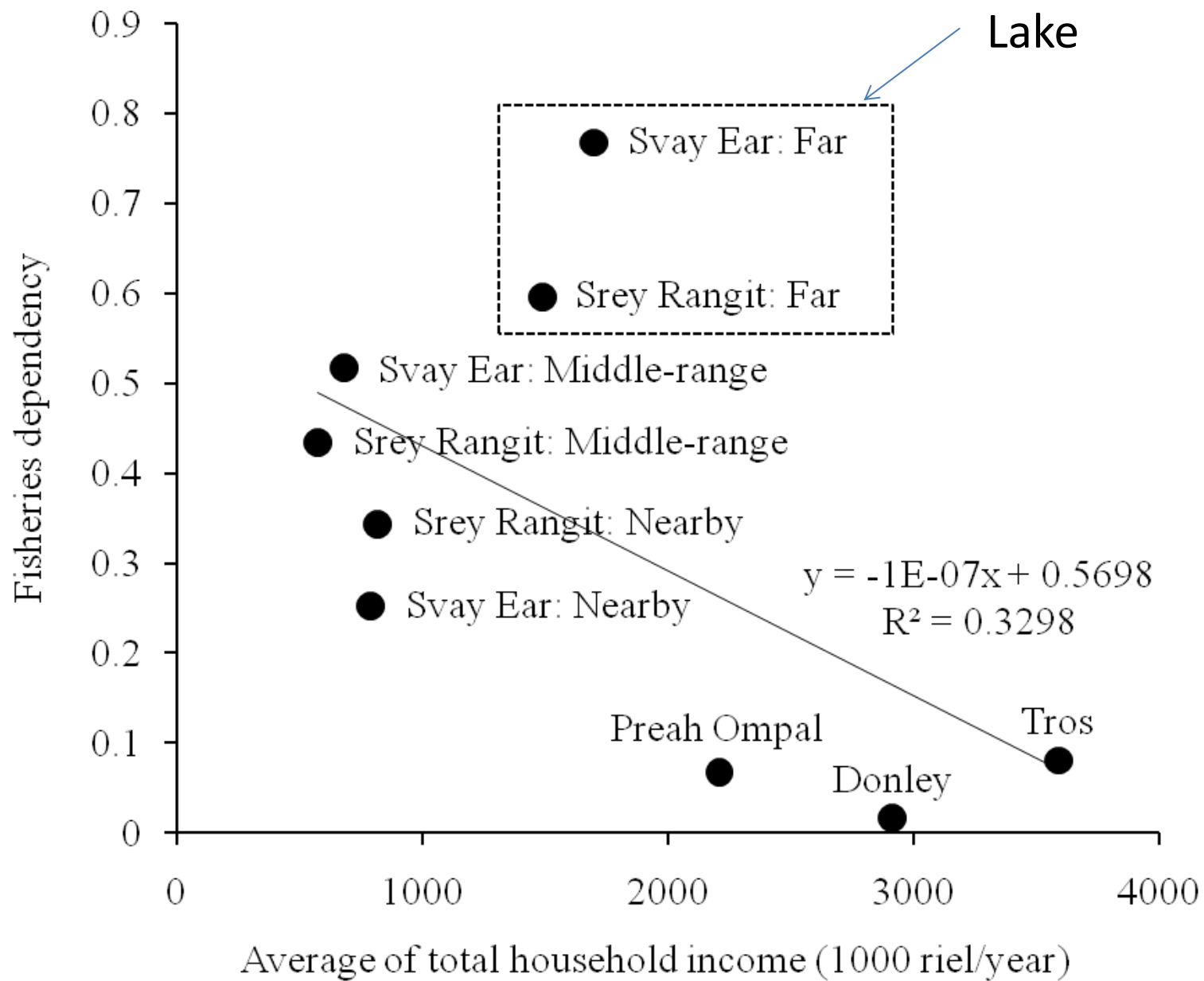
# House hold income

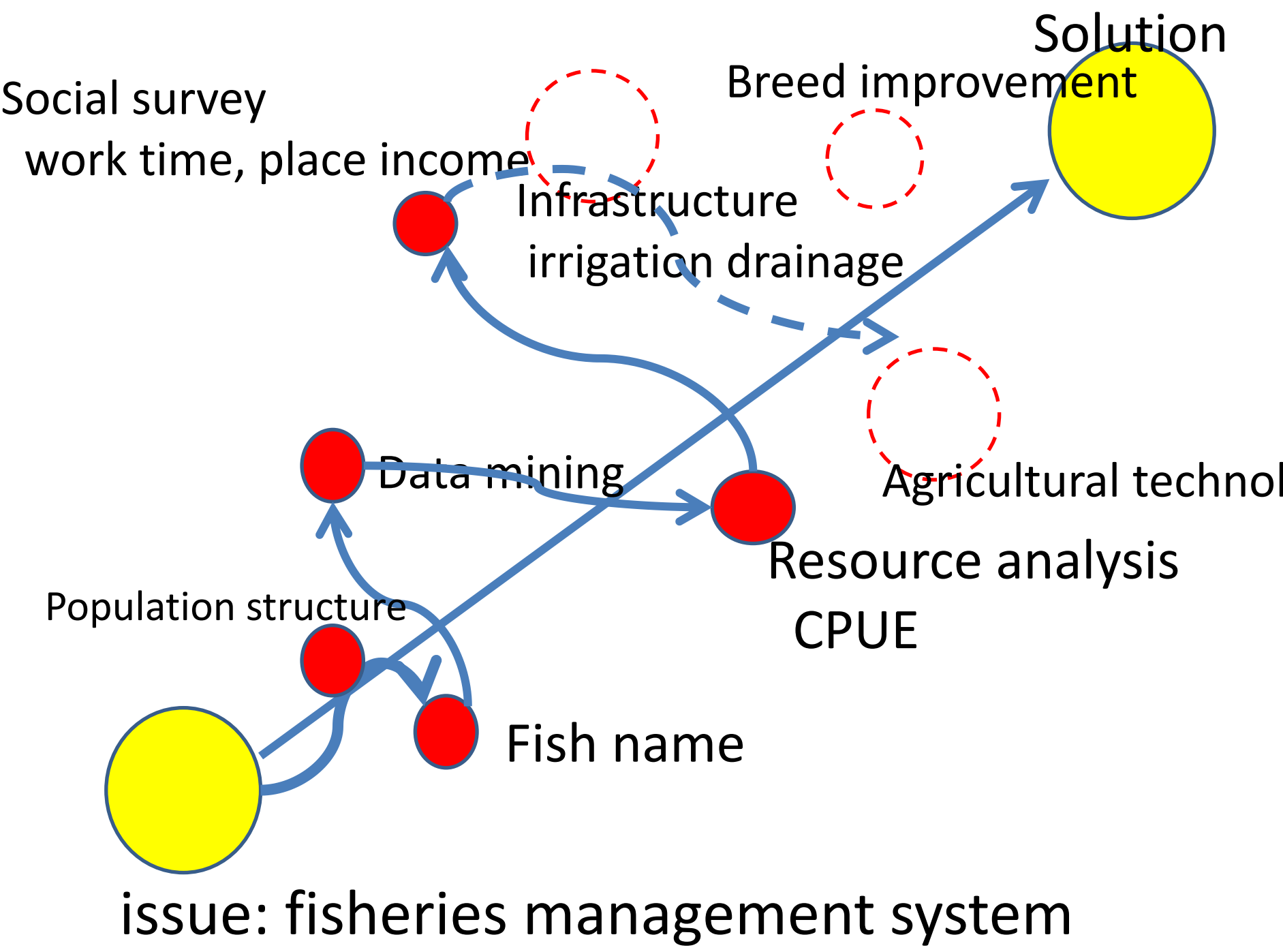


※4000 riel = 1US\$

(1000 Riel/y)

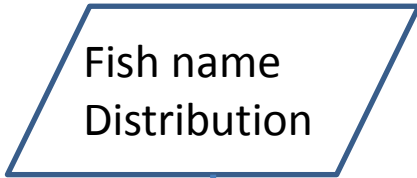




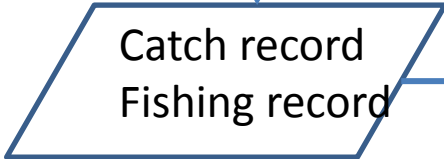


# Research flow chart

Ichthyology



Fisheries Sci

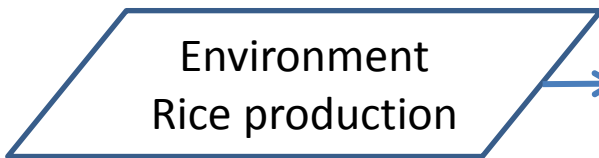


Hydrology



Causal  
analysis

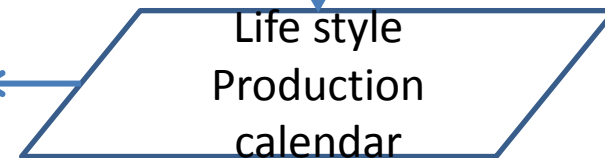
Agronomy  
Plant science



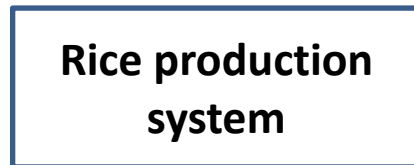
Econometrics



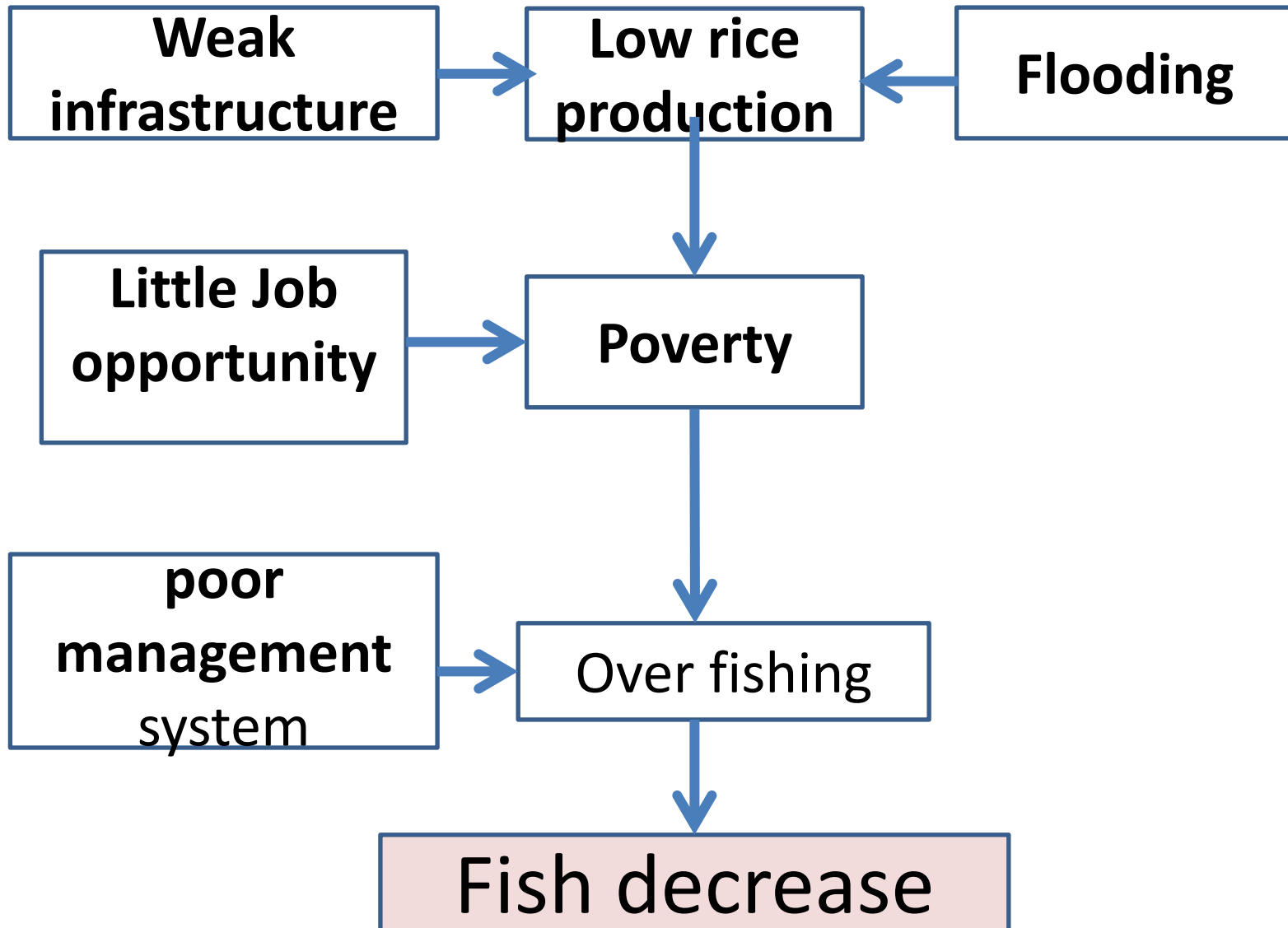
Sociology



Causal  
analysis



# Problem structure



## Development project ( Key: master plan)

### 1. Income increase

Agricultural production

Fish landing site, processing, Distribution

New Job (job training)

### 2 . Agricultural improvement

Selection of cultivar

Production calendar

### 3. Infrastructure

Drainage, Flood control

Transportation

### 4. Fisheries system

Co-management

Fishing law

Cooperative (right based management)



Master Plan

**Infrastructure**  
**Aquatic system**  
**Land improvement**

**Agriculture**  
**Technologies**  
**cultivar**

**Job opportunity**

**rice production**

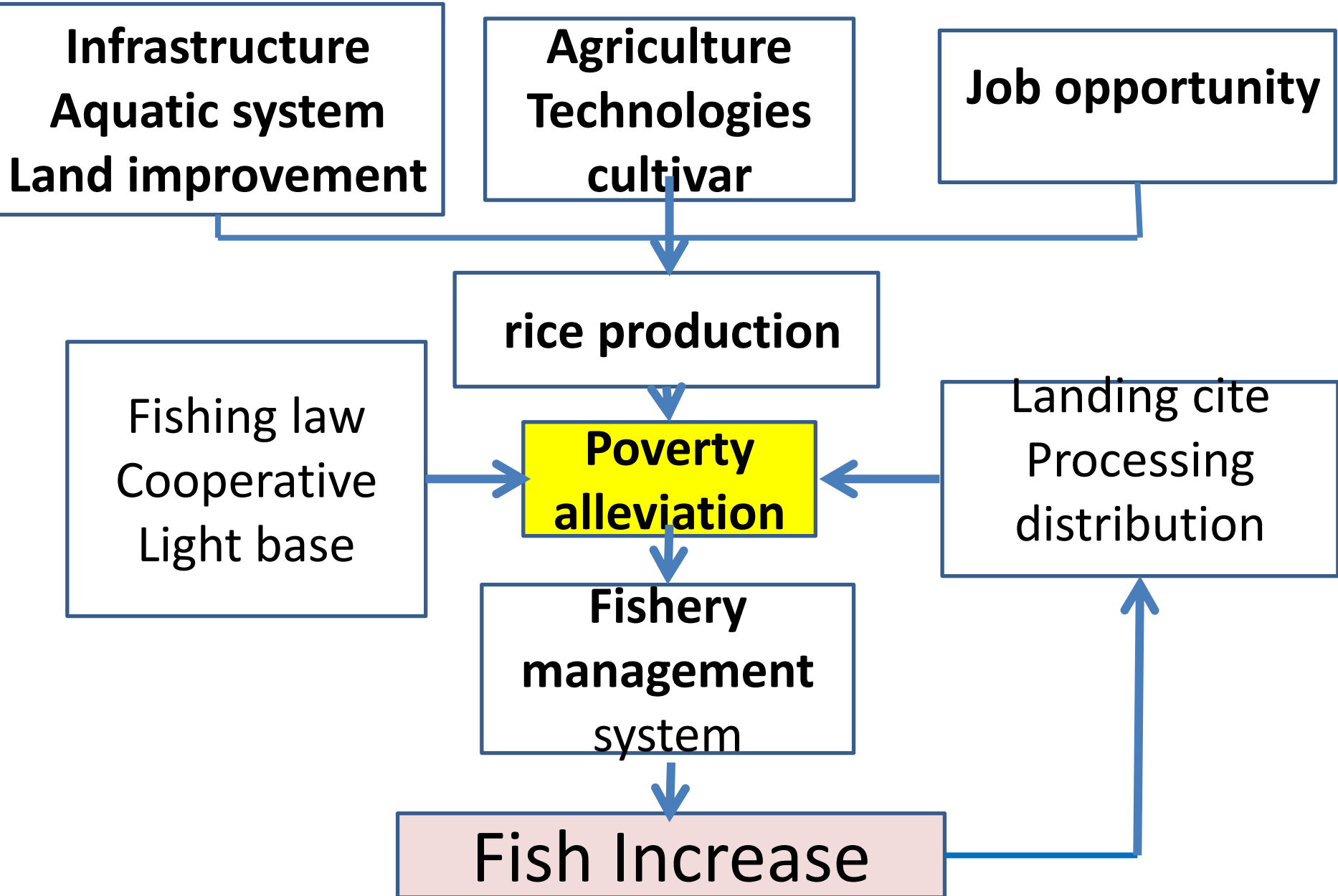
Fishing law  
Cooperative  
Light base

**Poverty  
alleviation**

Landing cite  
Processing  
distribution

**Fishery  
management  
system**

**Fish Increase**



## 2. exercise

case study

fisheries in Philippines

Small scale fisheries are

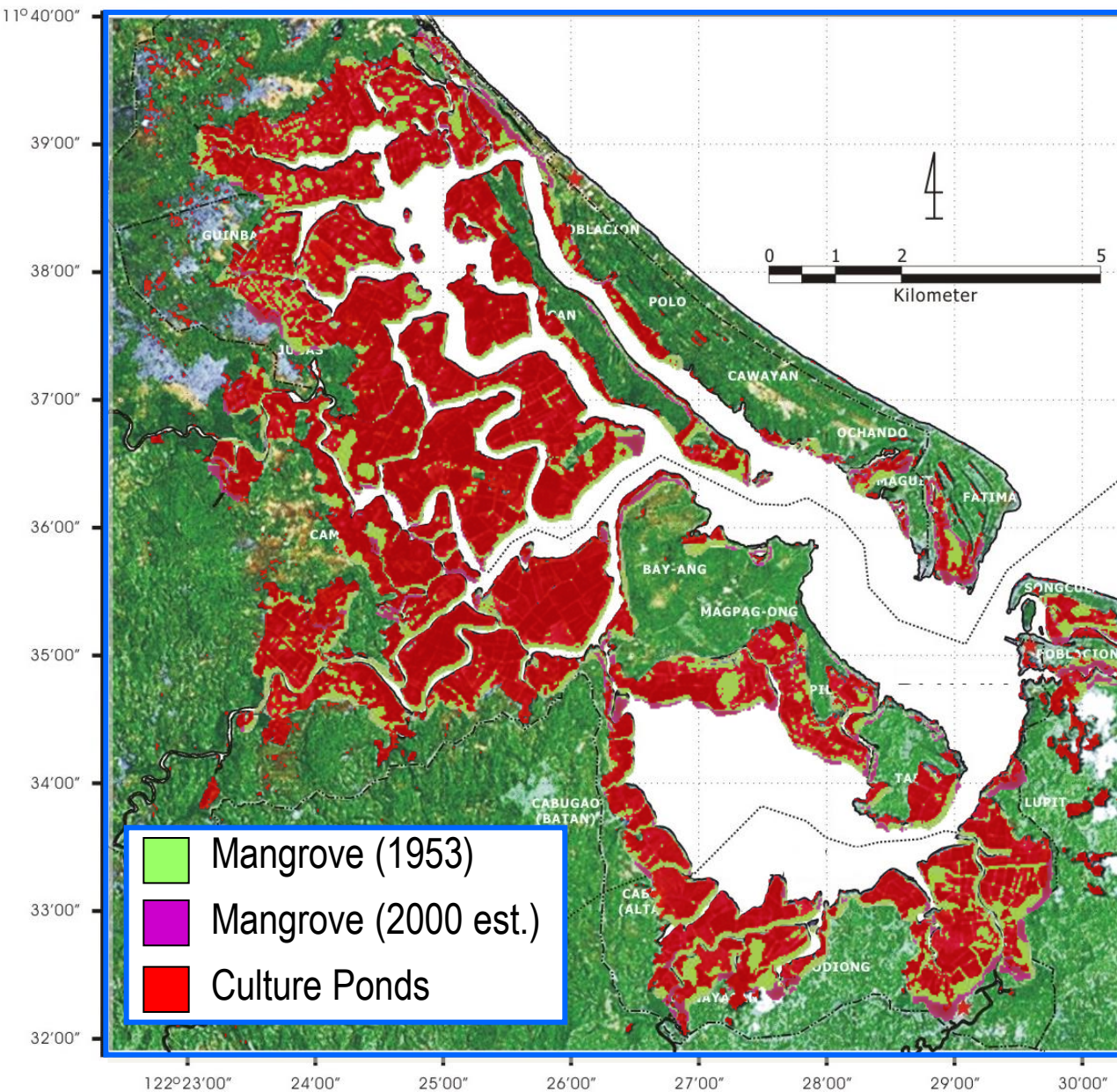
last resort for poverty farmer



Batan Bay, Aklan



# Batan Estuary Environment



## MANGROVES:

1953: **4,800 ha**

2000: **~300 ha**

## CULTURE PONDS:

1999: **4,597 ha**

(Babaran *et al.*, 2000)

# Batan Estuary Fisheries



**Set net**



**Lift net**



**Filter net**



**Oyster/mussel stakes**

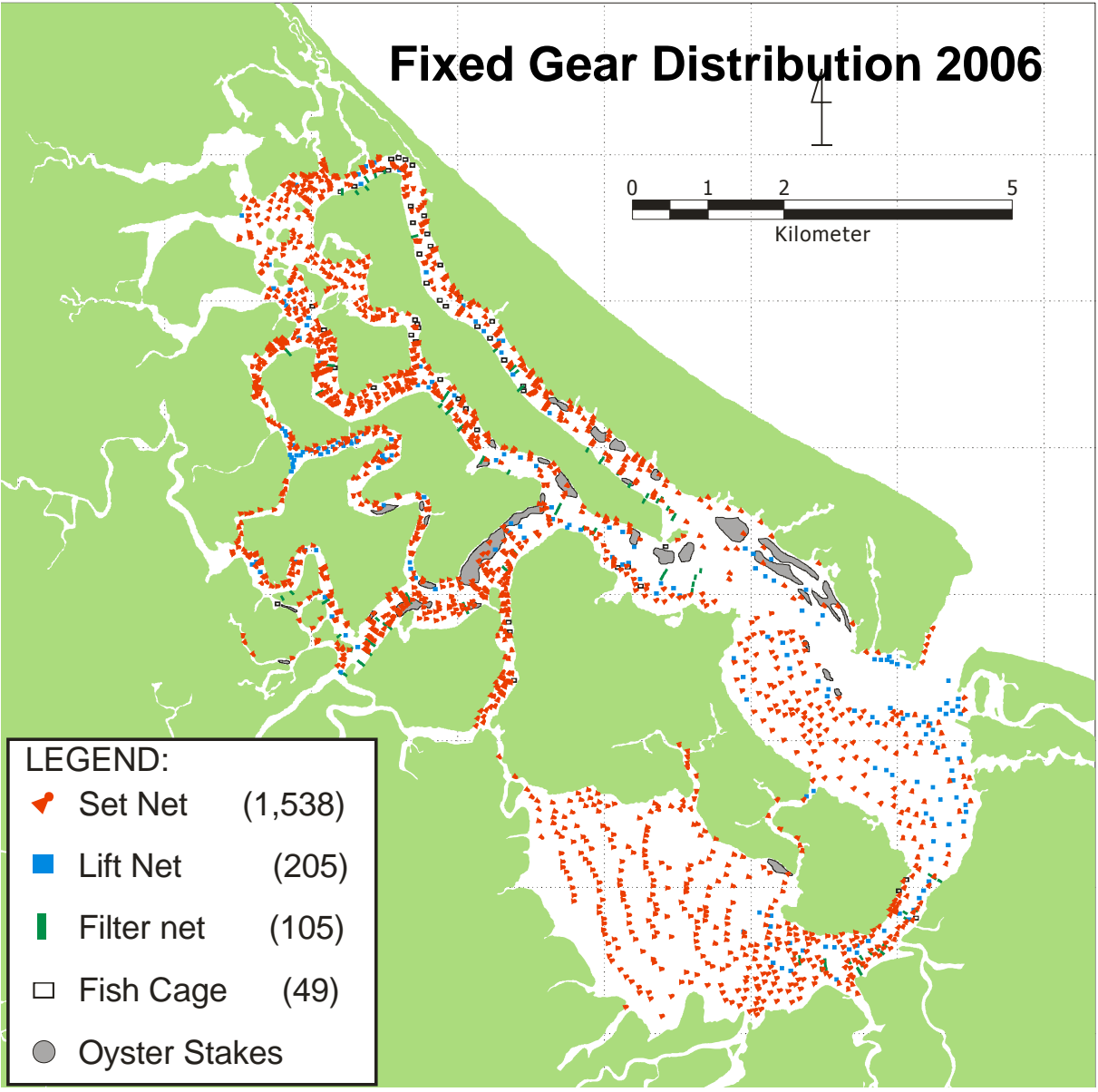


**Fish cage**



# Batan Estuary Fisheries

## Fixed Gear Distribution 2006



## G.P.S. SURVEY & MAPPING

|              | 1991*      | 2006                 |
|--------------|------------|----------------------|
| Cage         | nd         | 49                   |
| Filter net   | 53         | 105                  |
| Liftnet      | 59         | 205                  |
| Set-net      | 314        | <b>1538</b><br>(81%) |
| <b>Total</b> | <b>426</b> | <b>1897</b>          |

\* after Ingles *et al.*, 1992

**445% increase**

# Batan Estuary Fisheries

The **shrimp fisheries** in the Batan Estuary is the most **important livelihood...** (Ingles *et al.*, 1992).

## Important Shrimp Species in the Batan Estuary



**Tiger shrimp**  
*Penaeus monodon*  
(¥ 600/kg)



**Banana prawn**  
*Penaeus merguensis*  
(¥ 300/kg)



**Greasyback shrimp**  
*Metapenaeus ensis*  
(¥ 200/kg)



**Sergestids**  
*Acetes sp.*  
(¥ 150/kg)

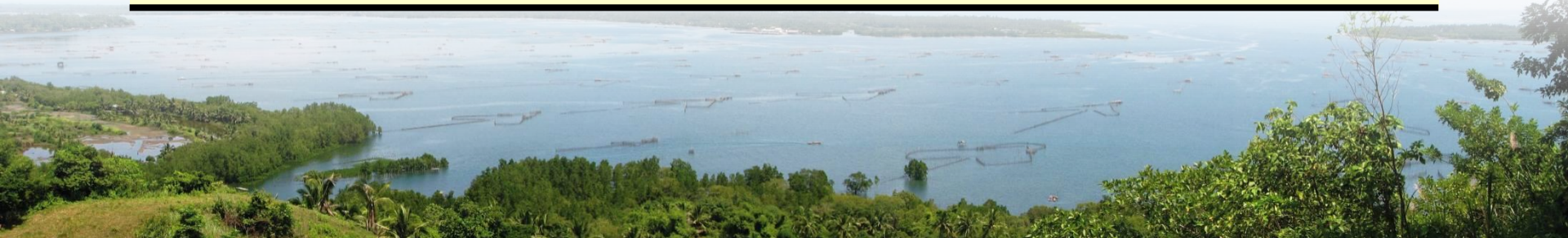




# Batan Estuary Fisheries

## Trend in CPUE of Set Nets in Batan Estuary

| Year        | CPUE (kg/gear/d) | Reference                    |
|-------------|------------------|------------------------------|
| 1970s       | 24               | this study (interview)       |
| 1980s       | 10               | this study (interview)       |
| 1991        | 7.66             | Ingles <i>et al.</i> , 1992  |
| 2000        | 5                | this study (interview)       |
| 2000        | 3.44             | Babaran <i>et al.</i> , 2000 |
| <b>2006</b> | <b>1.65</b>      | <b>this study</b>            |



The **shrimp fisheries** in the estuary is the most **important livelihood...** (Ingles *et al.*, 1992).

## Important Shrimp Species in the New Washington estuary



**Tiger shrimp**  
*Penaeus monodon*  
**Sugpo (PhP 300/kg)**



**Banana prawn**  
*Penaeus merguensis*  
**Pasayan/Puti-an (PhP150/kg)**

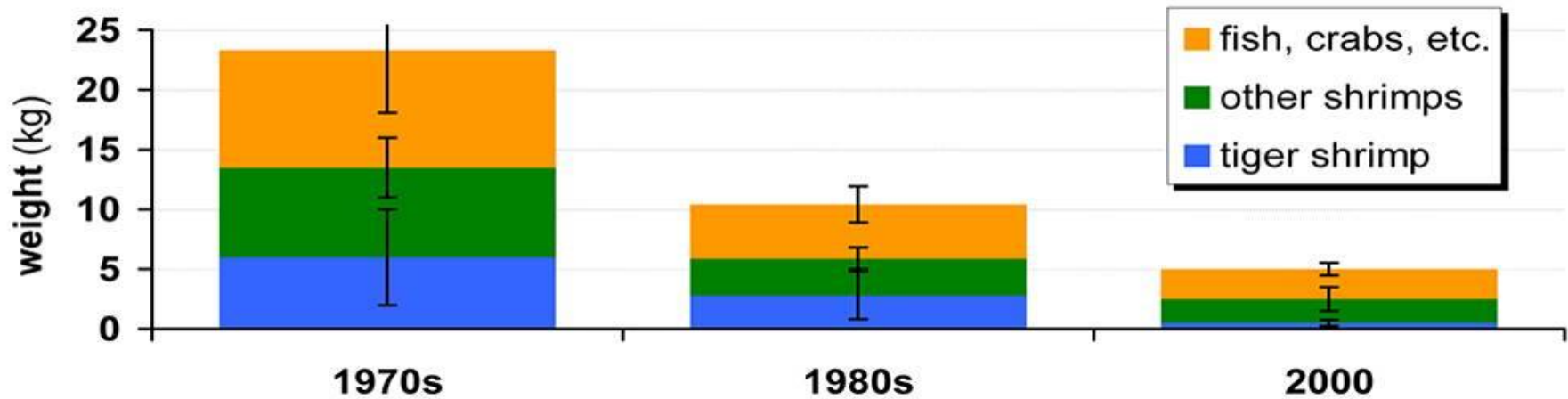


**Greasyback shrimp**  
*Metapenaeus ensis*  
**Batud (PhP70/kg)**



**Sergestids**  
*Acetes sp.*  
**Hipon (PhP80/kg)**

## Average daily catch (kg/gear/d), n=105 (interview survey)



**Tiger shrimp**

*Penaeus monodon*

Sugpo (P 300/kg)

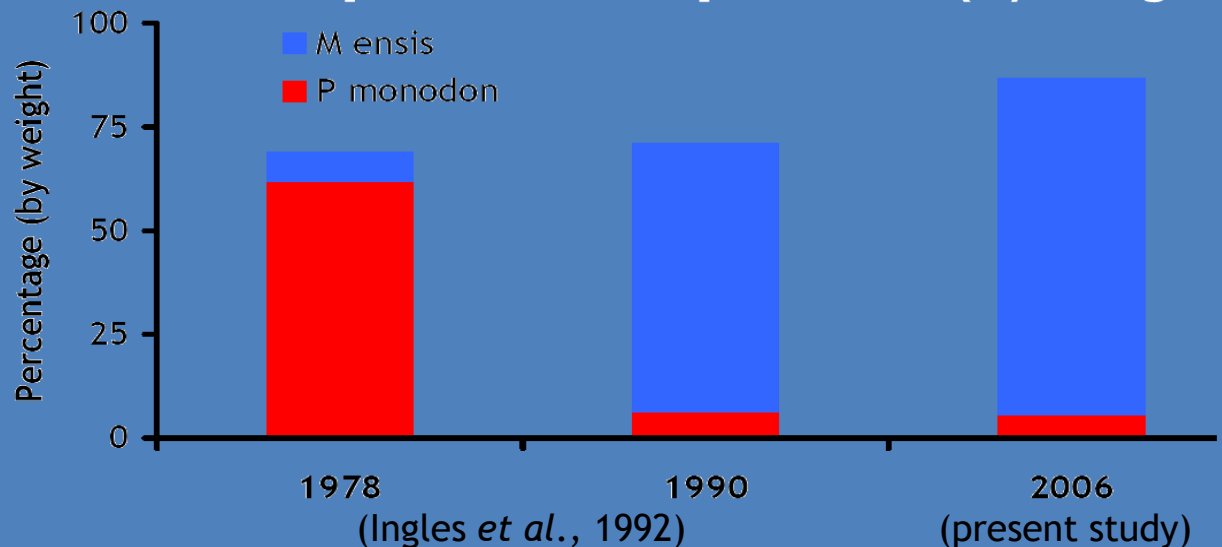


**Greasyback shrimp**

*Metapenaeus ensis*

Batud (P 100/kg)

## Shrimp catch composition (by weight)

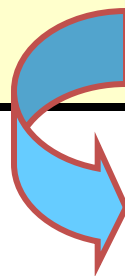


Average catch composition from *tigbakol* in New Washington Estuary from January-July 2013 (7 mo)

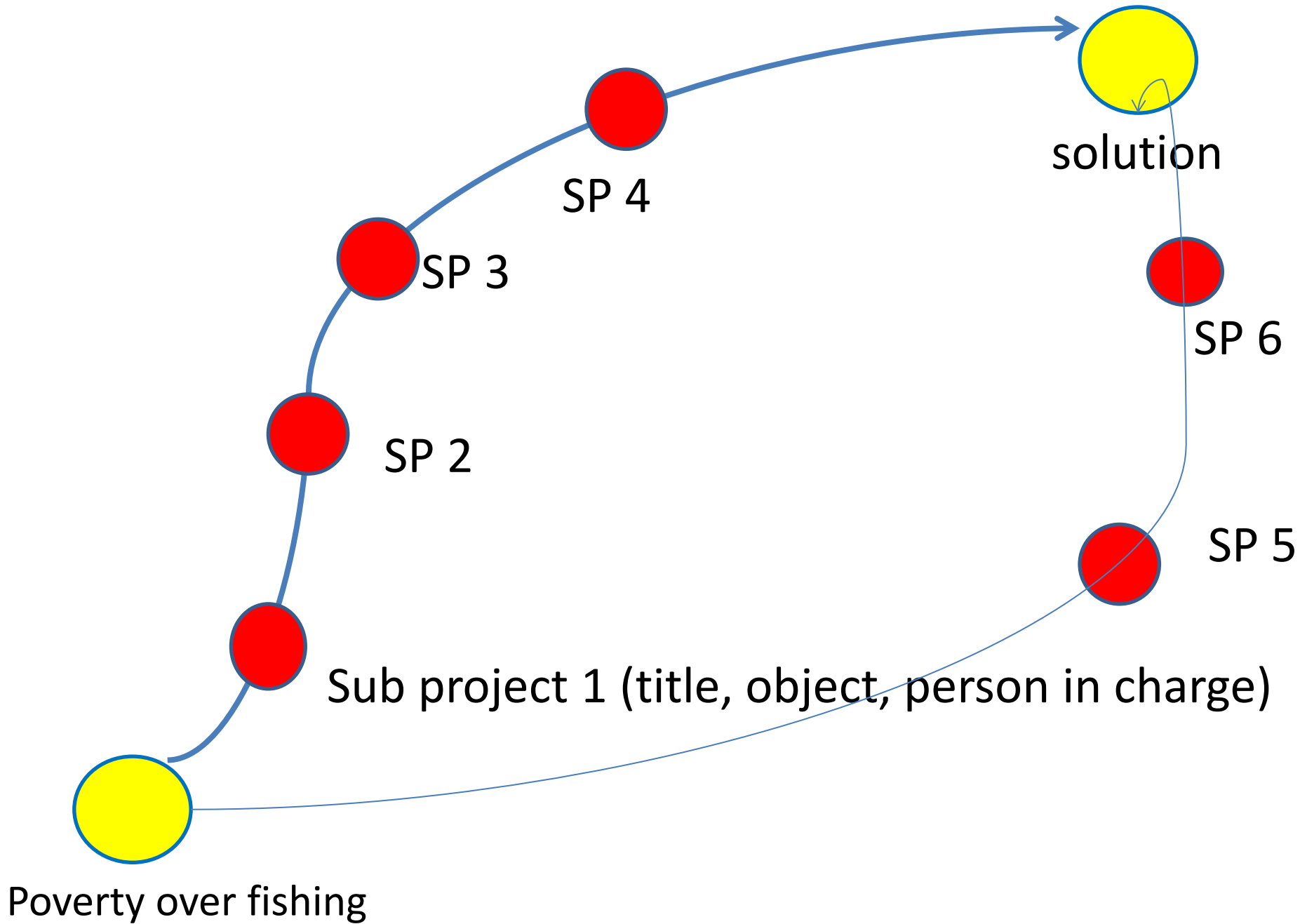
|                      | Frequency<br>(individuals) | Dominance<br>(% weight) |
|----------------------|----------------------------|-------------------------|
| Fish                 | 58%                        | 55%                     |
| Crabs                | 17%                        | 32%                     |
| <i>M. ensis</i>      | 14%                        | 6%                      |
| <i>M. merguensis</i> | 9%                         | 6%                      |
| <i>Acetes</i> sp.    | 2%                         | 0%                      |
| <i>P. monodon</i>    | 0.2%                       | 0.6%                    |
|                      | (4 pcs, 73g total)         |                         |

## Trend in CPUE of *tigbakol* in NW Estuary

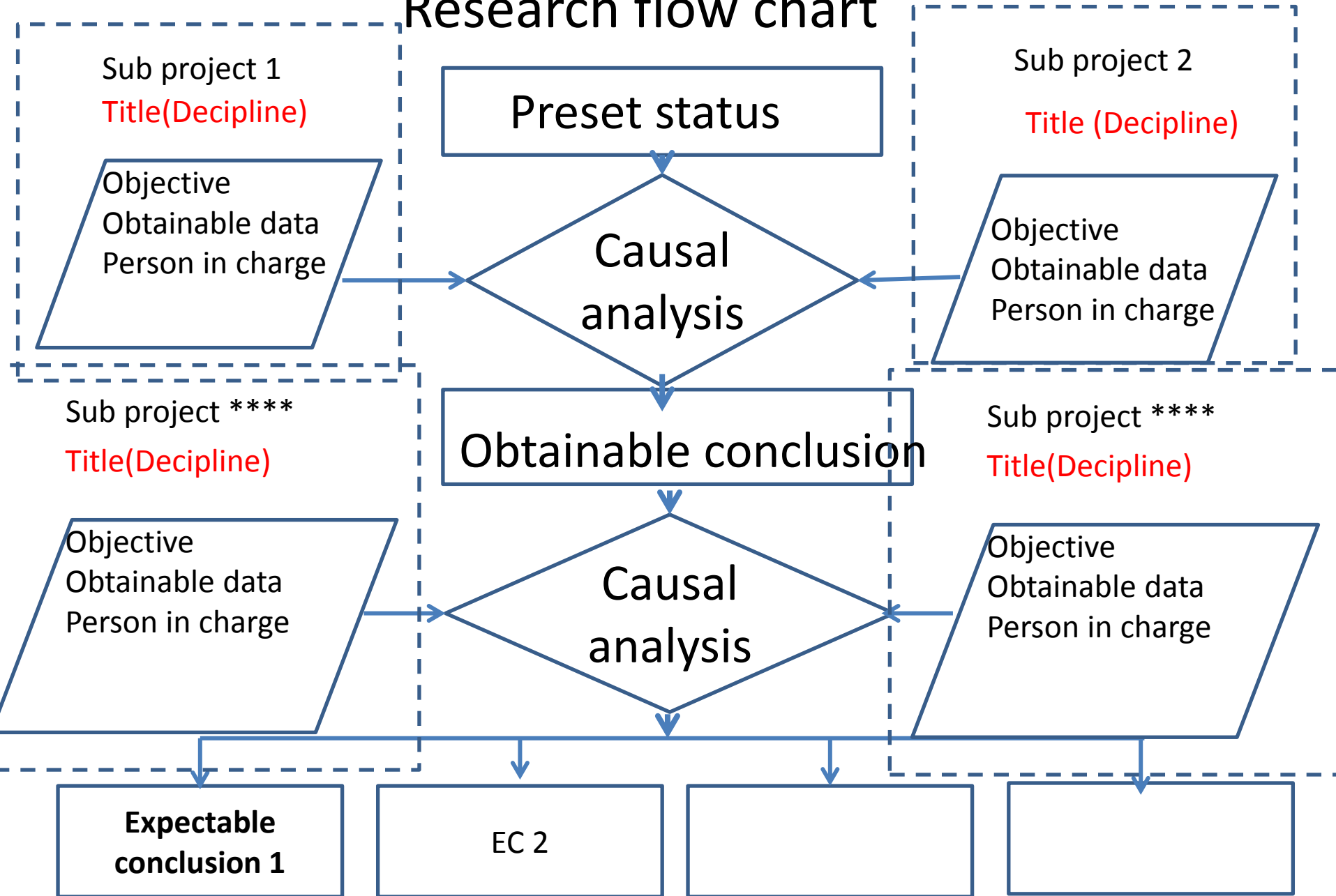
| Year        | CPUE (kg/gear/d) | Reference                    |
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| 1970s       | 24               | this study (interview)       |
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| 1991        | 7.66             | Ingles <i>et al.</i> , 1992  |
| 2000        | 5                | this study (interview)       |
| 2000        | 3.44             | Babaran <i>et al.</i> , 2000 |
| 2006        | 1.65             | Altamirano, 2010             |
| <b>2013</b> | <b>0.73</b>      | <b>actual catch data</b>     |



**Total Sales: US\$2/day**



# Research flow chart



Master Plan

**Infrastructure**  
**Aquatic system**  
**Land improvement**

**Agriculture**  
**Technologies**  
**cultivar**

**Job opportunity**

**rice production**

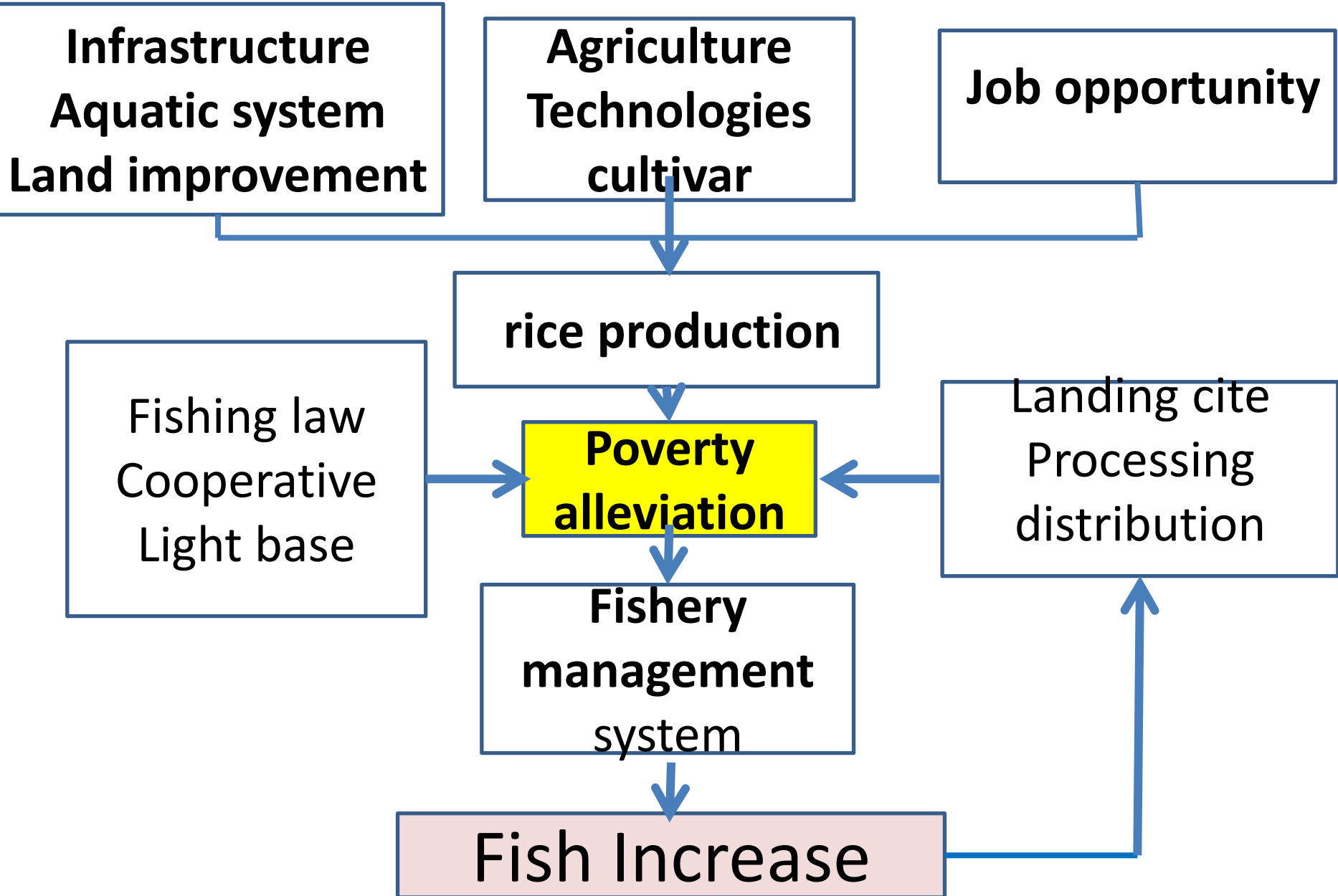
Fishing law  
Cooperative  
Light base

**Poverty  
alleviation**

Landing cite  
Processing  
distribution

**Fishery  
management  
system**

**Fish Increase**





One person should have at least one subproject

Clarify the objectives

If necessary talent for necessary subproject ,  
you can invite other students or professors

i