

**Influence of salinity on the survival of
Bithynia siamensis goniomphalos, first intermediate
host of liver fluke, *Opisthorchis viverrini***

Speaker : Supawadee Piratae

Department of Parasitology, Faculty of Medicine, KKU.

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Content

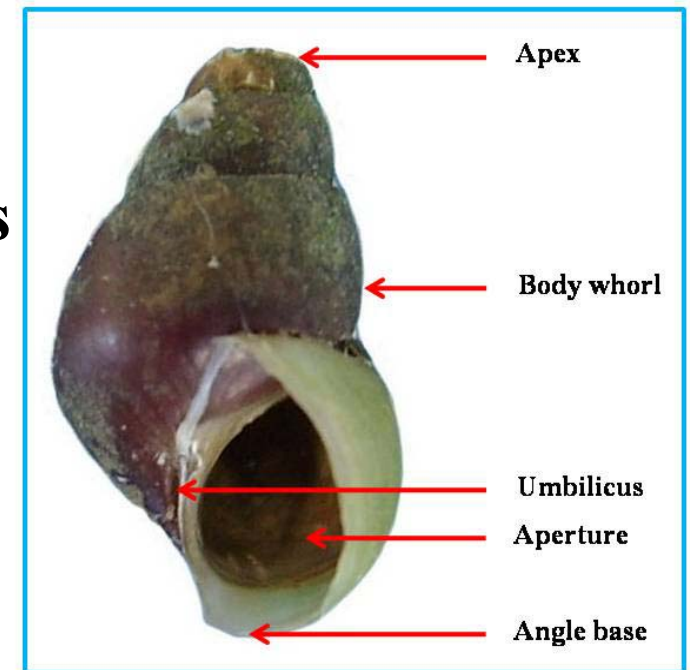
- **Background & rationale of the study**
- **Objectives**
- **Methods**
- **Results**
- **Discussion & Conclusion**



Background & rationale of the study

Bithynia siamensis goniomphalos

- **Shell: conic or ovate-conoidal, smooth, brownish or yellow brown color, without color band**
- **Apex: eroded**
- **Operculum: concentric with spiral nucleus**
- **Size: length and width, 10.2-14.9 mm and 5.6-8.5 mm**
- **Distribution: northeastern of Thailand**
- **Parasitology: first intermediate host of human liver fluke,**

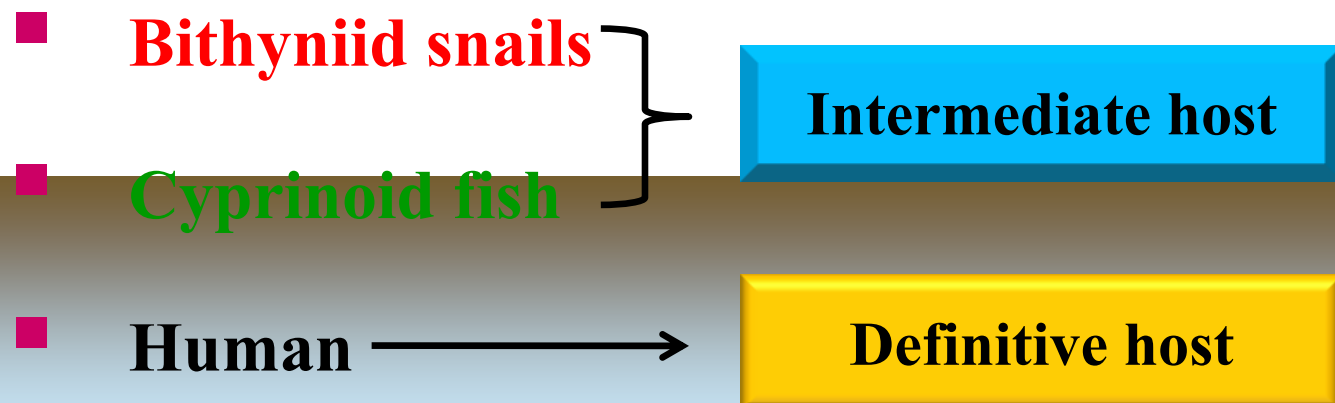


Opisthorchis viverrini

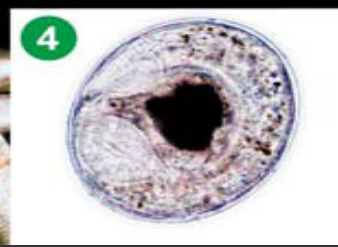
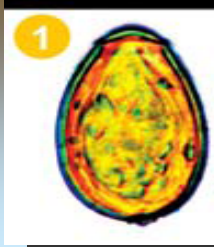
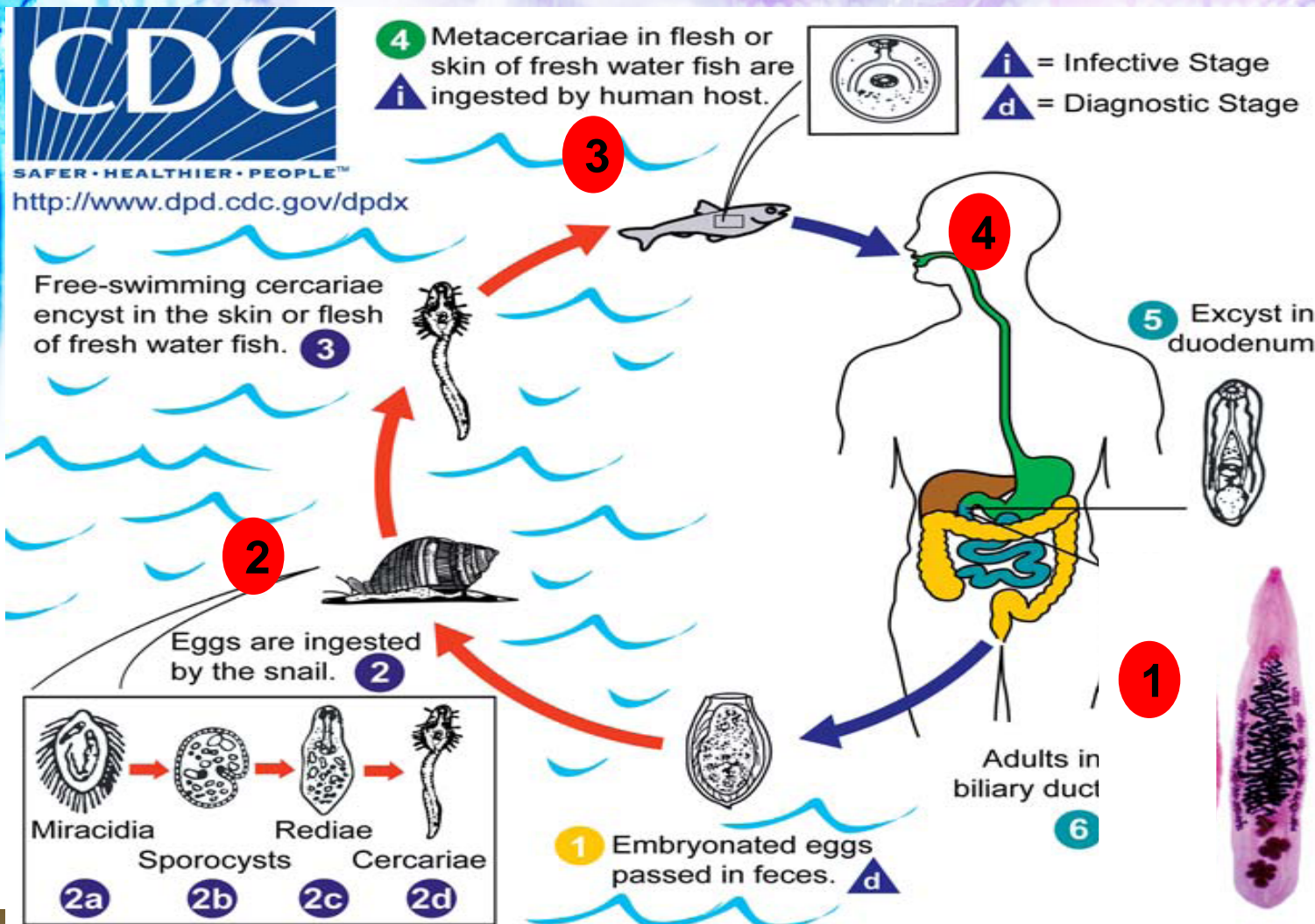
Opisthorchis viverrini (Ov)



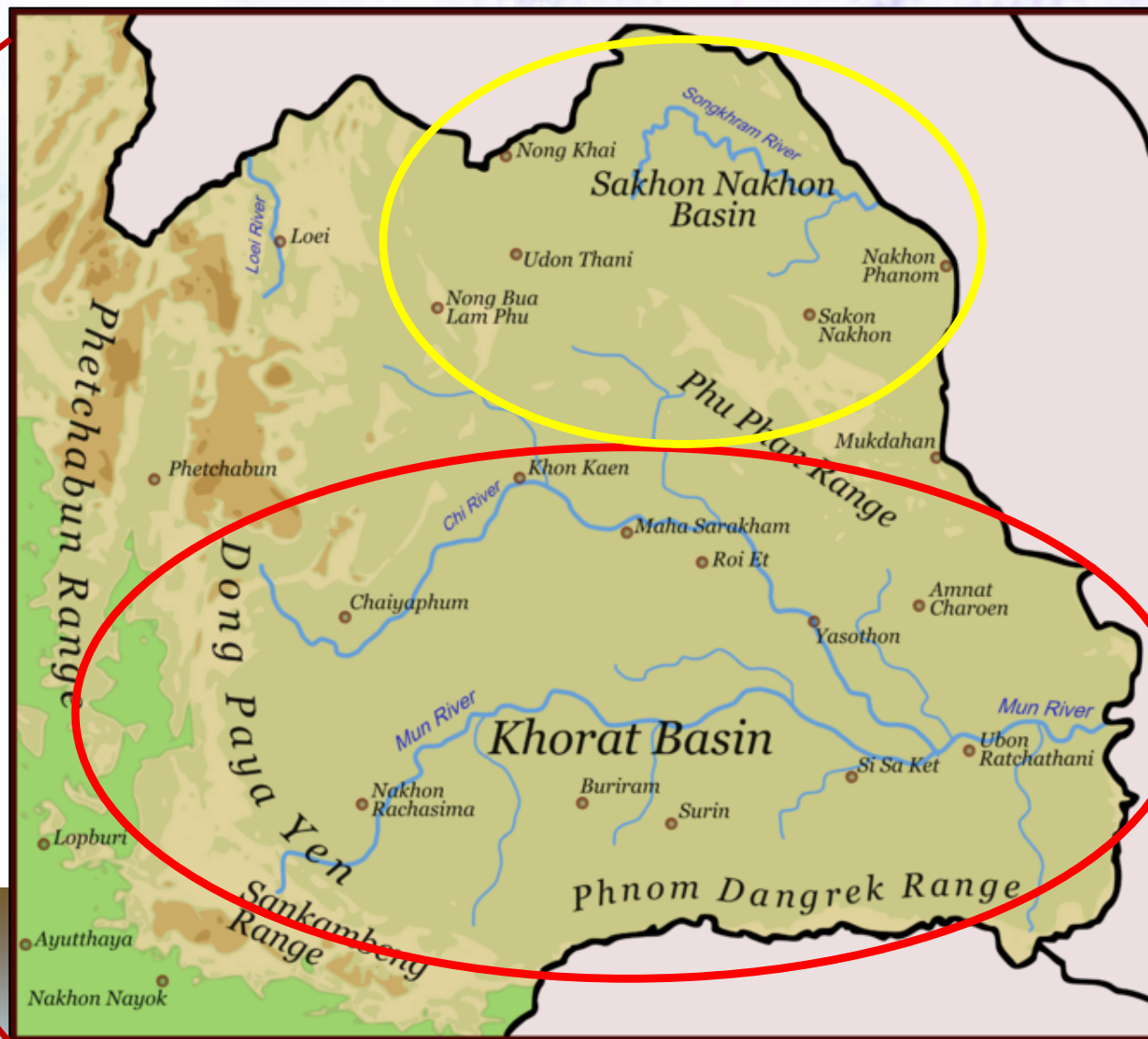
- **Causes: Opisthorchiasis, pathological changes in biliary tract, cholangiocarcinoma**
- **Group I carcinogen (IARC, 1994)**
- **Endemic area: greater Mekong basin, especially in **Northeastern Thailand** and Laos**
- **Life cycle: 3 hosts**



Life cycle of Ov (Sripa *et al.*, 2007)



Northeast Thailand



How water in northeastern becomes salty?

➤ **Salinity is one of important factors controlling distribution of snail. (Jacobsen & Forbes, 1997)**

- **reproductive output**

- **feeding rate**

- **growth rate**

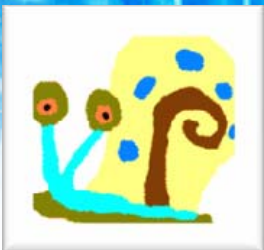
- **size at birth of snail**

- **Prevalence of parasitic diseases**



Objectives

- **To study influence of salinity on distribution of *B. siamensis goniomphalos* in Khorat basin**
- **To evaluate salinity concentrations for survival of *B. siamensis goniomphalos* in laboratory**

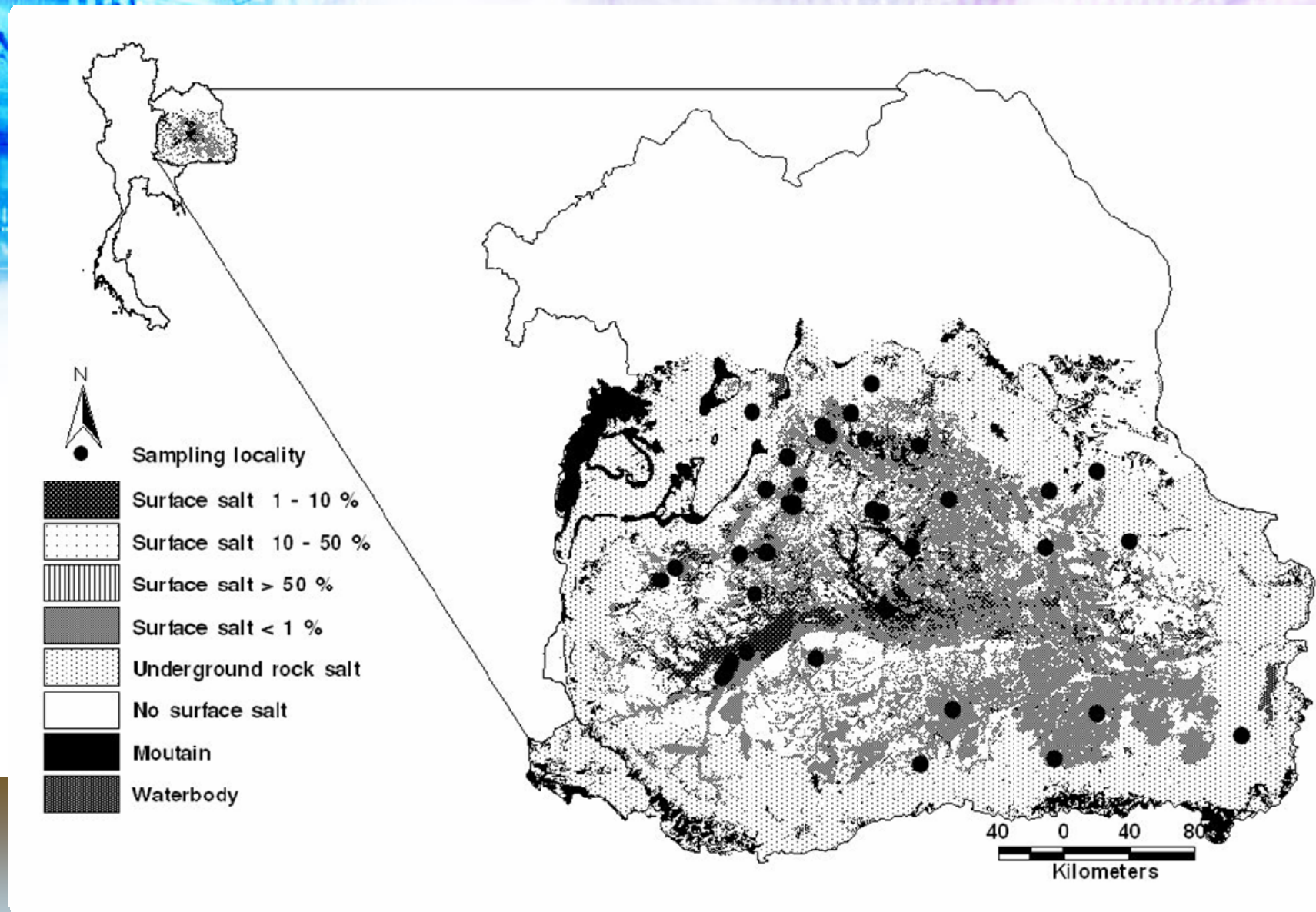


Methods

I: Density of snail in salinity levels

II: Survival of snail in salinity levels

Density of snail in salinity levels



➤ 56 water reservoirs in Korat basin

Physico-Chemical Characteristics

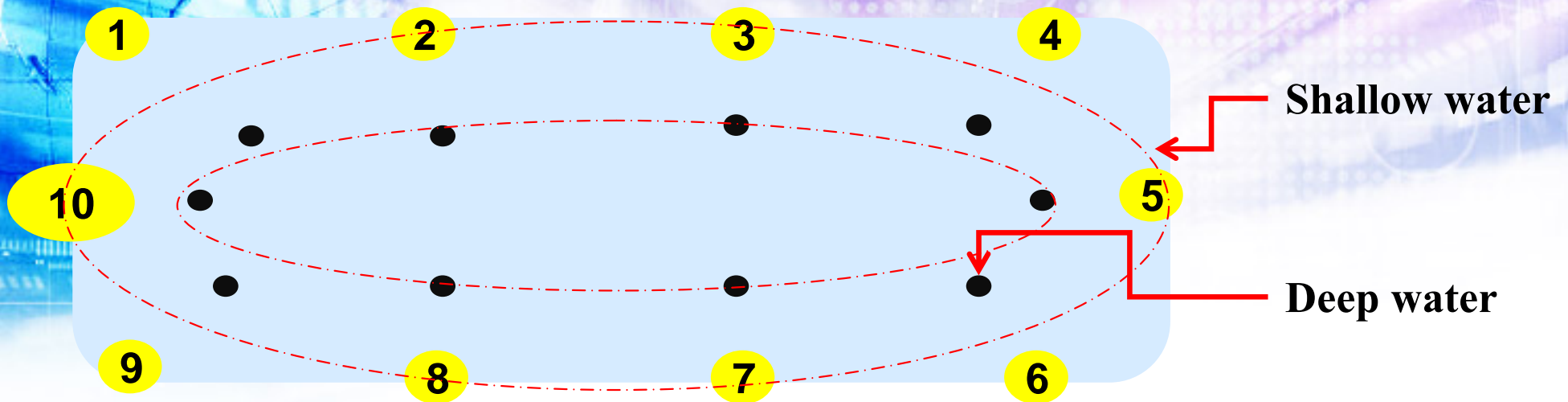


- **pH**
- **Temperature**
- **Dissolved oxygen**
- **Salinity**
- **Conductivity**



- **Turbidity**

Snail Collection



■ Station at shallow water

- manual collection 5 min./person
- scoop 5 times/station



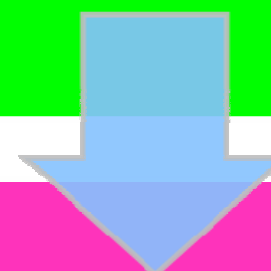
■ Deep water habitat

- Ekman dredge 2 times/station

**Species identification by following
available keys**



**Analyze the density of *B. siamensis*
goniomphalos of each station**



**Statistical relation test between
salinity and density of snail**



**Results I : Density of *B. siamensis goniomphalos*
in salinity**

Water qualities

56 localities snail sampled

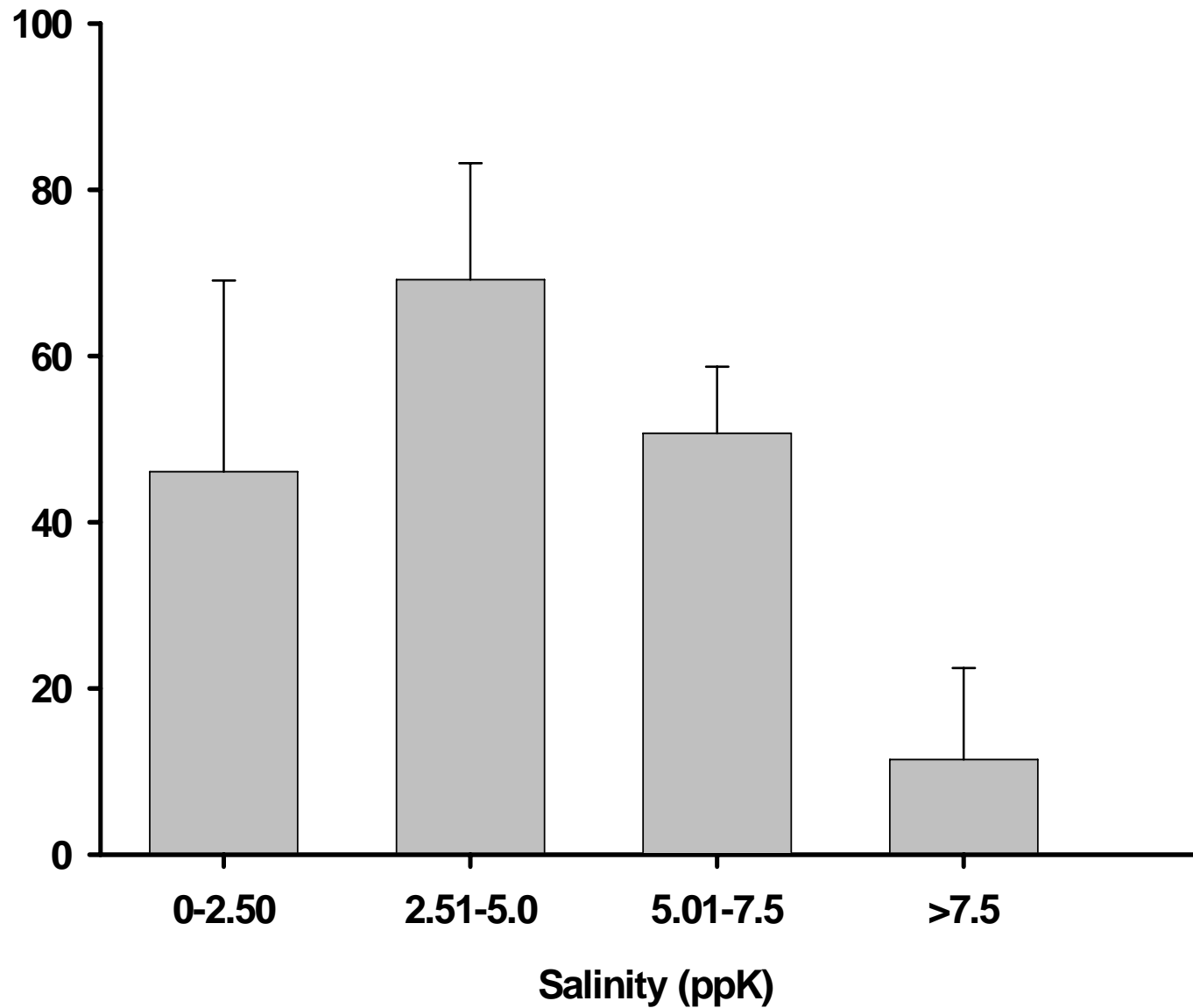
- pH: 6.02-8.07
- temperature: 21.90-38.6 °C
- dissolved oxygen: 0.01-6.47 ppm.
- turbidity: 3.20-420.30 NTU
- conductivity: 0.12-63.40 mS/cm
- salinity: 0.05-32.00 ppK

52 localities snail presented

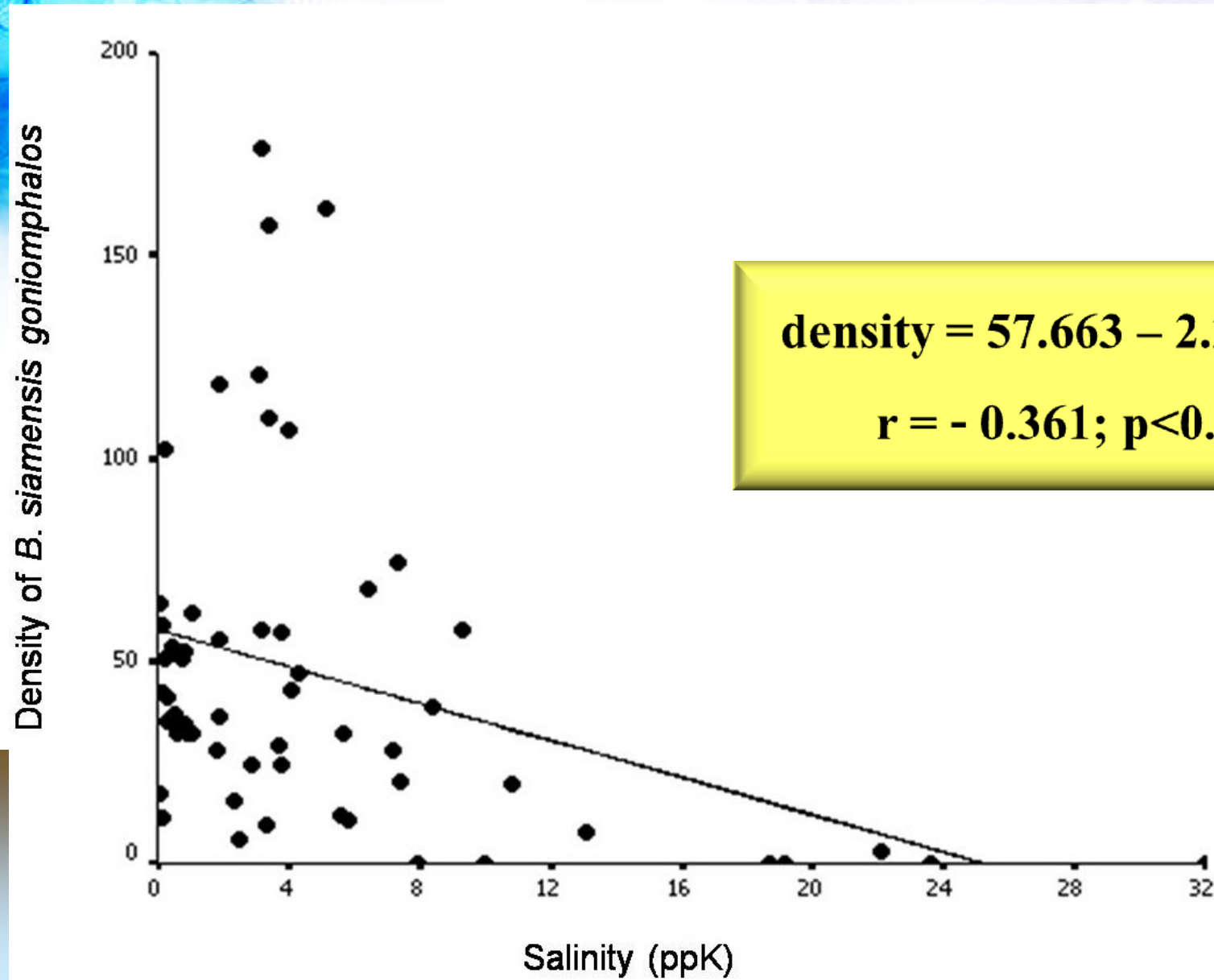
- pH: 6.02-8.07
- temperature: 21.90-38.6 °C
- dissolved oxygen: 0.01-6.47 ppm.
- turbidity: 3.20-420.30 NTU
- conductivity: 0.12-22.31 mS/cm
- salinity: 0.05-13.06 ppK

Density of *B. siamensis goniomphalos*

Density of *B. siamensis goniomphalos*



Negative correlation on density of *B. siamensis goniomphalos* with salinity levels



II: Survival of BSG snail in salinity levels



**Thung Sang swamp (16.438884N, 102.844477E), Muang,
Khon Kaen**



**Examined for trematode infection by cercarial shedding
both daytime and nighttime for 3 times in a week**



**The non-infected and healthy snail samples were used for
experiment.**

II: Laboratory investigation

➤ **6 groups of snails depend on shell size (length) and sex**

1. A – small male

4. D – small female

2. B – medium male

5. E – medium female

3. C – large male

6. F- large female

➤ **Rearing in 11 various salt concentrations**

0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 ppk.



**Results II: Survival of *B. siamensis*
goniomphalos snail in salinity levels**

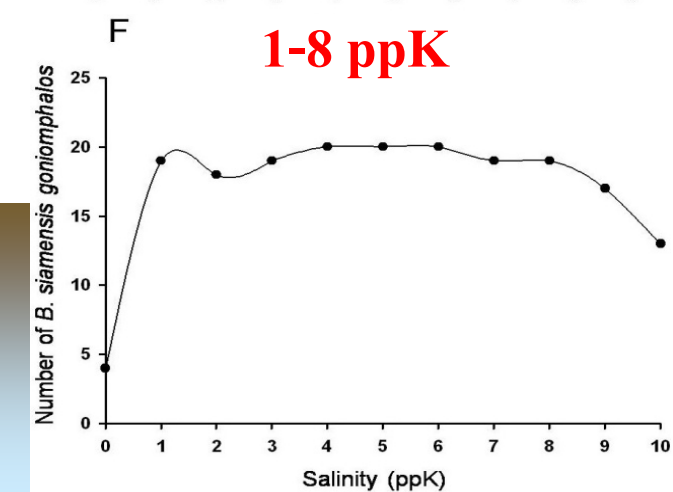
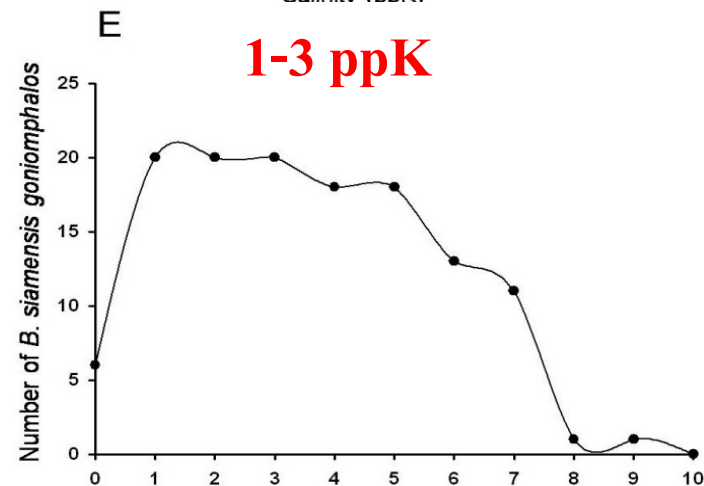
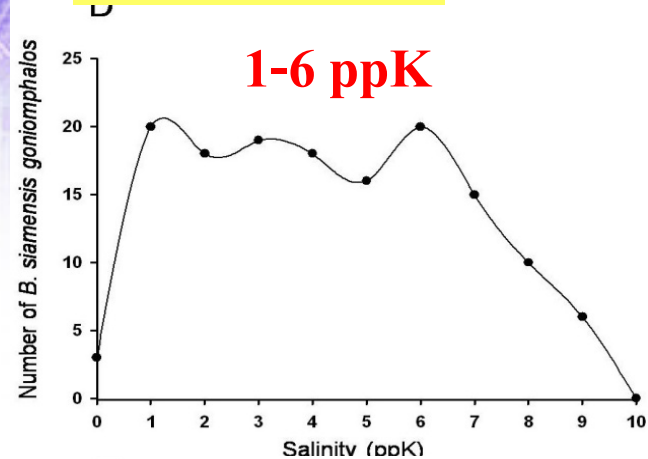
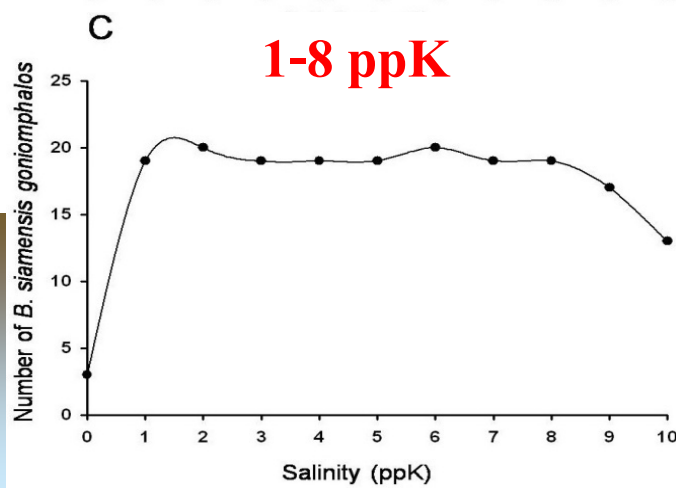
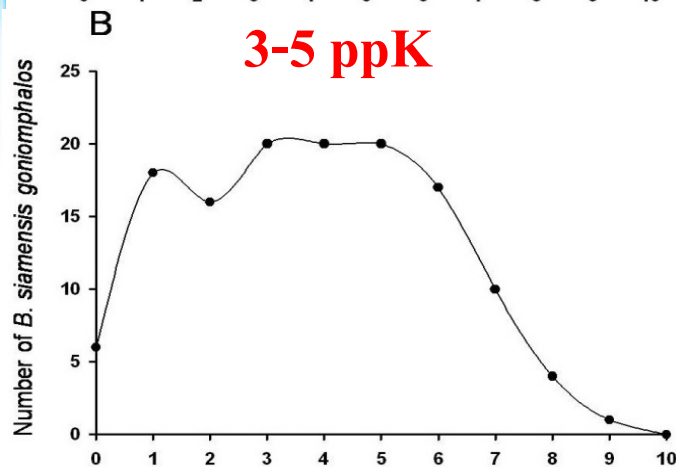
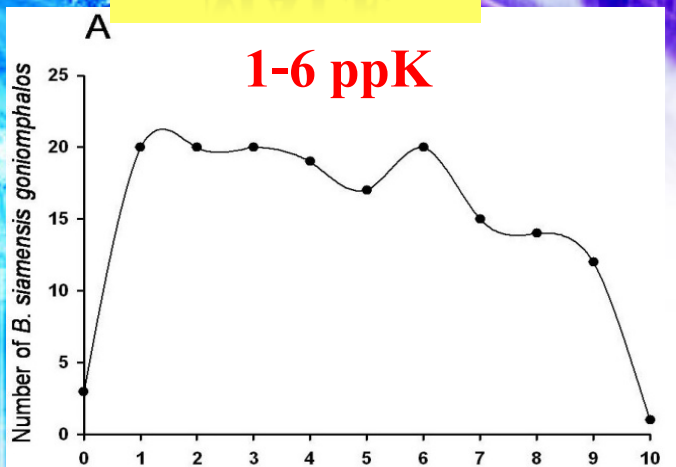
MALE

FEMALE

SMALL
< 5 mm

MEDIUM
5-8 mm

LARGE
> 8 mm



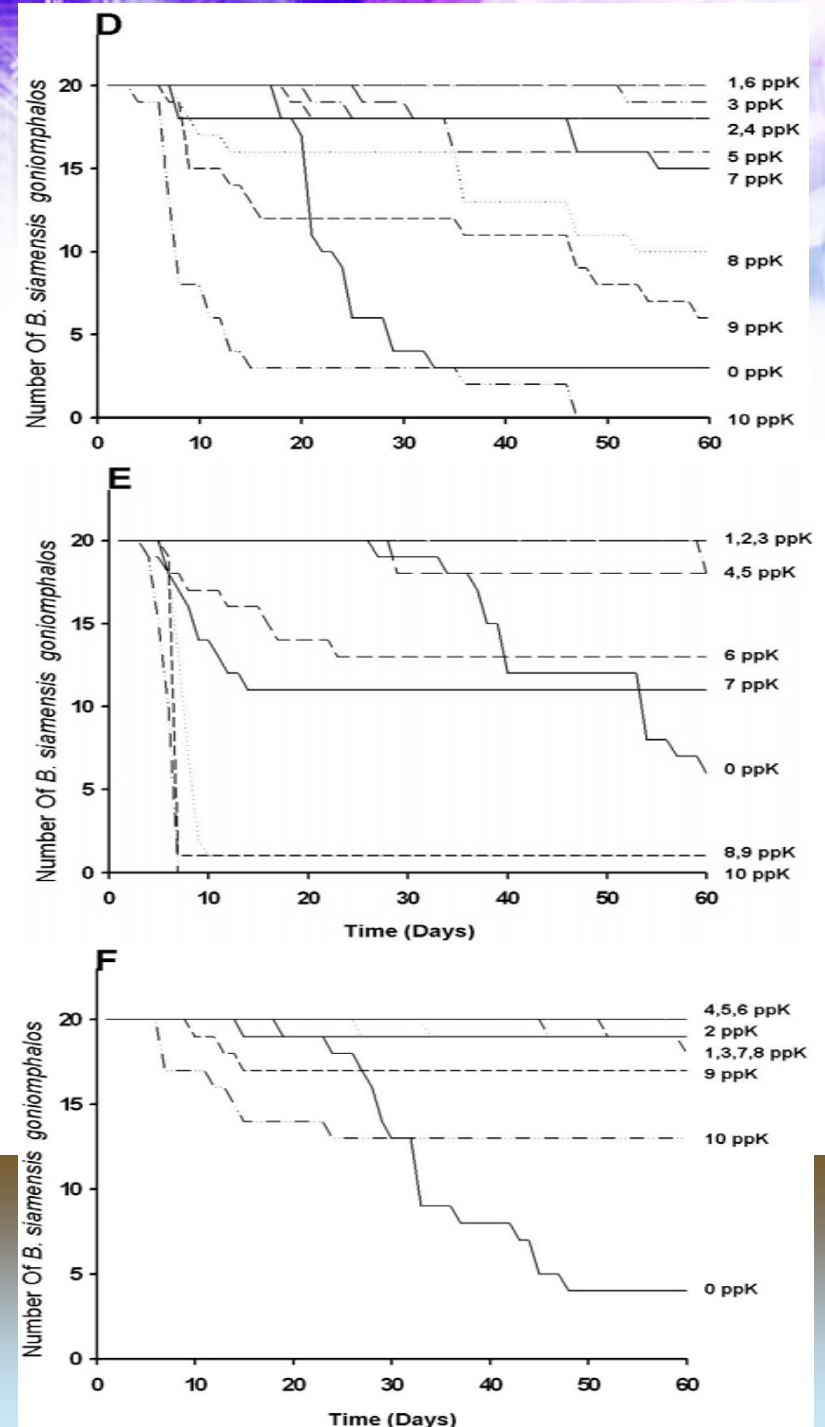
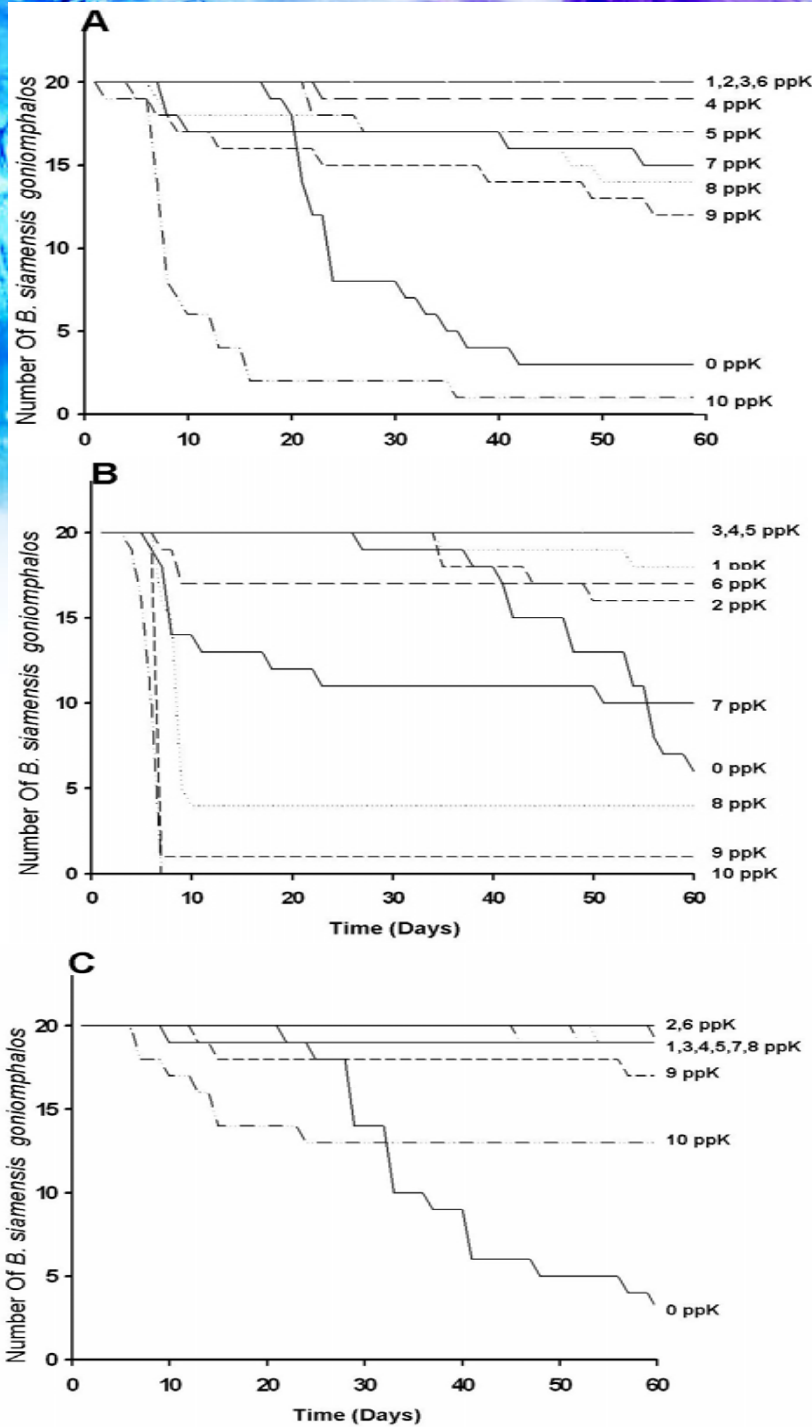
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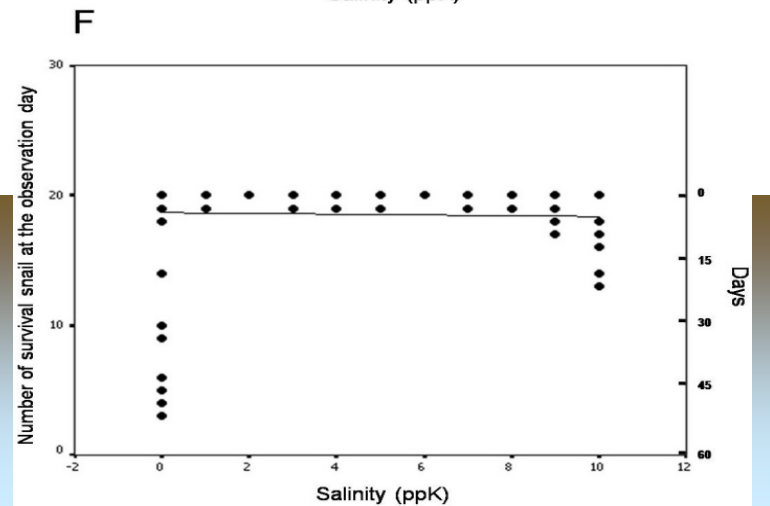
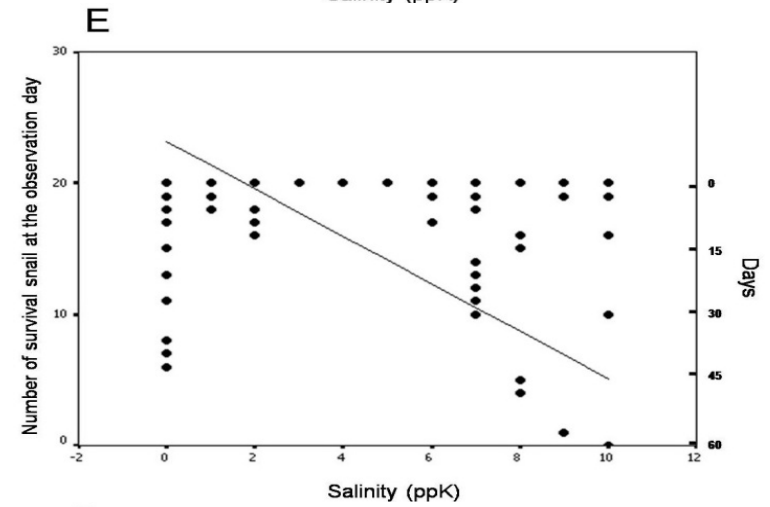
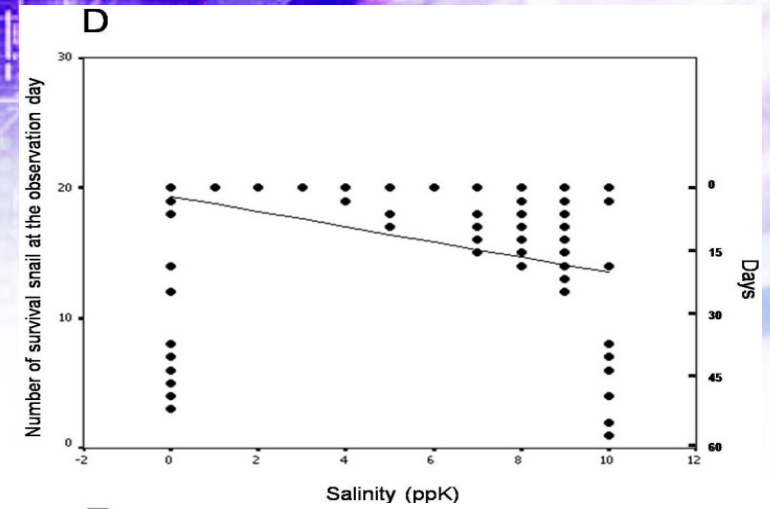
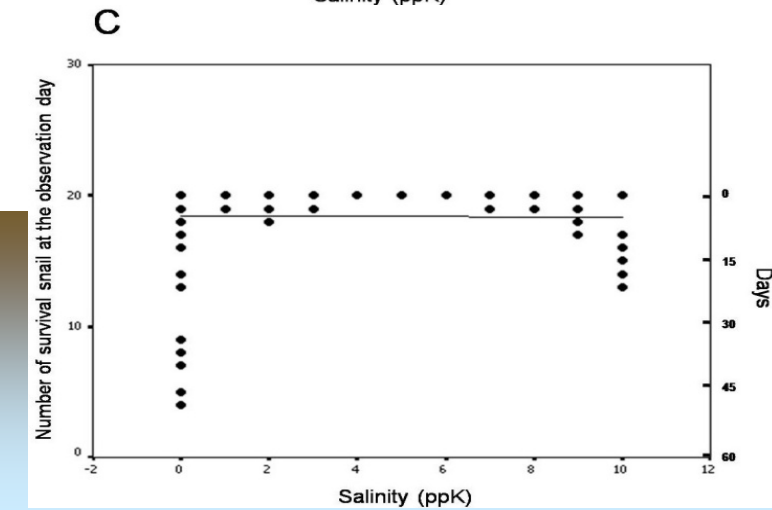
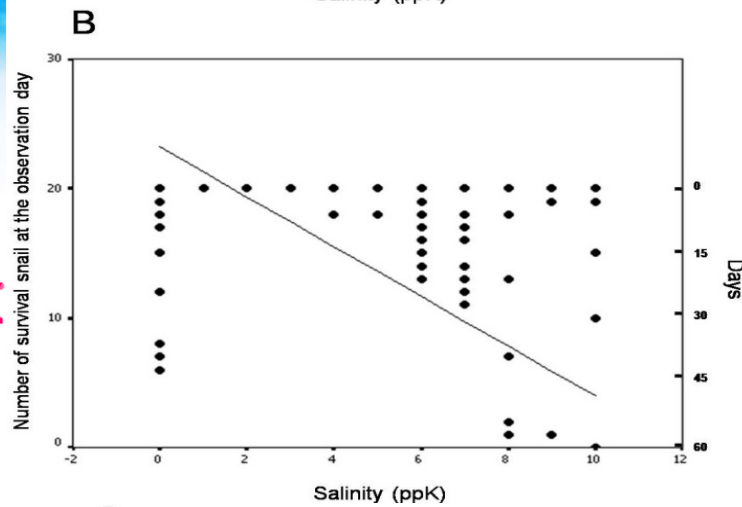
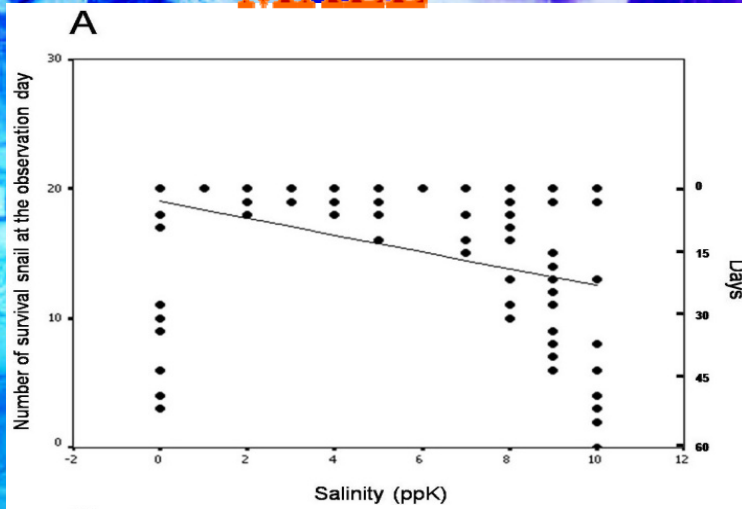
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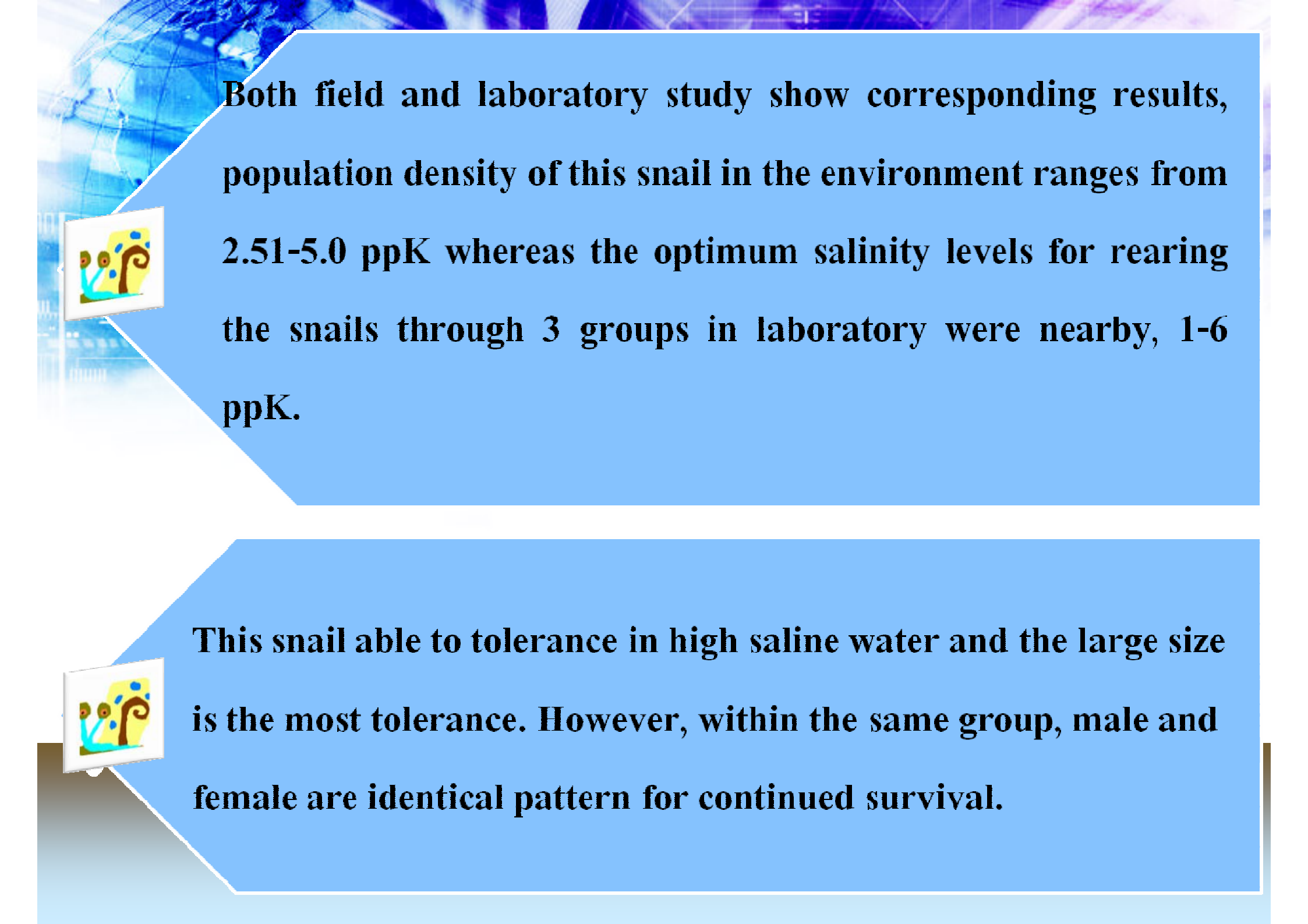
Discussion & Conclusion



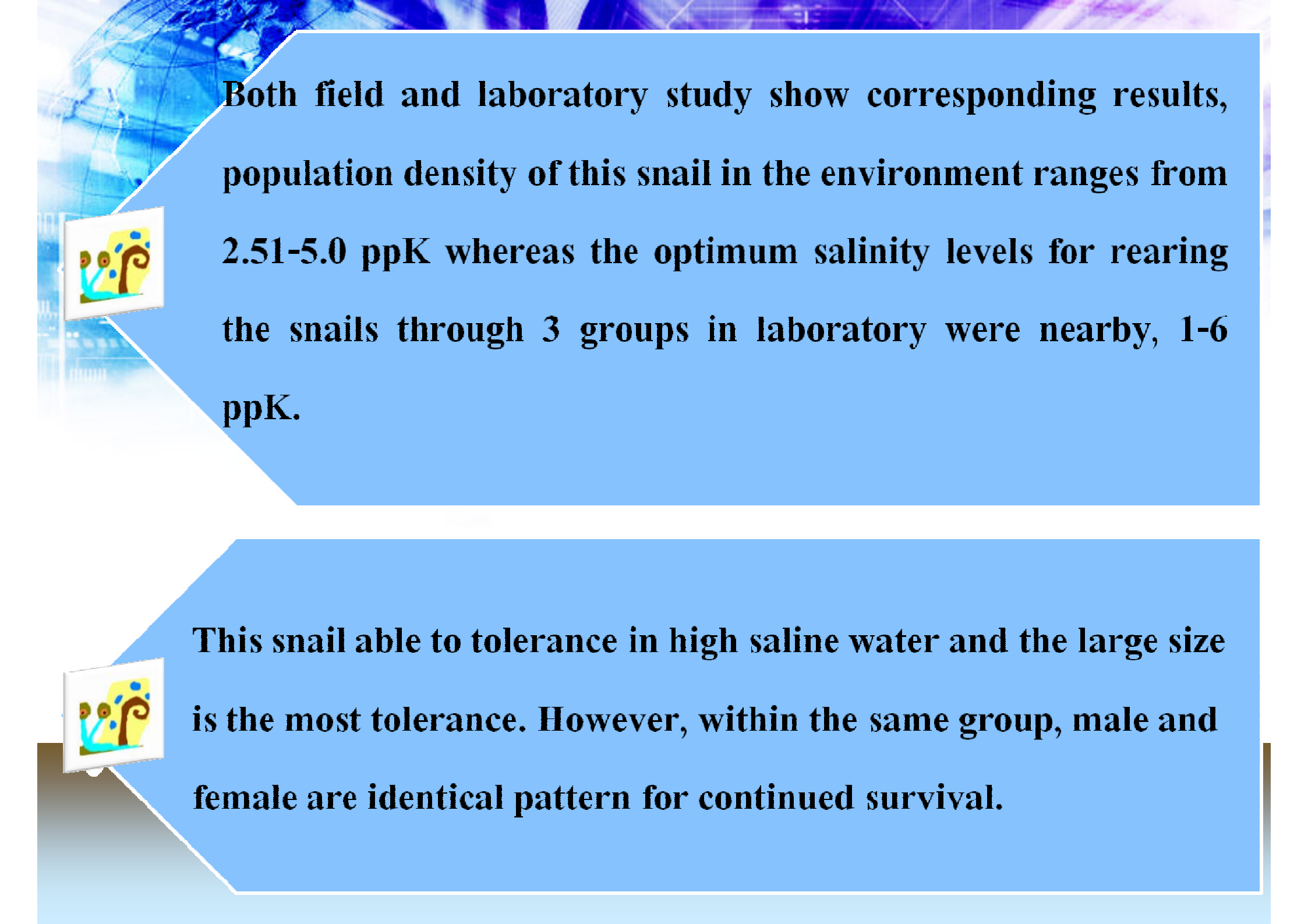
Salinity effects on distribution and limits the survival of snail, benthic animals that exposed directly with surface salt.



The presence study demonstrates that salinity indeed affects for distribution and survival of *B. siamensis goniomphalos*.



Both field and laboratory study show corresponding results, population density of this snail in the environment ranges from 2.51-5.0 ppK whereas the optimum salinity levels for rearing the snails through 3 groups in laboratory were nearby, 1-6 ppK.



This snail able to tolerance in high saline water and the large size is the most tolerance. However, within the same group, male and female are identical pattern for continued survival.

Acknowledgments

Advisor committees



Assoc. Prof. Dr. Smarn Tesana



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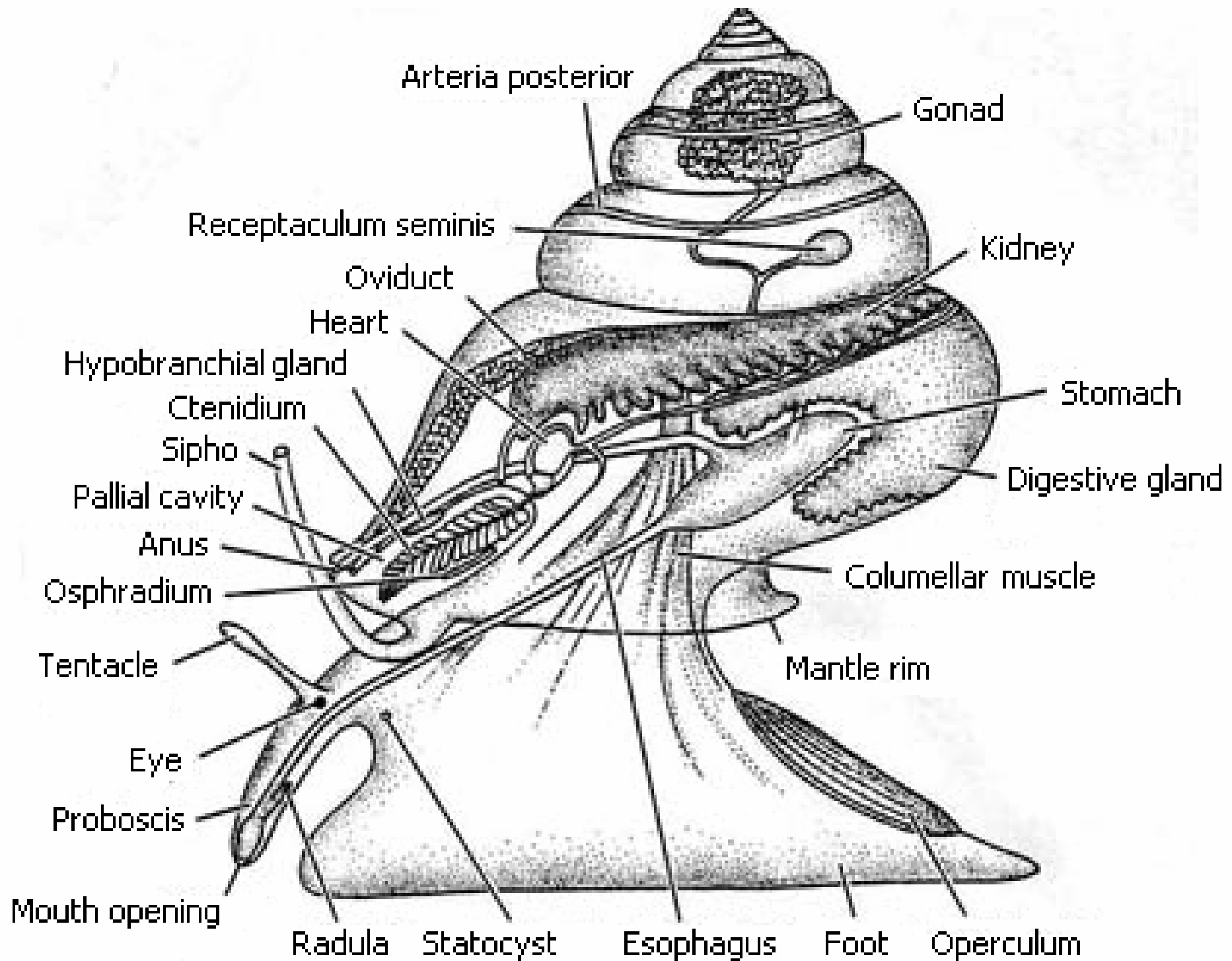
**Food-borne Parasite
Research Group**





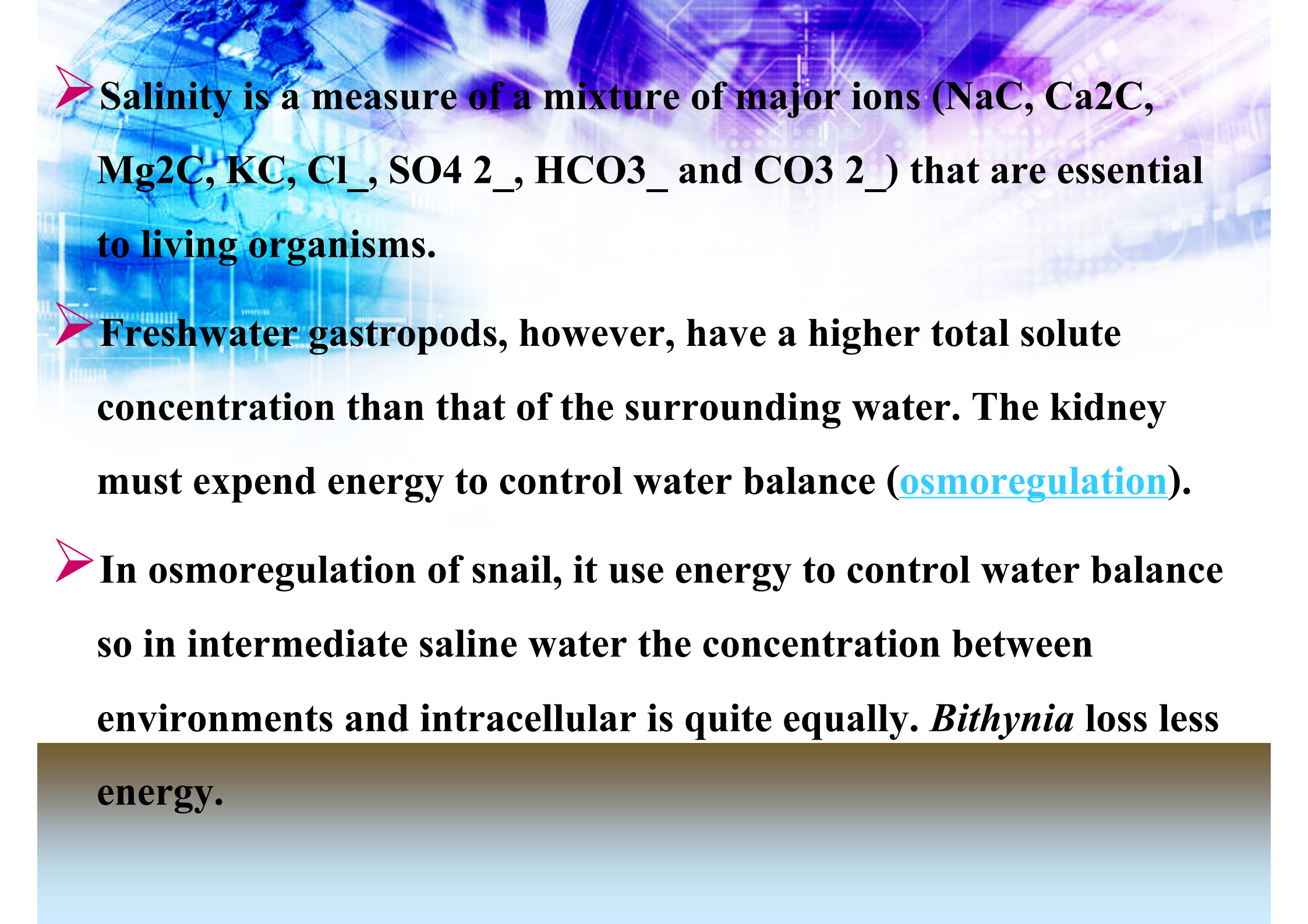
*Thank you for your
kind attention.*



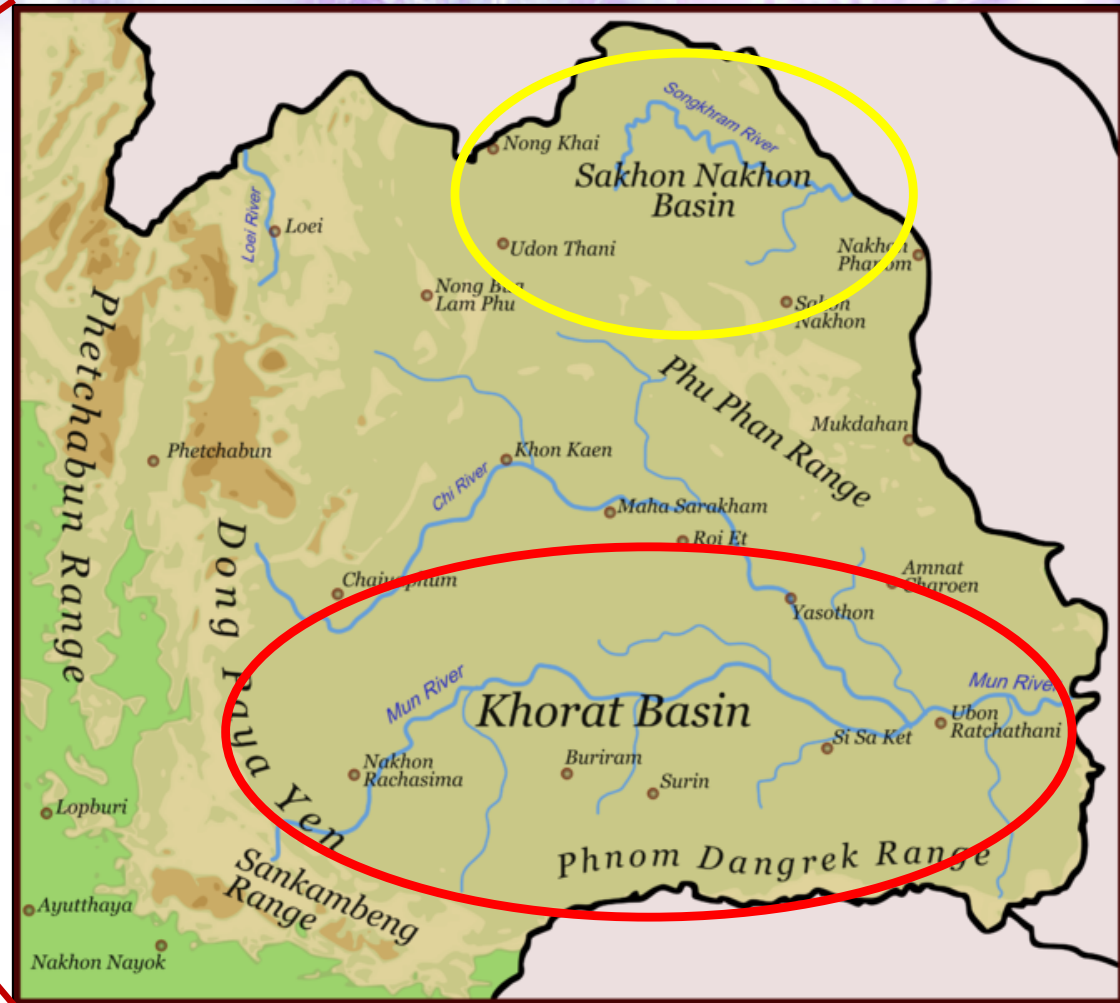


How is salinity occurring?

- **The rock salt layers behaved as a sticky fluid and they were mobilized and flown upward to form salt domes.**
- **These basins usually slide together and emerge near the ground.**
- **Salty soil may spout along the groove in the floor and uplifting saline-groundwater.**
- **However water from an artesian well will press which caused distribute of salinity.**

- 
- **Salinity is a measure of a mixture of major ions (Na^+ , Ca^{2+} , Mg^{2+} , K^+ , Cl^- , SO_4^{2-} , HCO_3^- and CO_3^{2-}) that are essential to living organisms.**
 - **Freshwater gastropods, however, have a higher total solute concentration than that of the surrounding water. The kidney must expend energy to control water balance ([osmoregulation](#)).**
 - **In osmoregulation of snail, it use energy to control water balance so in intermediate saline water the concentration between environments and intracellular is quite equally. *Bithynia* loss less energy.**

Northeast Thailand



➤ The present with rock salt layer which underlines on the upper of rock stratum and length 0.8-0.9 km in the Sakon Nakorn basin and 1.2-1.3 km in Khorat basin.



Salinity effects on distribution and limits the survival of snail, benthic animals that exposed directly with surface salt.



In case of *B. siamensis goniomphalos*, salinity tolerance is the key factor manage geographical distribution in northeast region Thailand.



The ability to salinity adaptation of *B. siamensis goniomphalos* caused it can alive and spread out parasitic diseases which this snail plays role for intermediate host.