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Transboundary migrations: Unlocking secrets of the Mekong catfish

Vũ Vi An

2nd Lower Mekong Fish Passage Conference 2025
Borei Angkor Resort & Spa, Siem Reap, Cambodia,
5 – 7 Feb 2025

Lower Mekong Basin

~1,300
Fish species

60 million
people live in the Mekong basin

4.4 million
tons of fish production

50 kg
of fish are consumed by a person a year. Fish is the 2nd largest dietary component

17 billion
$US are the total value of the fisheries

3% National GDP
Cambodia: 18%
Laos : 13%
Thailand : 1.8%
Vietnam : 3%

80%
of people in the LMB depend directly and indirectly on natural systems for food security, livelihoods and customs

2/3
of the rural population participate in fishing to a certain extent for food and employment

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So et al. (2015)

Lower Mekong Basin

- Catch per unit effort: ↓
- Number of fish species in fishers' catch: ↓
- Fishers/ catch: Dominated by small-size fish species
- Inland capture fish production: ~2.3 million tons
  - Long-distance migratory species : **37%**
    Likely impact of dams: Very High
  - Short-distance migratory species : 50%
    Likely impact of dams: High
  - Limited migratory species : 13%
    Likely impact of dams: Little

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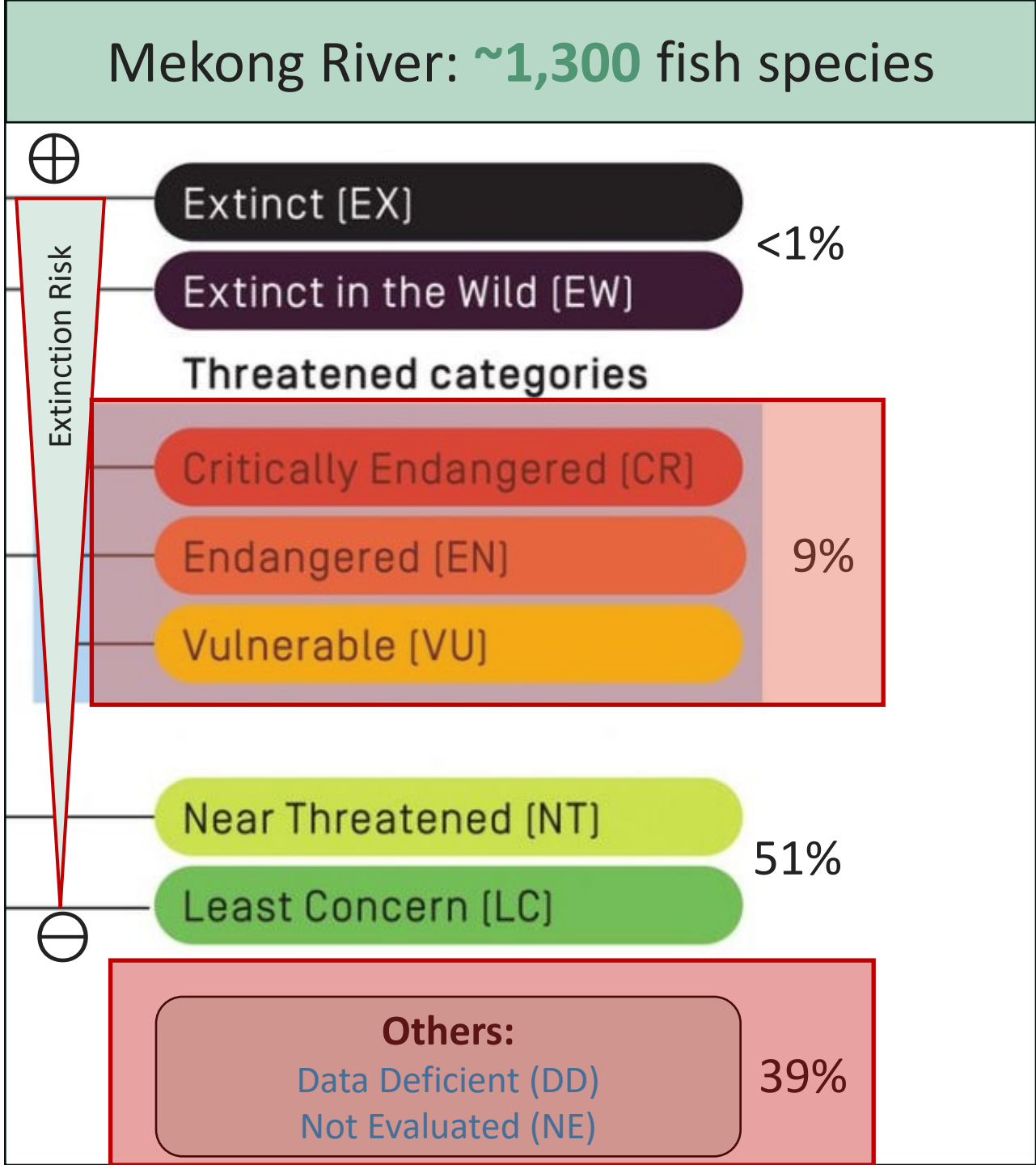


Cowx et al. (2024), So et al. (2014)

Catfishes in the Mekong River: their Migration

Do they connect between **Freshwater** & **Marine** waters?

Pangasius elongatus

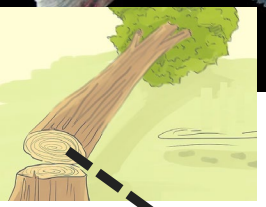
Pangasius krempfi

Pangasius bocourti

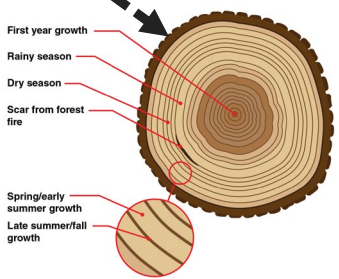
Pangasius mekongensis

Plotosus canius

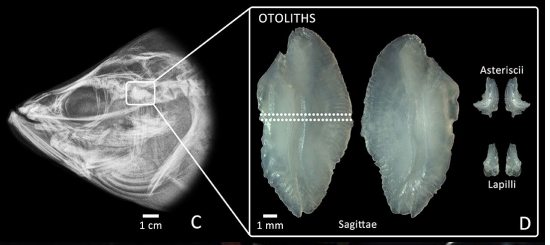
Otolith (ear-bone)

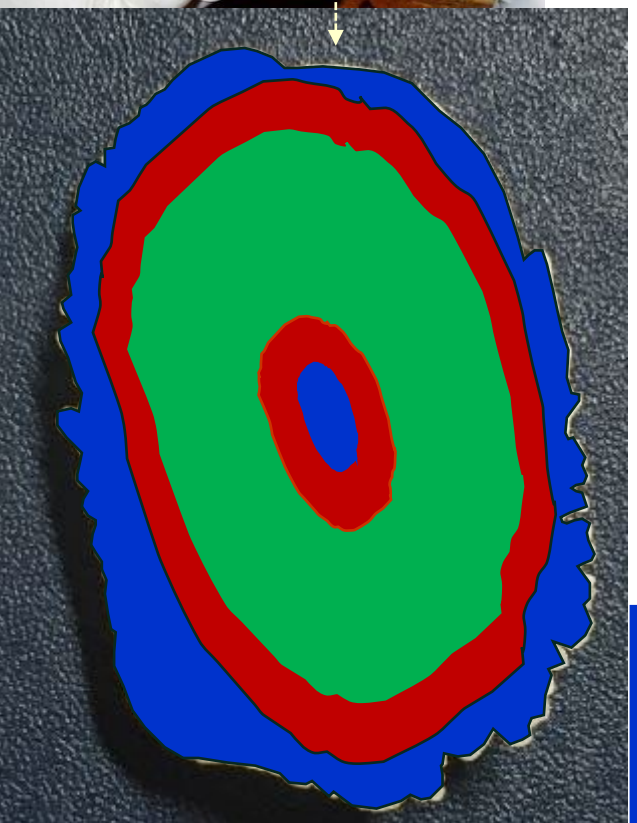


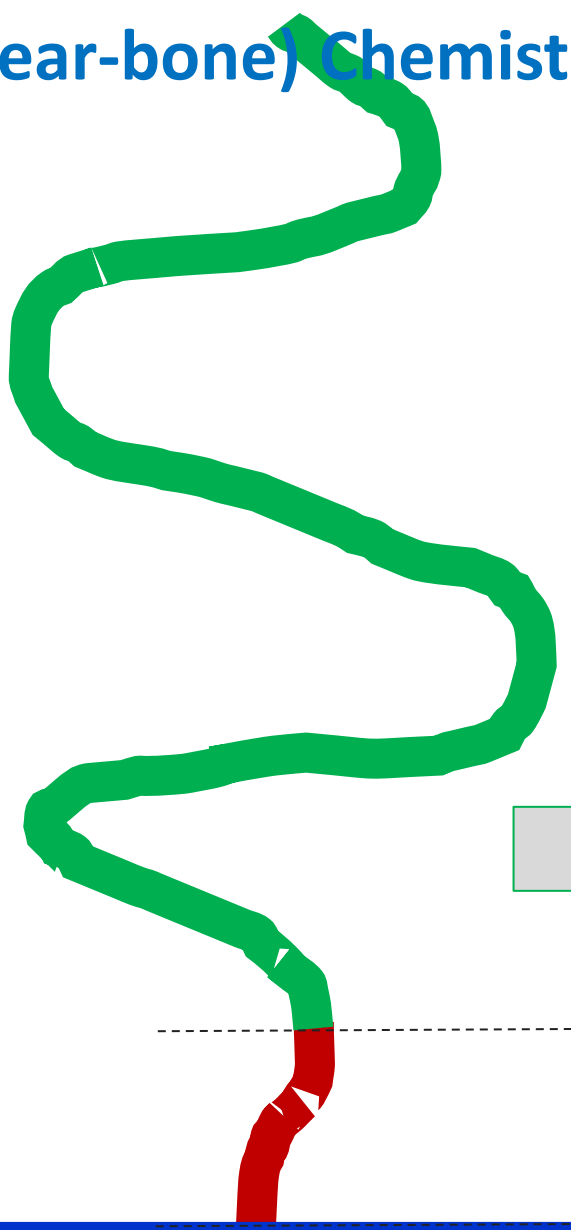
Tree rings

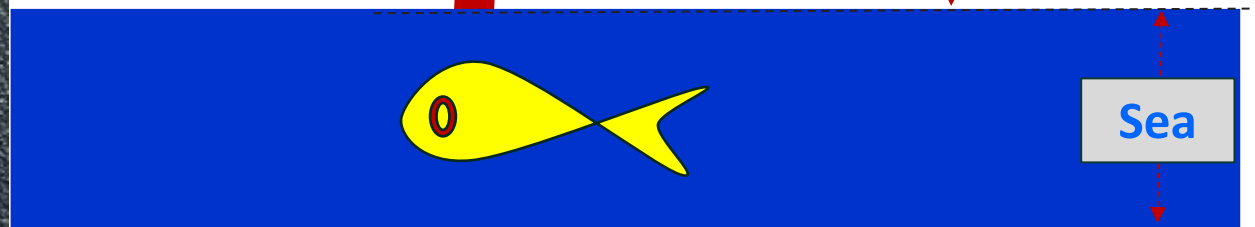


Otolith (ear-bone) Chemistry









Sr Strontium 87.62

- A good indicator for **Salinity**
- Very closed relationship b/t concentrations of Sr in otoliths & salinity.

Resident in fresh water *if* $\frac{Sr}{Ca} x1000 \leq 3.25$

Resident in brackish water *if* $3.25 < \frac{Sr}{Ca} x1000 \leq 10.17$

Resident in marine water *if* $\frac{Sr}{Ca} x1000 > 10.17$

$^{87}Sr/^{86}Sr$

Sea: (0.70918±0.00006): very stable

Mekong River: highly variable

Freshwater 85.4 µg/L

Brackish 1,164.1 µg/L

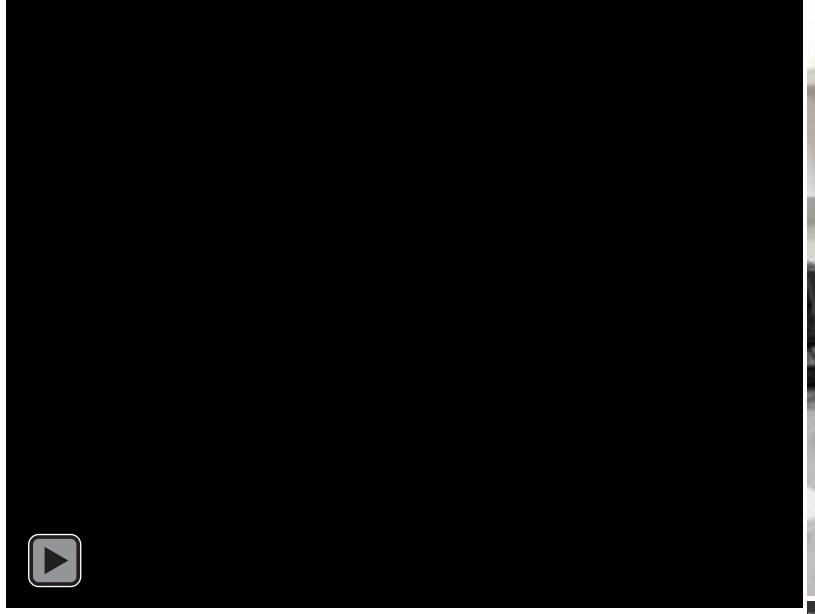
Sea 7,086.7 µg/L

Vu et al. (2021); Vu et al. (2022)

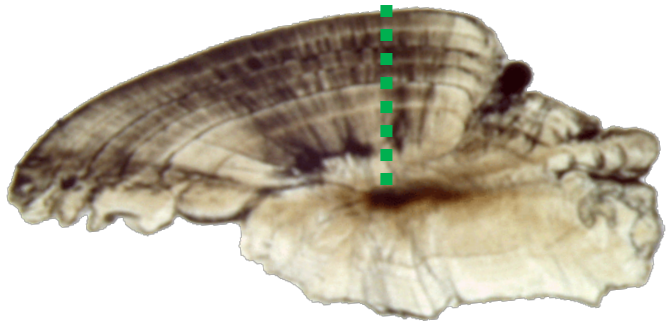
Otolith (ear-bone) Chemistry

1. Laser Ablation - Inductively Coupled Plasma Mass Spectrometry (**LA – ICPMS**):

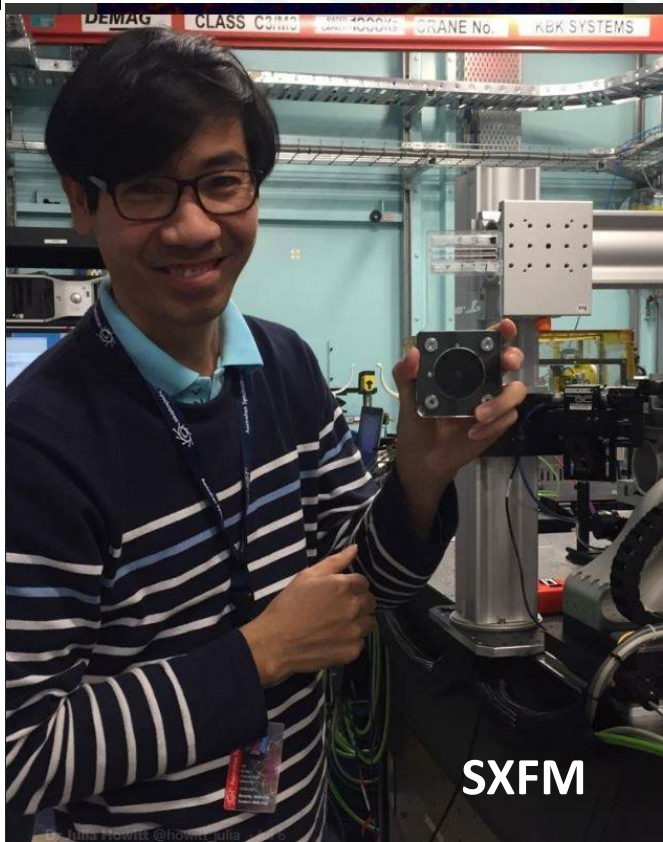
2. Scanning X-ray Fluorescence Microscopy (**SXFM**)



Measure elements along a transect line



Map elements on otolith plane



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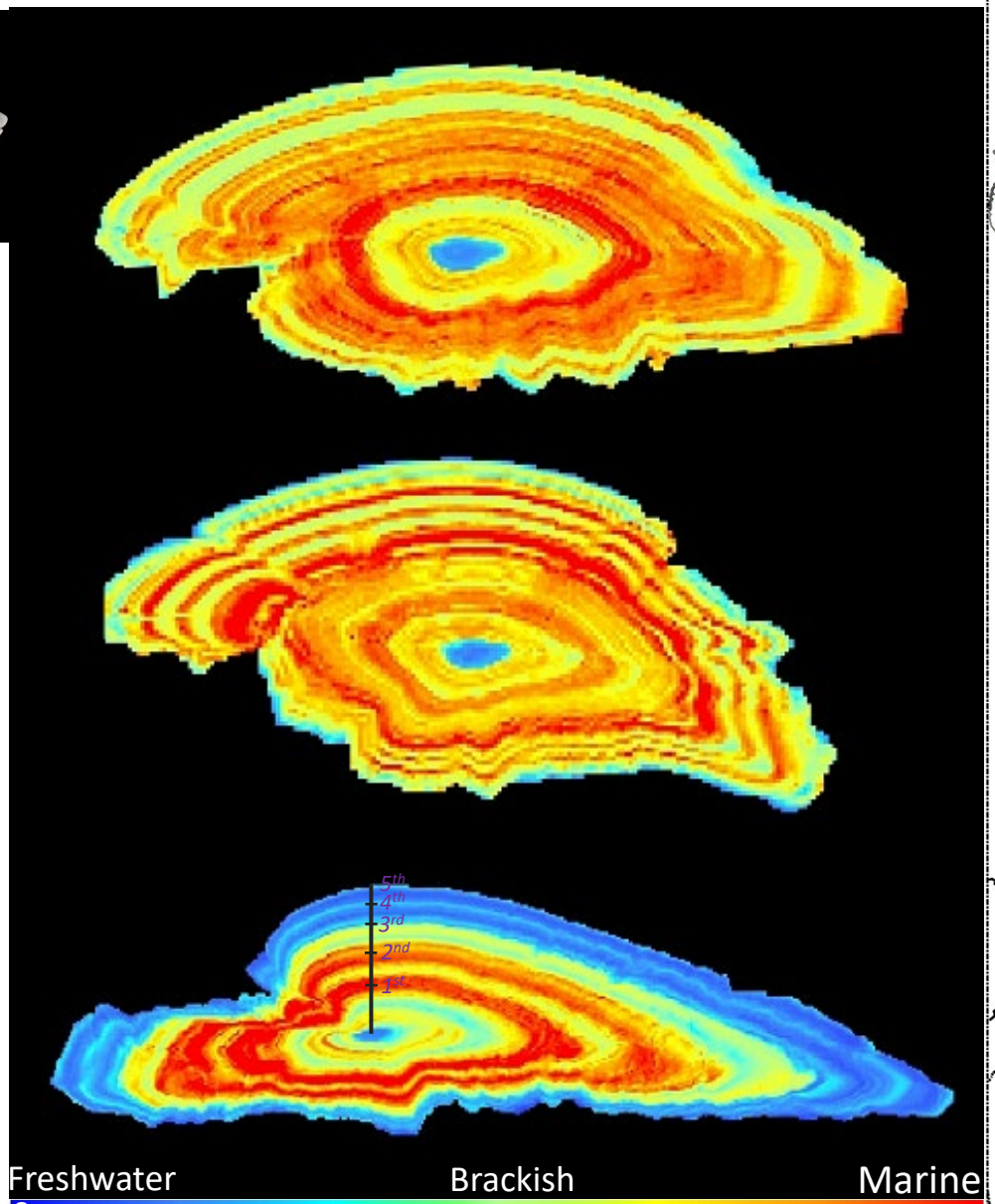
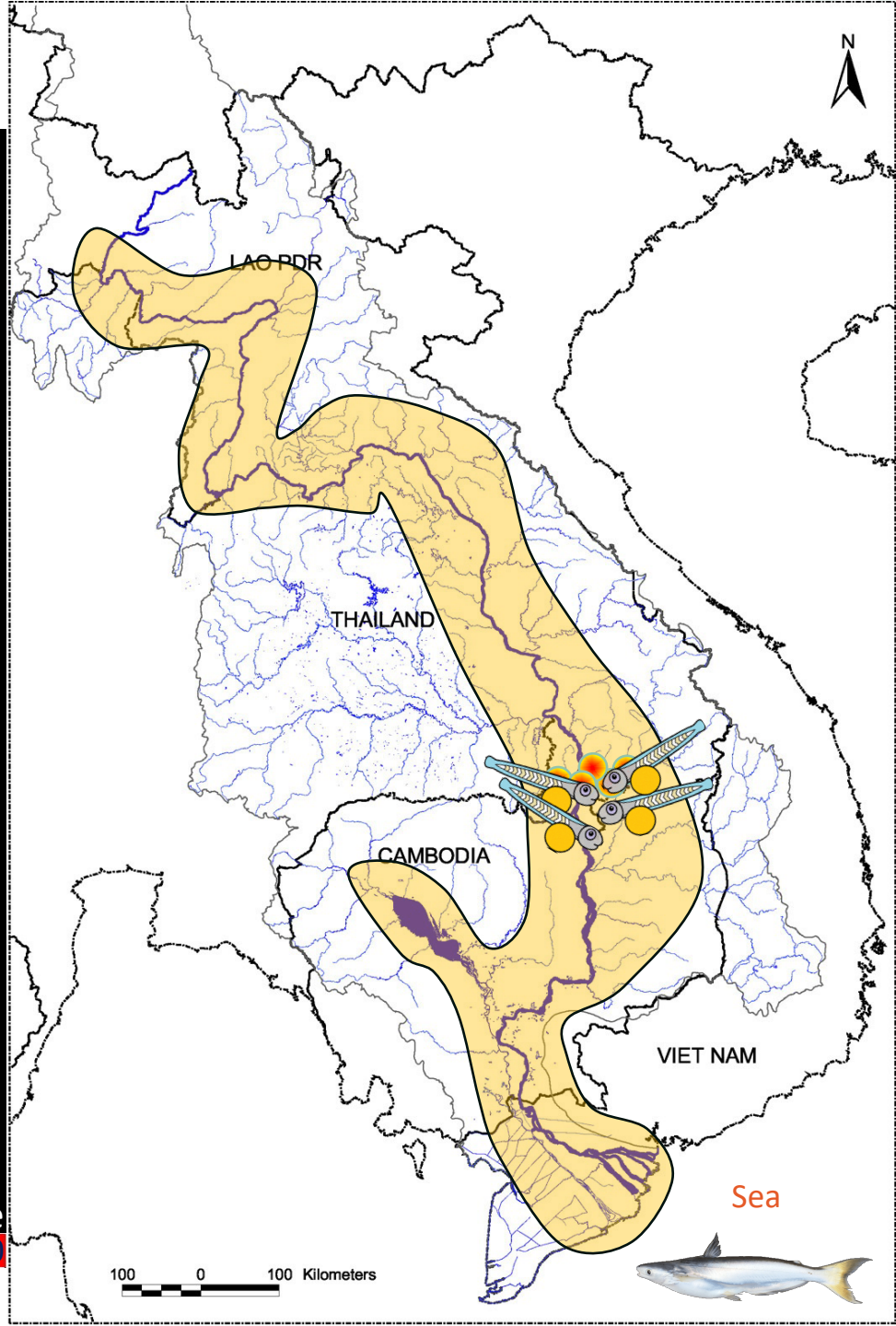
1. *Pangasius krempfi*

Vu et al. (2022); Poulsen et al. (2024)





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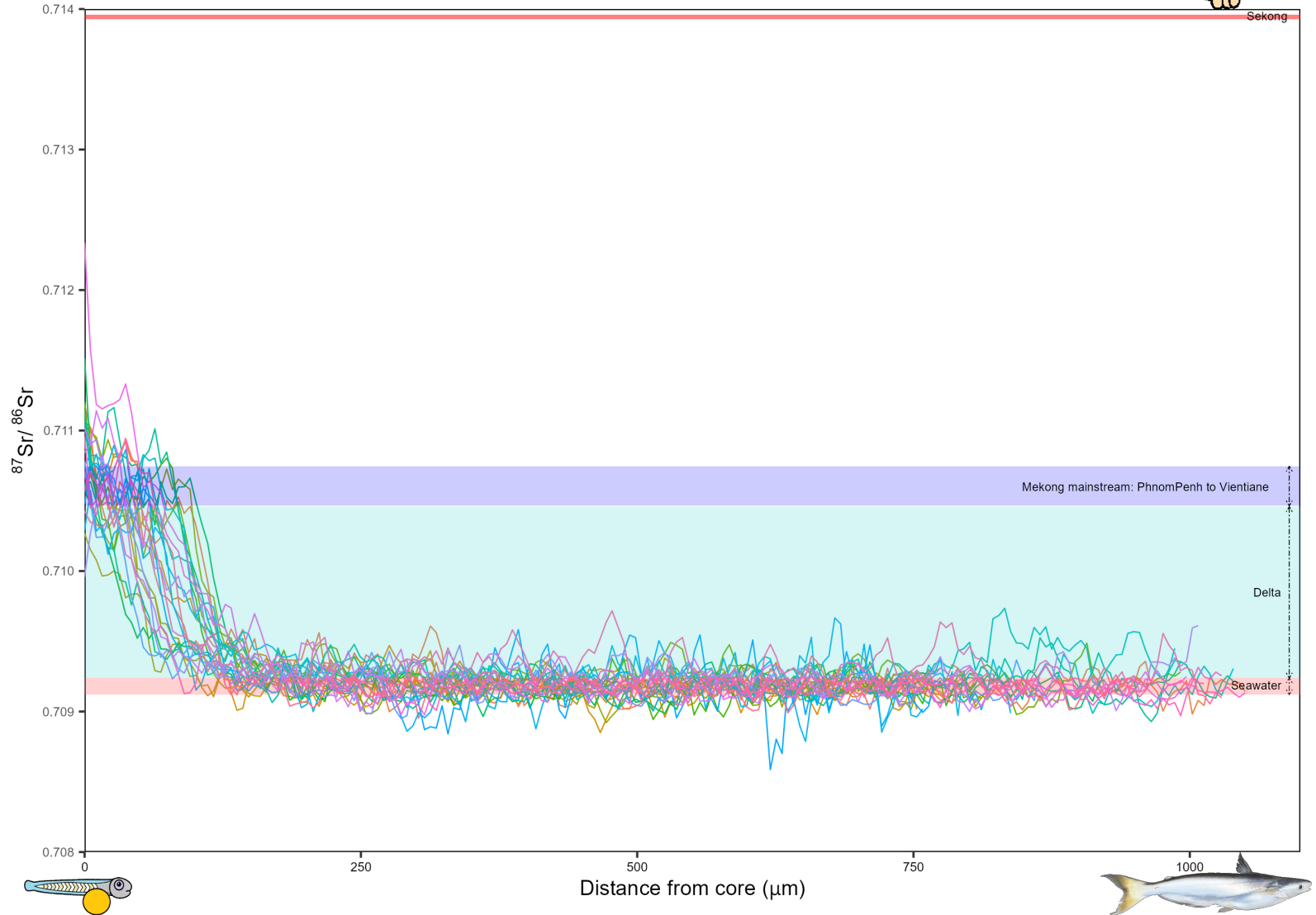
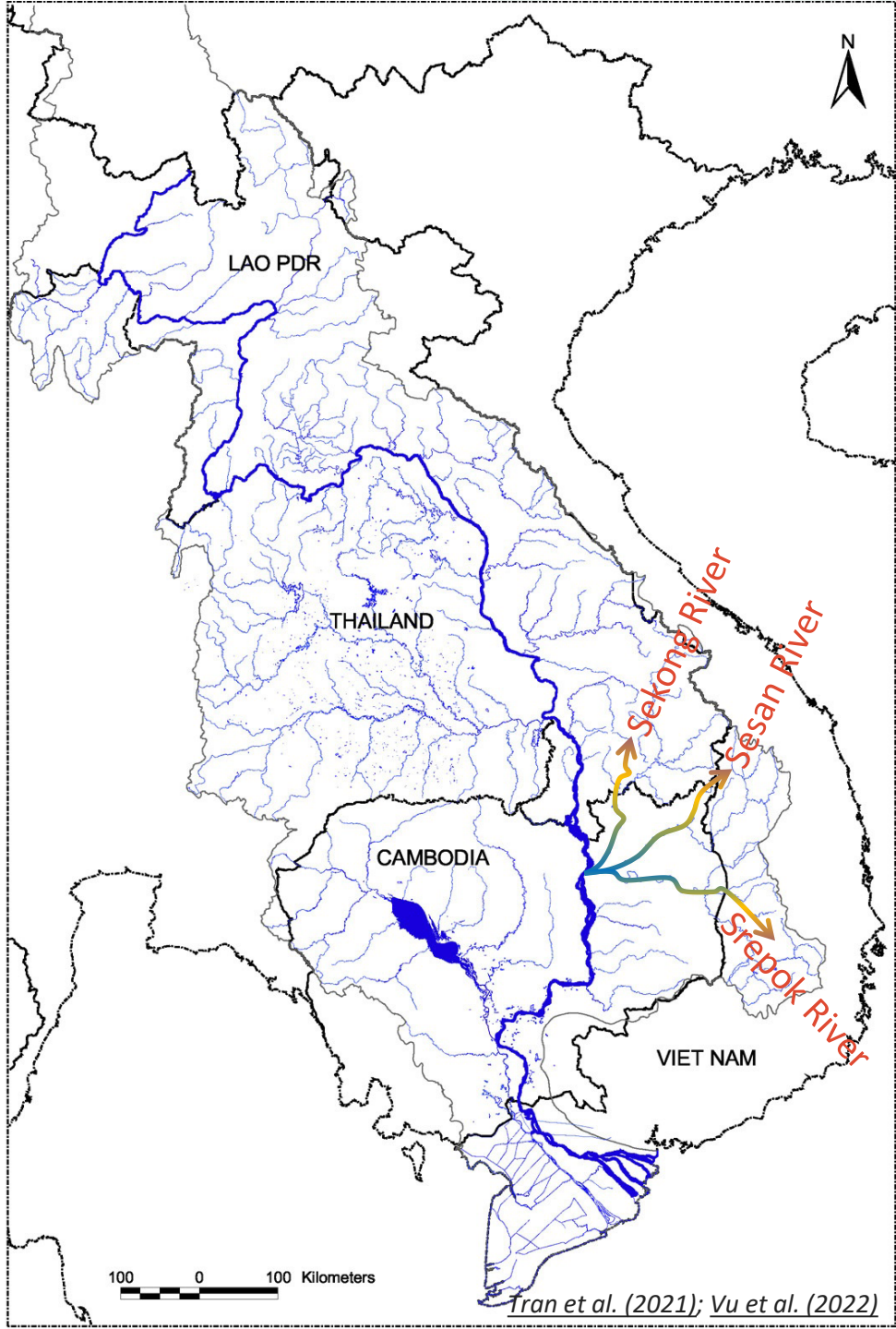
1. *Pangasius krempfi*

Do they migrate to **3S** river systems?



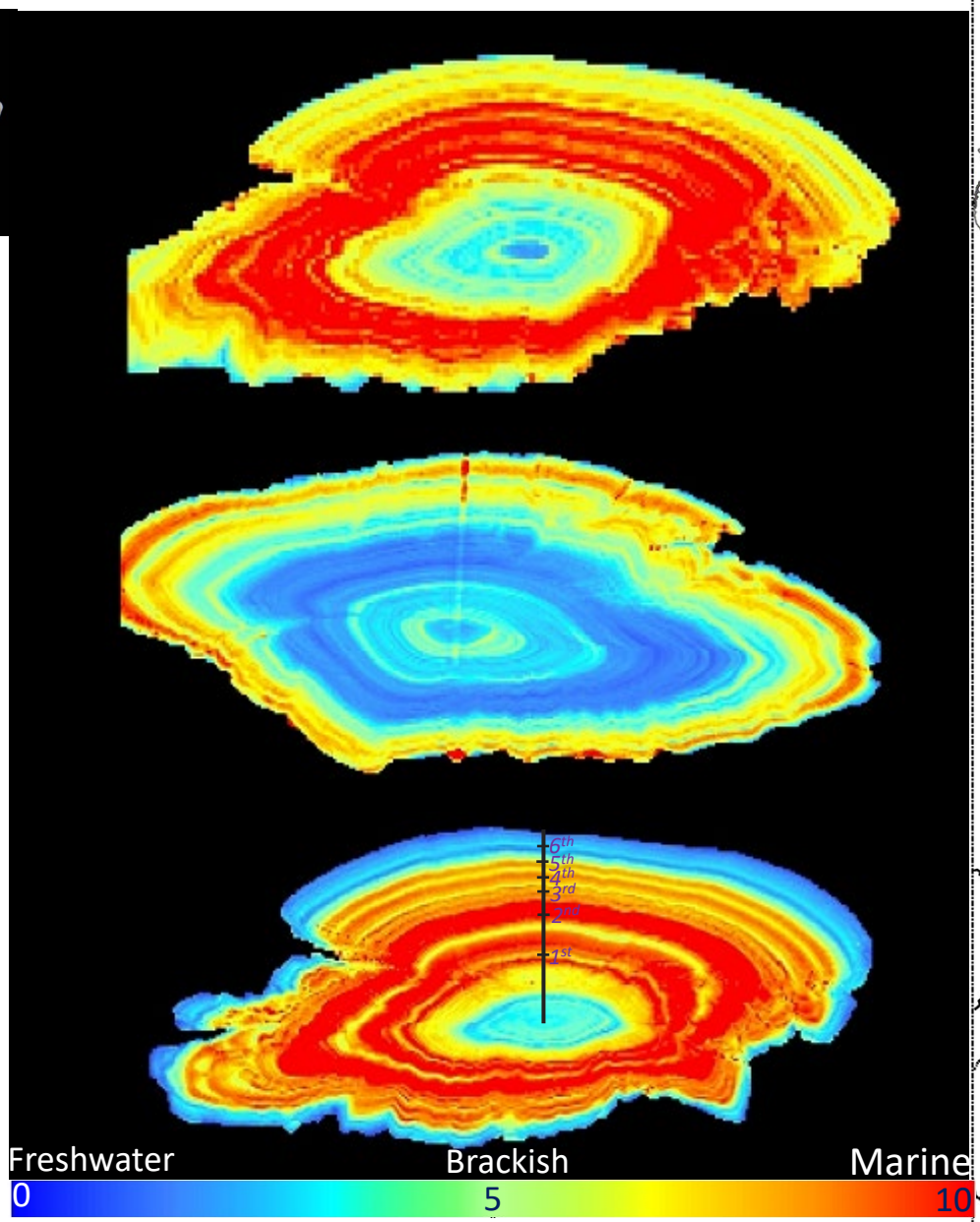


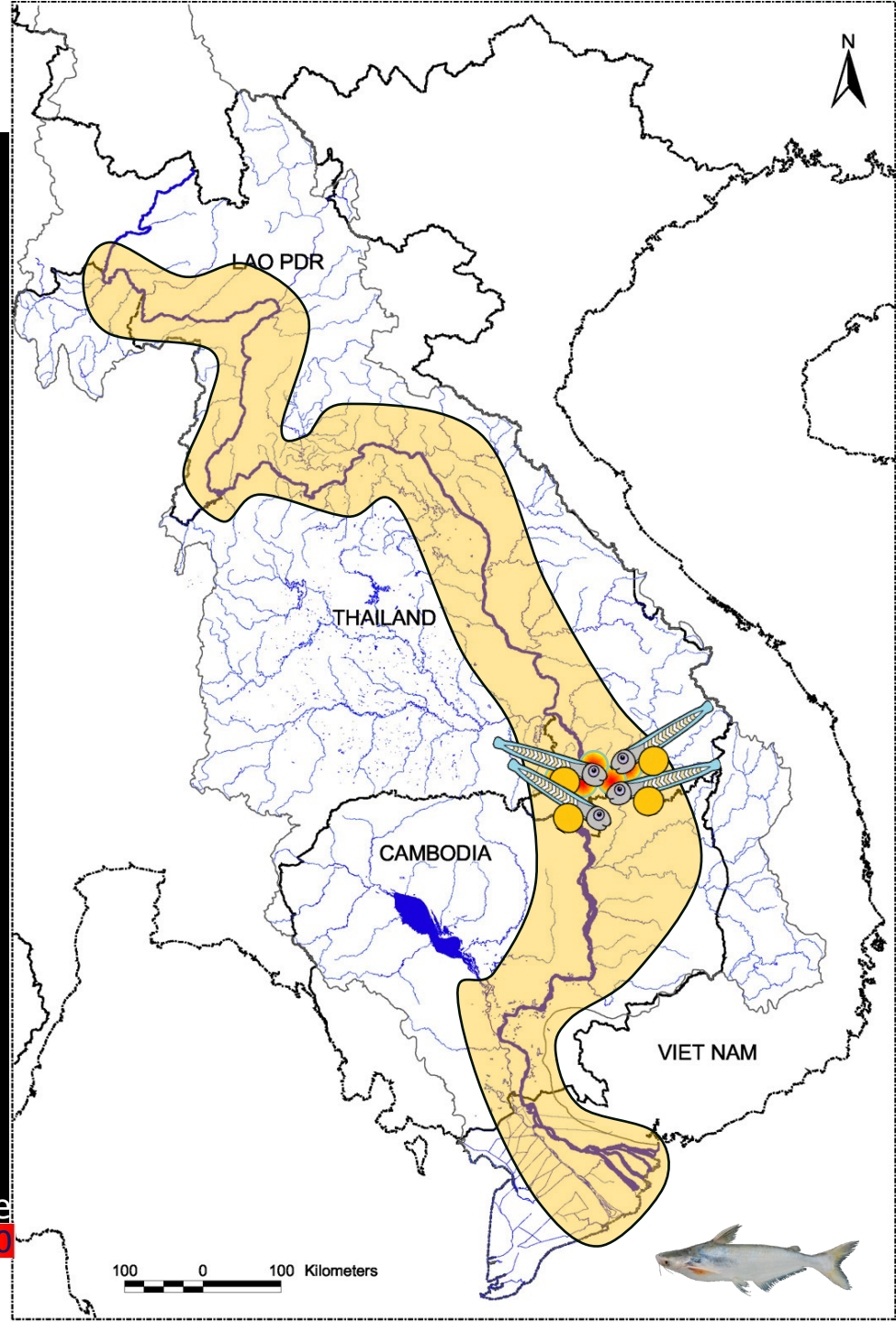
Tran et al. (2021); Vu et al. (2022)

2. *Pangasius mekongensis*

Vu et al. (2022)

- Migration patterns
  (anadromy: migrate b/t freshwater & marine waters)
- Similar to *P. krempfi*





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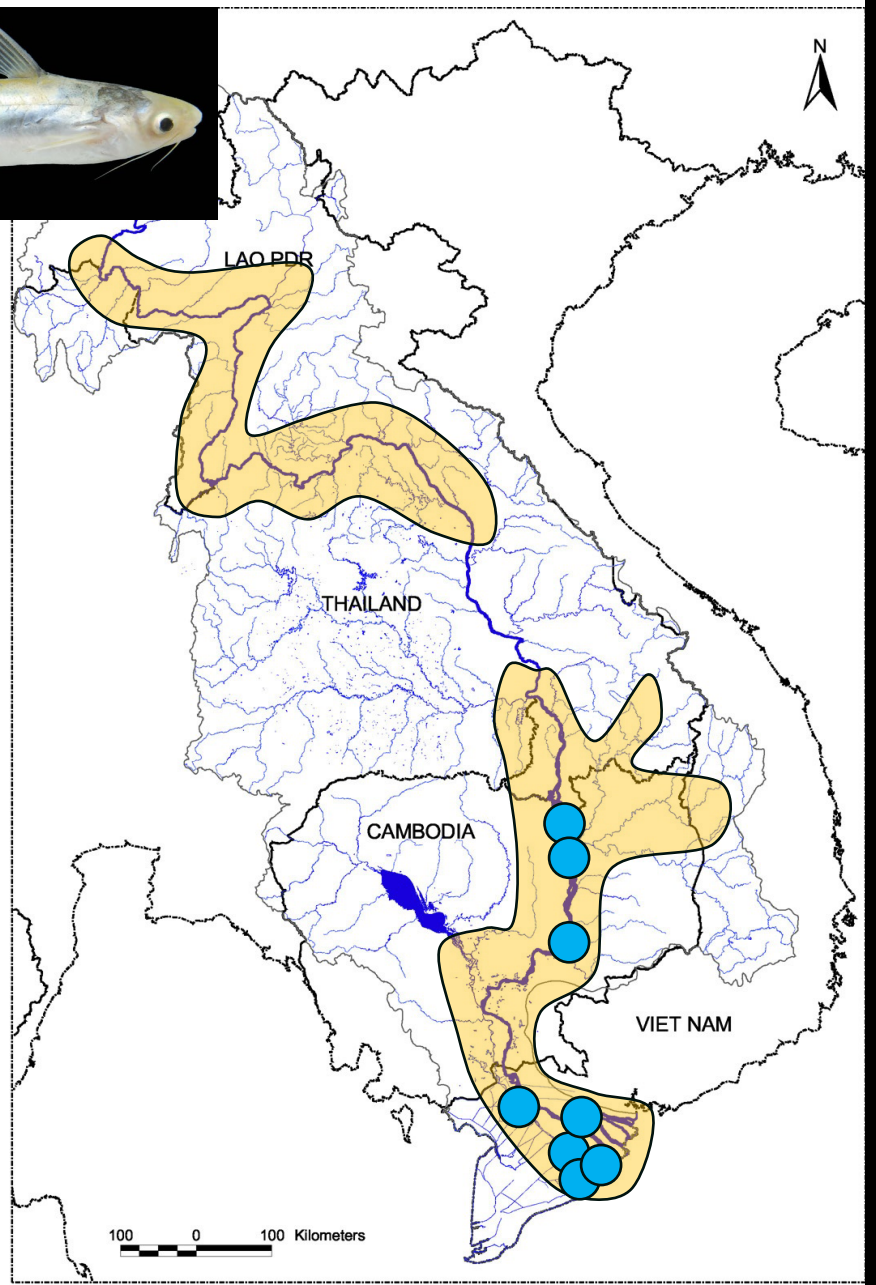
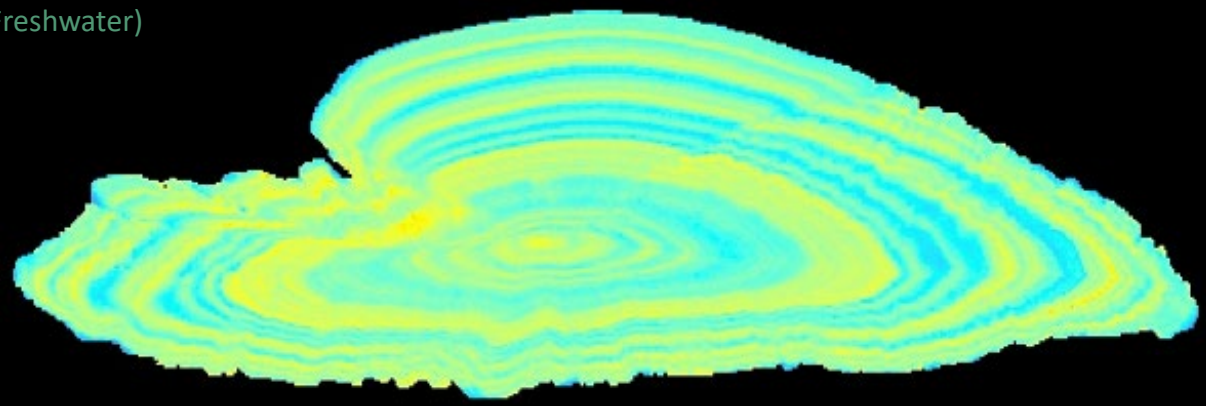
3. *Pangasius elongatus*

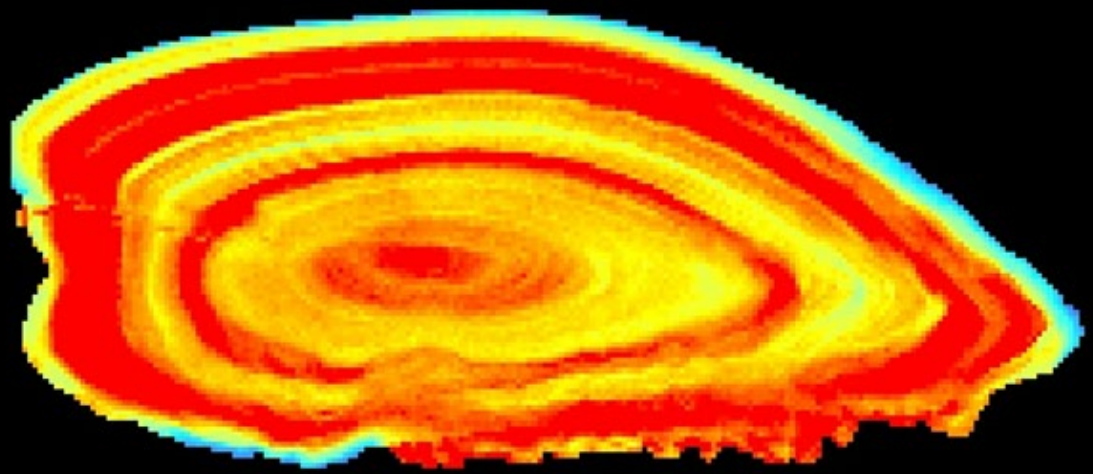


Migration pattern 1: 62%
(Freshwater)



Sr:Ca (x1000)

Migration pattern 2: 38%
(Freshwater – Brackish)



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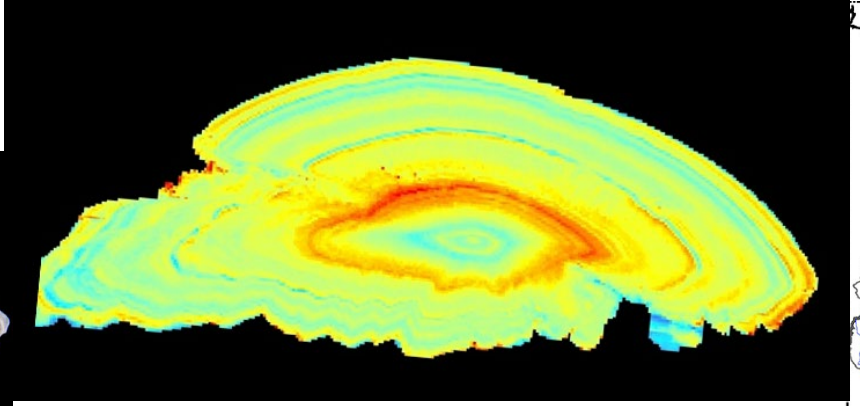
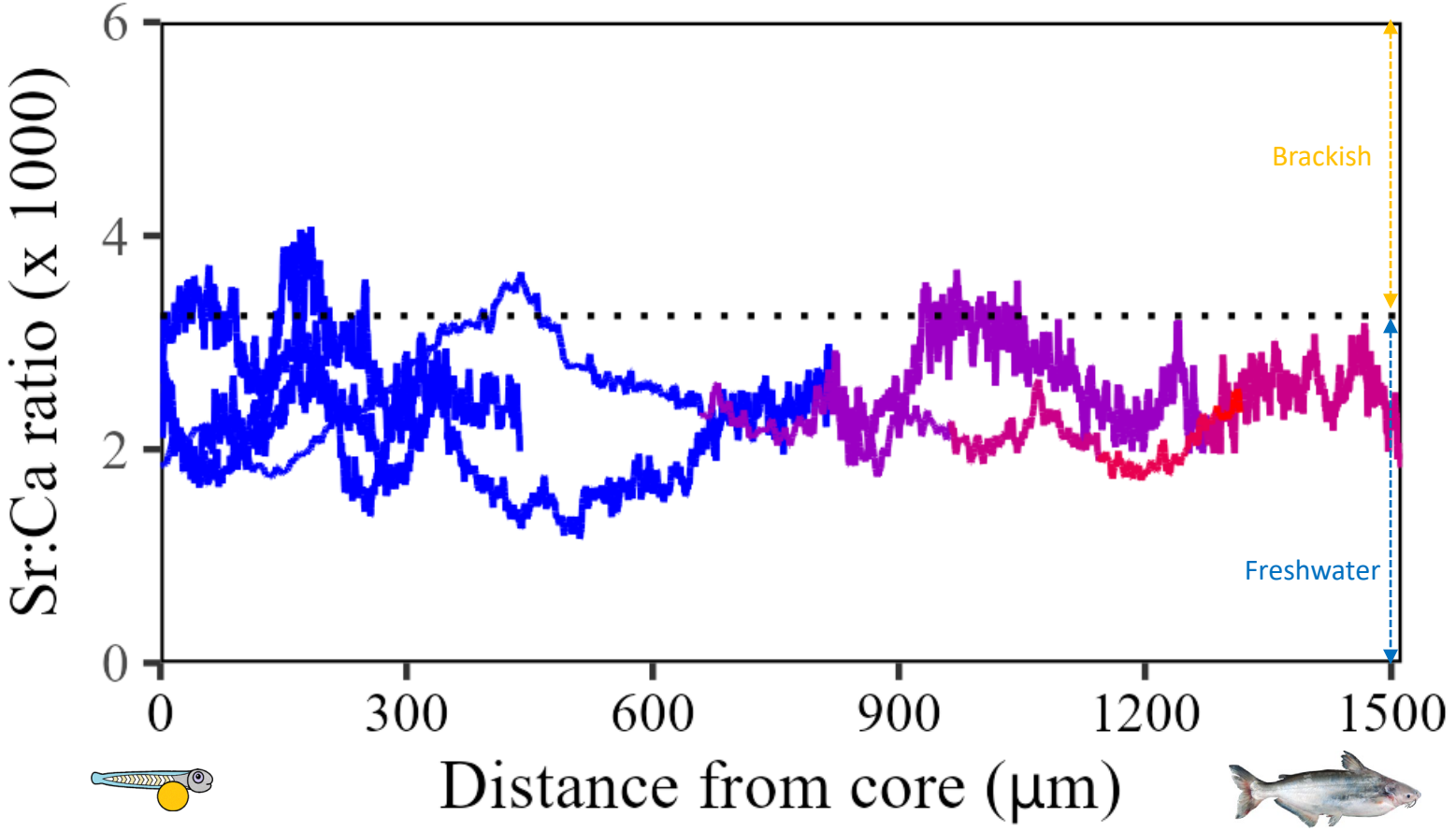
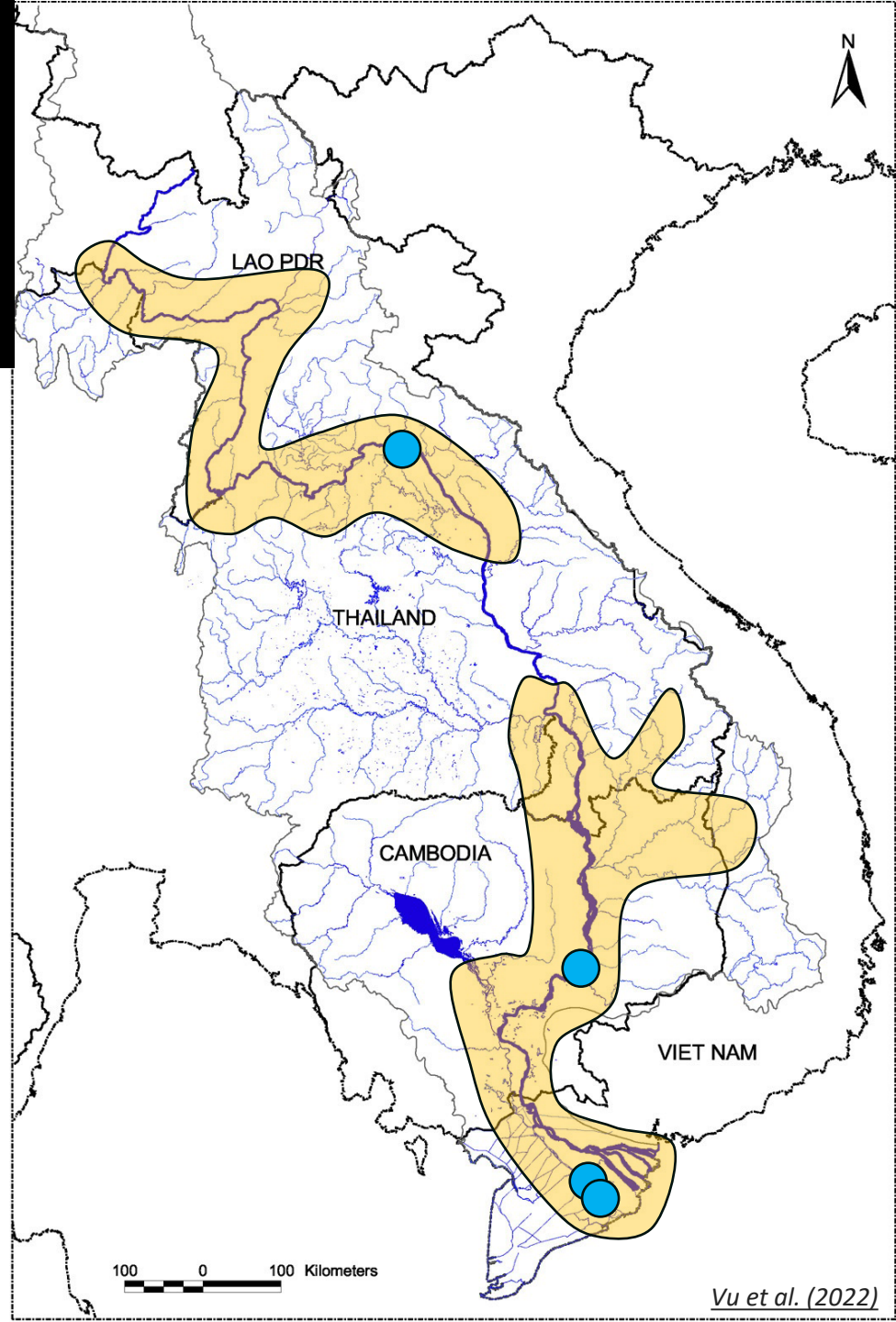
Vu et al. (2022)

4. *Pangasius bocourti*

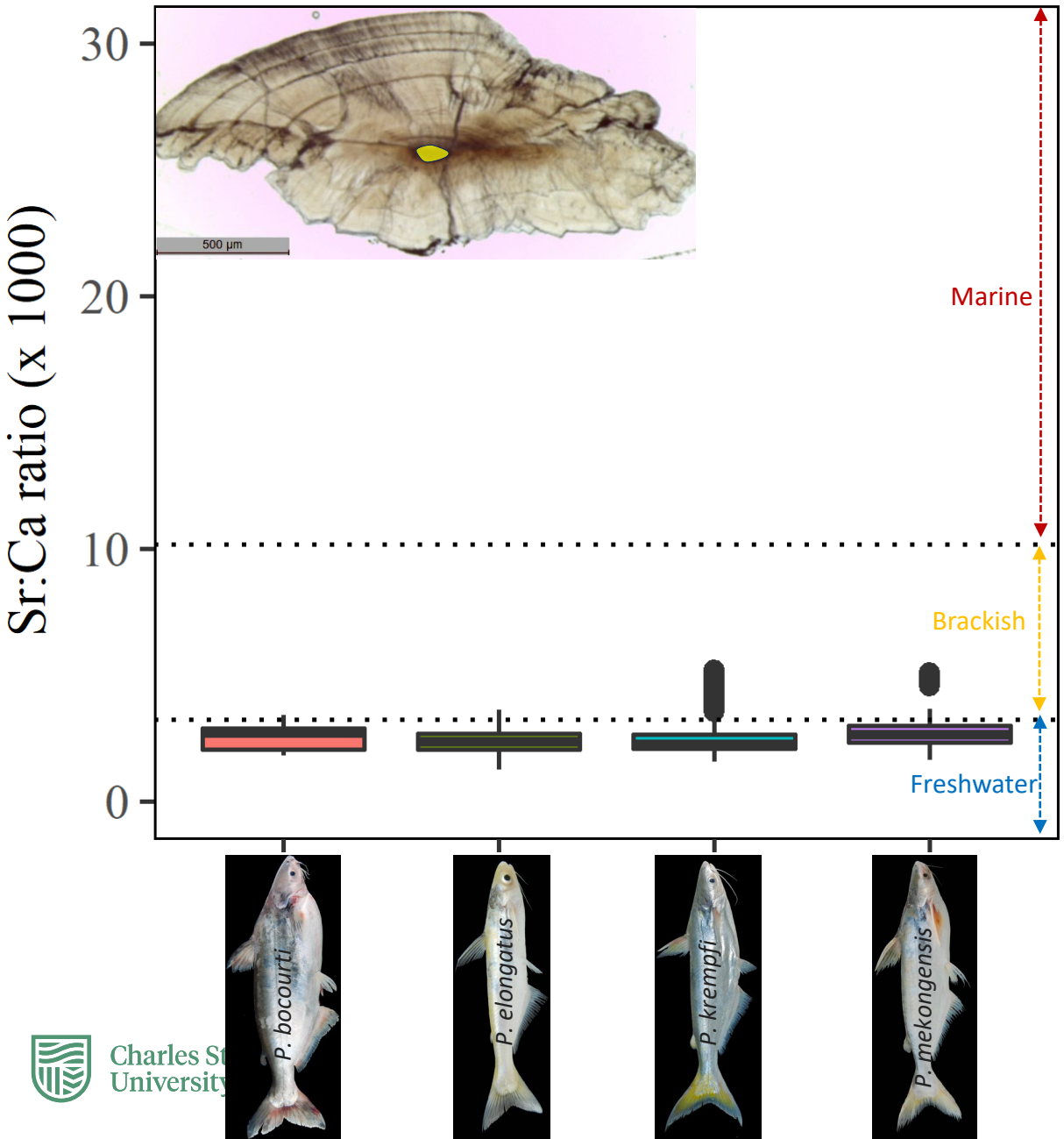




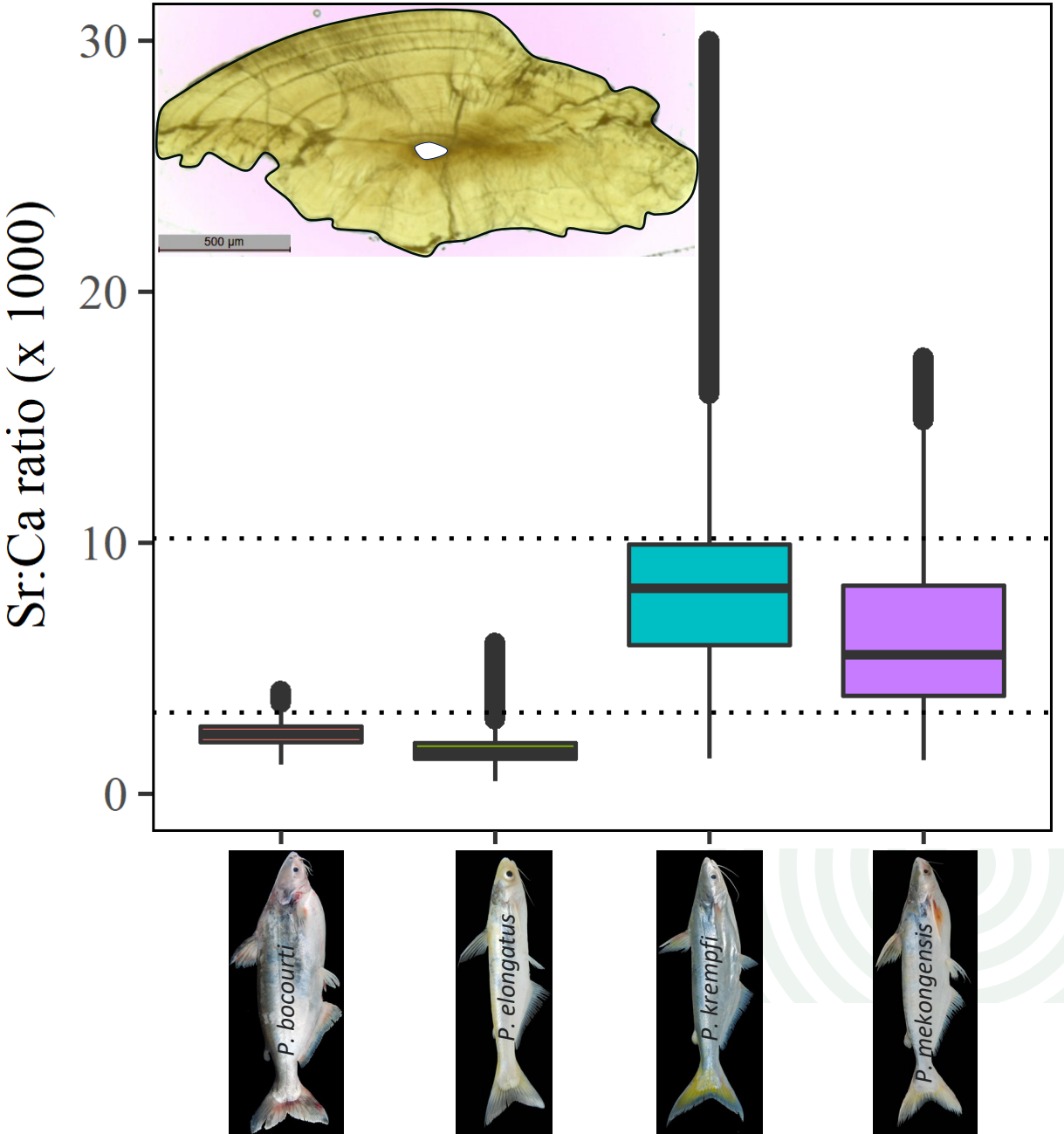


Vu et al. (2022)

Otolith Core = at Birth (Spawning sites)



Otolith beyond the Core = after Birth (Migration)



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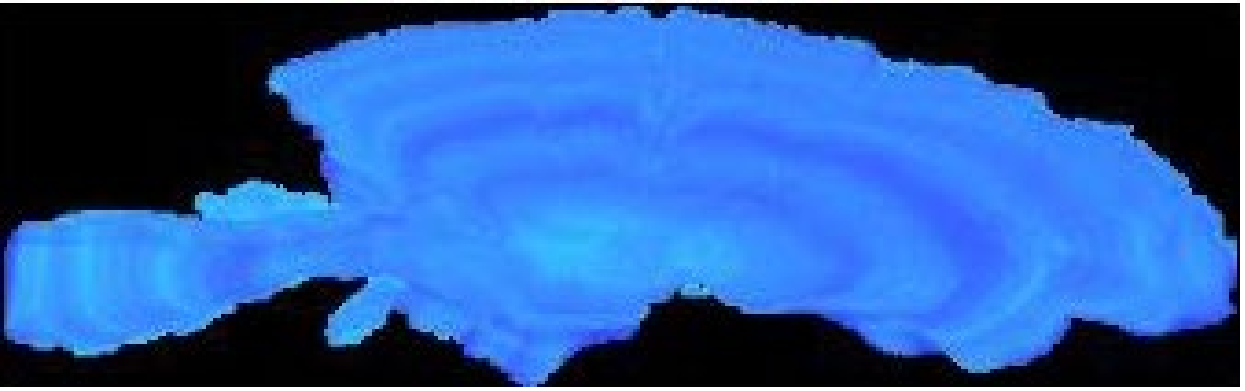
5. *Plotosus canius* (Gray eel-catfish)

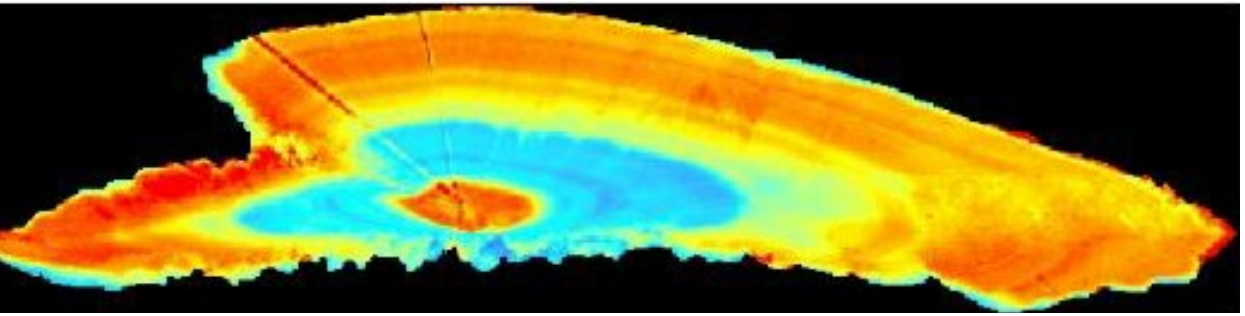
1. Remain in Freshwater: 24%



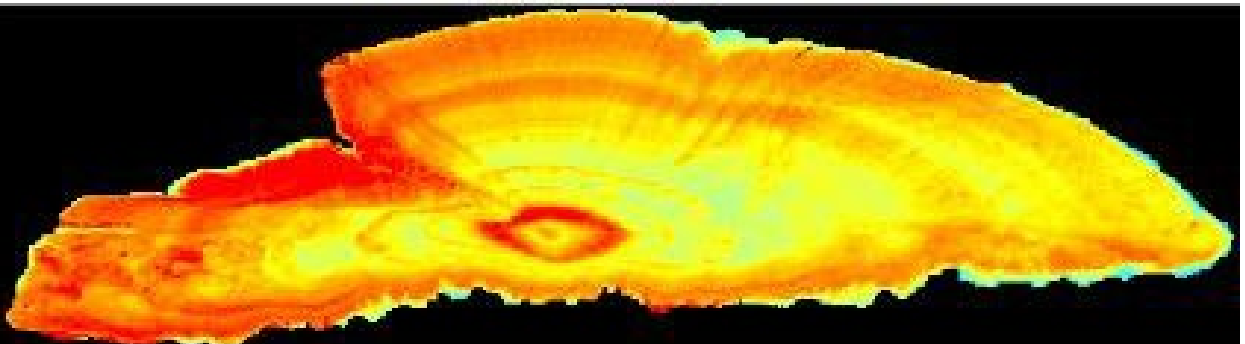
Sr:Ca (x1000)

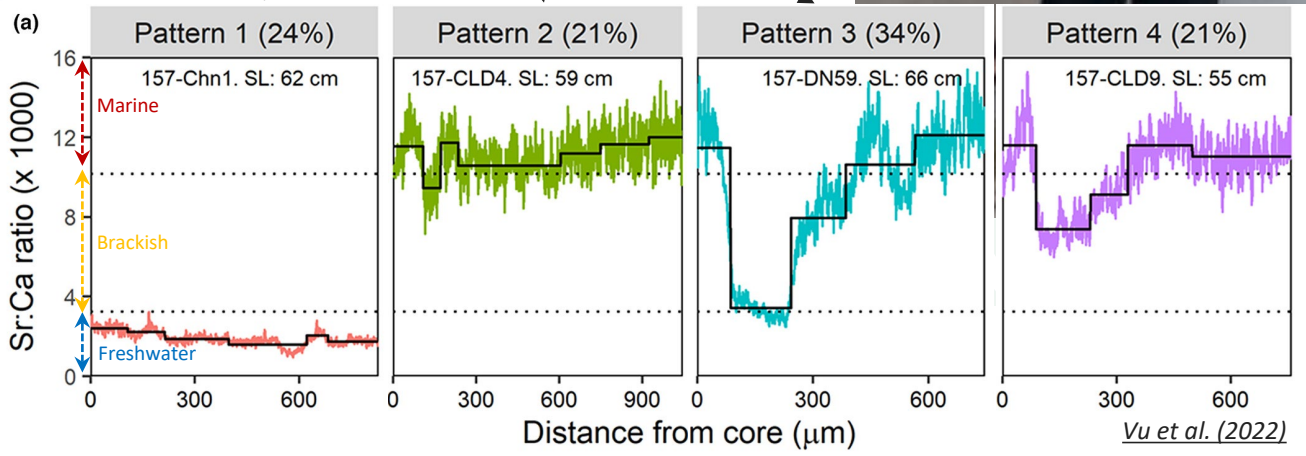
I have **Multiple Migration Strategies**!

3. Move between Fresh & Marine water: 34%



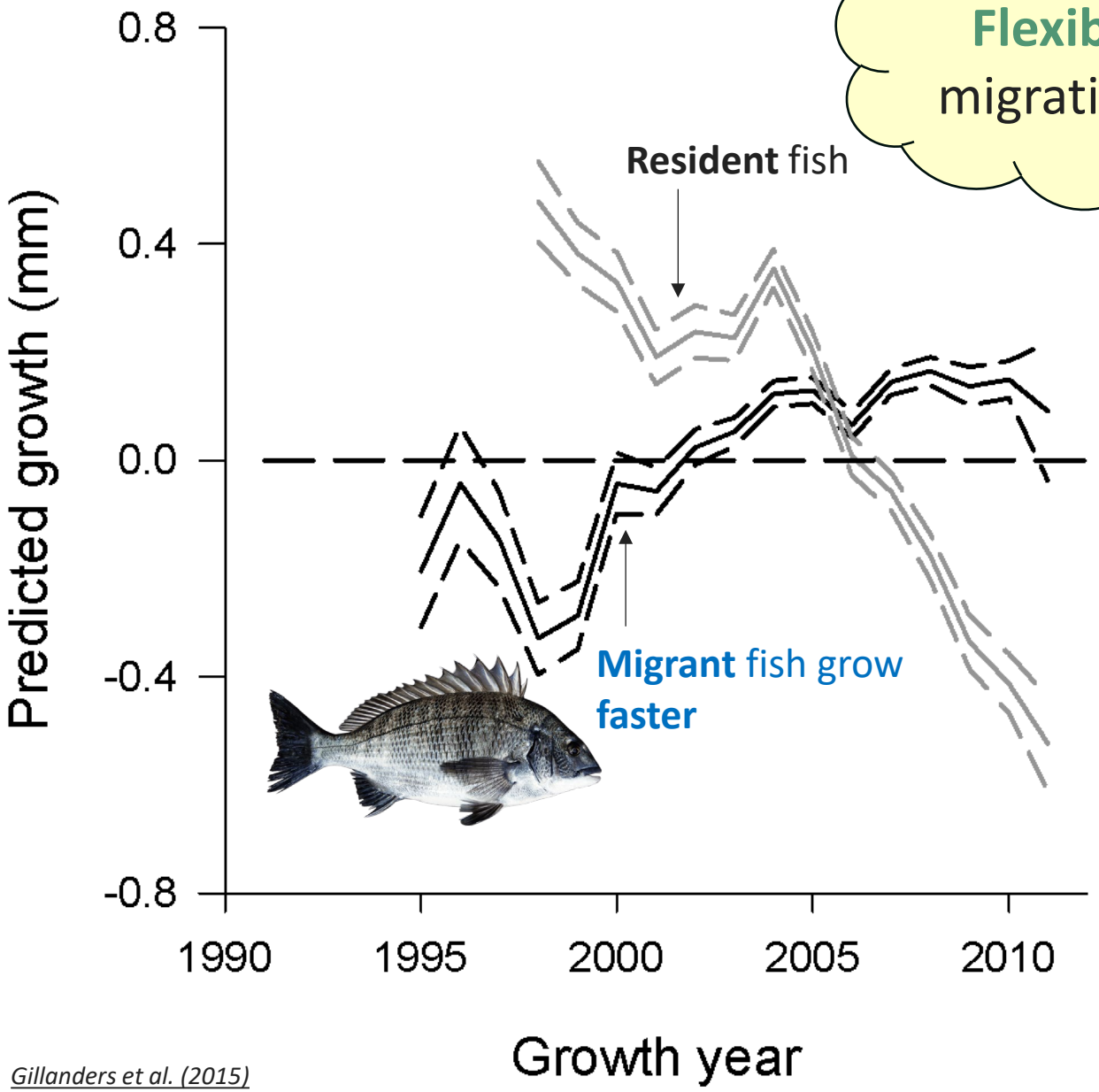
4. Remain in Marine & Brackish: 21%





Vu et al. (2022)

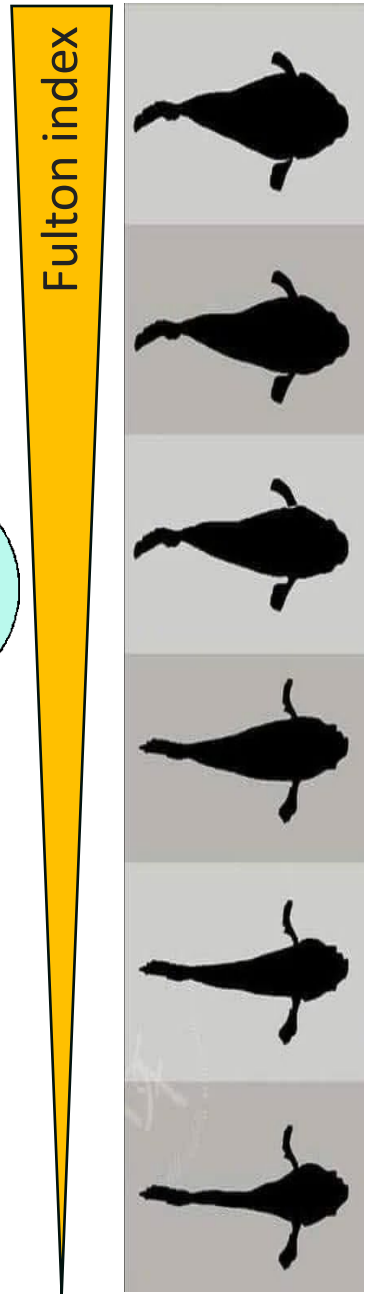
Growth rate



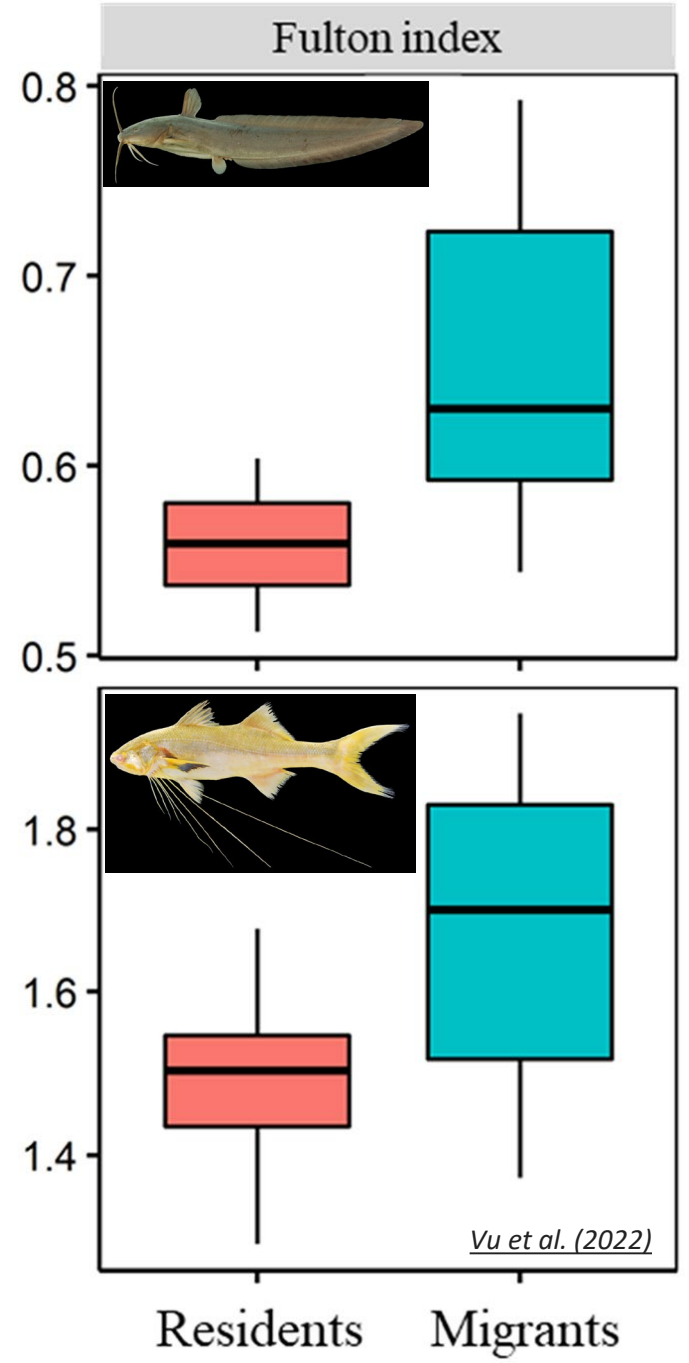
Why **Flexible** migration?

River

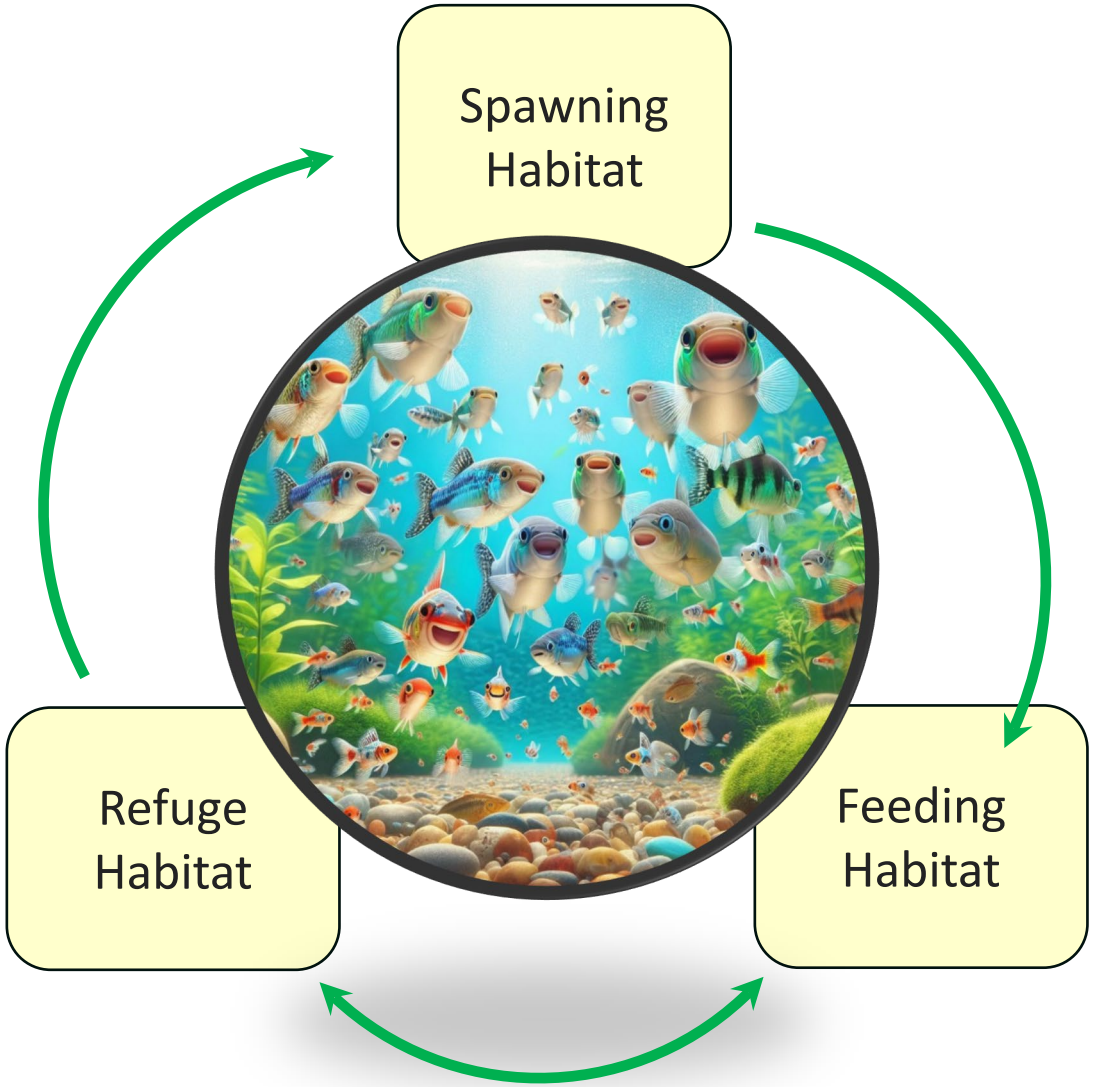
s



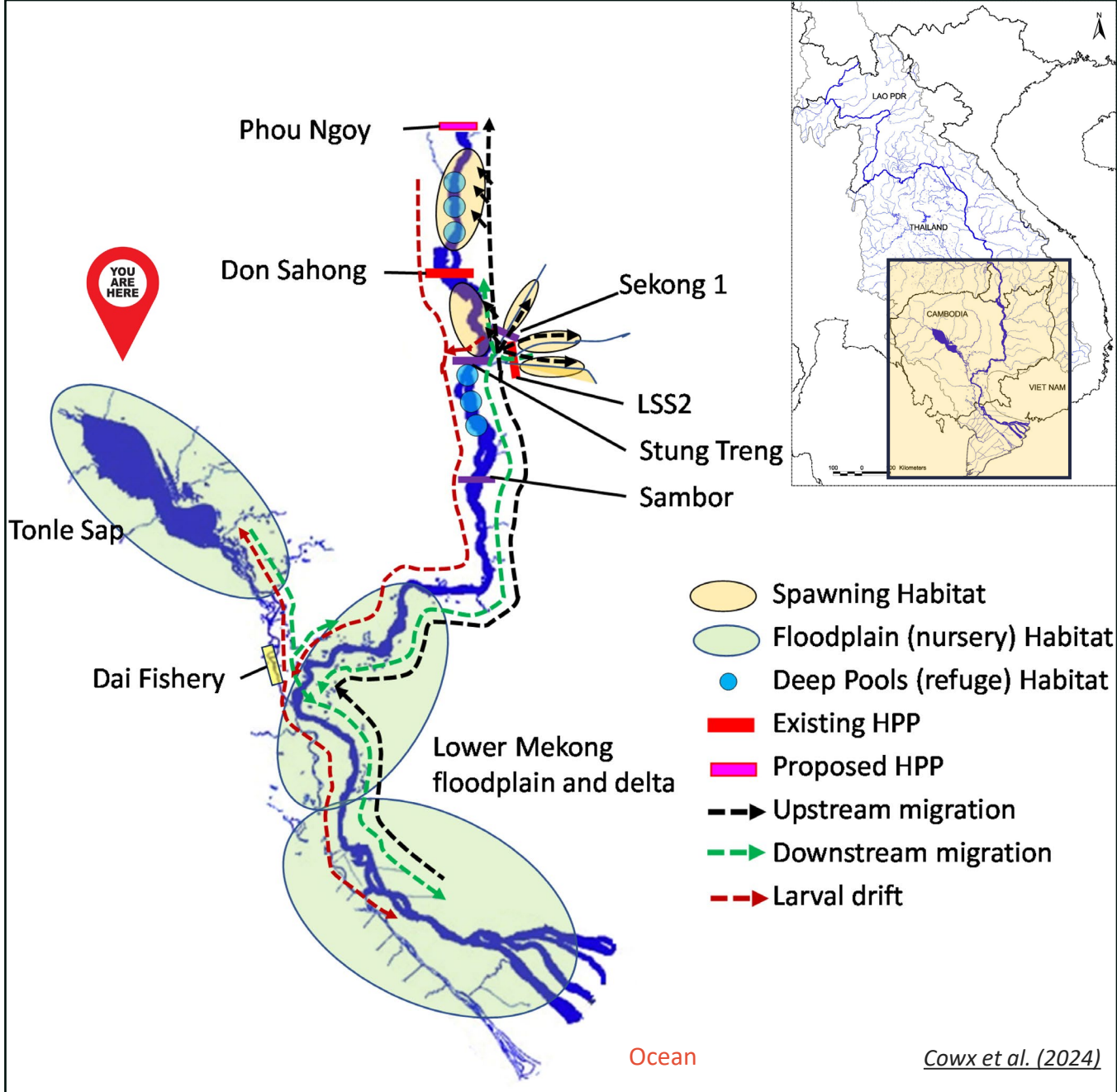
Body condition (Fulton index)



Gillanders et al. (2015)



Critical habitats & Fish migration



Transboundary lower Mekong migratory super swimway in Cambodia and Vietnam

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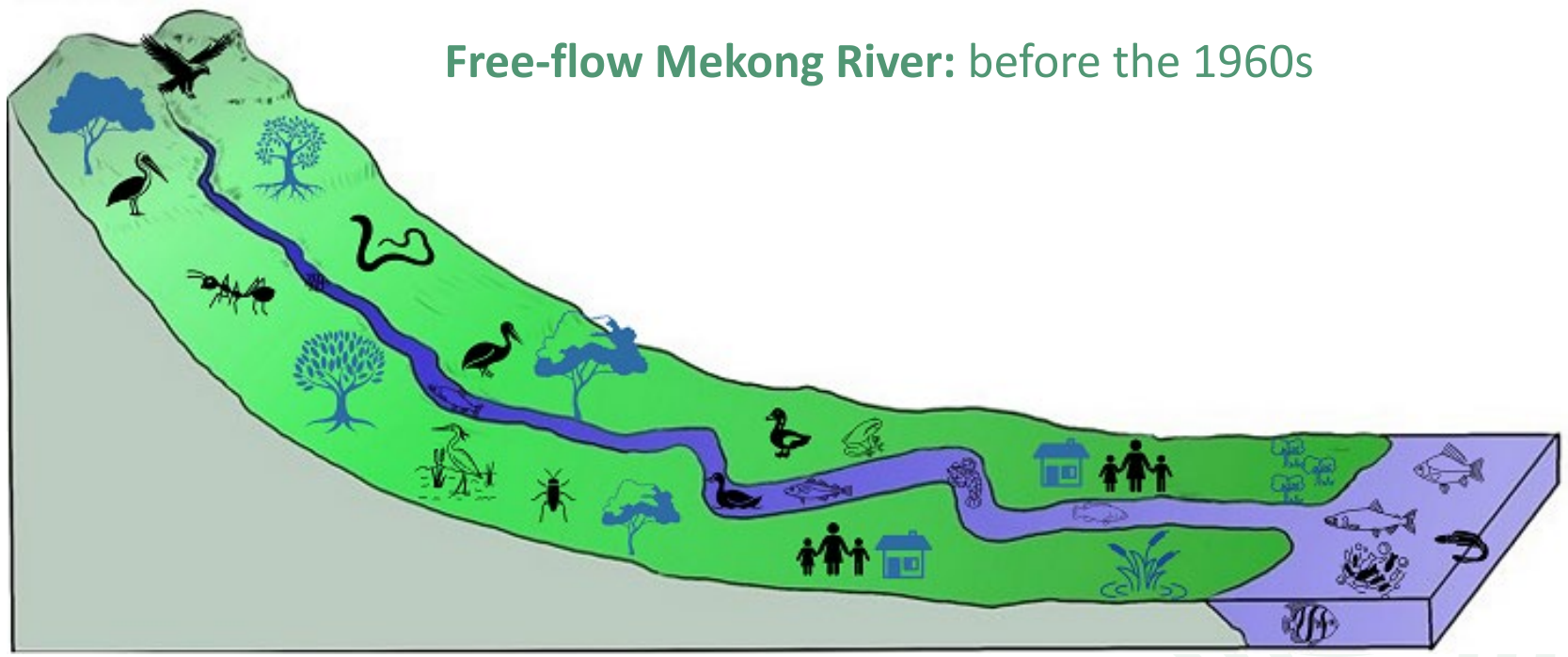
1. Identify threats → Stop those threats (eg. dam removal).
   Is it possible?

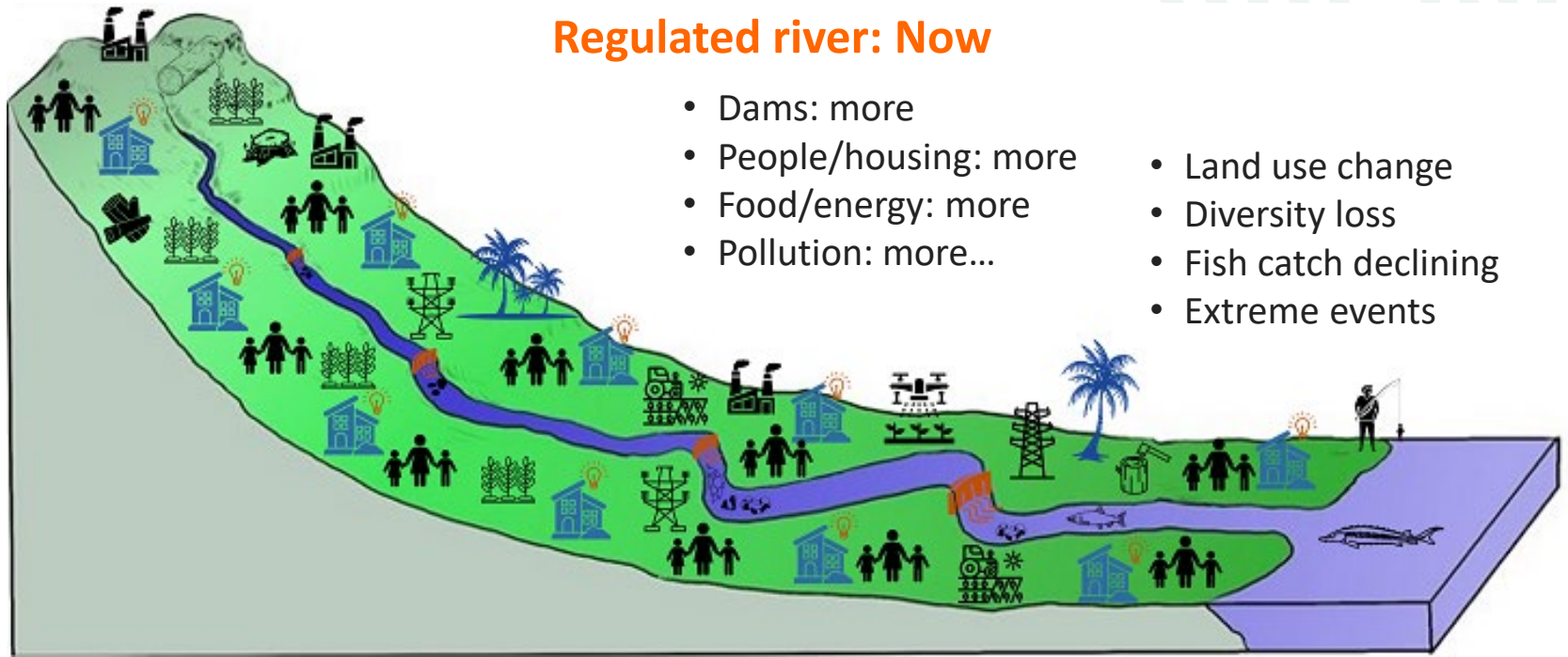
2. Understand fish ecology (habitat requitement in diff stages each species).
   - ❖ Regulate/manage for sustainable ways (eg. fishing regulations, conservation zones…)
   - ❖ Mitigate (eg. fishway, renewable energy)

   Is it possible?

- ✓ Long-distance migratory species: 37%
- ✓ ~1300 fish species in the Mekong River. 39%: very limited data.



Free-flow Mekong River: before the 1960s



Regulated river: Now

- Dams: more
- People/housing: more
- Food/energy: more
- Pollution: more…

- Land use change
- Diversity loss
- Fish catch declining
- Extreme events

Acknowledgement

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AUSTRALIA

Australia Awards Scholarships

NATIONAL GEOGRAPHIC

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THANK YOU

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