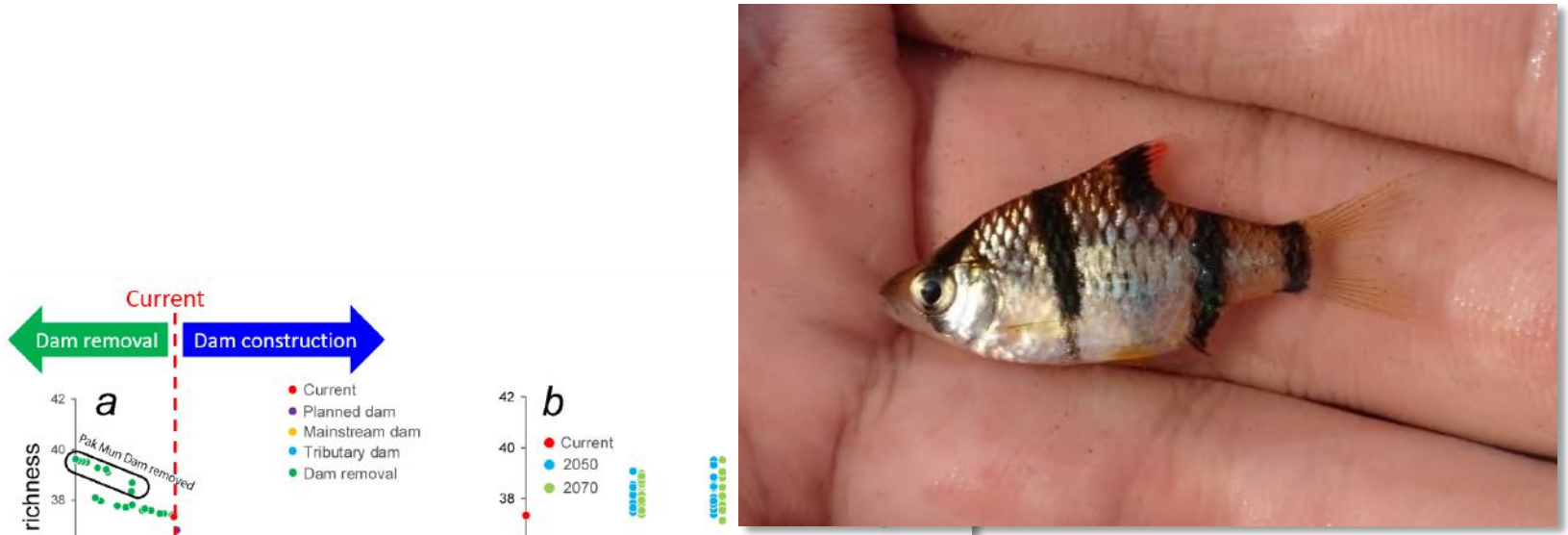
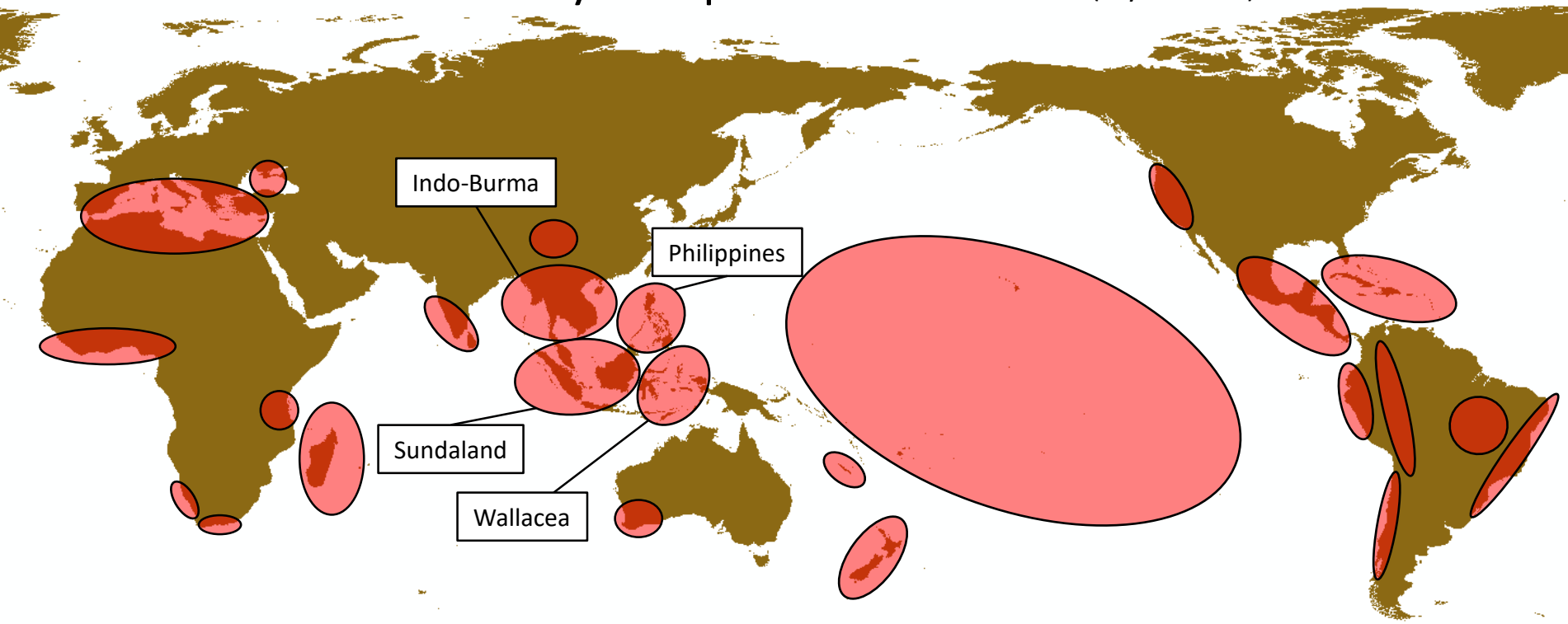
Anticipating the impacts of hydropower dams in the Mekong River by a freshwater fish observation network



Yuichi Kano, Kyushu University

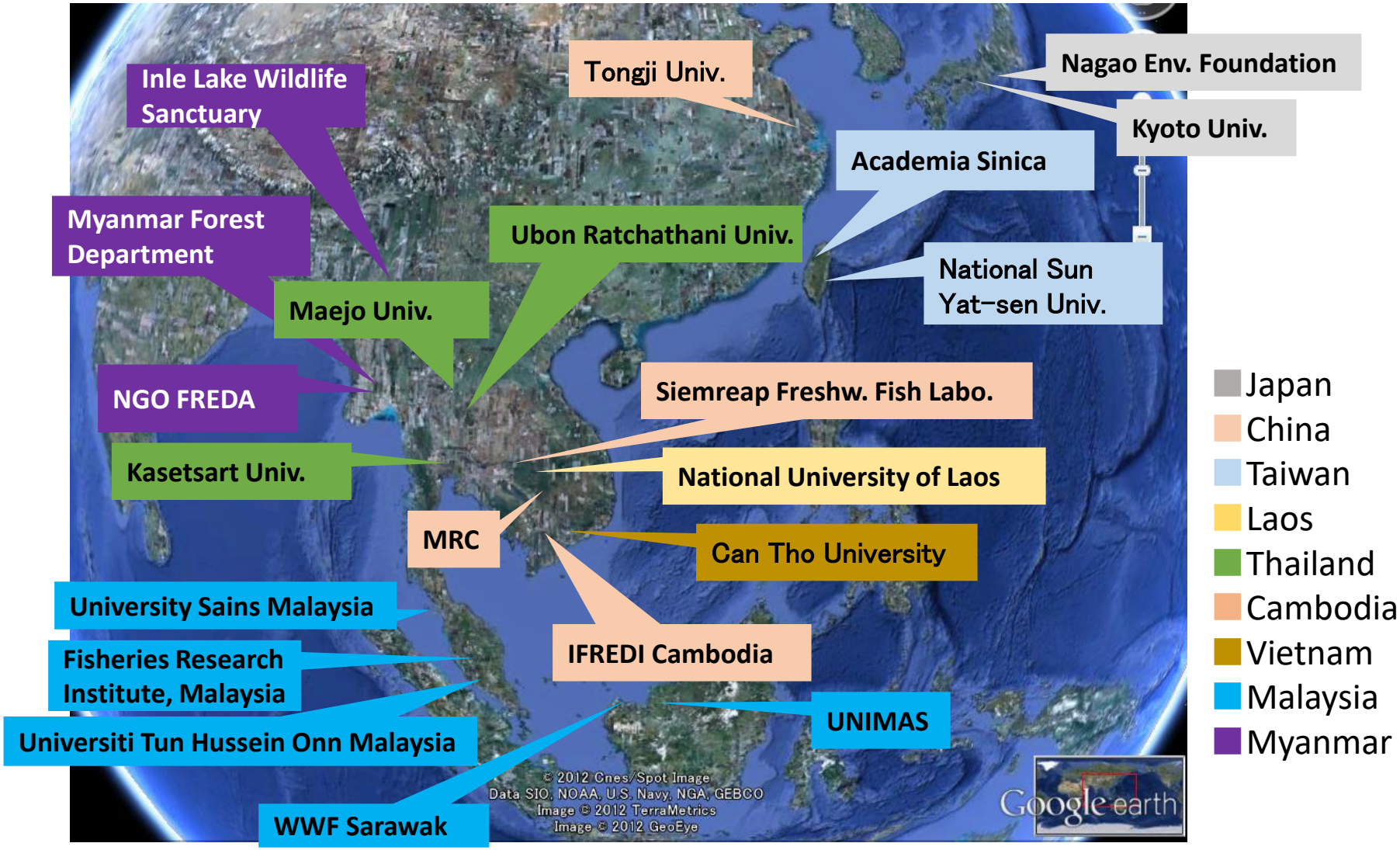
Biodiversity Hotspots of the World (Myers 2000)



Whole area of Southeast Asia is included as “Hotspot”

	Area	Freshwater fish species
All the World	100%	100% (12,000 species)
SE Asia	4%	20% (3,000 species)

Our freshwater fish observation network in Asia

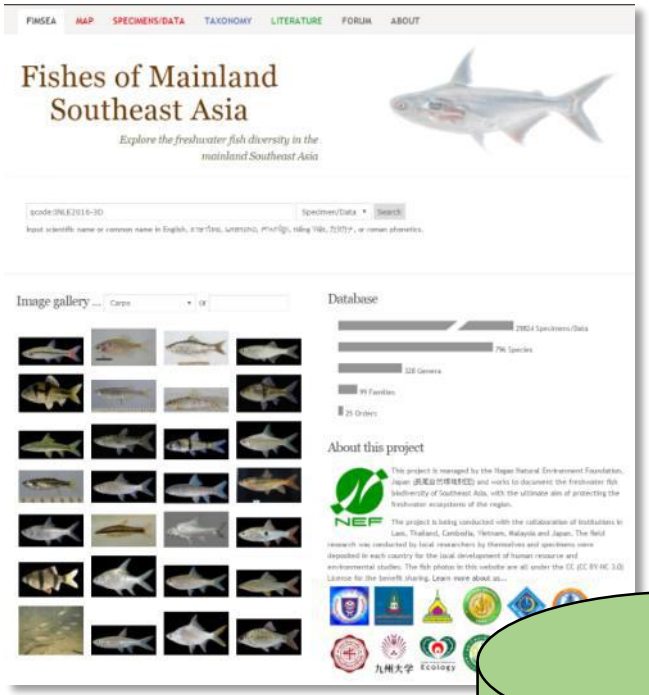


21 institutions, mainly in SE Asia

- Data sharing
- Collaborative researches
- Mutual assistances in the field works

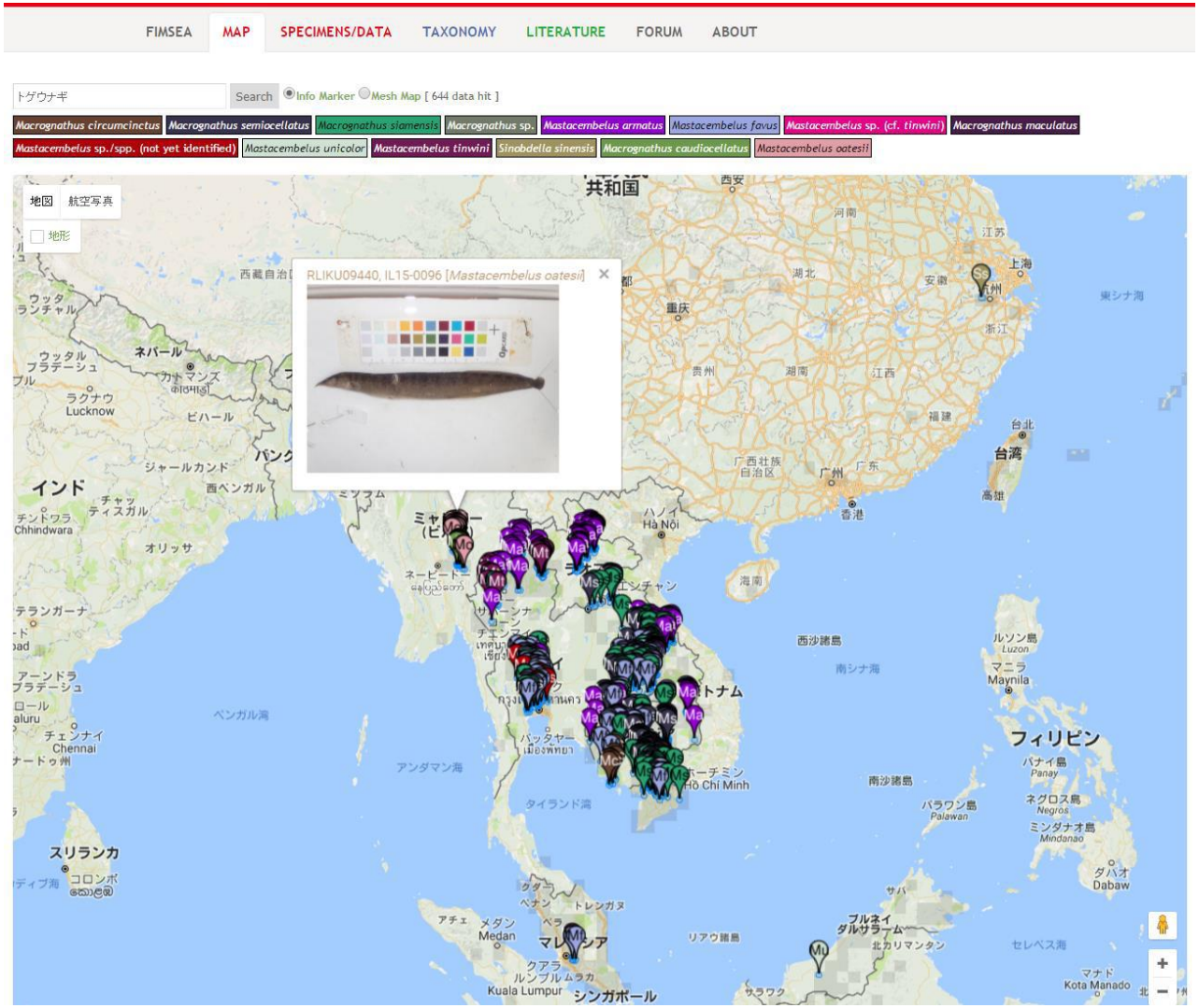
http://ffish.asia

From 2013~



Object: freshwater fish
Scale: Monsoon Asia
Contents: distribution, photo images, 3D models, literatures

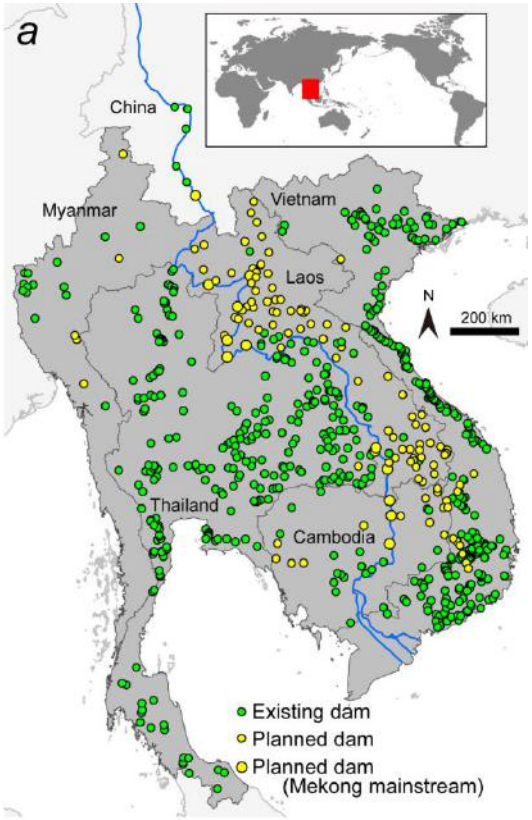
>30000 data



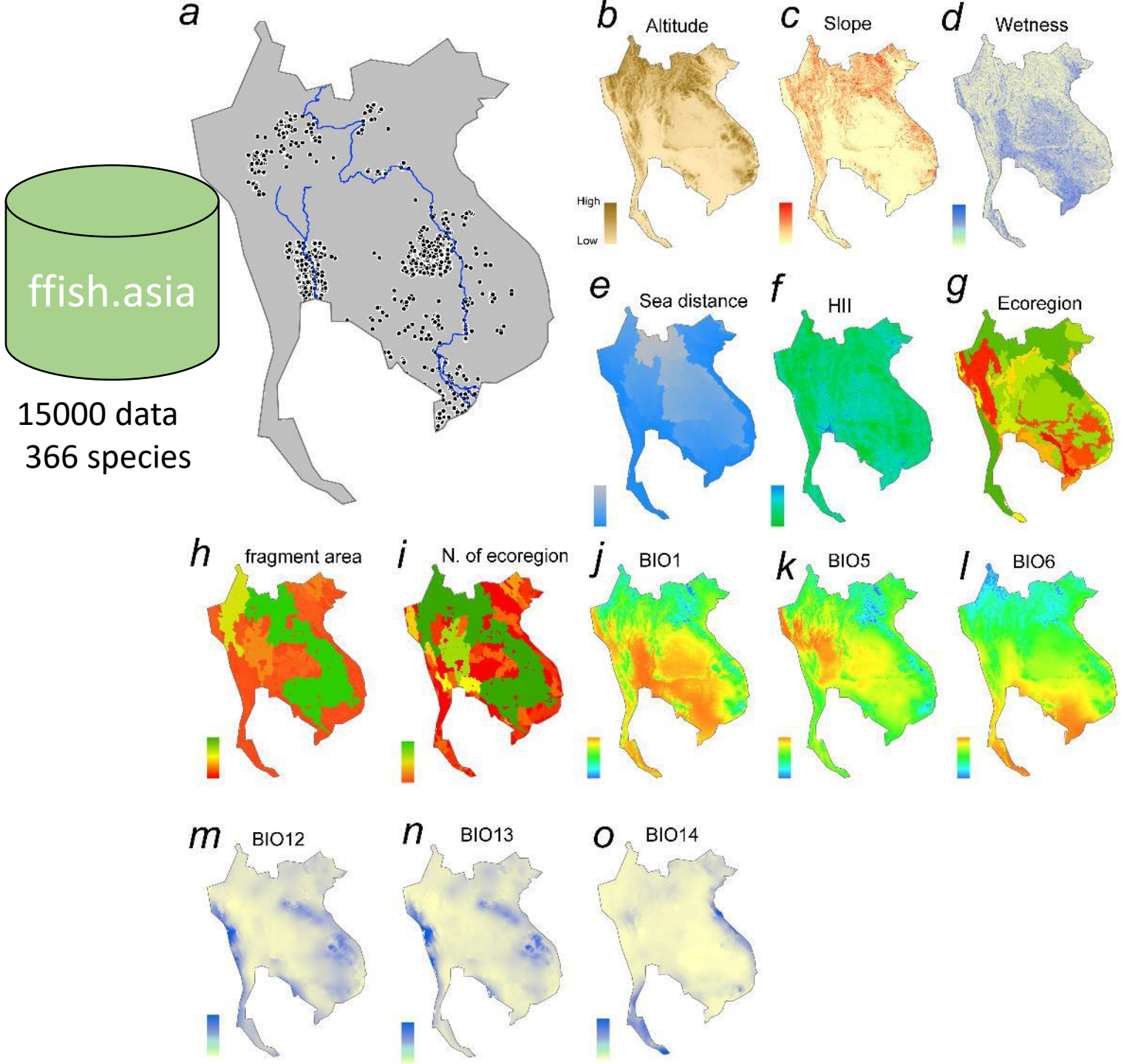
e.g. Search result for “spiny eel”

The most significant concern for freshwater fishes in Indo-Burma

Hydropower dams

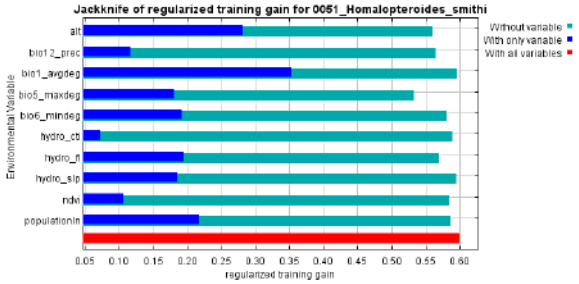


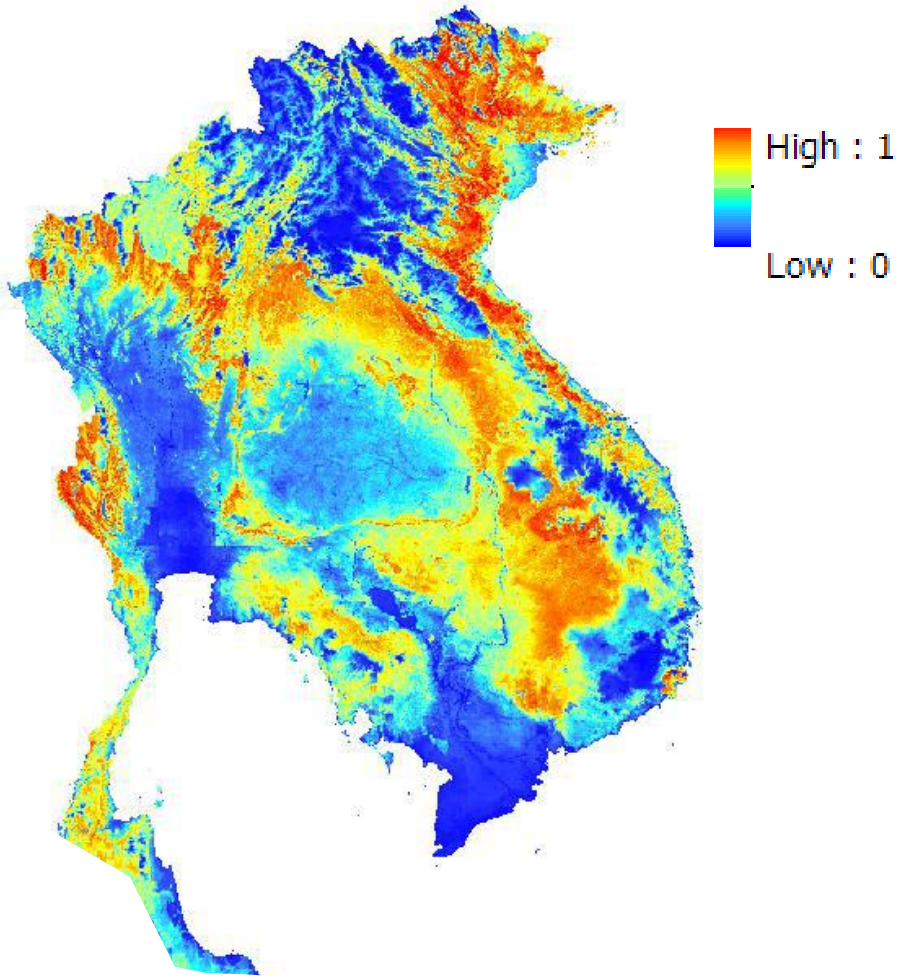
Simulate the impact using the our data


ffish.asia
15000 data
366 species
a
b
Altitude
High
Low
c
Slope
d
Wetness
e
Sea distance
f
HII
g
Ecoregion
h
fragment area
i
N. of ecoregion
j
BIO1
k
BIO5
l
BIO6
m
BIO12
n
BIO13
o
BIO14

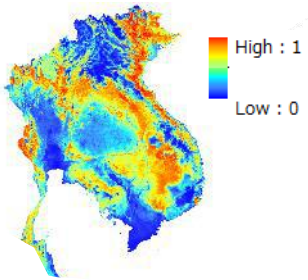
Maxent for each species

Homalopteroides smithi

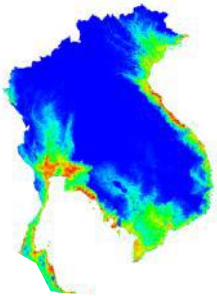




e.g.
Homalopteroides smithi



e.g.
Apocheilus panchax



Sum whole 366 species

Current species richness

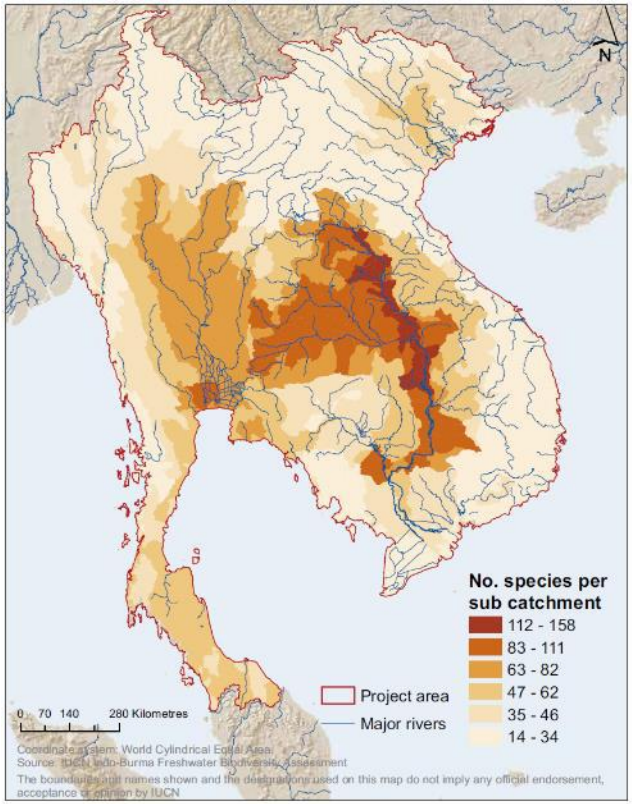
Impact of Pak Mun Dam

Inle Lake:
15-25 species/km^2

High : 100

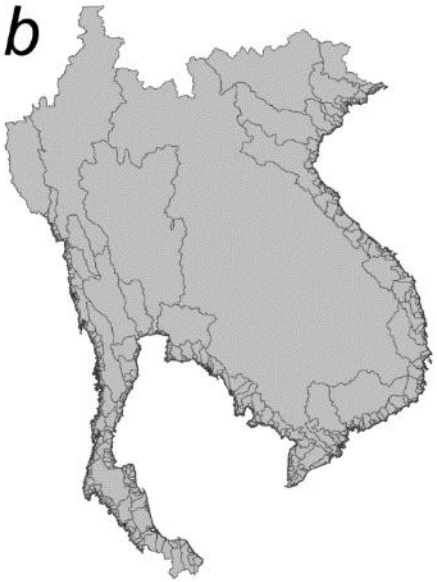
Low : 0

Tonle sap:
90-100 species/km^2

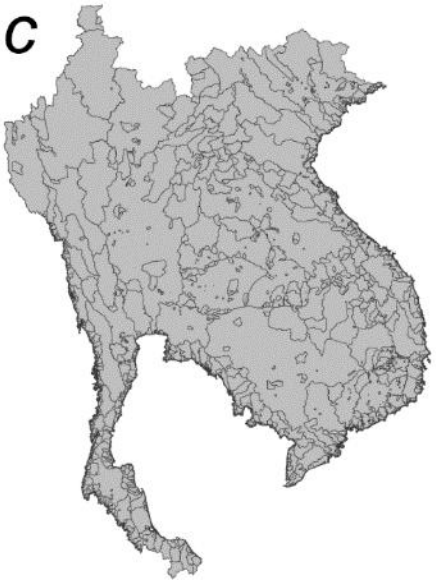


Allen 2012

Layers concerning dam (= ⚡ electric generating capacity)



Mainstream dam scenarios: 20
Tributary dams scenario: 20
Mixed dam scenarios: 20

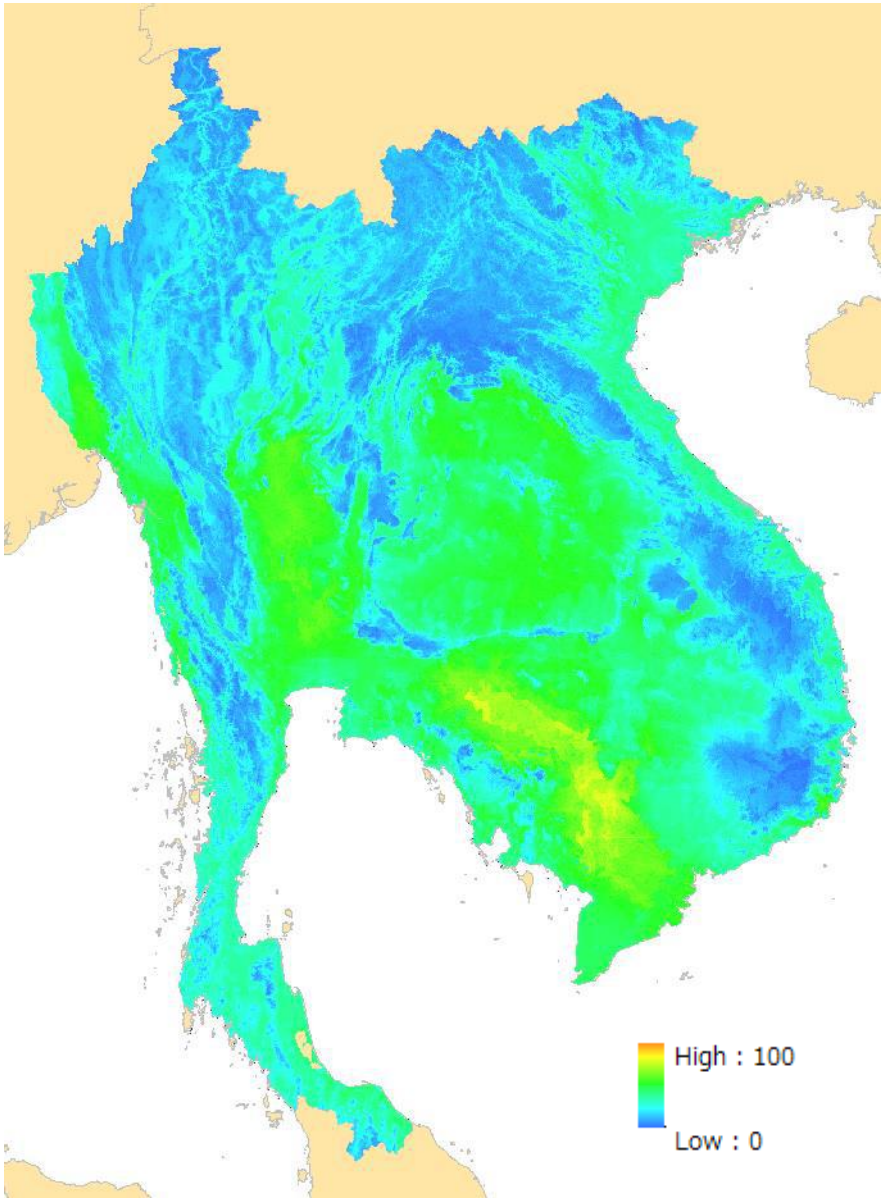


0%: 0 MW

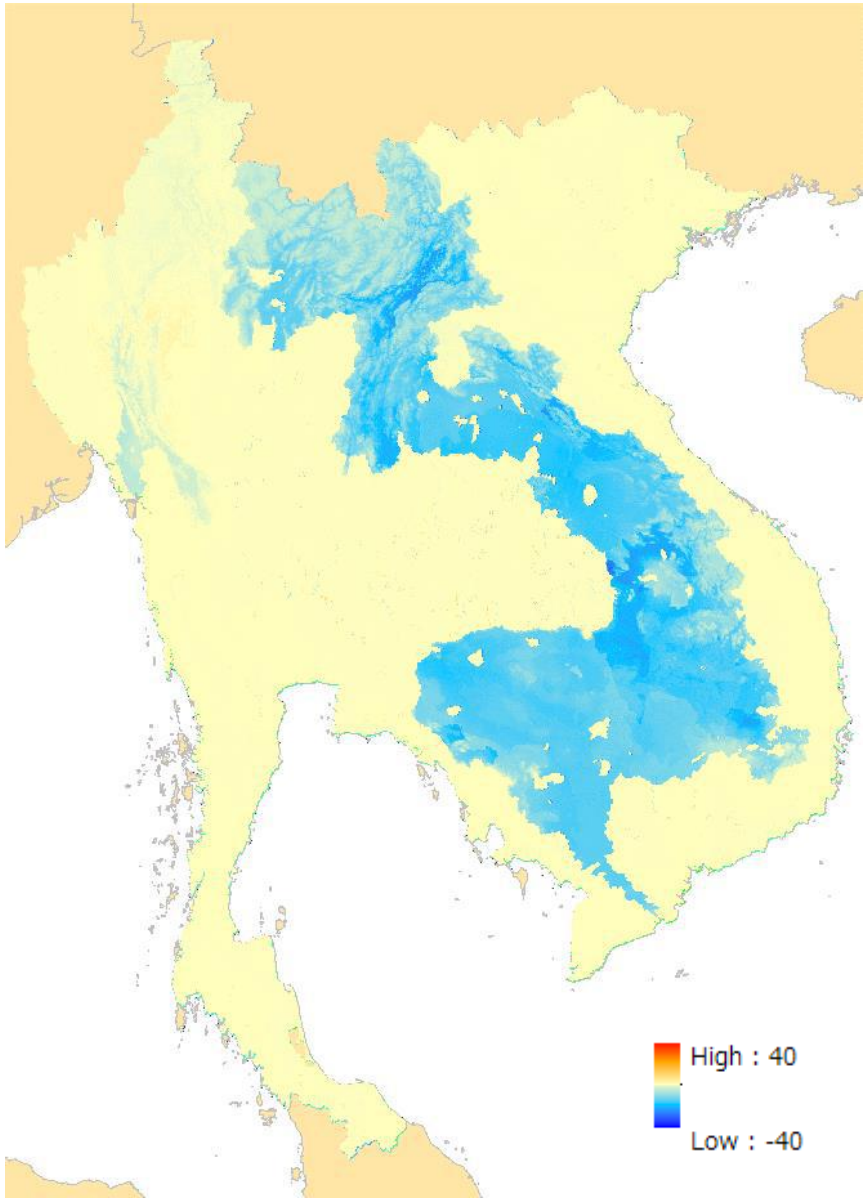
MW = f(watershed, slope)

100%: 30,000 MW

80 % planned dam scenario

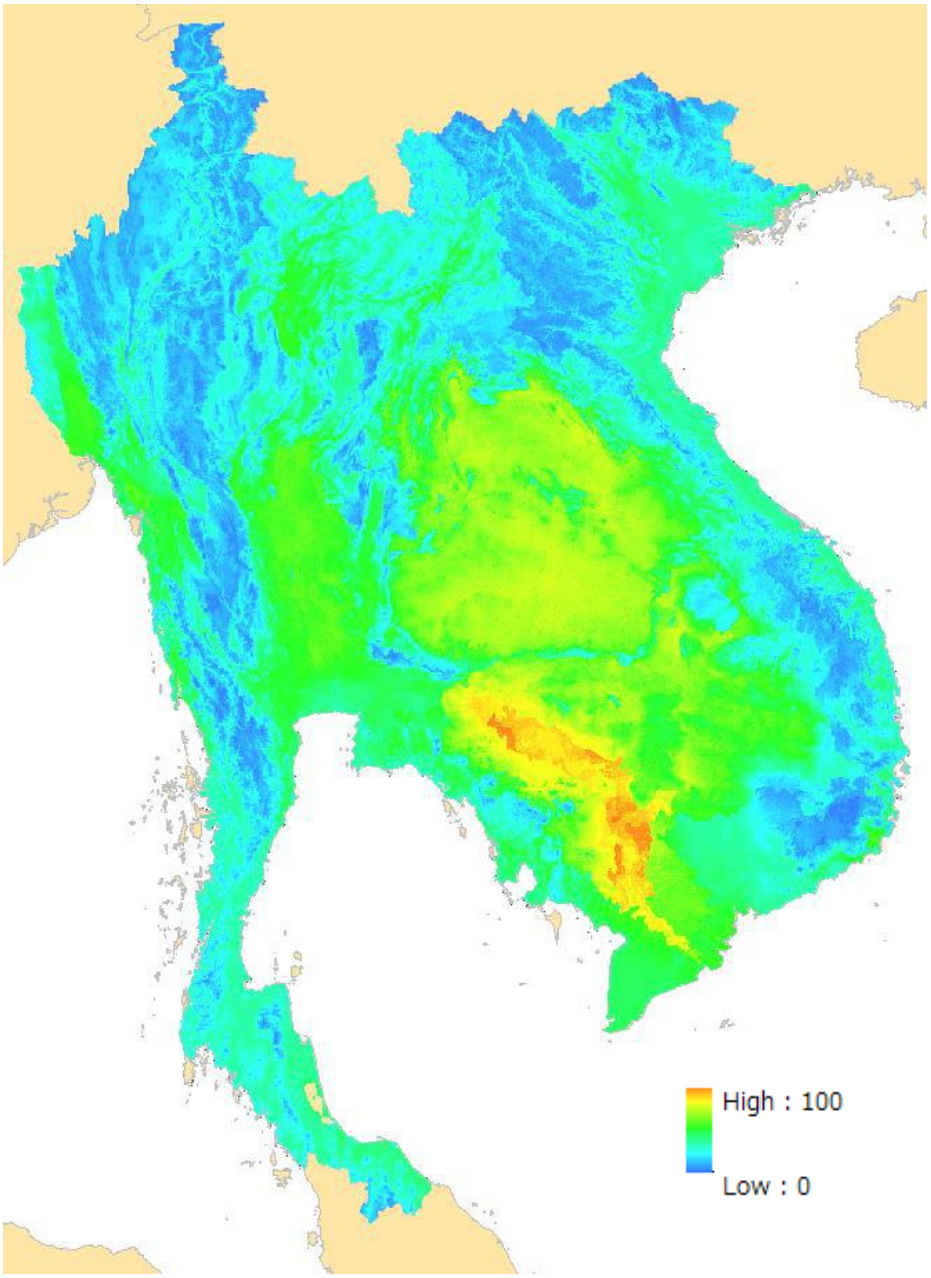


Species richness

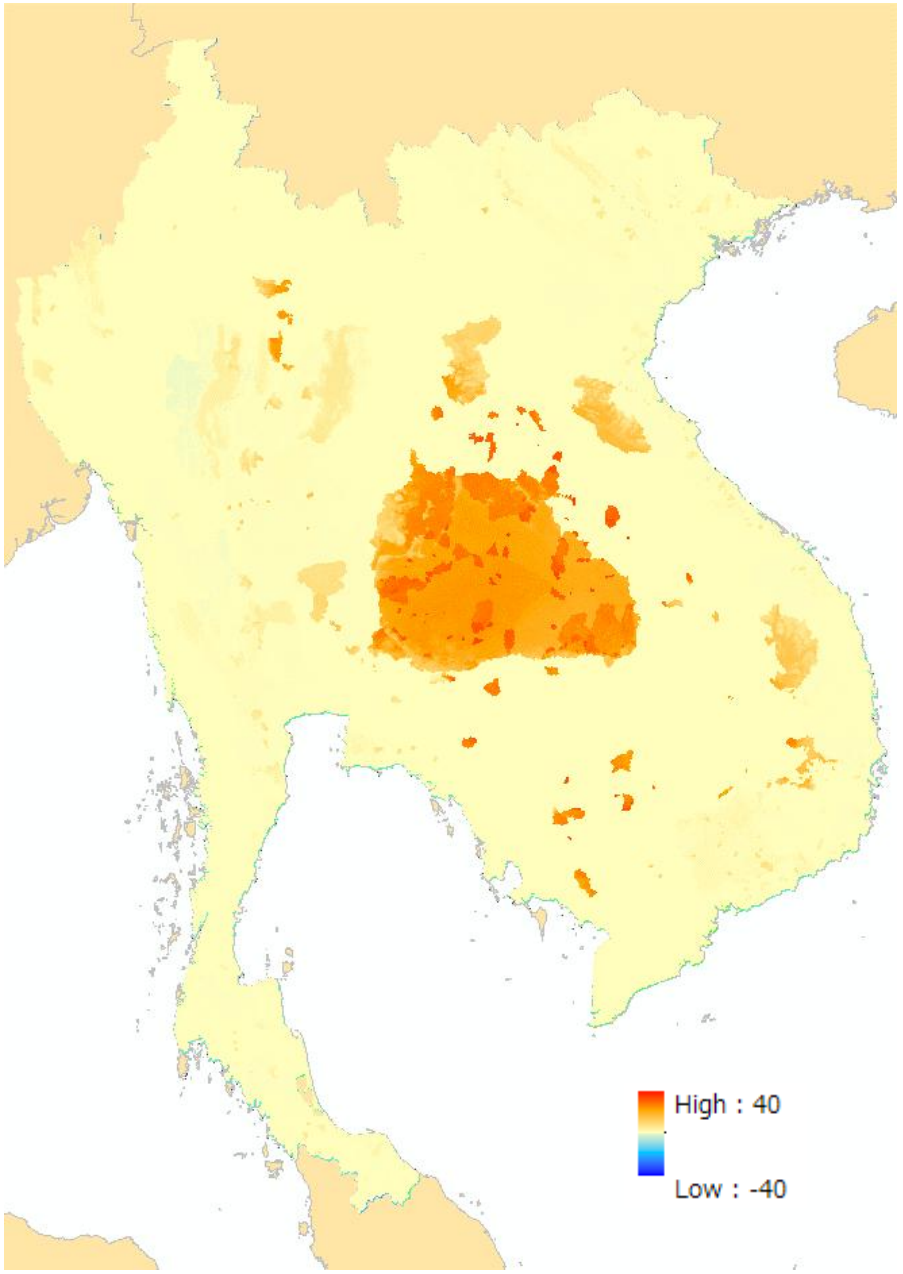


⊿ Current species richness

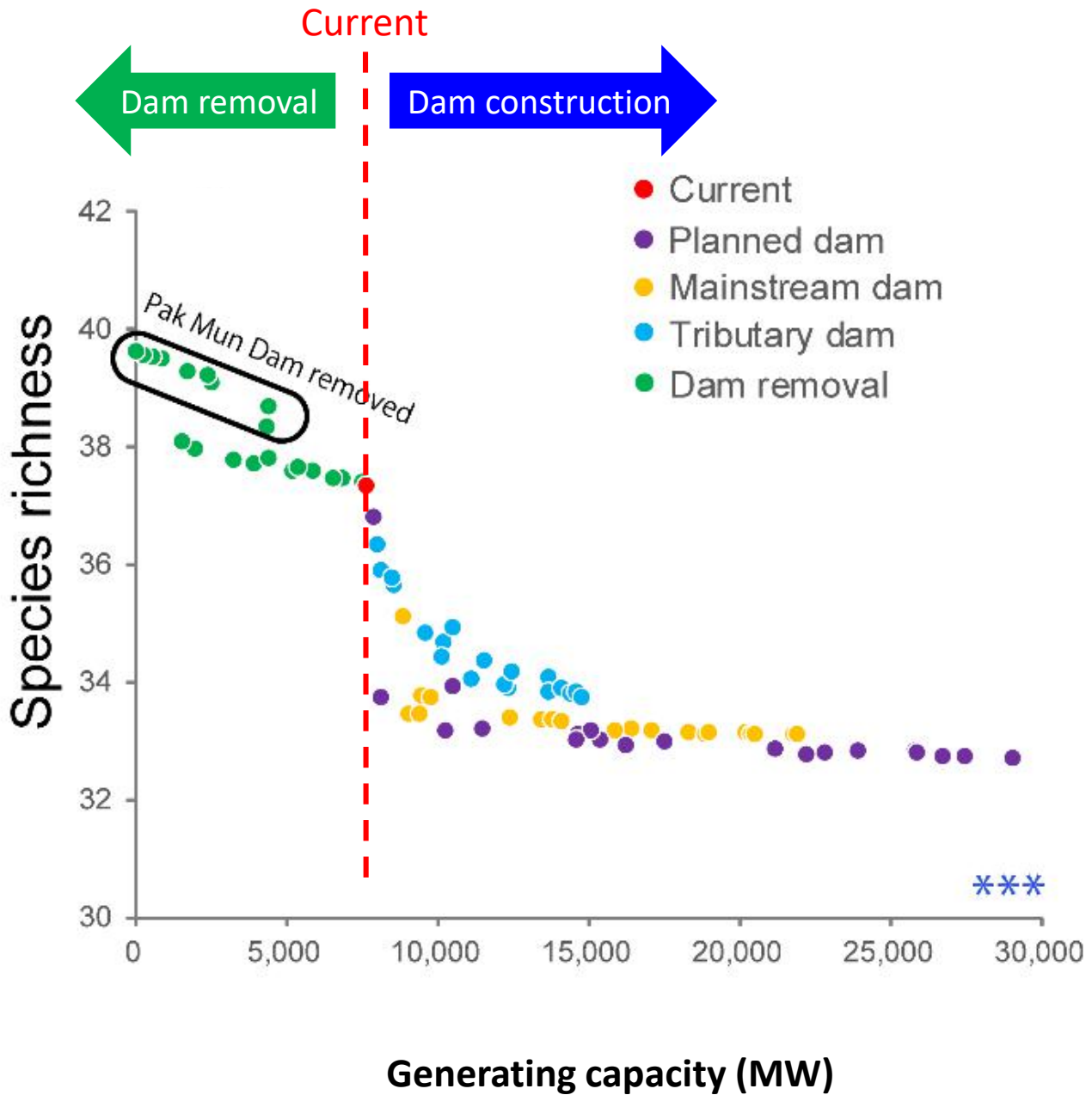
0 % dam (dam removal) scenario



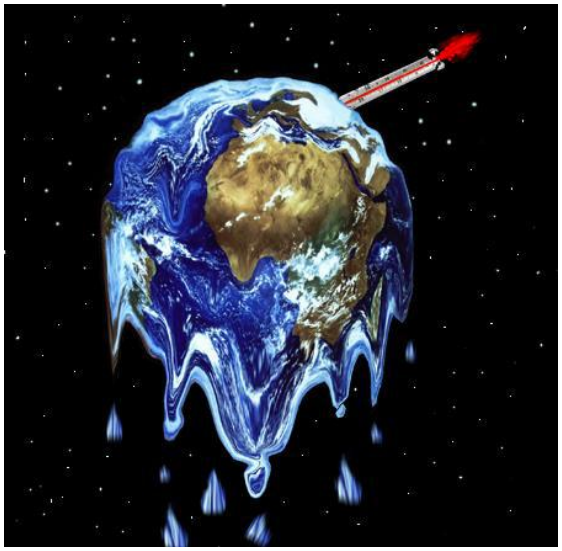
Species richness

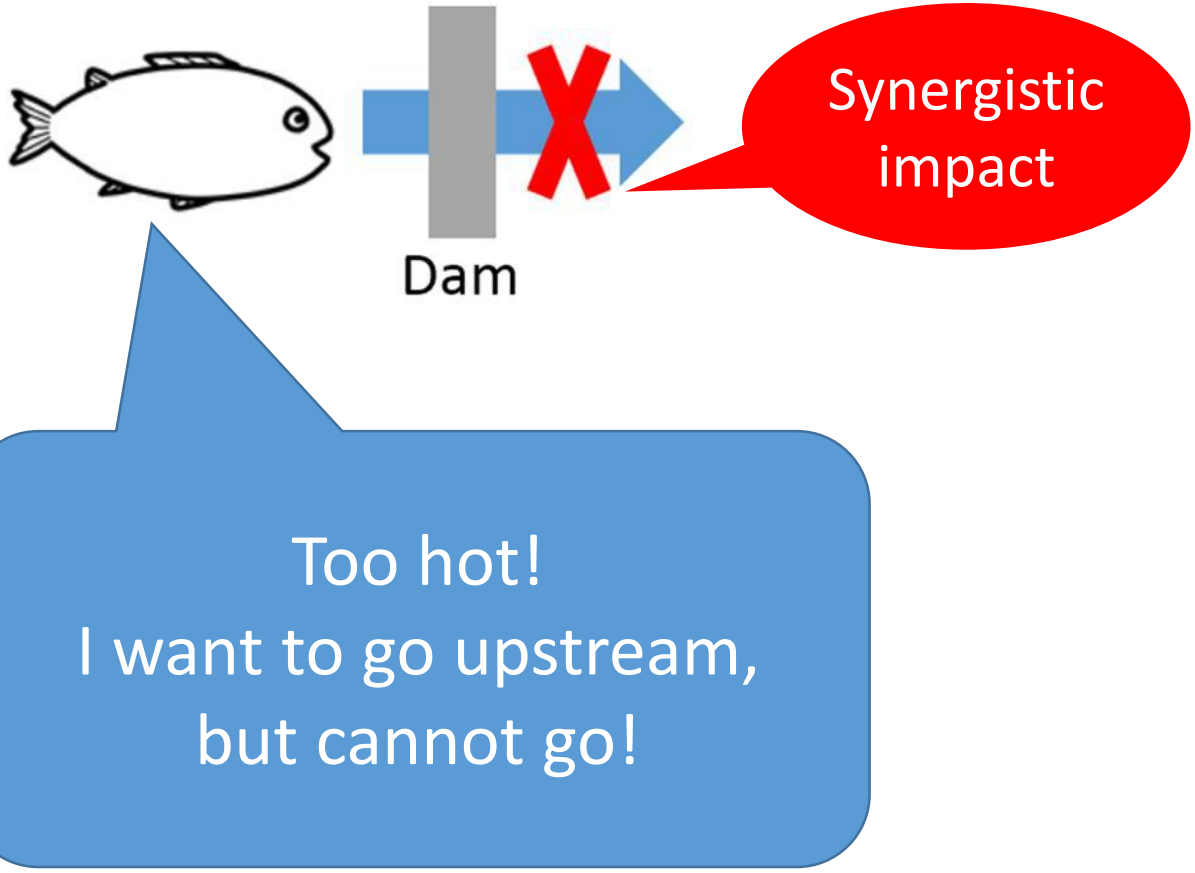


⊿ Current species richness

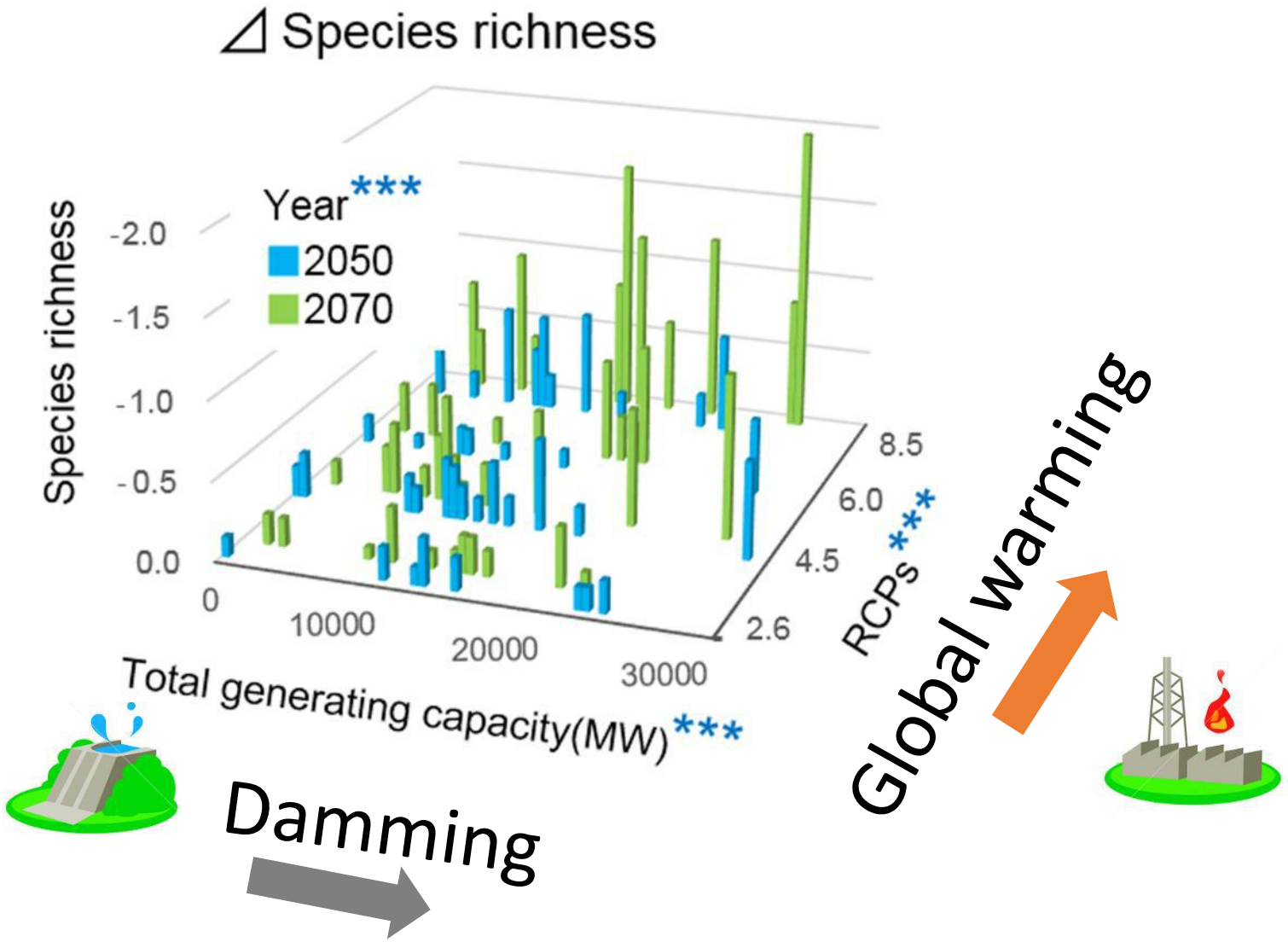

Current
Dam removal
Dam construction
Current
Planned dam
Mainstream dam
Tributary dam
Dam removal
Pak Mun Dam removed
Species richness
42
40
38
36
34
32
30
0
5,000
10,000
15,000
20,000
25,000
30,000
***
Generating capacity (MW)

Global warming is also a potential driver



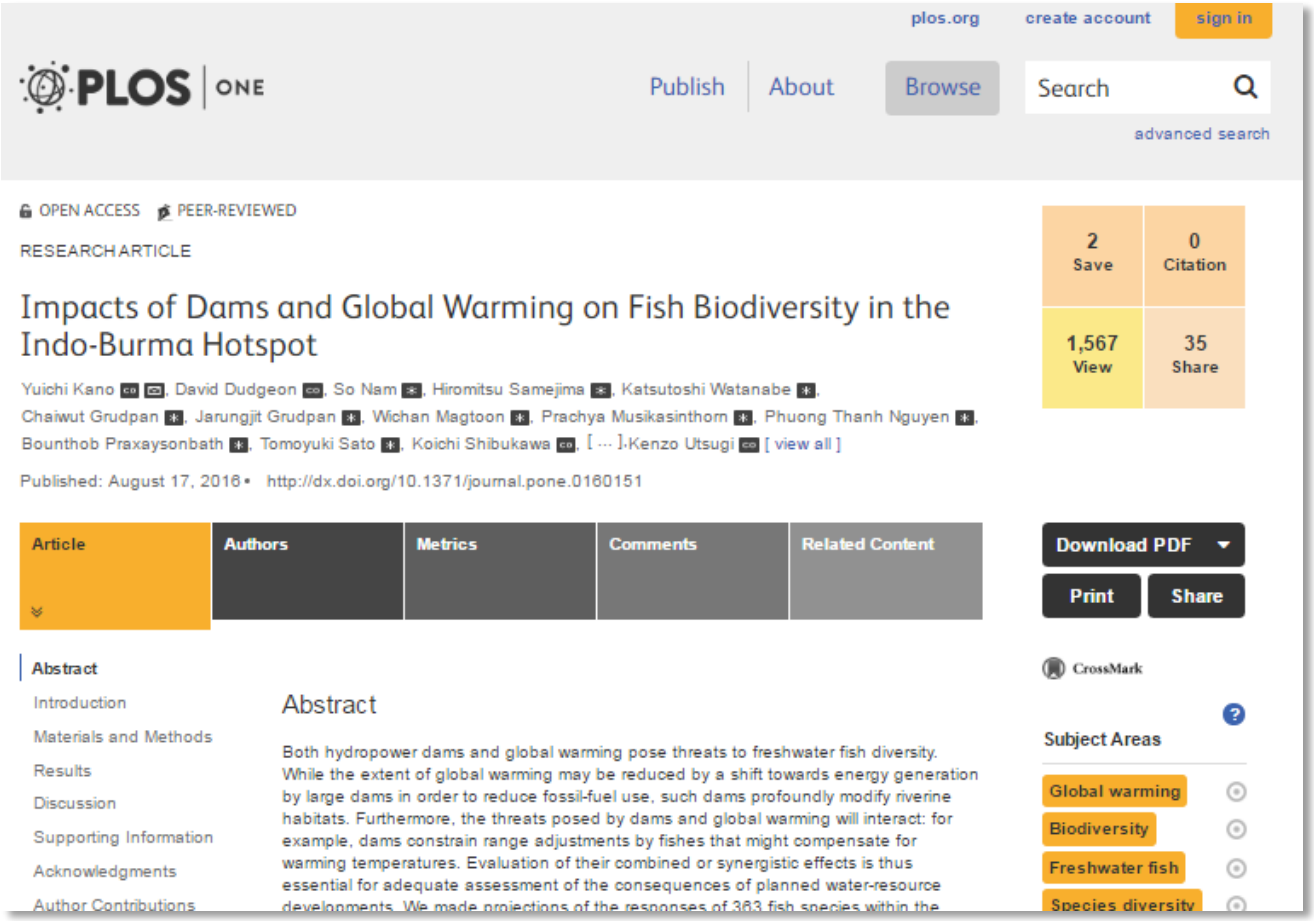


Synergistic impact



Publication

Kano et al. (with 19 coauthors) 2016. Impact of dams……..Indo-Burma Hotspot



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RESEARCH ARTICLE

Impacts of Dams and Global Warming on Fish Biodiversity in the Indo-Burma Hotspot

Yuichi Kano, David Dudgeon, So Nam, Hiromitsu Samejima, Katsutoshi Watanabe, Chaiwut Grudpan, Jarungjit Grudpan, Wichan Magtoon, Prachya Musikasinthorn, Phuong Thanh Nguyen, Bounthob Praxaysonbath, Tomoyuki Sato, Koichi Shibukawa, […], Kenzo Utsugi [view all]

Published: August 17, 2016 • http://dx.doi.org/10.1371/journal.pone.0160151

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Abstract
Introduction
Materials and Methods
Results
Discussion
Supporting Information
Acknowledgments
Author Contributions

Abstract

Both hydropower dams and global warming pose threats to freshwater fish diversity. While the extent of global warming may be reduced by a shift towards energy generation by large dams in order to reduce fossil-fuel use, such dams profoundly modify riverine habitats. Furthermore, the threats posed by dams and global warming will interact: for example, dams constrain range adjustments by fishes that might compensate for warming temperatures. Evaluation of their combined or synergistic effects is thus essential for adequate assessment of the consequences of planned water-resource developments. We made projections of the responses of 363 fish species within the

CrossMark

Subject Areas

Global warming
Biodiversity
Freshwater fish
Species diversity

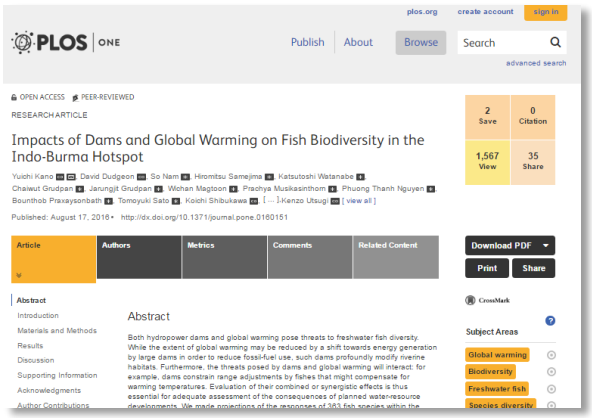
Summary

Freshwater fish observation network

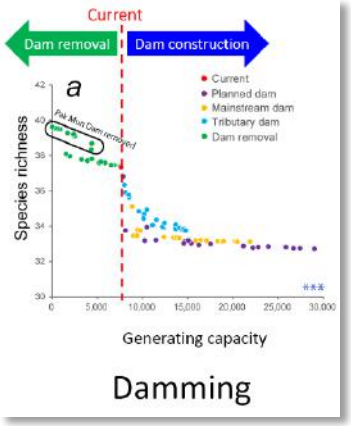
Database

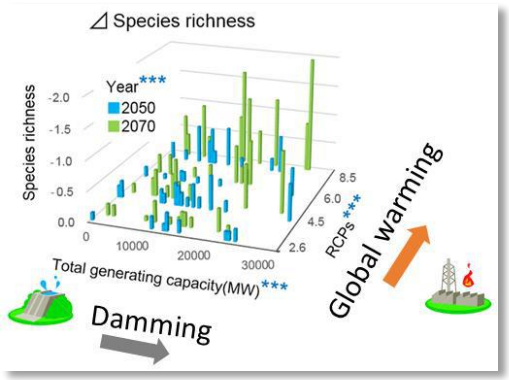
Distribution data

	A	B	C
1	species	x	y
2	Acanthoco	99.66258	19.27219
3	Acanthoco	98.36644	17.78086
4	Acanthoco	98.37061	17.75889
5	Acanthoco	99.47934	18.77903
6	Acanthoco	99.48483	18.83153
7	Acanthoco	99.50324	18.81019
8	Acanthoco	99.45561	18.40189
9	Acanthoco	100.4084	19.89428
10	Acanthops(	104.0988	15.34289
11	Acanthops(	99.98547	14.96239
12	Acanthops(	106.9807	13.66463
13	Acanthops(	104.9923	15.47739
14	Acanthops(	105.0176	14.69972
15	Acanthops(	105.4225	14.70178
16	Acanthops(	104.4034	15.13538
17	Acanthops(	104.1582	15.33678



Publication of scientific paper



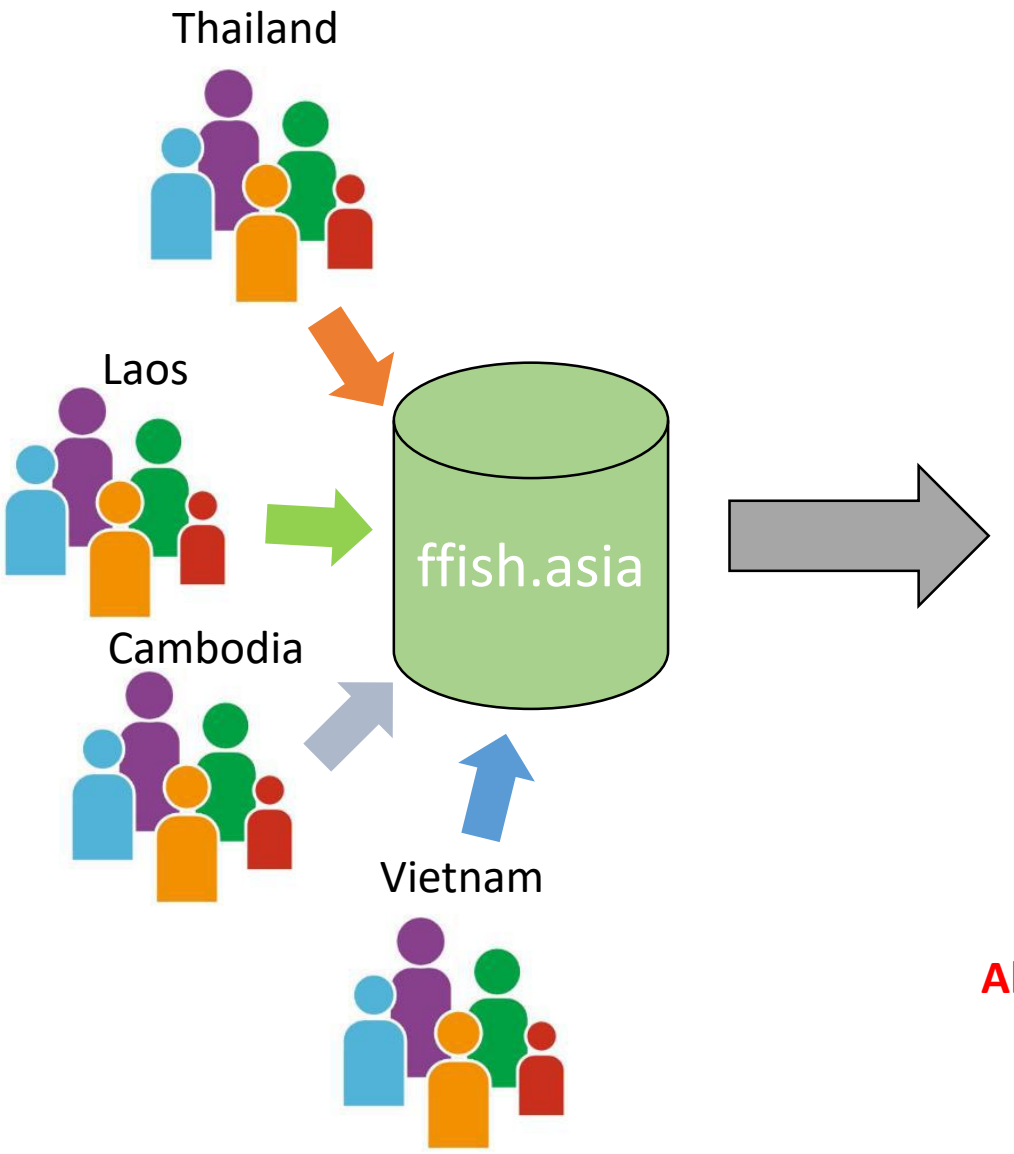


Simulate impacts of dams and global warmings

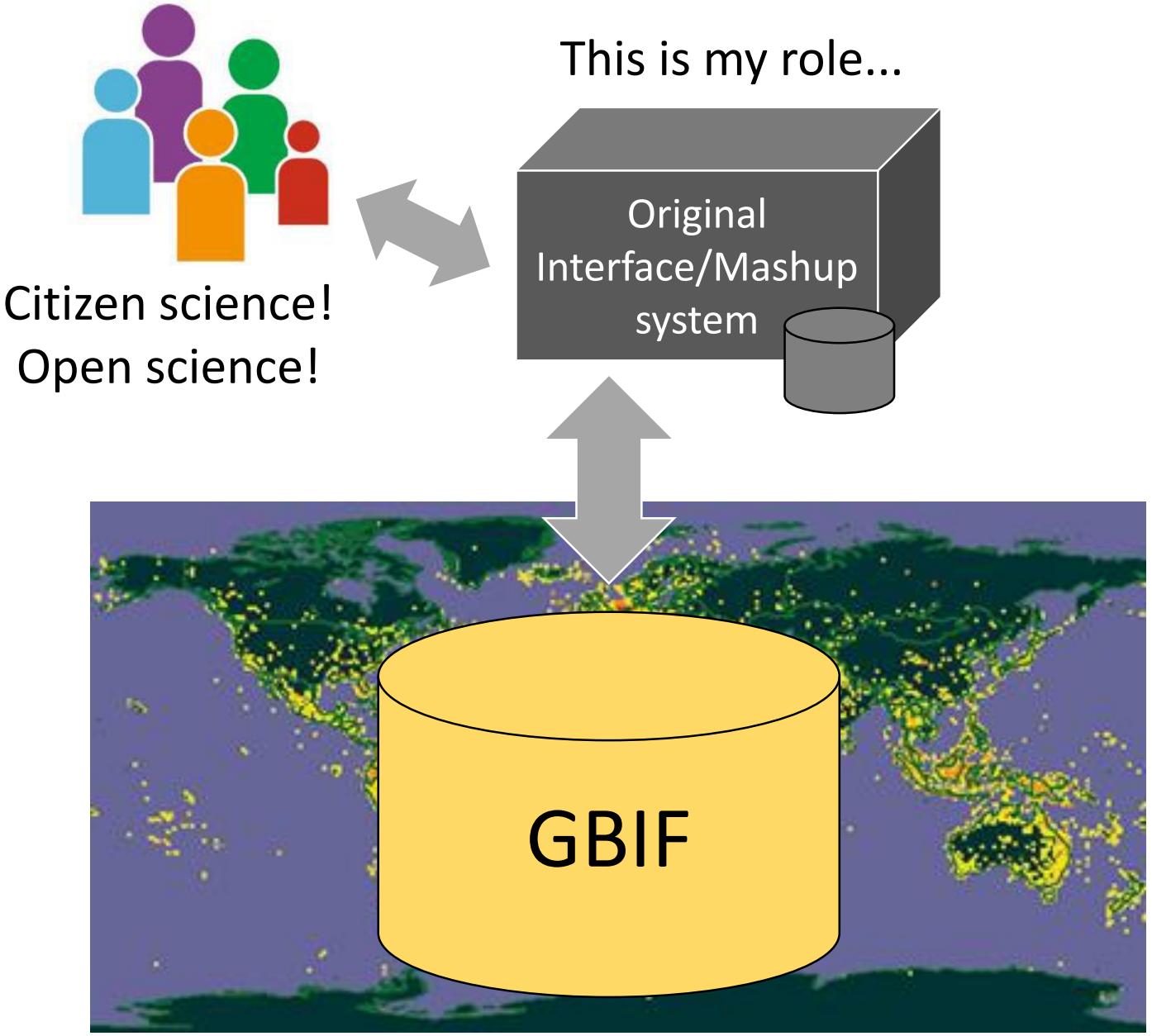
Thank you!

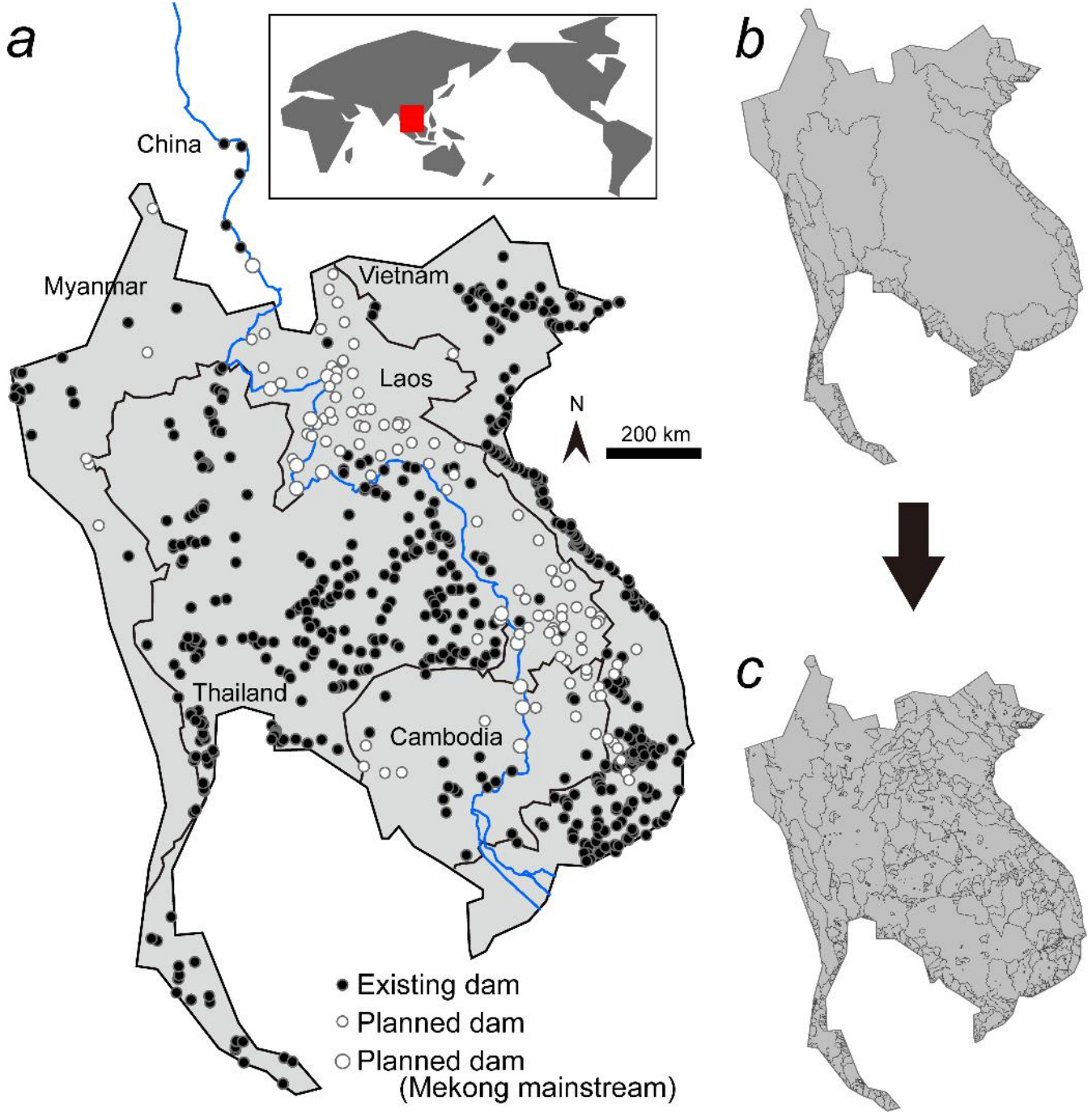
Ladies in SE Asia fish markets

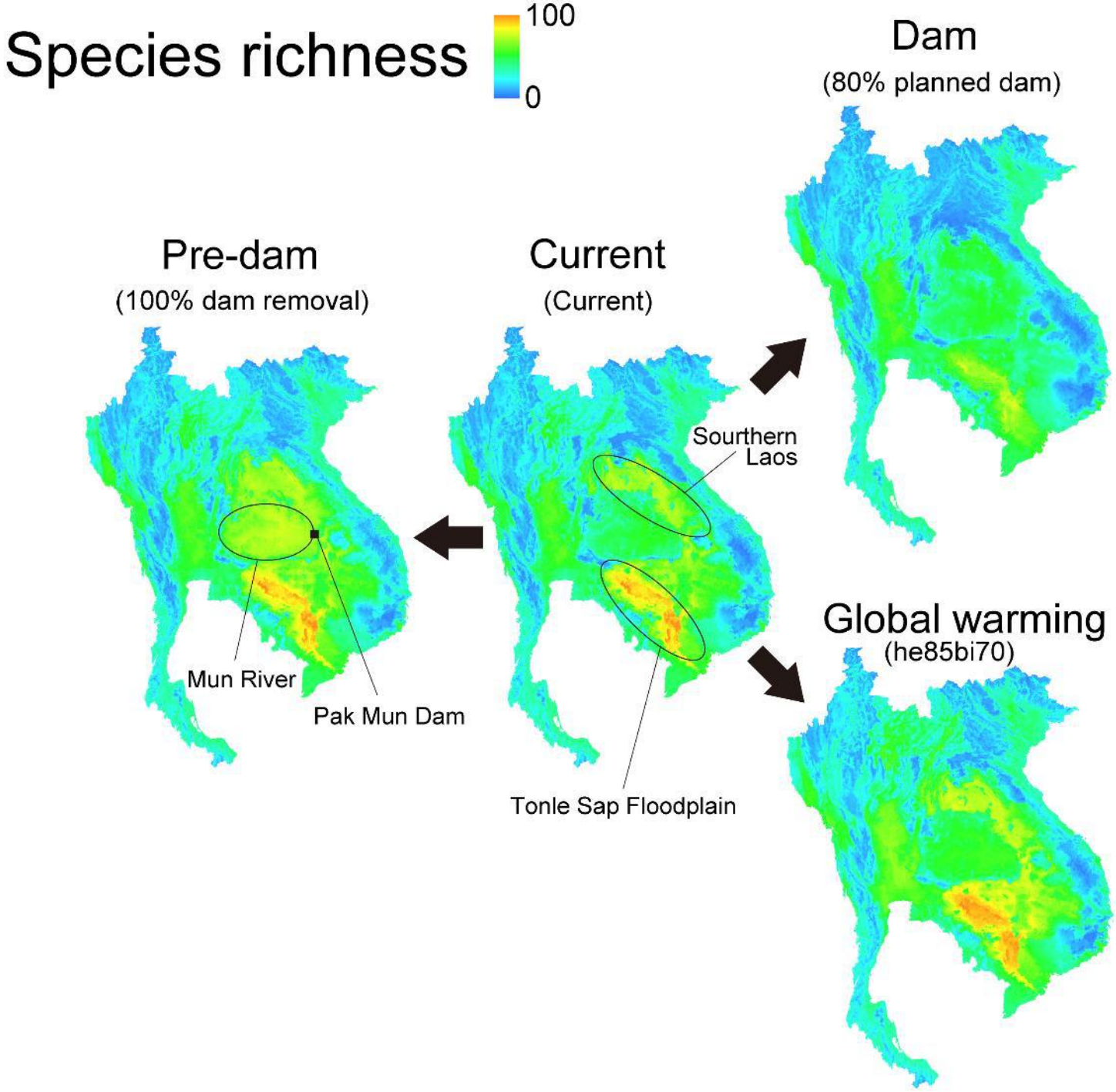
One of a typical contribution of a local database

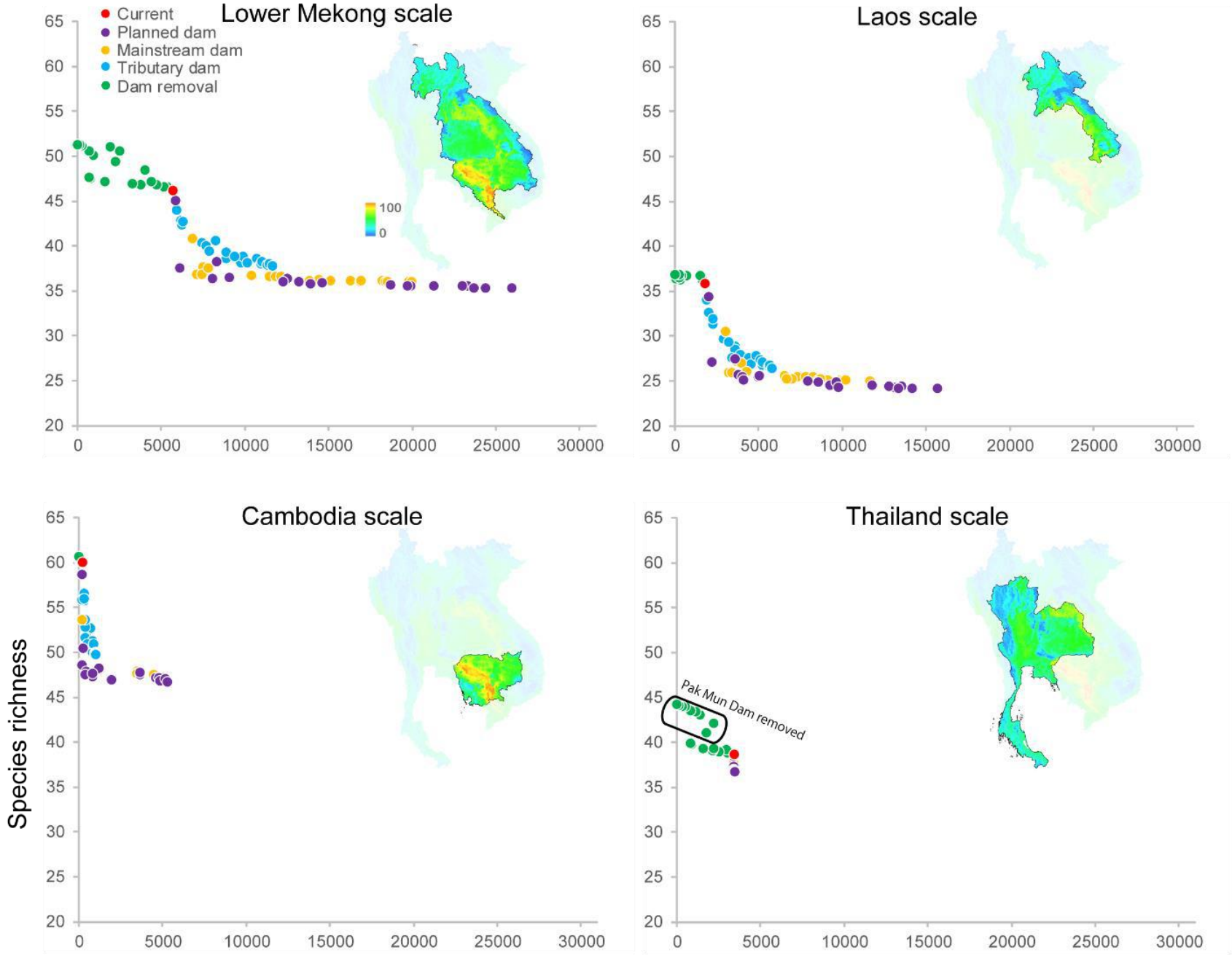


All the stakeholders included as co-authors


This is my role...
Original Interface/Mashup system
Citizen science!
Open science!
GBIF

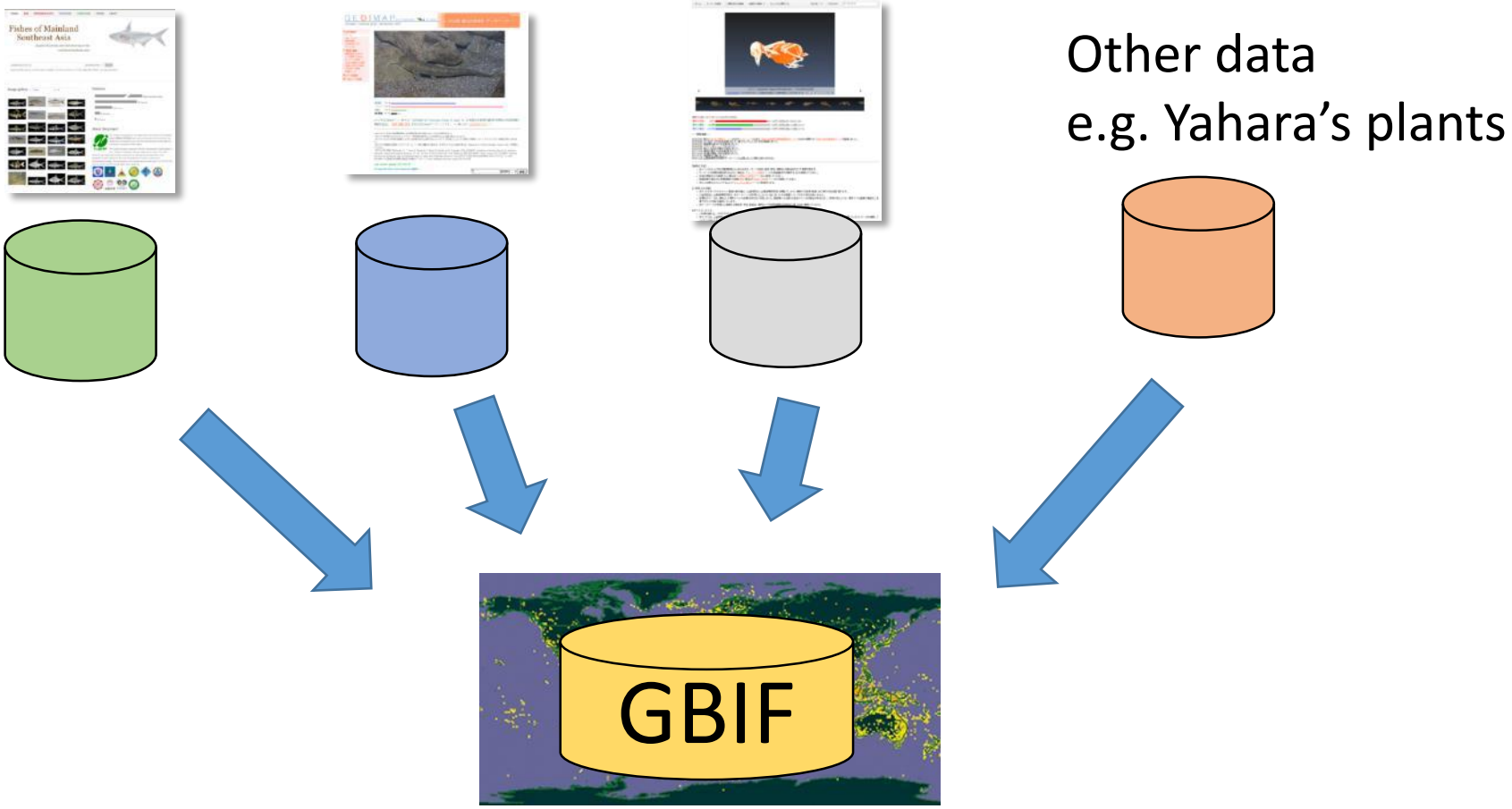

a
China
Myanmar
Vietnam
Laos
Thailand
Cambodia
N
200 km
Existing dam
Planned dam
Planned dam
(Mekong mainstream)
b
c


Species richness
100
0
Dam
(80% planned dam)
Pre-dam
(100% dam removal)
Current
(Current)
Sourthern
Laos
Mun River
Pak Mun Dam
Tonle Sap Floodplain
Global warming
(he85bi70)


Lower Mekong scale
Current
Planned dam
Mainstream dam
Tributary dam
Dam removal
100
0
Laos scale
Cambodia scale
Thailand scale
Pak Mun Dam removed
Species richness
Generating capacity

The database system should be fundamentally remodeled

Firstly, I must register the data to GBIF.....



Retrieving our data like “reverse import”.....

Other data
e.g. Yahara’s plants

Retain originality in each mashup system with local DB

Other data
e.g. Yahara's plants

Interface/Mashup system

Interface/Mashup system

Interface/Mashup system

Original data....

GBIF

Retrieving our data like "reverse import".....

e.g. fishbase

Sharing data with other researchers

Current species richness (native only)

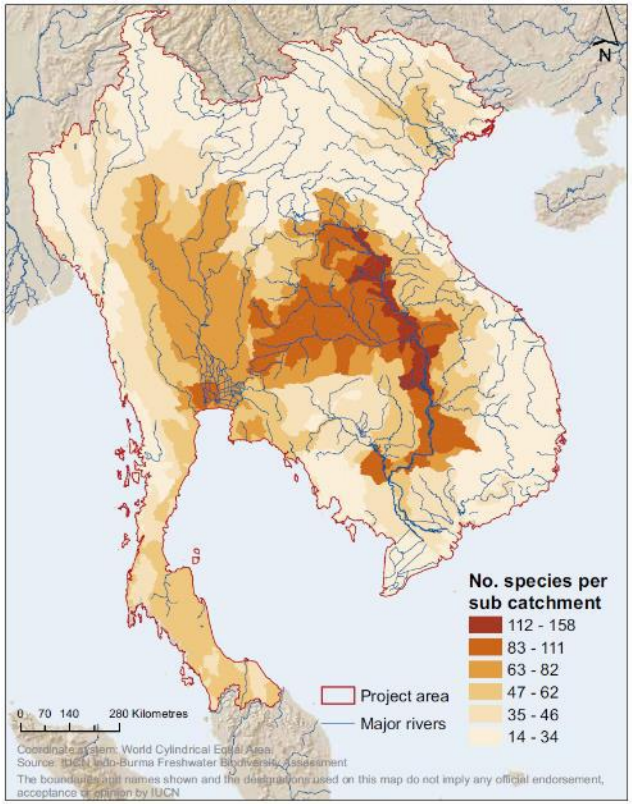
Impact of Pak Mun Dam

Inle Lake:
15-25 species/km^2

High : 100

Low : 0

Tonle sap:
90-100 species/km^2



Allen 2012