USE OF SPATIALLY EXPLICIT MODELS OF ASIAN SALMONIDS FOR THEIR CONSERVATION PLANNING

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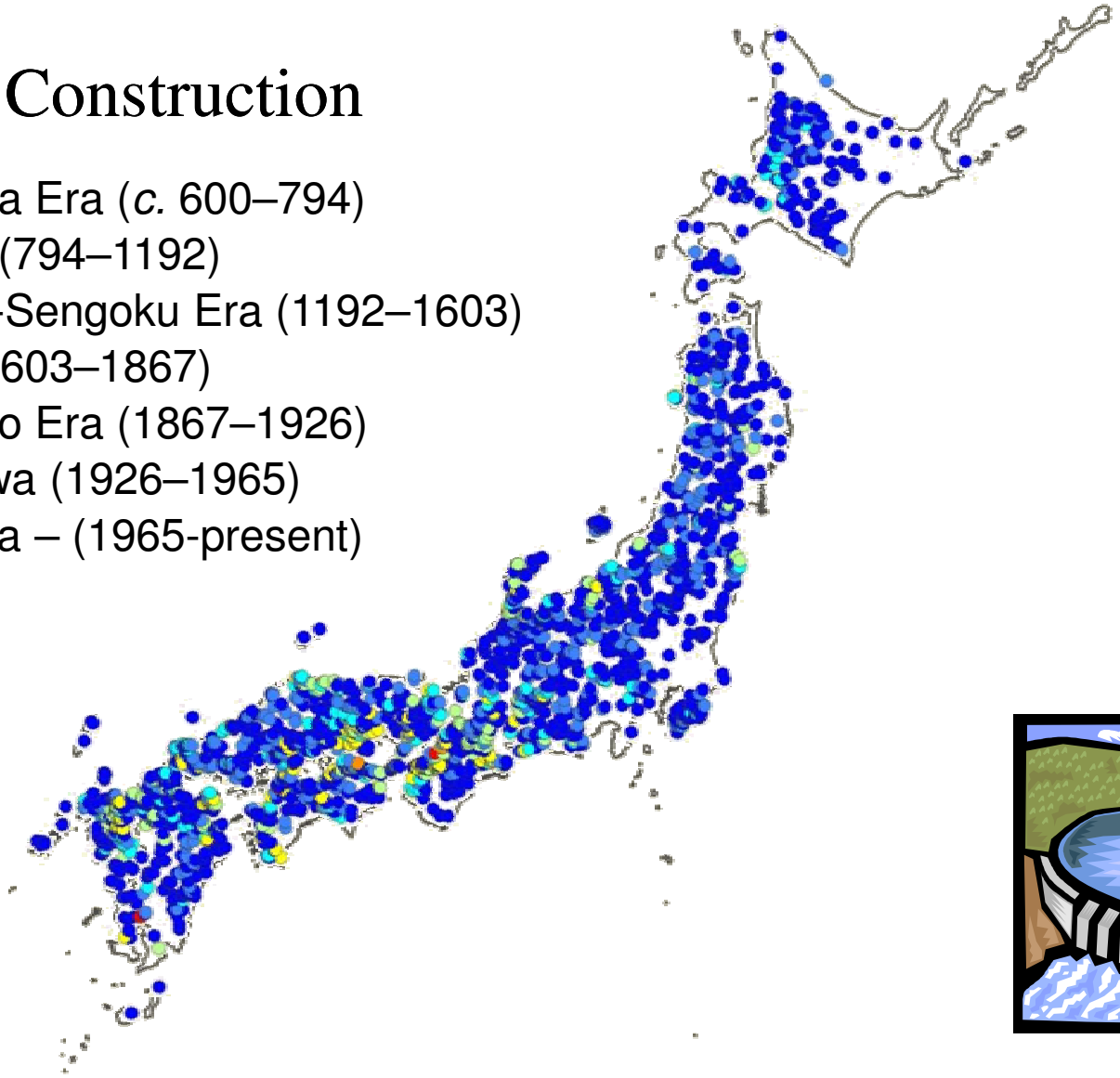
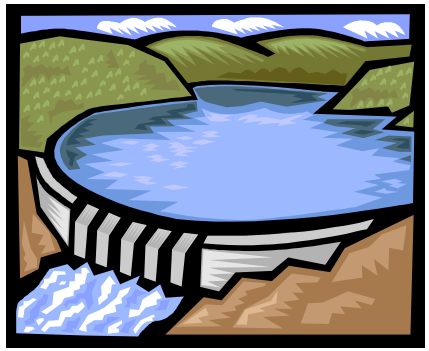
Large Dams (>15m) in Japan

Period of Construction

- Asuka-Nara Era (*c.* 600–794)
- Heian Era (794–1192)
- Kamakura-Sengoku Era (1192–1603)
- Edo Era (1603–1867)
- Meiji-Taisho Era (1867–1926)
- Early Showa (1926–1965)
- Late Showa – (1965-present)





Period of Habitat Isolation

- Asuka-Nara Era (*c.* 600–794)
- Heian Era (794–1192)
- Kamakura-Sengoku Era (1192–1603)
- Edo Era (1603–1867)
- Meiji-Taisho Era (1867–1926)
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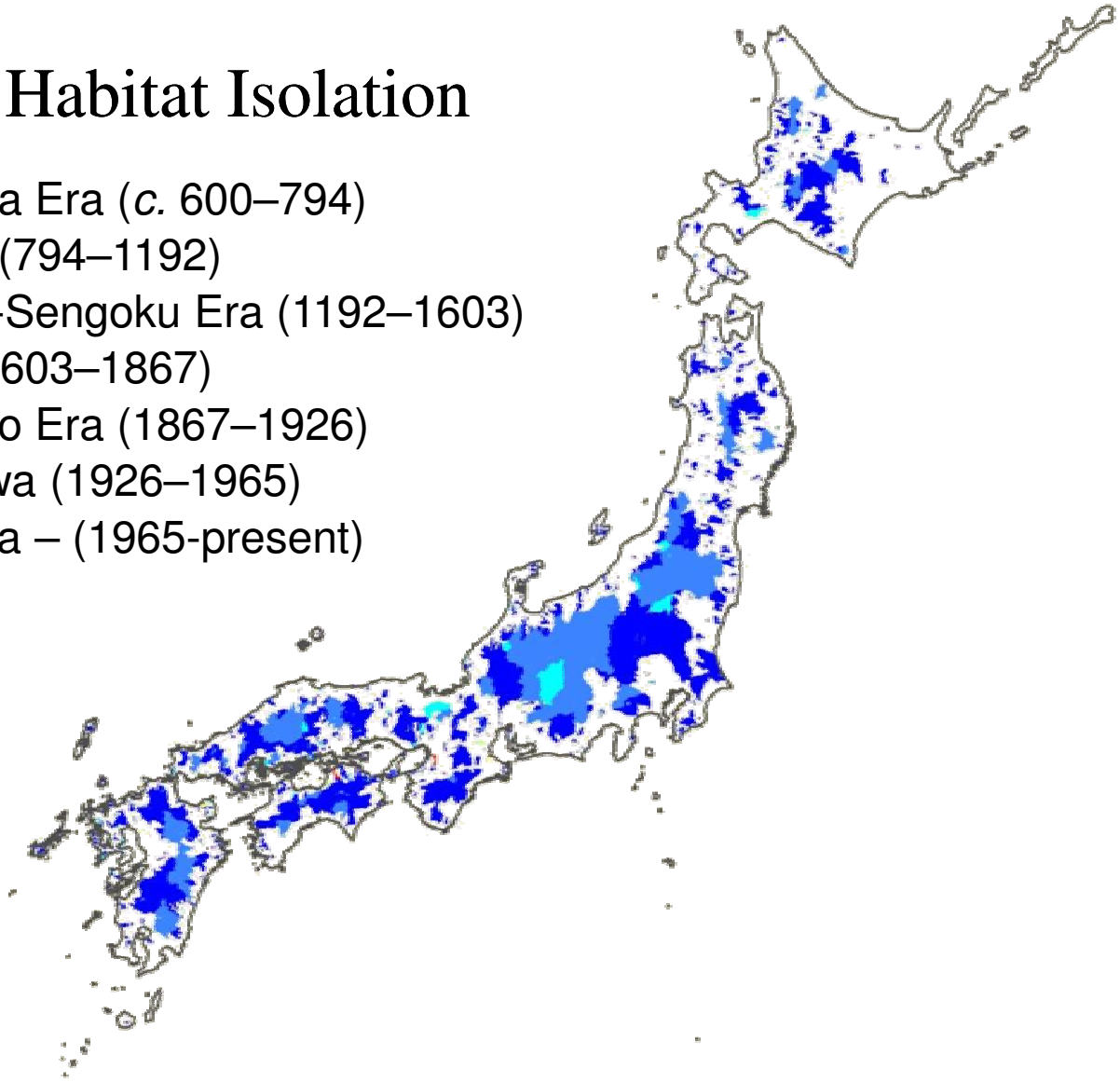
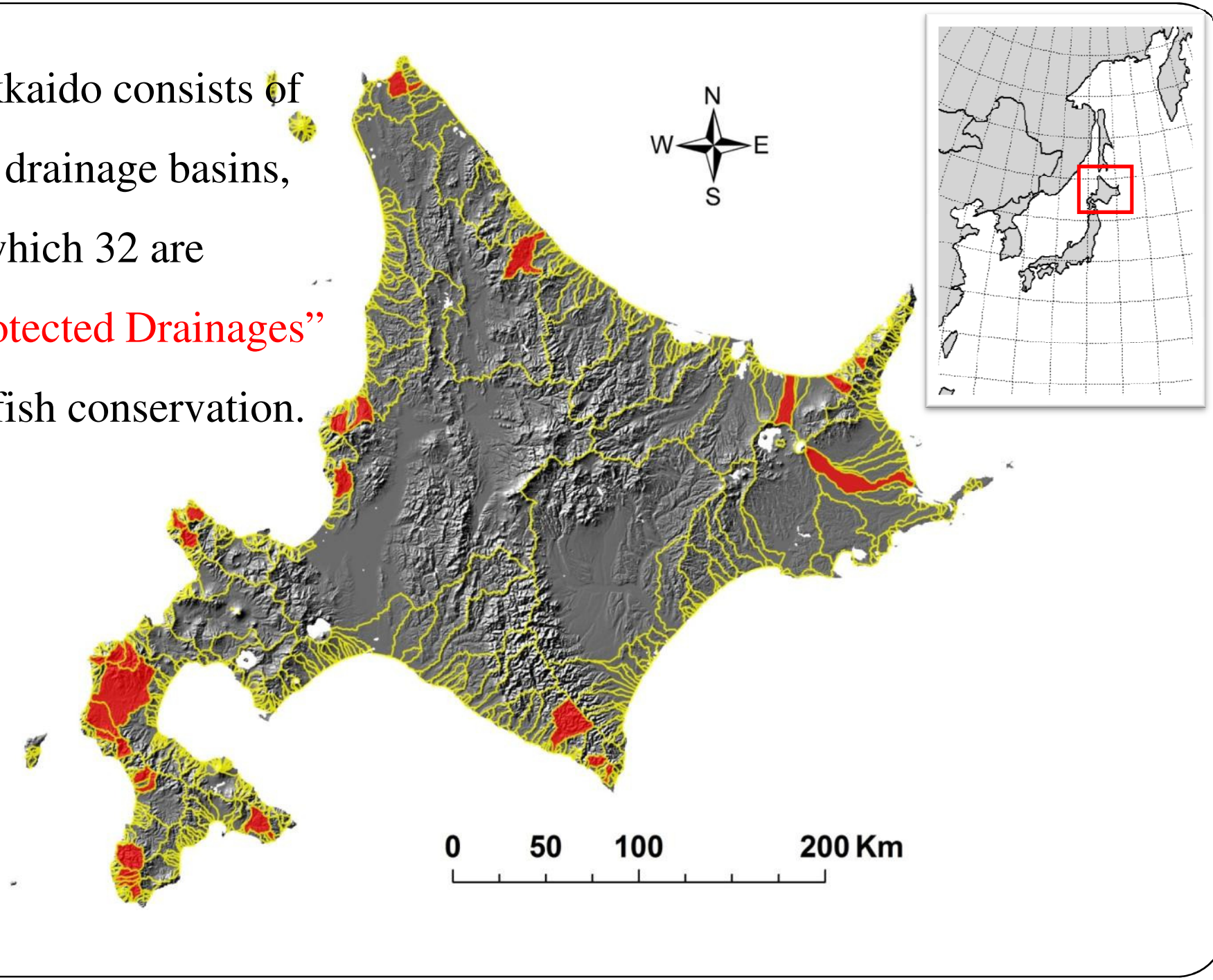


Questions

- ✓ *What are the effects of dams and resulting habitat fragmentation on salmon and other fishes?*

- ✓ *How can we measure the effects?*

Hokkaido consists of 574 drainage basins, of which 32 are "Protected Drainages" for fish conservation.



Originally, designed for the conservation of commercially important salmonids, i.e. masu salmon.



Conservation of Critically Endangered Sakhalin taimen has become another objective since 1990s.



Questions

✓ *Can the same set of Protected Drainages effectively conserve two different salmonids with potentially different habitat preferences?*

✓ *Is the selection of the 32 Protected Drainages science-based?*

First Analysis:

Dams

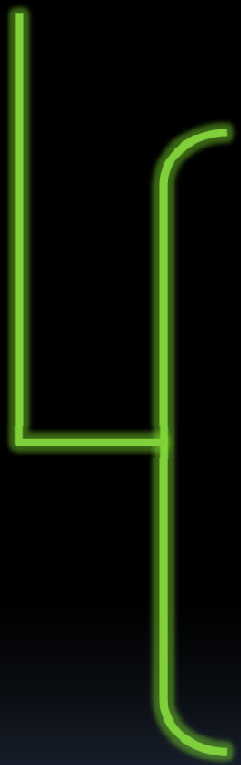
Specific objectives:

1) To measure the loss of fish species richness and occurrence probabilities due to damming; and

2) To delineate the areas of the impact

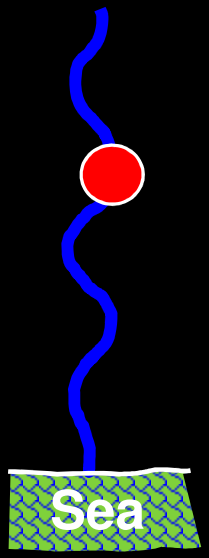
What does “Dammed” mean?

7,848 fish surveys



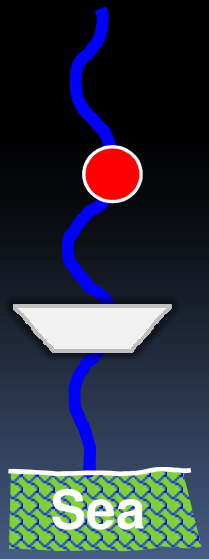
6,009

1,839



No dam

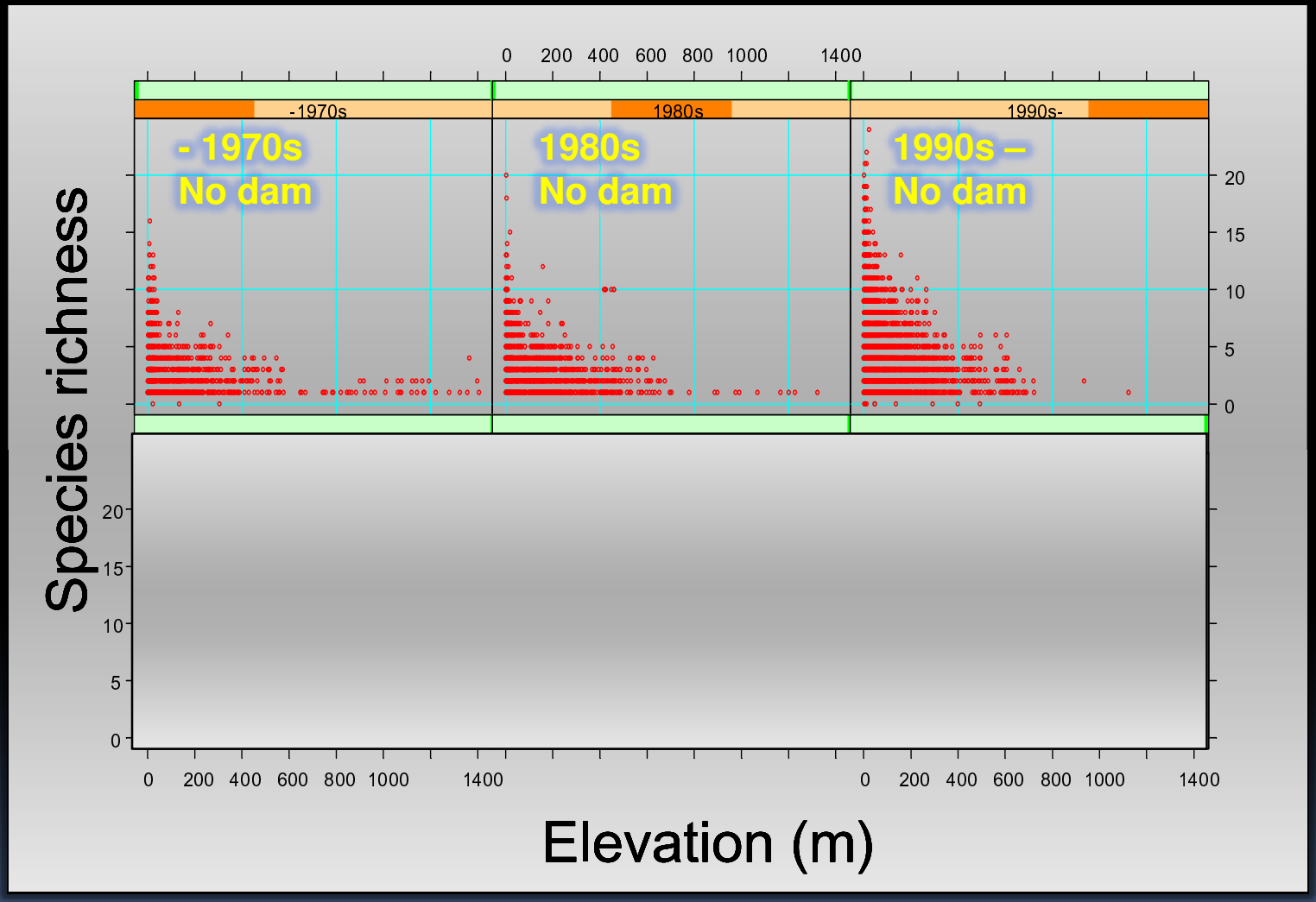
DAM = 0



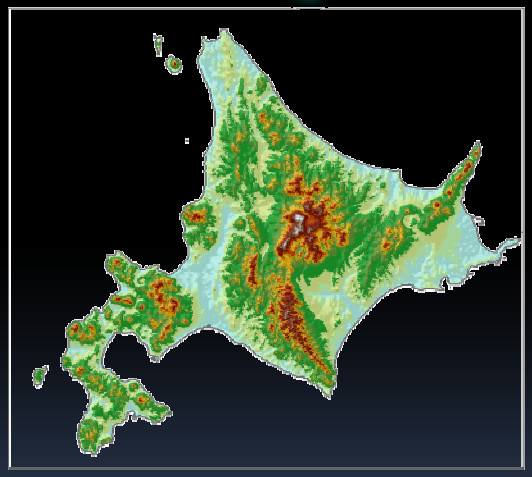
Dammed

DAM = 1

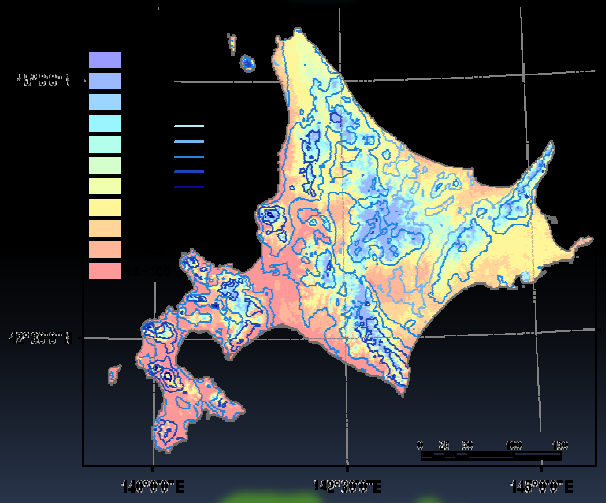
Fish species richness vs. elevation, survey periods, and damming



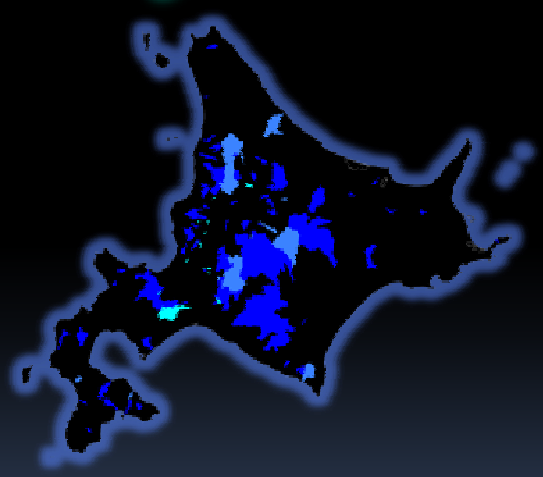
Fish Species Richness



Geomorphology

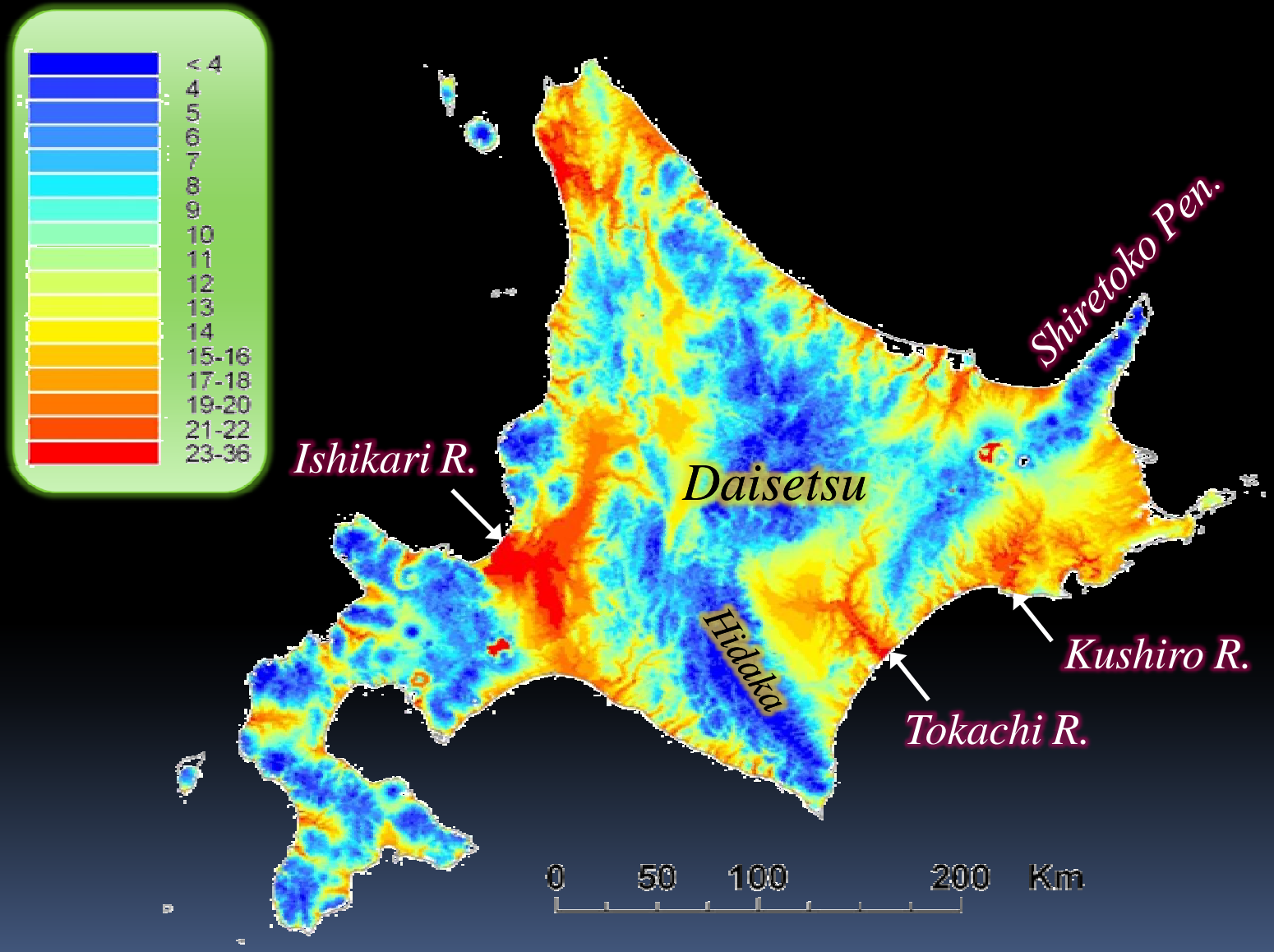


Climate



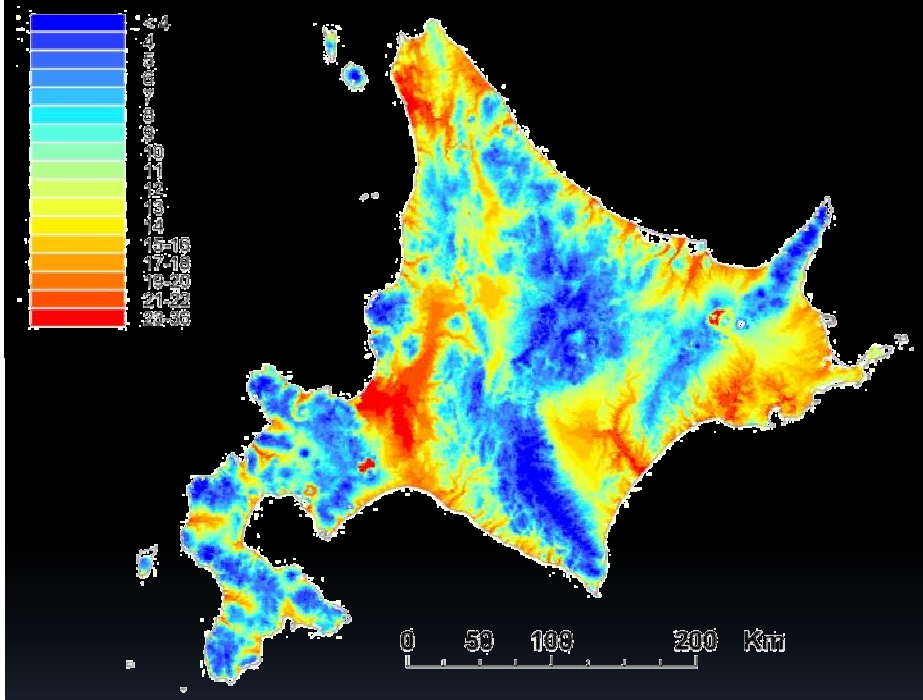
Human impact

Predicted Fish Species Richness

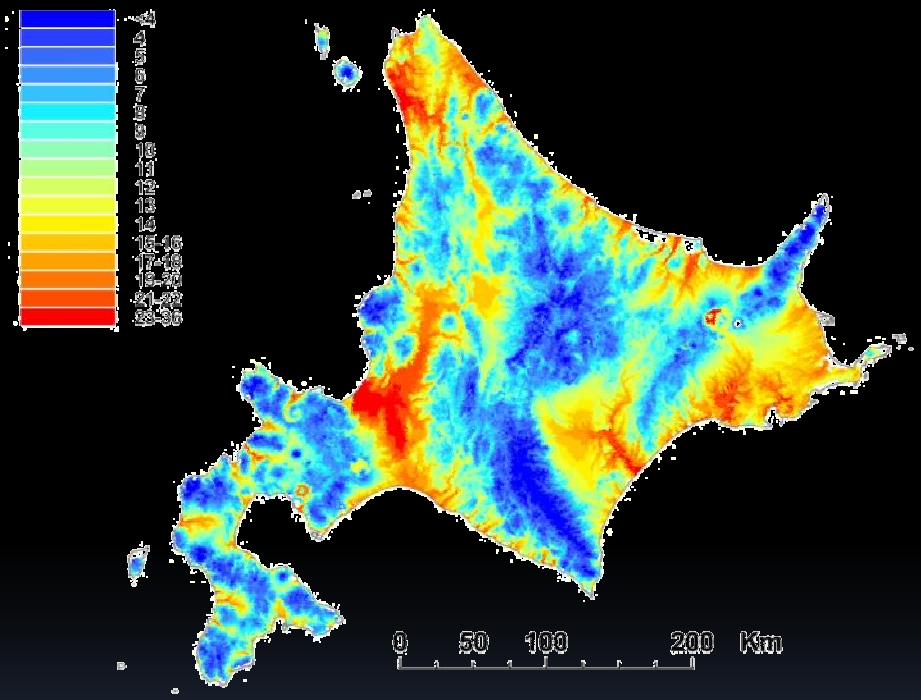


Prediction under Two Scenarios

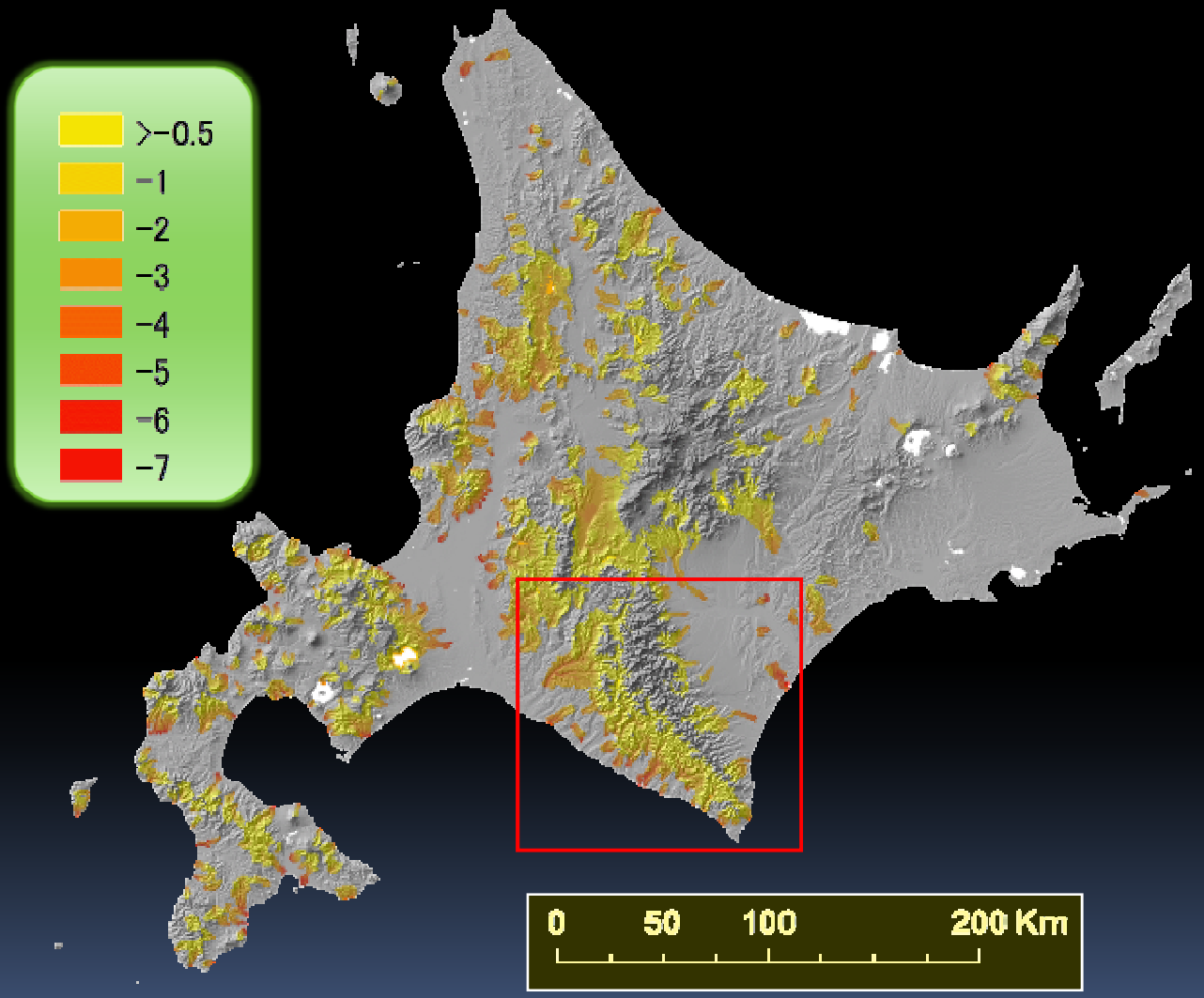
DAM=0
(Hypothetical status of no dams)

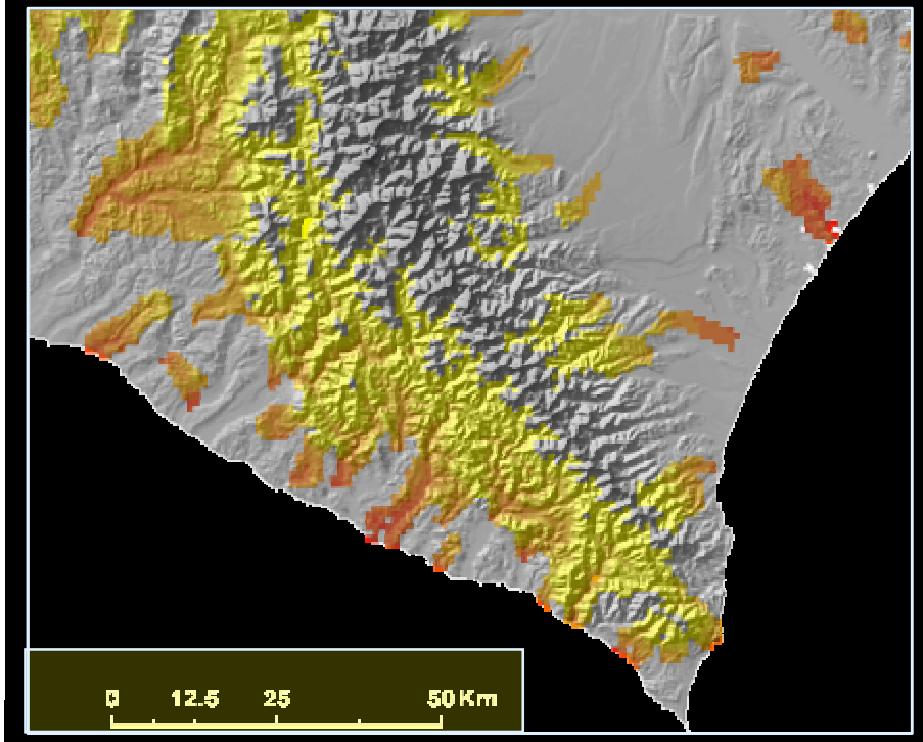


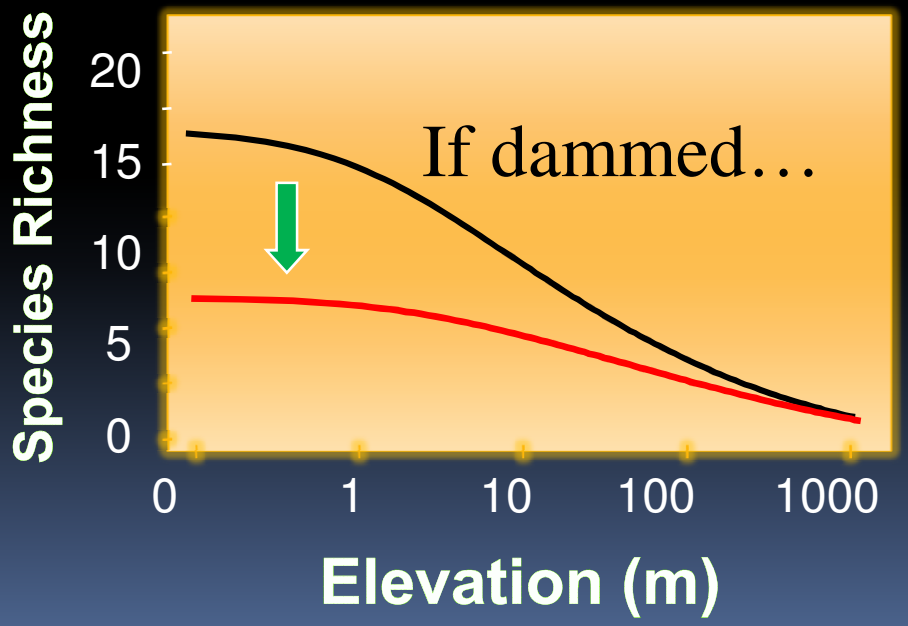
DAM=0 or 1
(Actual damming status)



Predicted Loss of Species Richness due to Damming




0 12.5 25 50 Km


Species Richness
20
15
10
5
0
If dammed…
0
1
10
100
1000
Elevation (m)

Masu salmon
(*Oncorhynchus masou*)

Summary of the 1st analysis:

✓ Fish species richness (SR) has decreased due to damming. The lower in elevation dams were constructed, the more significant the loss of SR.

✓ The probability of occurrence of masu salmon were also negatively affected by damming.

Second Analysis:

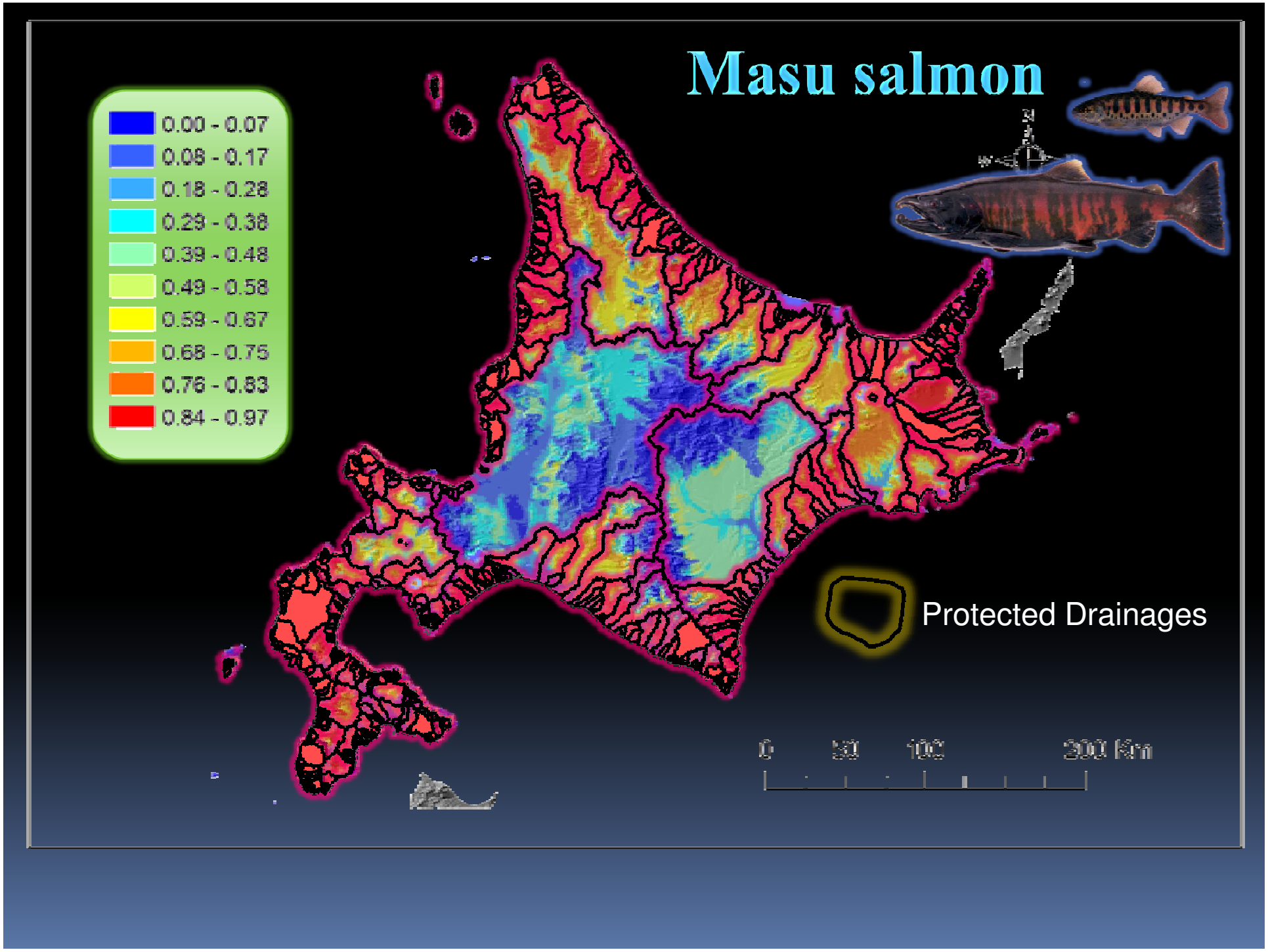
Protected Drainages

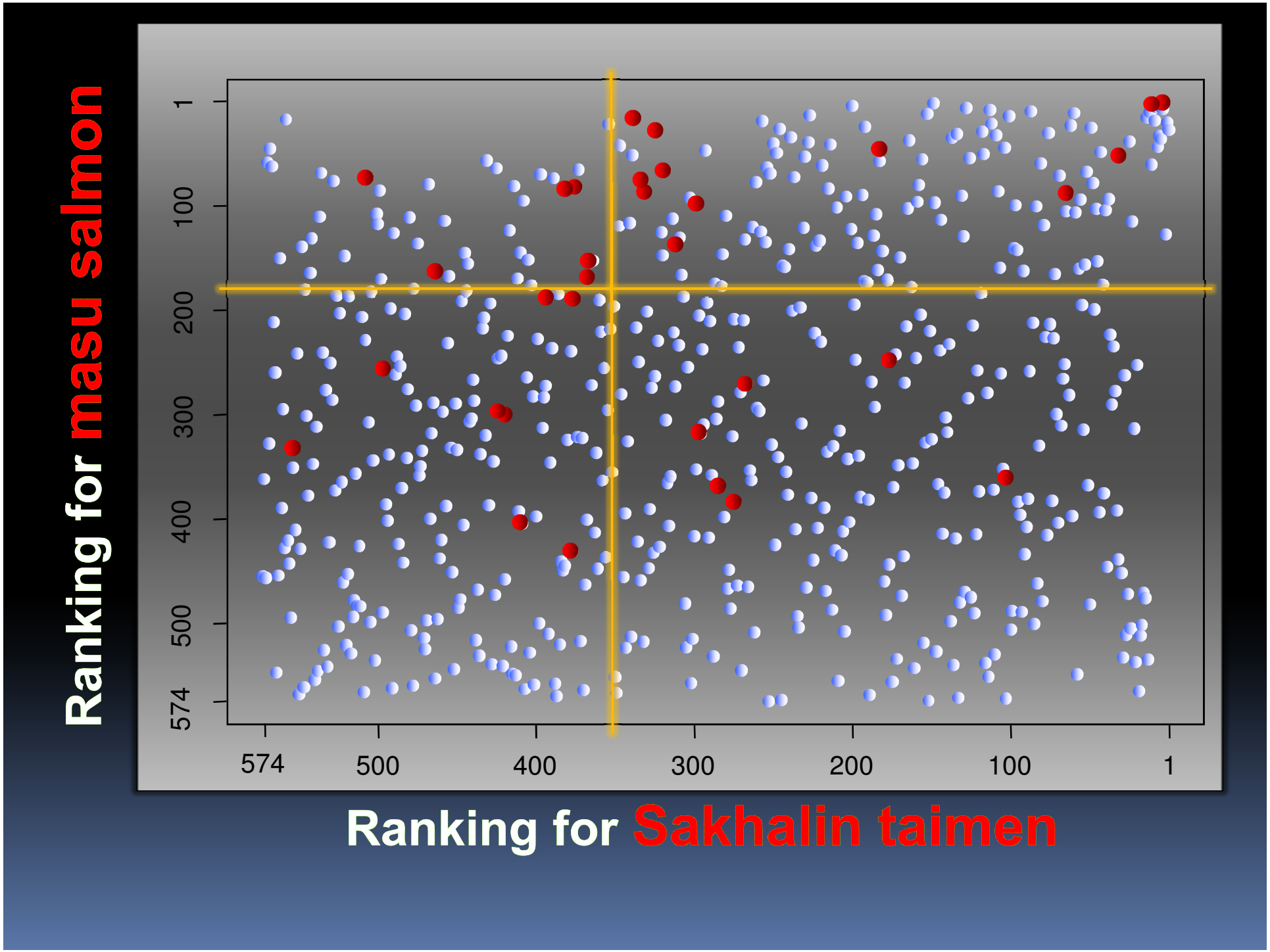
Specific objectives:

1) To rank the river drainages on the basis of fish occurrence probability; and

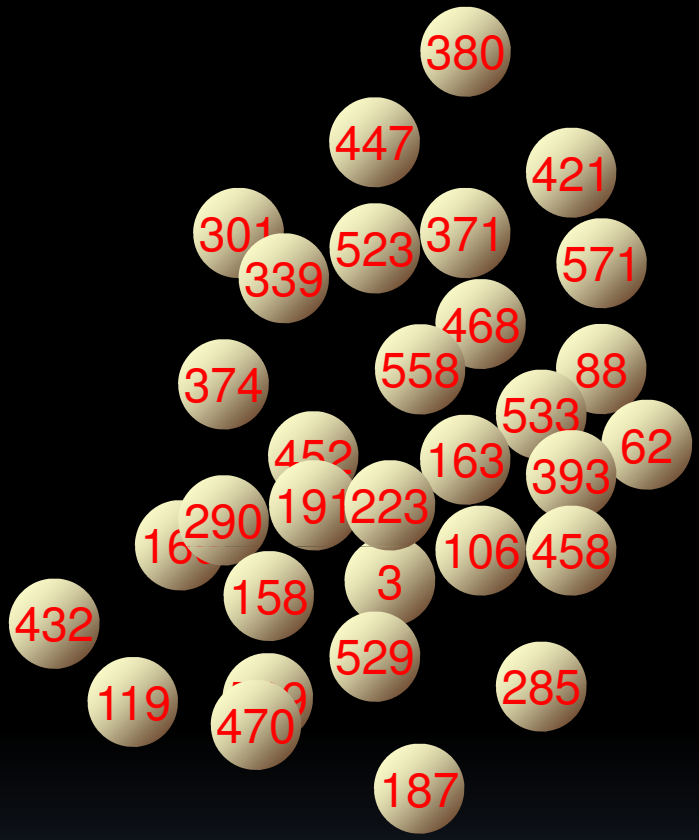
2) To assess the existing Protected Drainages based on the ranking

Sakhalin taimen

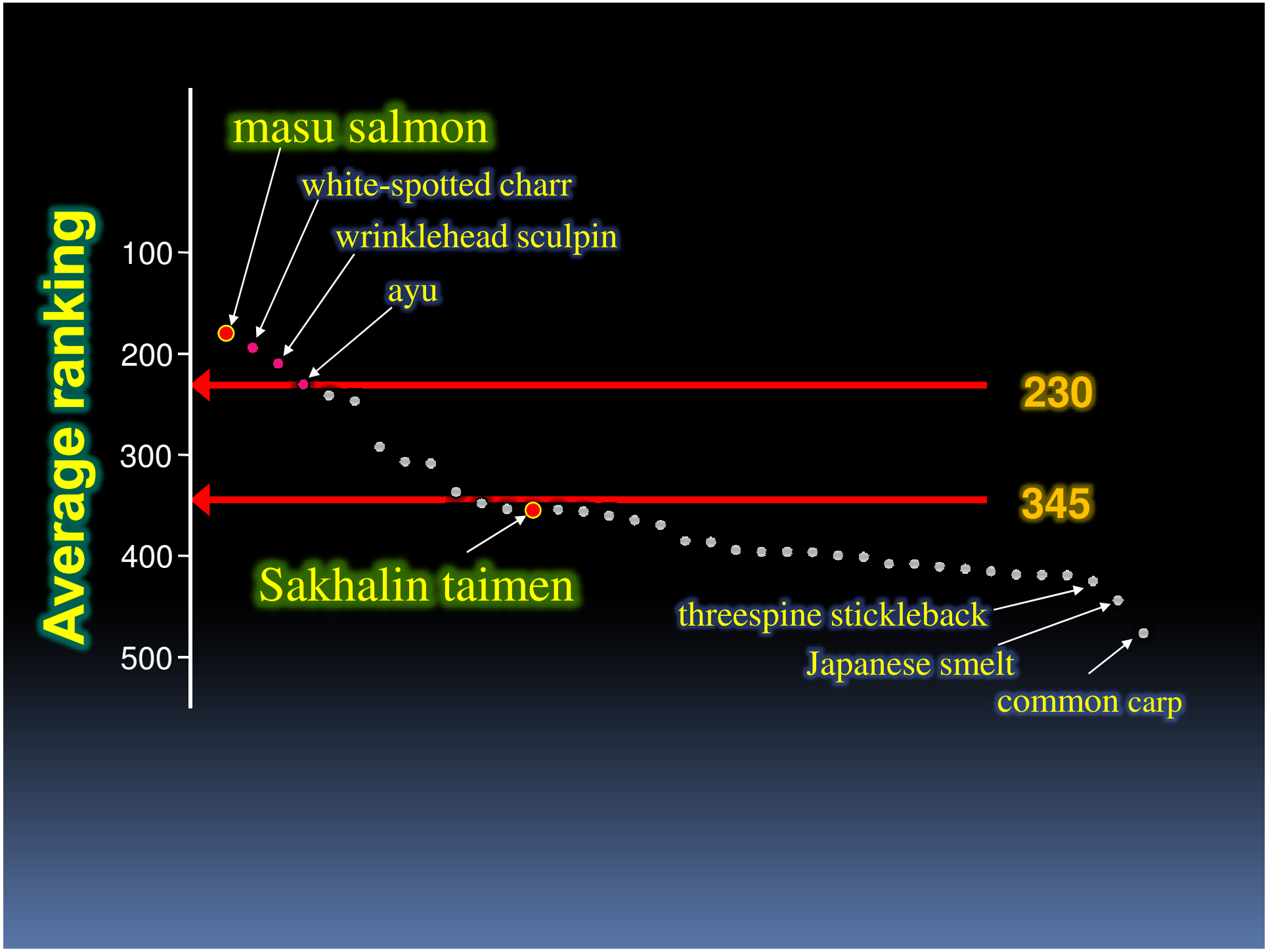

Masu salmon
0.00 - 0.07
0.08 - 0.17
0.18 - 0.28
0.29 - 0.38
0.39 - 0.48
0.49 - 0.58
0.59 - 0.67
0.68 - 0.75
0.76 - 0.83
0.84 - 0.97
Protected Drainages
0
50
100
200 Km


Ranking for masu salmon
574
500
400
300
200
100
1
574
500
400
300
200
100
1
Ranking for Sakhalin taimen

If the 32 Protected Drainages were selected at random,



Averages will range between 230-345 (95% confidence interval)


Average ranking
100
200
300
400
500
masu salmon
white-spotted charr
wrinklehead sculpin
ayu
230
345
Sakhalin taimen
threespine stickleback
Japanese smelt
common carp

Summary of the 2nd analysis:

✓ Masu salmon populations are effectively protected by the existing Protected Drainages.

✓ The endangered Sakhalin taimen, on the other hand, are not protected at all.

✓ Only 4 out of 37 fish species have statistically higher occurrence probability in the Protected Drainages than in the other drainages of Hokkaido.

Thank you for your attention !