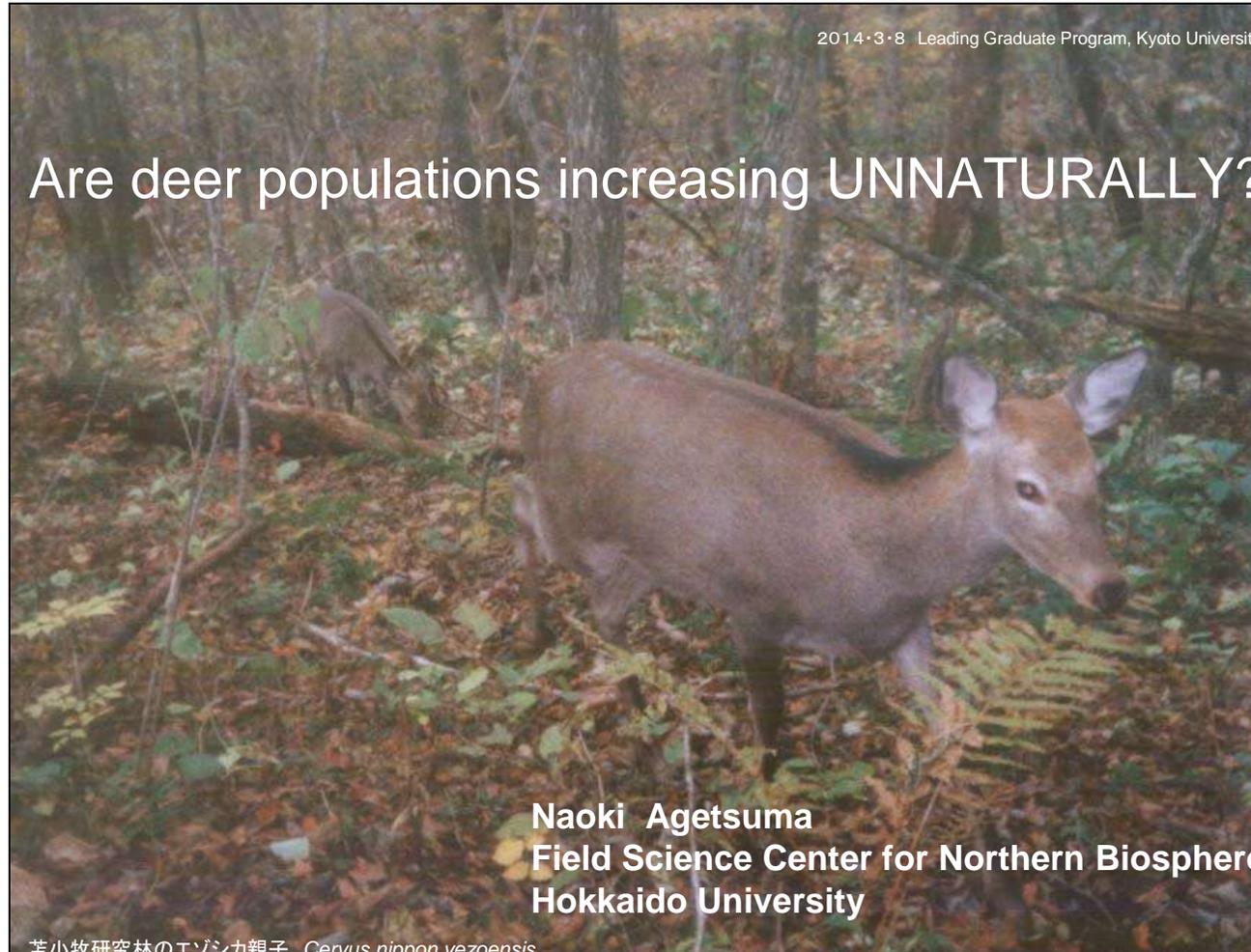


# Are deer populations increasing UNNATURALLY?



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**Hokkaido University**

苫小牧研究林のエゾシカ親子 *Cervus nippon yezoensis*

I will talk about sika deer, one of major wildlife in Japan.

The problems involving deer are very common to other Japanese wildlife. So, deer is a good subject for thinking about wildlife conservation.

Recently, deer populations in Japan are rapidly increasing, like as in other temperate zones in the world.

## Deer problems

Damages on forestry and agriculture products

Destruction of natural ecosystems

Increasing deer causes mainly 2 problems.

The one is damages on agricultural crops and forestry products.

Another is destruction of natural ecosystem and endanger biodiversity.

High feeding pressure of deer changed natural vegetations during these 40 years.

## Common hypotheses of deer population increase

- Global warming hypothesis
- Wolf extinction hypothesis
- Declining hunter hypothesis

As for the reasons of the recent deer increase, 3 hypotheses are commonly mentioned in Japan.

Severe winter and heavy snow decreased by global warming. Then, winter mortality of deer decreased and many deer can survive.

Japanese wolf was extinct about 100 years ago. Then, deer population is out of natural control.

Number of Japanese hunters decreased greatly during these 40 years. Then, hunting pressure might also decrease.

Deer mortality decreased

—————→ deer greatly increased



Thus, these hypotheses suggest that mortality of deer decreased greatly relative to past time. Then, deer increased greatly.

Many researchers express recent deer increase as:

Unnatural

Overabundance

Explosion

Eruption

So many researchers believe that recent increase of deer population is "unnatural", "overabundance", "population explosion" and "population eruption". These terms are used even in scientific journals.

But, they have never defined what is natural and what is unnatural.

# Defining UNNATURAL

## Population dynamics in past time

Check within the variation or out of the variation?

natural

unnatural

I think if the population size is within the variation of population sizes in past time, it is probably natural.

If the population size outstands the variation, it would be unnatural.

So we must know past population dynamics of deer.

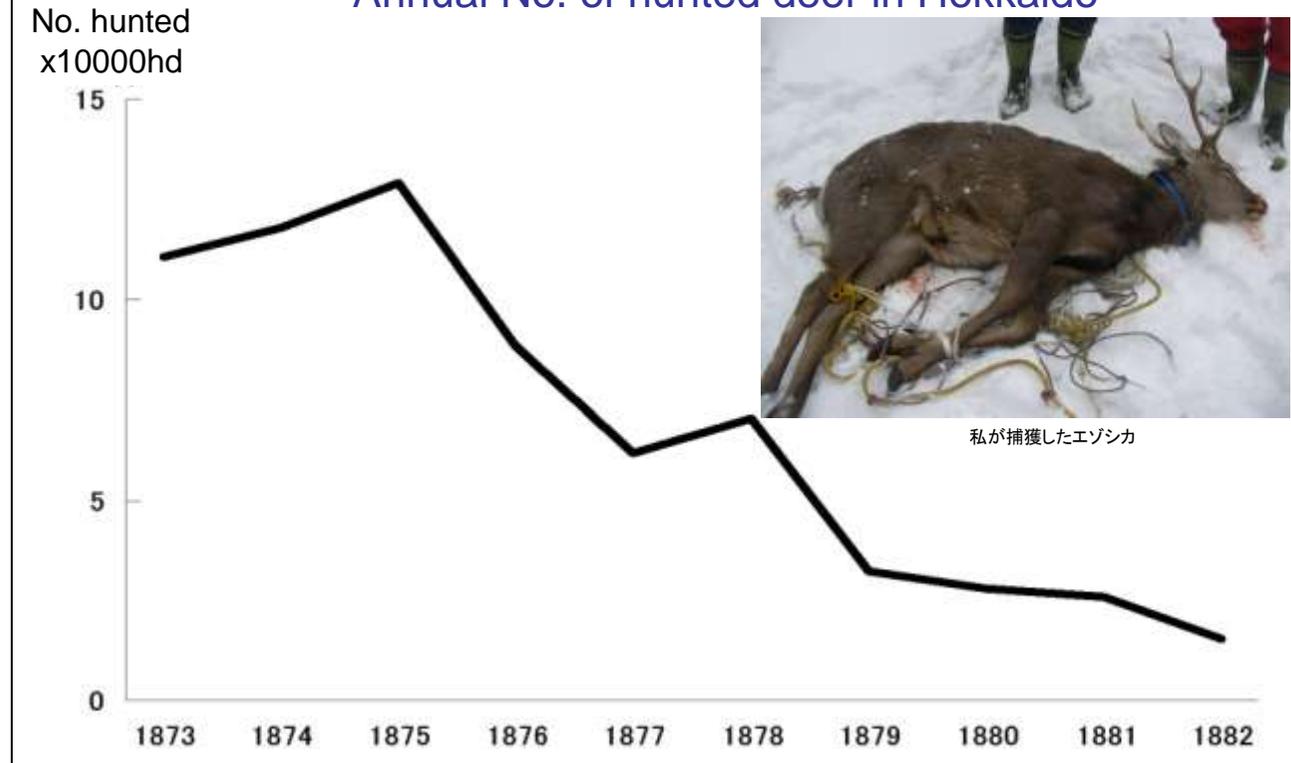
Surely, many researchers have confirmed population increase in these 30-40 years.

But, that is too narrow time window when we think about natural ecosystem. We should track back as far as possible.

Then, I estimated past deer population sizes and dynamics more than 60 years ago.

# Estimating past population size from hunting statistics

## Annual No. of hunted deer in Hokkaido



For the estimation of past population sizes, I used descriptions about deer in literatures and hunting statistics in the past time.

Here is annual number of hunted deer in Hokkaido more than 100 years ago.

I calculated minimum population size to realize this series of annual number of hunting during this 10 years period.

Then, I figured out a minimum estimate of population size in 1873.

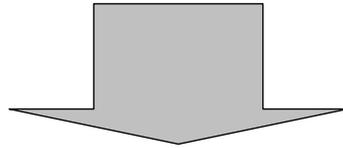
# Estimating past population size

## Ezo sika deer

**1873: min. est. 370-470 thousands**

Excluding predated deer by wolf and bear, deaths by temporal heavy snow fall

揚妻(2009)



**2005: 400-600 thousands**

北海道発表データ

苫小牧研究林のエゾシカ



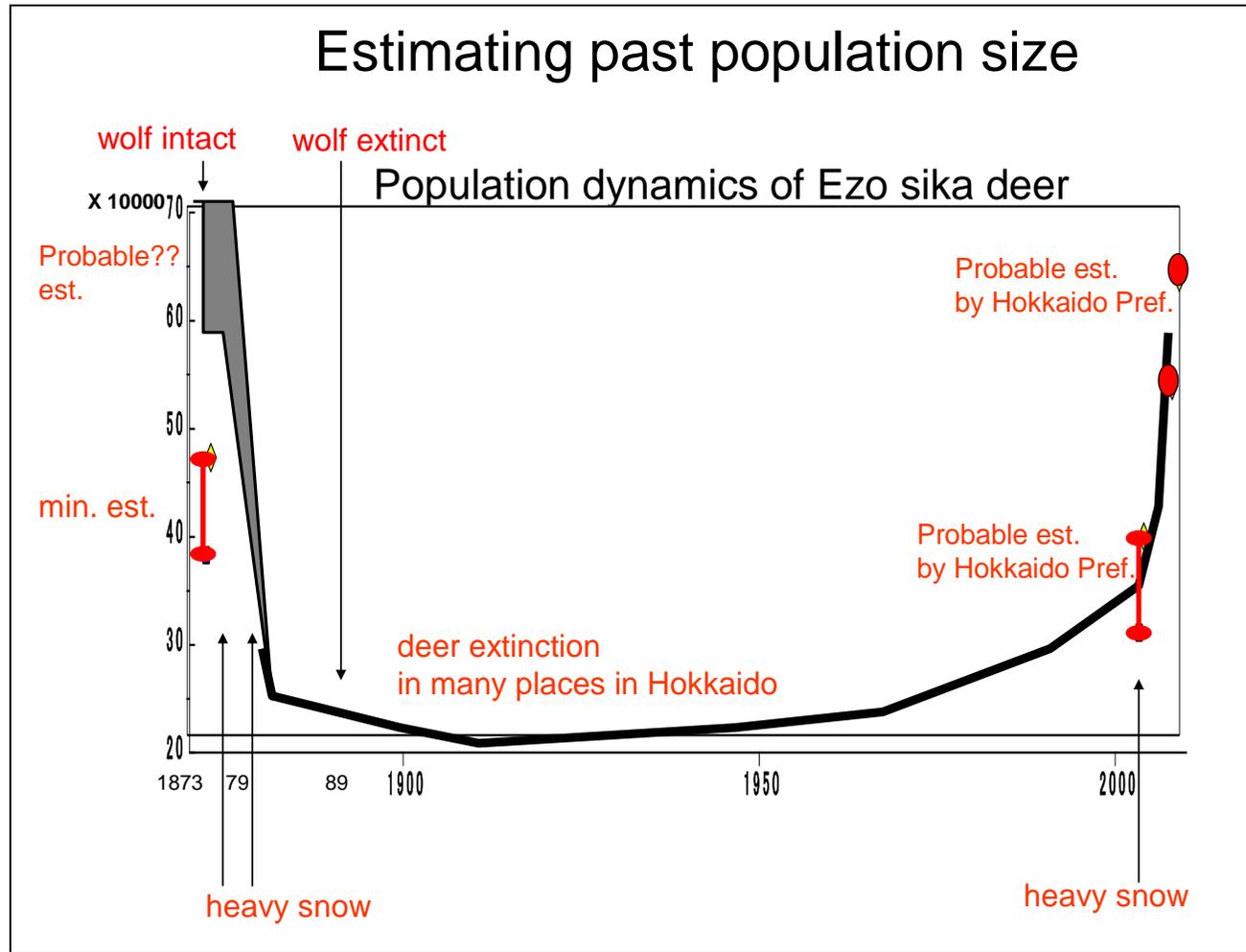
The estimated population size is 370 to 470 thousands.

This figure does not include predation by wolves, brown bears and wild dogs, nor number of deaths by temporal heavy snow falls.

So, much more deer must live in Hokkaido than this figure.

But, this figure is about the same as the population size in 2005 when the deer was thought to be unnaturally overabundance.

# Estimating past population size



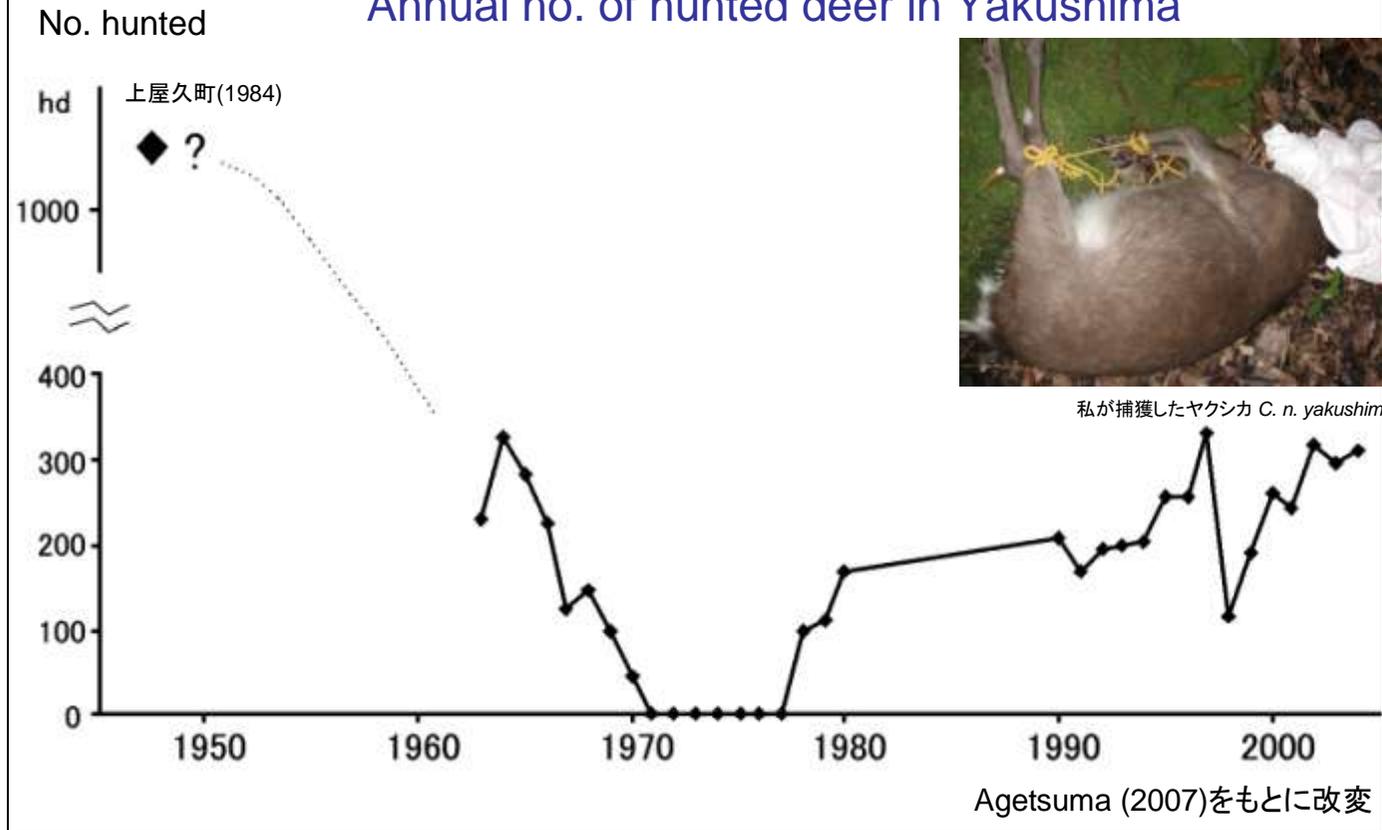
Here is a rough sketch of population dynamics of sika deer in Hokkaido in these 140 years.

Originally, deer were so abundant, even when wolves were intact.

Then, deer decreased rapidly around 1880, and after 100 years, eventually deer came to recover.

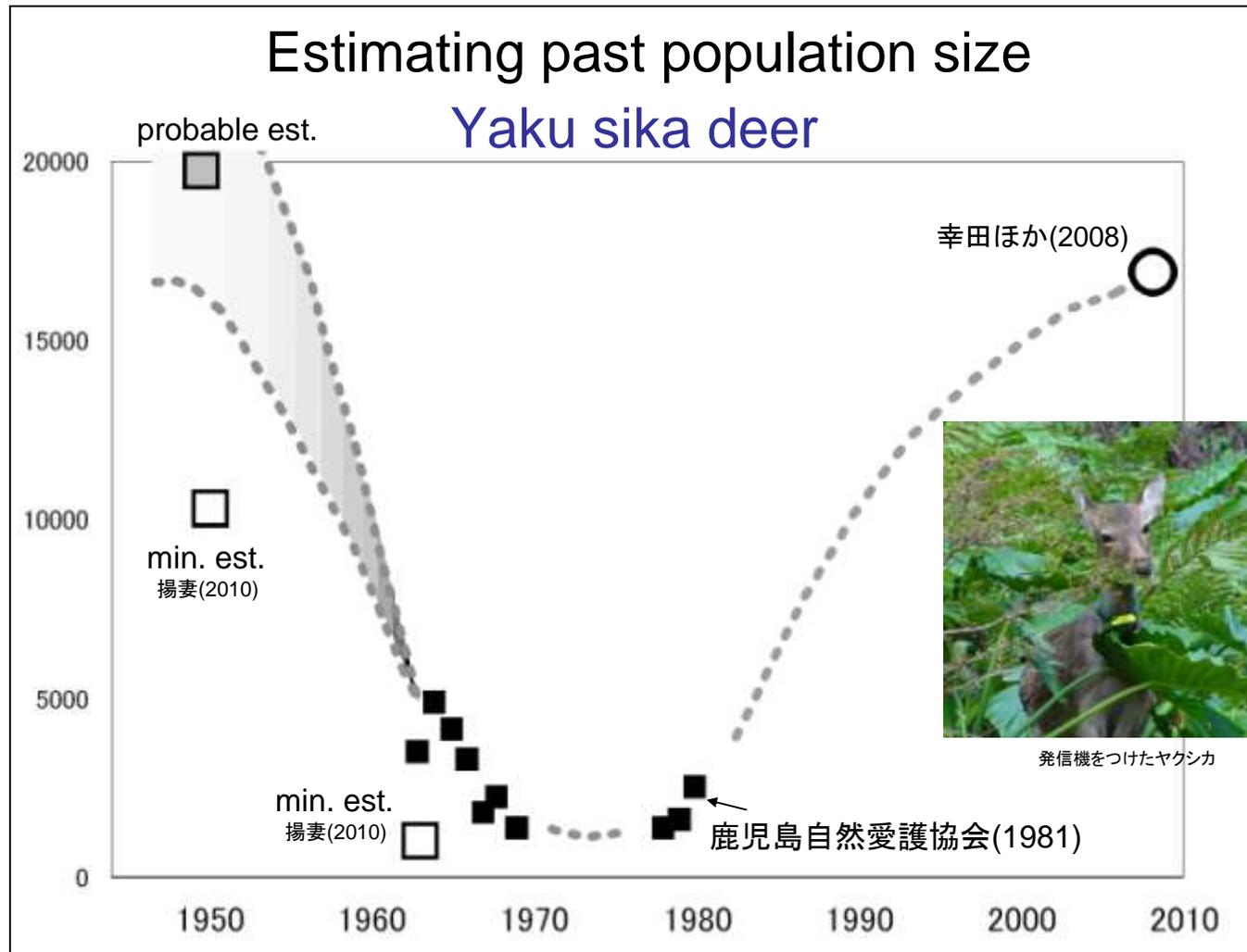
# Estimating past population size from hunting statistics

## Annual no. of hunted deer in Yakushima



Next, I made similar estimation in much warmer area, the island of Yakushima using hunting statistics here.

I estimated deer population size in 1950.



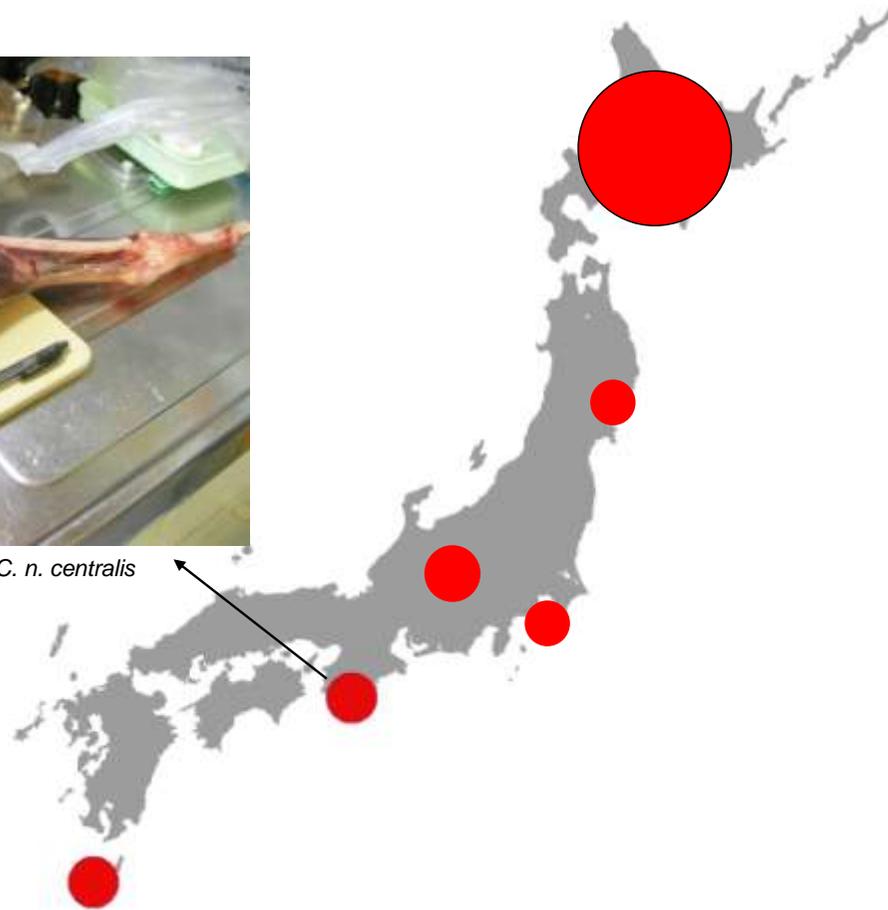
Then, I found that there were at least 10,000 deer, probably around 20,000 deer lived in this island until 1950.

The population size might be almost the same as in 2008 when deer was thought to be overabundant.

● similar dynamics reported



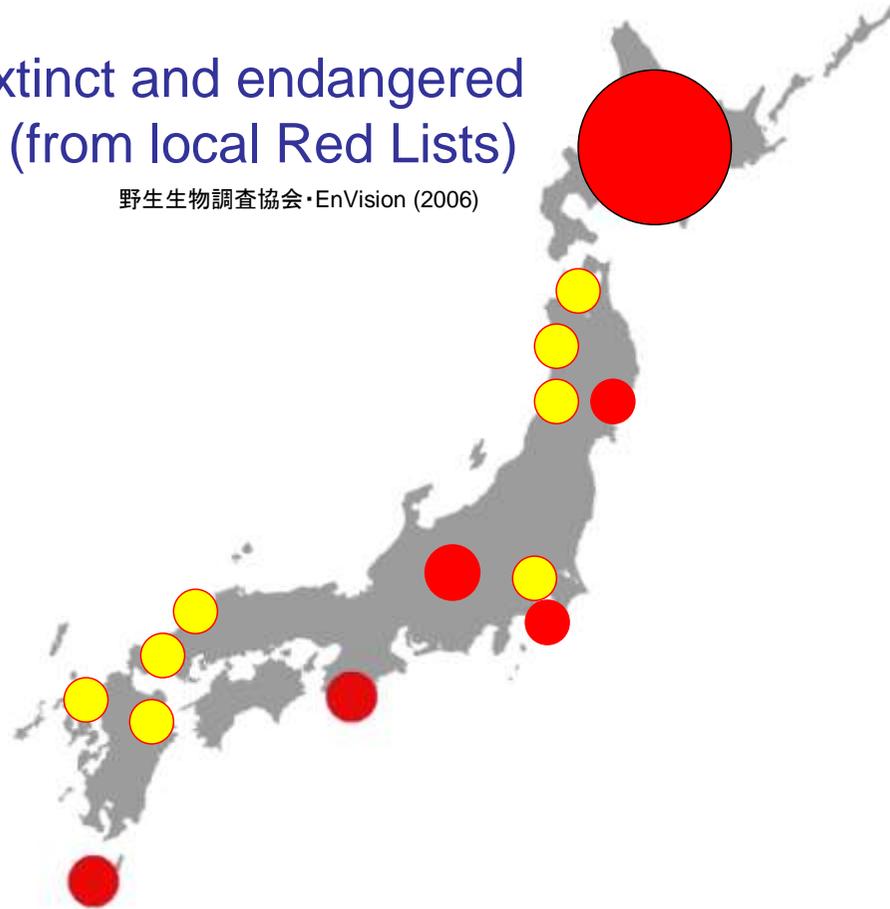
和歌山研究林近くのホンシュウジカ *C. n. centralis*



Similar dynamics of Hokkaido and Yakushima were reported in Nagano Prefecture, Boso peninsula in Chiba Prefecture and Mt. Ohto in Wakayama Prefecture, and maybe also true in Iwate Prefecture.

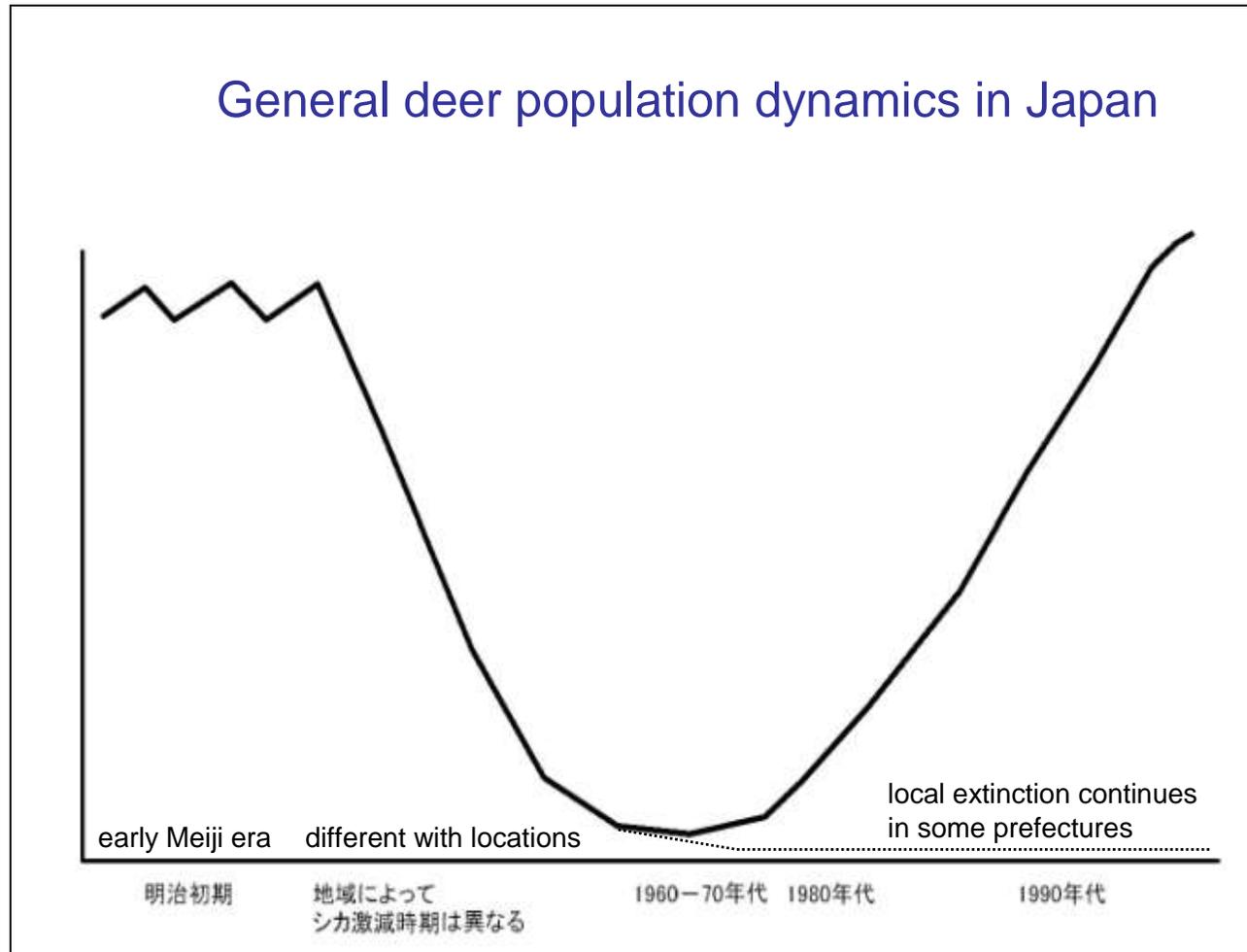
- similar dynamics reported
- locally extinct and endangered in 2006 (from local Red Lists)

野生生物調査協会・EnVision (2006)



Moreover, even in 2006, sika deer is still extinct in several prefectures or recognized as endangered species in local Red List. In these prefectures, obviously deer populations do not recover to natural level.

## General deer population dynamics in Japan



Here is a schema of deer population dynamics of Japan.

In past time, deer was so abundant across the Japanese Archipelago from Kagoshima to Hokkaido, then they rapidly decreased.

Decreasing periods are different with locations. Deer seems to decrease earlier in cooler areas, and later in warmer areas.

Anyway, around 1960-1970 (about 40 years ago), deer populations were the least across the Japanese Archipelago.

And, then, they came to recover after 1980.

## Verification of common hypotheses of deer population increase

- Global warming hypothesis
- Wolf extinction hypothesis
- Declining hunter hypothesis

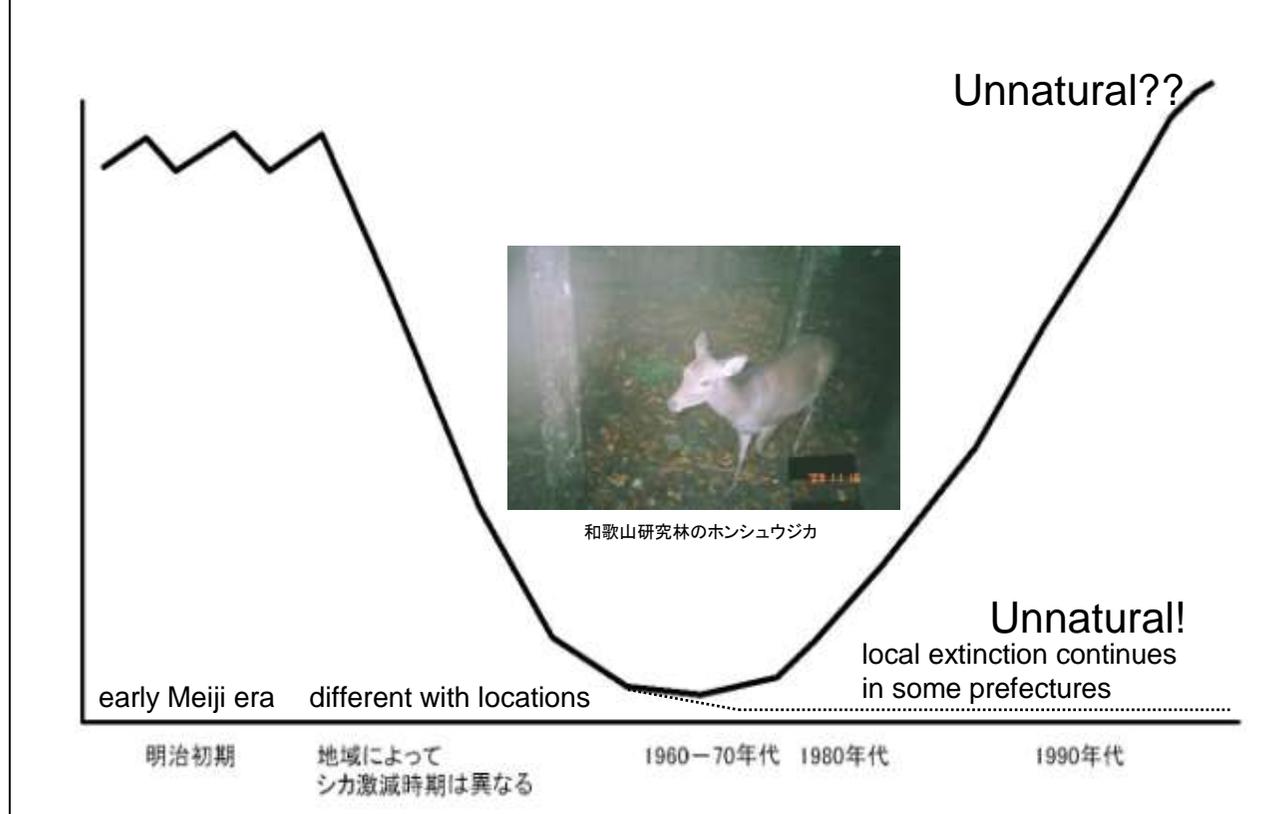
This fact is very suggestive when we think about wildlife management.

For example, now we can verify the common hypotheses of recent increase of deer population.

In past time, even if effect global warming was little, even if hunting and predation pressure were so high, but deer population size was so large.

Therefore, these hypotheses are not likely to explain the recent increase of deer.

## General deer population dynamics in Japan

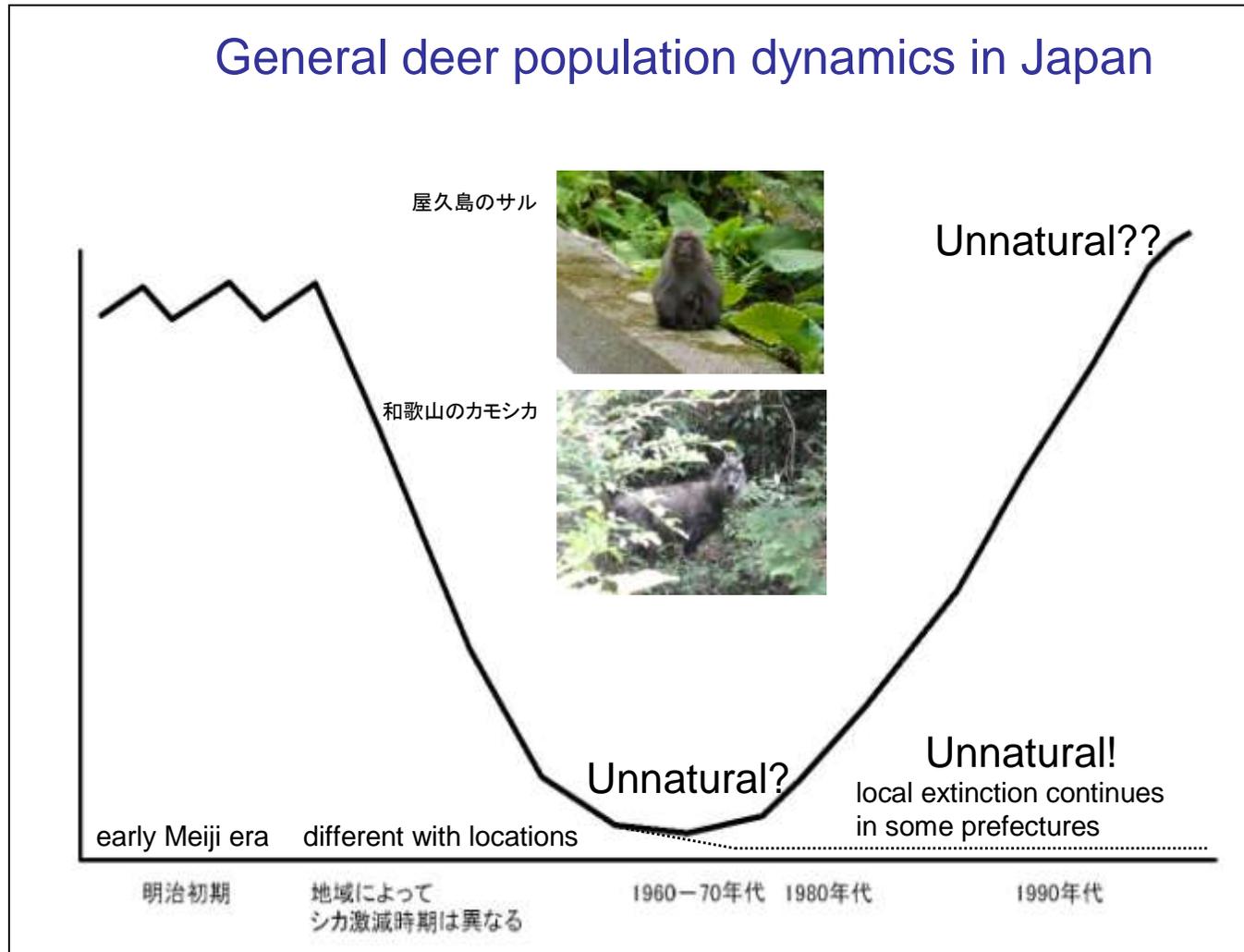


For another example, we can get some suggestions about what is natural or unnatural condition of Japan.

I cannot judge whether deer population size now is larger than historical population size, because I could not estimate exact past population sizes.

But, I believe that deer population size now is not so extremely larger than historical population size.

## General deer population dynamics in Japan



At least, it is safe to say that population size 40 years ago is very low in the deer history during these 100-200 years of period.

In addition, other wildlife such as monkey, serow and bear would be the least in Japan in this time.

Therefore, we should not regard the natural condition at this time as a standard of original of Japanese natural condition.

# My interests

## TRUE factors of the population dynamics

Agetsuma(2007)・揚妻(2010)(2013)

## Past conditions of natural ecosystems when deer was so ABUNDANT

苫小牧研究林で実施しているシカ高密度化実験



シカを高密度化させた林



シカを排除した林

Now, my interests are, what are true factors causing population dynamics of deer. Why deer was so abundant in past time, and why they rapidly decreased and then recovered recently, and why similar trends can be found in so different environments from south to north Japan.

Also, I am interested in what and how natural vegetations established in past time when deer was so abundant.

Most plant ecologists insist high deer density destructed natural vegetations. If it is true, in past time, destructed vegetations spread over and over Japan. But, I wonder any other possibility.

The end



ヤクシカ行動観察中

These questions are very closely related with wildlife management and nature conservation.

So, I hope these questions will be answered in the near future.

Thank you.