

## Importance of diversity in foods and culture for sustainable resource use

10:00 – 10:30, April 27, 2010

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By Kyoto Univ. Ecological Research Center



By NHK (Close-up Gendai)

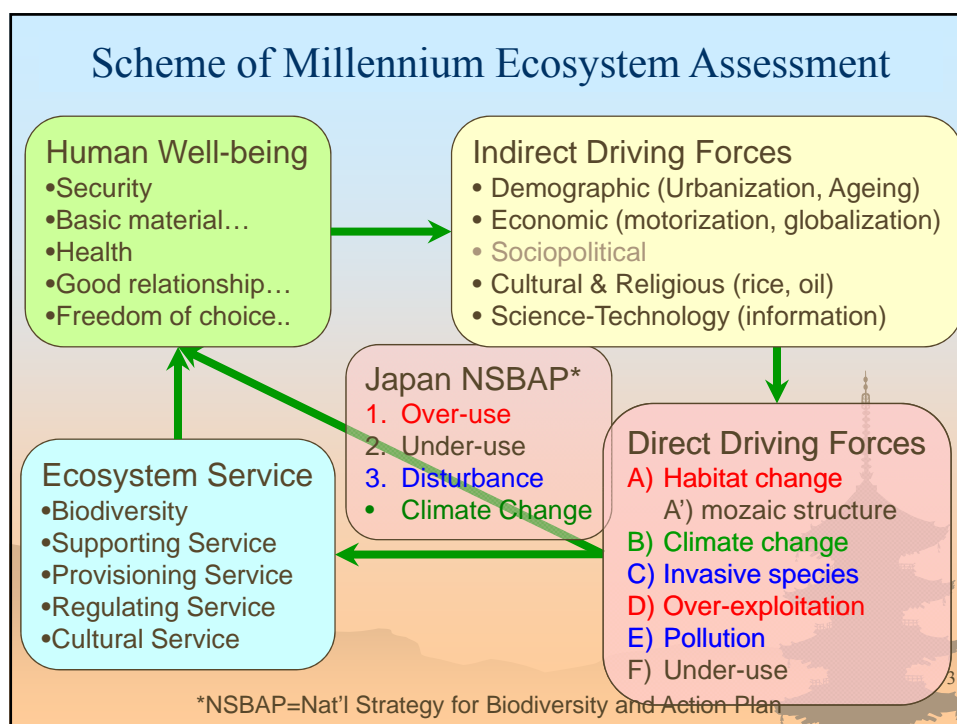


Satoyama photo by Dr. Kada

<http://risk.kan.ynu.ac.jp/matsuda/2010/100427.pdf>

### Overview

- **Japanese activities in Biodiversity**
  - Japan Sub-global Assessment of Millennium Ecosystem Assessment
  - Japan Biodiversity Outlook (compiled by Nakashizuka et al.)
  - SATOYAMA Initiative & “Living in harmony with nature”
- Provisioning service supported by biodiversity.
- Build multiple species management
- Merits of harvesting multiple species
- Resource management vs. Pest control
- Diversity in foods and culture is important



### Report from workshops on the Science-Policy interface and 2020 targets *Nagoya, March 2010* General comments by **DIVERSITAS**

- ✿ Changing disturbance regimes are an important direct driver of biodiversity change - experience from “Satoyama” and High Nature Value farmland in Europe shows that **underuse can actually be a problem for biodiversity**.

## Summary of J-SGA, Ecosystem Services in Japan

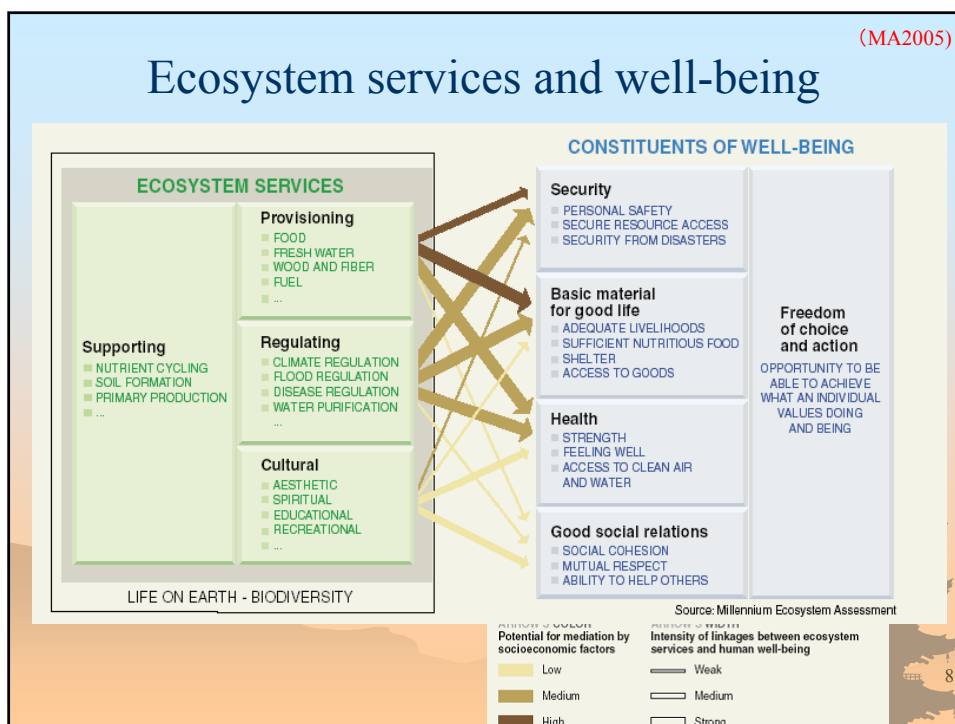
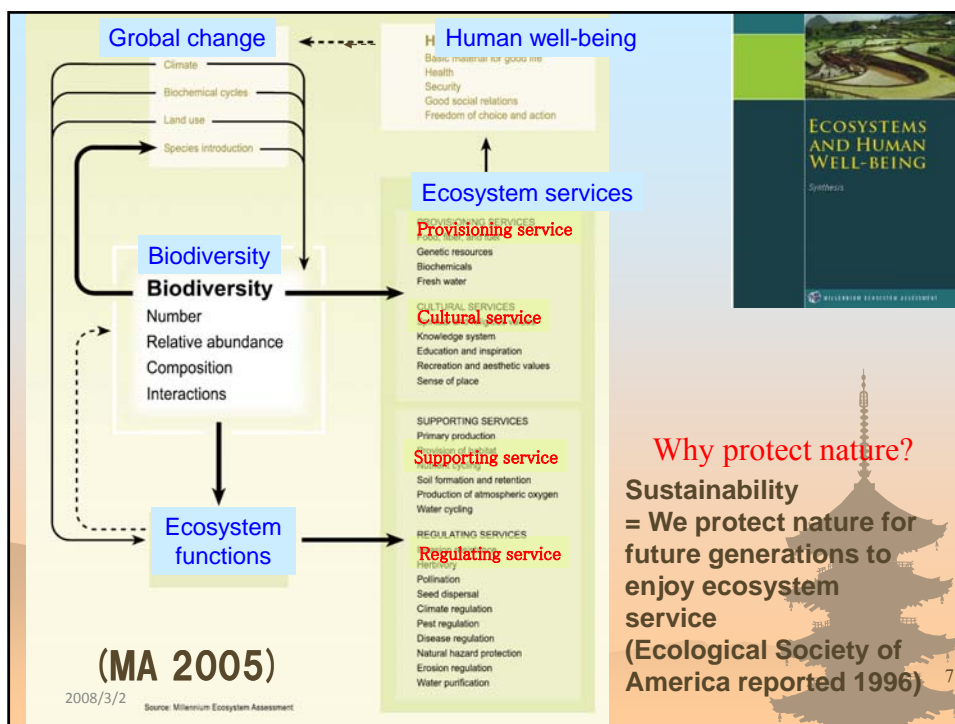
(Chap.3 draft by Matsuda, Okuro, Yumoto, Hayashi et al.)

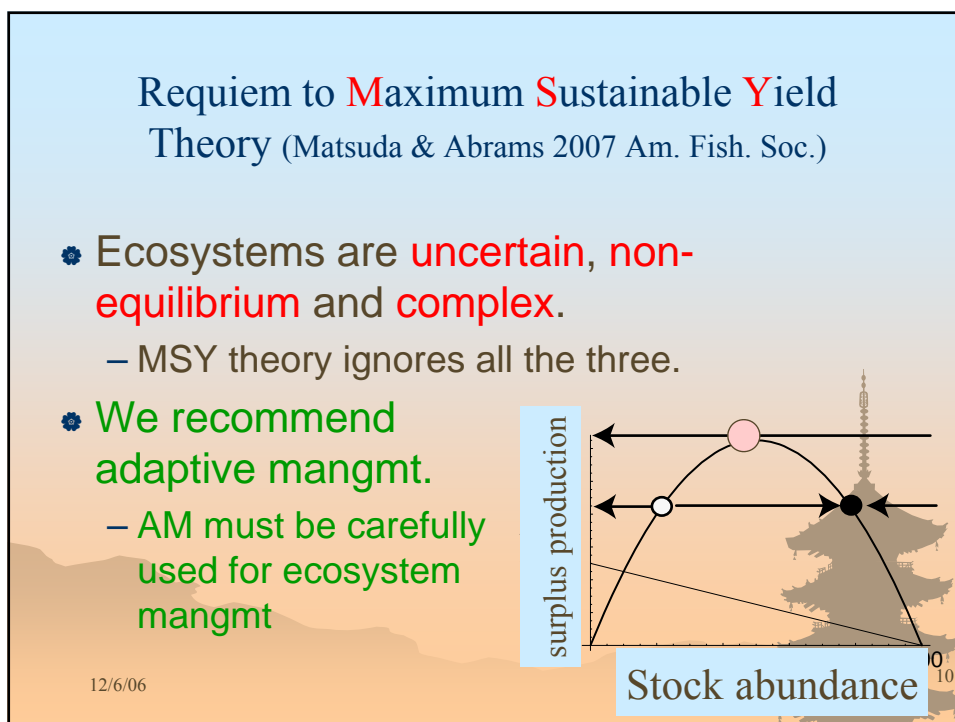
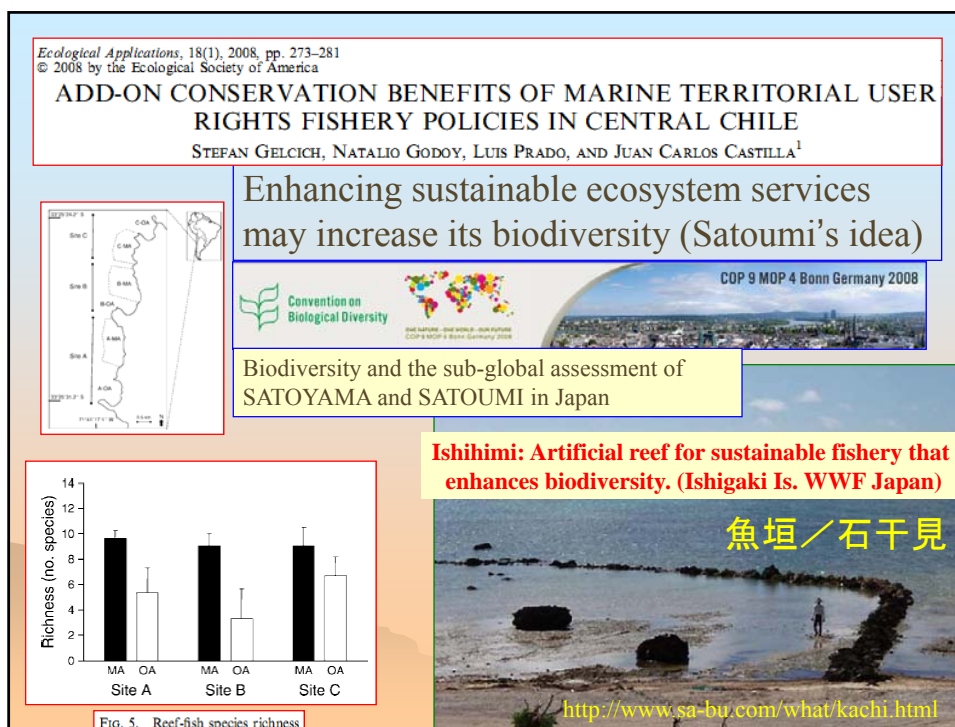
Ecosystem services	flux	potential	notes
Provisioning	foods	↘ ↗	increase import products
	woods/fibers	↓ ↗	Import woods, decrease fibers potential
	water	↗ →	increase hydroenergy
Regulating	air		↗ clean-up by abandoned paddy fields
	water		↘ degradation of water quality in 50 yrs
	soil		→
	living things	↘	serious pollen disease by cedar forests
Cultural	spiritual	↘	decrease shrine/temple forests
	aesthetic	↗	sightseeing resources
	recreational	→	decrease hiking/ increase ecotourism
	arts	↘	decrease crafts
Supporting	terrestrial	↘	wetlands, rivers, plains
	marine	↘	tidal flood, beach,
Biodiversity		↘	decrease of rare & common species

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- Resource management vs. Pest control
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## Overview

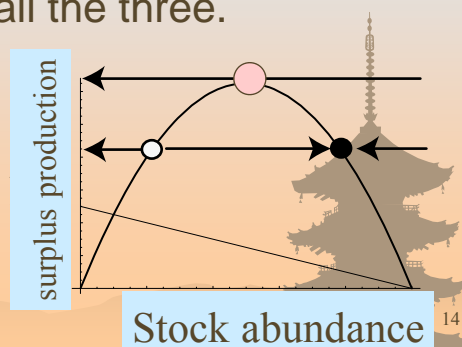
- Japanese activities in Biodiversity
- Provisioning service supported by biodiversity.
- **Build multiple species management**
  - **Requiem to Maximum Sustainable Yield**
  - **Ecosystem fluctuates naturally**
  - **Target Switching in Fisheries**
- Merits of harvesting multiple species
- Resource management vs. Pest control
- Diversity in foods and culture is important



13

## Requiem to Maximum Sustainable Yield Theory

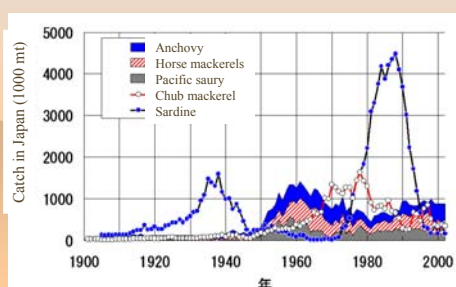
- Ecosystems are uncertain, non-equilibrium and **complex**.
- MSY theory ignores all the three.
- Does MSY theory guarantee species persistence?
  - **No!!**



14

## Diversity-stability relationship

- Classic idea (Elton 1954) (May 1972 *Nature*)
  - Diversity stabilizes abundance of each species
- Modern idea (Tilman 1999 *Ecol.*)
  - Diversity stabilizes the total biomass of ecosystem



Resource management of  
single species is hopeless

↓  
Ecosystem mangament!

## Target switching of multispecies fisheries

(Katsukawa & Matsuda, Fish.Res. In press)

Policy 1 (no switching; NSF)

$$F_i = f_i / (2(1 + hx_i))$$

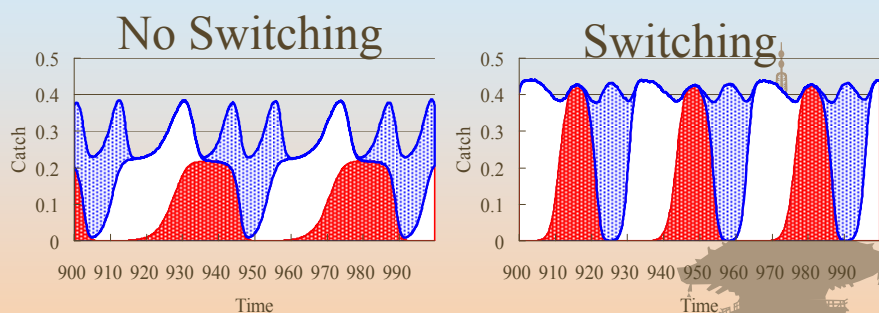
Policy 2 (switching; SF)

$$F_i = f_i x_i / (\sum x_i) (1 + hx_i)$$

Fishers may focus on relatively  
abundant fish species.



**Switching** increases & stabilizes total catch and save the stock at low levels



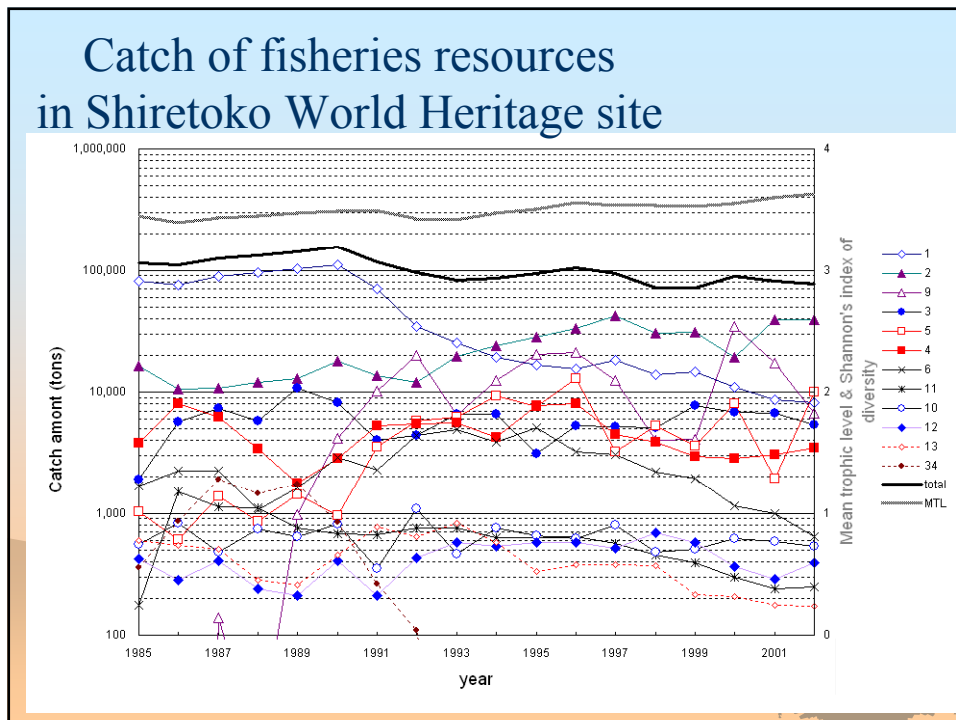
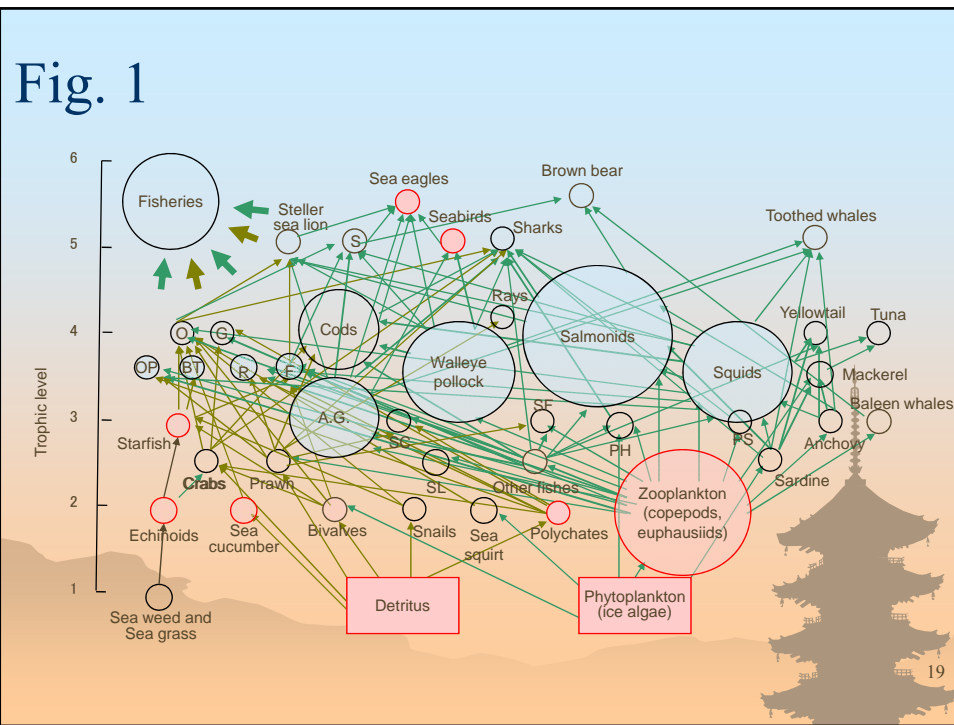
If stock fluctuations of alternative fish are negatively correlated or independent

<http://kaiseki1.ori.u-tokyo.ac.jp/~katukawa/blog/blosxom.cgi/study/article/switching.wikiedfish>

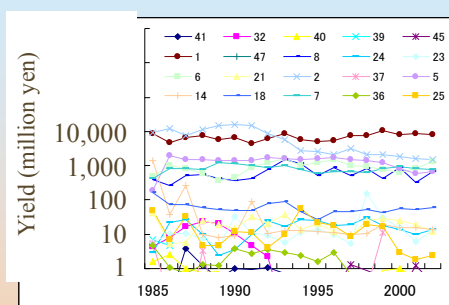
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- **Merits of harvesting multiple species**
  - Stabilizing the total yield from the community
  - Reducing monitoring cost of unused species,
  - Save bio-resource when it is low
- Resource management vs. Pest control
- Diversity in foods and culture is important



## Yield of fisheries resources in Shiretoko World Heritage site



$$\text{Price} = \frac{\text{Yield}}{\text{Catch}}$$

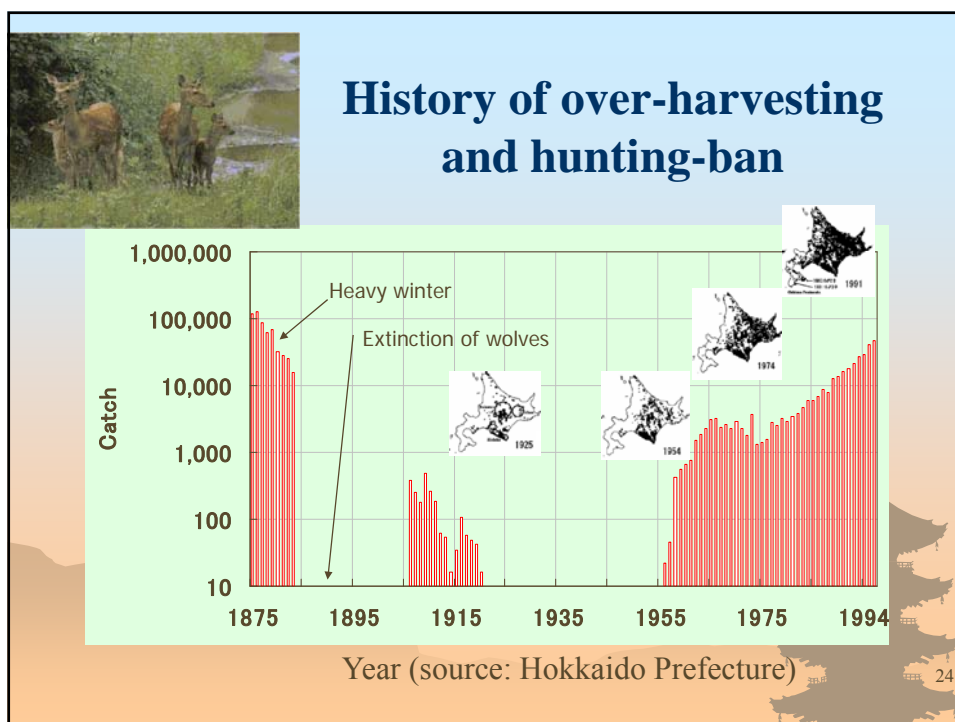
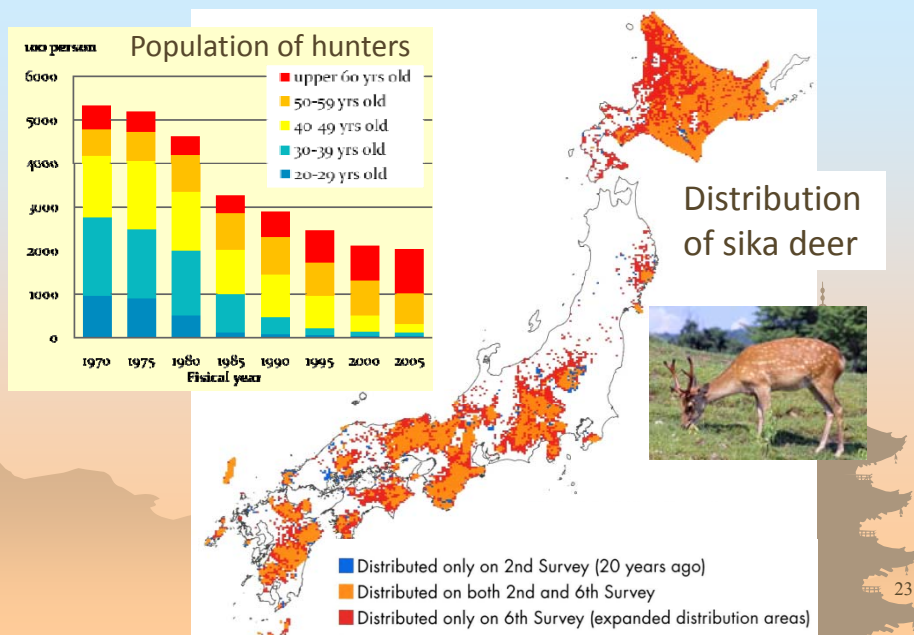
- Catch of sardine, anchovy, red king crab, *Sebastes* and herring substantially decreased by >96%. Greenling decreased their catch by 70% and the fish price by 64%

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## Underutilization of secondary habitat (Satoyama)



## Purposes of deer management in eastern Hokkaido (1997)

- To use deer as **natural resources**,
- To **avoid extinction and overabundance** of deer,
- To conserve ecosystems,
- To **decrease damage** on agriculture and forestry

25

## Stage-Structured Model

Simple model with uncertainties

$$\begin{pmatrix} N_c(t+1) \\ N_f(t+1) \\ N_m(t+1) \end{pmatrix} = \begin{pmatrix} 0 & r(t)L_{ff}(t) & 0 \\ L_{fc}(t) & L_{ff}(t) & 0 \\ L_{mc}(t) & 0 & L_{mm}(t) \end{pmatrix} \begin{pmatrix} N_c(t) \\ N_f(t) \\ N_m(t) \end{pmatrix}$$

$$L_{fc}(t) = L_{mc}(t) = \exp[-Q(t)H_c(t)]\exp[-M_c(t)]\exp[-R_c(t+1)],$$

$$L_{ff}(t) = \exp[-Q(t)H_f(t)]\exp[-M_f(t)]\exp[-R_f(t+1)],$$

$$L_{mm}(t) = \exp[-Q(t)H_m(t)]\exp[-M_m(t)]\exp[-R_m(t+1)]$$

26

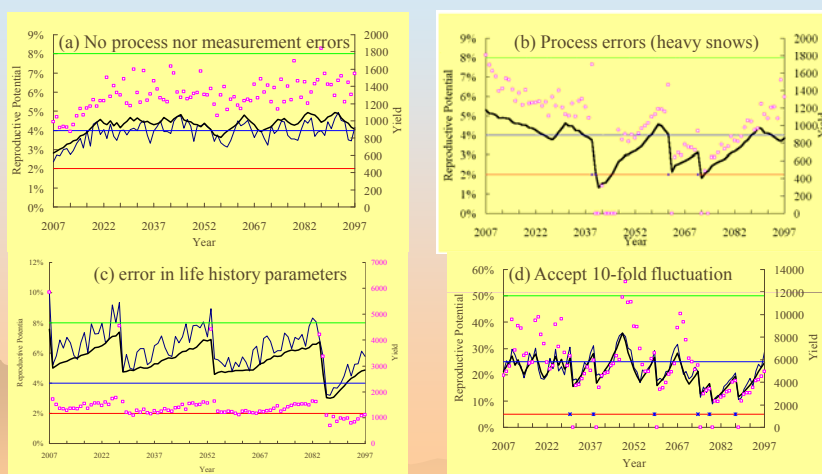
## Density-dependent hunting pressure

<http://www.hokkaido-ies.go.jp/HIESintro/Natural/ShizenHP2/SIKA/DTdeerHP.htm>

<b><math>\%P &gt; 50\%P_{1993}</math></b>	<b>Emergency culling</b>
<b><math>25\% &lt; \%P</math></b>	<b>Gradual population reductions</b> (catch females)
<b><math>5\% &lt; \%P</math></b>	<b>Gradual population increases</b> (catch males)
<b><math>\%P &lt; 5\%</math> or after the severe winter</b>	<b>Hunting bans</b>

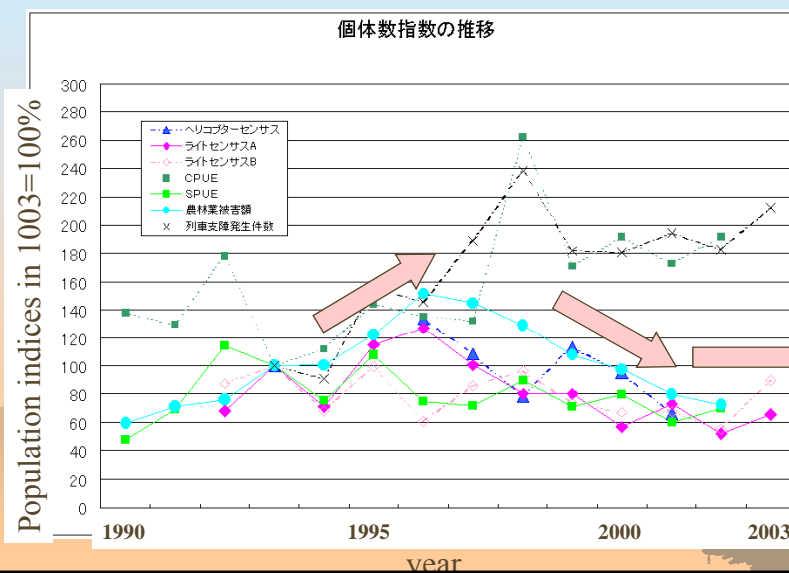
27

## Risk management based on a population dynamic model



28

## Trends in Population indices



<http://risk.kan.ynu.ac.jp/matsuda/2010/100427.pdf>

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## 環境問題は、伝統知でより 統一的に把握できる

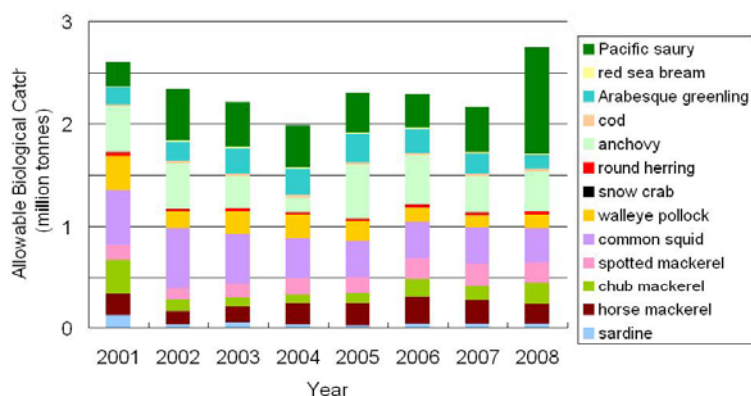
- 非市場的価値  
–External-market value
- 生態系サービス  
–Ecosystem services
- リスク/ベネフィット  
–Risk/benefit
- (自然の)管理責任  
–Stewardship
- フードマイレージ  
–Food Mileage
- 公衆含意  
–Public involvement
- 契約  
–Contract

- 勿体無い  
–Mottainai
- 自然の恵み  
–Grace of nature
- 程ほど  
–moderate
- 自然への畏敬  
–Awed by nature
- 地産地消  
–Local foods for local consumption
- 話し合い  
–Mutual consensus
- 宜しくお願いします  
–Regards without request

31

## We can use >2 million tons of pelagic fishes sustainably in Japanese EEZ.

- But demand-supply mismatch: overfishing and underuse.



source: Fisheries Research Agency, Japan

32

Source: Fisheries Research Agency, Japan



## New Zealand imports Pacific saury (samma)



[http://kaiseki.ori.u-tokyo.ac.jp/~katukawa/blog/2008/07/post\\_378.html](http://kaiseki.ori.u-tokyo.ac.jp/~katukawa/blog/2008/07/post_378.html)

## Ecological risks from the perspective of Asia

**Rice and fish** are **important and good** food although these are contaminated heavy metals and dioxins of which concentrations exceed European food safety standard. We need a new idea with environmental risks.

**Paddy field and artisanal fisheries** are environment friendly.

**Do not believe temporal global standard** and accept diversity of local codes. Rabbit hutch has few ecological footprint but it was criticized a decade ago. Not only protect with utilitarianism such as conservation of nature = ecosystem services, but also need to **feel wasteful** for not keeping redundancy.

Fishery in a developing country is characterized by co-management. Fishers need to **in-depth discuss** to make a decision.



Losing traditional rice terrace



Discussion of fishery cooperative (sometimes conversation amount to 200 times per year)

Source: Kyoto Univ. ERC

## A variety of Japanese food

物質供給サービス Dinner dishes at a hot spring inn

植物：25種 動物：13種 菌類：3種以上 合計 41種以上

**鍋**  
ズワイガニ・ハクサイ・ミズナ  
エノキダケ・ネギ・ダイズ・コムギ

**揚げ物**  
エビ・ヤマイモ  
シシトウ・レモン

**中皿**  
ニワトリ・トマト・ダイコン  
パセリ・サラダナ

**酢の物**  
ウシ  
イネ  
ダイコン

**香の物**  
ハクサイ  
ノザワナ  
コンブ  
ニンジン  
キュウリ

**デザート**  
ダイコン  
ブルー  
ベリー  
ミント

**お椀**  
イワシ・ネギ  
ヤマイモ  
シイタケ  
ショウガ

**煮物**  
ダイズ  
インゲンマメ  
ニワトリ  
サトイモ  
キャベツ  
カツオ

**止め椀**  
コムギ  
ダイズ  
シメジ  
ミツバ  
カツオ

**凌ぎ**  
サケ・エビ  
ショウガ

























**先付**  
ホヤ・コンブ・シメジ  
メンタイ・ダイズ

**食前酒**  
ウメ

**刺身**  
マグロ・タイ・アマエビ  
ホタテ・シソ・ダイコン

Source: Kyoto Univ. ERC

## Plant as medicine

 ウド 頭痛・歯痛	 オオイワカガミ 胃腸薬	 カタクリ 風邪・下痢	 ザゼンソウ 虫さされ	 ゼンマイ 利尿・貧血	 ハマゴウ 滋養強壮
 エソアジサイ 風邪・解熱	 オオバクロモジ 胃炎・腸炎	 カワラナデシコ 利尿	 シュンラン あかぎれ	 タムシバ 蓄膿症	 ユキツバキ 健胃・整腸
 エソエンゴサク 腹痛・胃痛	 オニノヤガラ 頭痛	 キブシ 利尿	 ニッコウキスゲ 風邪	 ナナカマド 疥癬・あせも	 マルバマンサク 痔・湿疹
 エゾリンドウ 食欲不振	 オミナエシ 下痢	 トキワイカリソウ 滋養強壮	 スギナ 糖尿病	 フクジュソウ 強心	 マツムシノウ 脳血栓予防

Source: Kyoto Univ. ERC

## Many Japanese names of colors refer to species

桜色 <i>Very Pale Orchid Pink</i>	黄はだ <i>Lemon yellow</i>	蒸栗色 <i>Chartreuse yellow</i>	藤色 <i>Lavender</i>	藤紫 <i>Wistaria Violet</i>
桃色 <i>Fuchsia Pink</i>	山吹茶 <i>Marigold yellow</i>	香朽葉 <i>Olive yellow</i>	松葉色 <i>Jade Green</i>	蘇芳 <i>Raspberry Red</i>
紅梅色 <i>Rose Pink</i>	桑茶 <i>Maize</i>	裏柳 <i>Mist Green</i>	萌黄 <i>Parrot Green</i>	桑染 <i>Malberry</i>
神楽色 <i>Brick Dust</i>	丁子茶 <i>Tan</i>	柳染 <i>Willow</i>	柳鼠 <i>Eggshell Green</i>	錦紫 <i>Amaranth Purple</i>
紅梅色 <i>Amber Red</i>	昆見茶 <i>Ocher Beige</i>	淡萌黄 <i>Apple Green</i>	若竹色 <i>Porcelain Green</i>	蟹椰子染 <i>African Brown</i>

Plants/animals  
146/225

Plants  
120/225

Tree species  
83/225

37

長崎盛輝(2001)「日本の伝統色 その色名と色調」青幻舎刊

## Thank you for attention

38