Environmental Risk

by Hiroyuki Matsuda

- What are risk and risk management? P-1 ppt 
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Keywords: Risk for ecotoxicology

- Biodiversity, Ecological risk, Ecosystem service, Endpoint, Environmental economy, Environmental risk, Hazard, Human health risk, Pollution, POPs, Precautionary principle , Prevention, Rio declaration , Risk, Risk assessment, Risk communication, Risk management, Scenario, Type II error, Uncertainty , Weight of evidence, Acute toxicity, Chronic toxicity, DDT, Dose-response curve, Ecotoxicology, Endocrine disrupter, Extrapolation, High risk group, LC50, LNT, LOAEL , NOAEL , QSAR, Risk-benefit analysis, Safety coefficient, Sensitivity , TBT, Threshold model, Effluent standard , Environmental standard , HC5, Non point source, Species sensitivity distribution

Keywords: Risk for conservation ecology

- Demographic stochasticity, EIA, Expected loss of biodiversity, Extinction risk, PVA, Redlist, Density effect, Discount rate, Ecological footprint, MSY , Overexploitation, TAC, Accountability, Adaptive management, AIC, Bayesian estimation, Confidence interval, Likelihood, Matrix population model, Maximum likelihood method, Measurement error, Population dynamics, Process error, State space model,

Keywords: Risk for Environment Policy

- MVP, Endangered species act, Environmental stochasticity, PBR, Scientific committee , Threatened, climate change, mitigation, adaptation, Cost-effective, CPUE , Exotic species, Ecosystem approach, Ecosystem management, Feasibility, Multi-disciplinary, Natural disturbance, Participatory approach, Passive restoration, , Regulatory science, Resilience, Succession, Sustainable use , Transdisciplinarity, ABS, Bottle neck effect, Genetic diversity, GMO, Business risk, LCA, Risk tradeoff, Screening assessment, Conservation ecology, game theory, Nash solution, the tragedy of the commons

Variety of risks

- Risks: disaster, public safety, environment, business, security etc.
- Environmental risks: human health, ecology, climate change etc.
- Ecological risks: biodiversity, ecosystem services
- Biodiversity: extinction risk, living planet index
- Ecosystem services: provisioning, regulating, cultural

What is risk? =
Endpoint, hazard and probability

- **Assessment endpoint**:
  - An event that is undesired
  - e.g., cancer, death, species extinction, …
- **Hazard**:
  - How severe is it when the undesired event happens
- **Probability**
  - That the endpoint happens.

A big problem—Scenario!

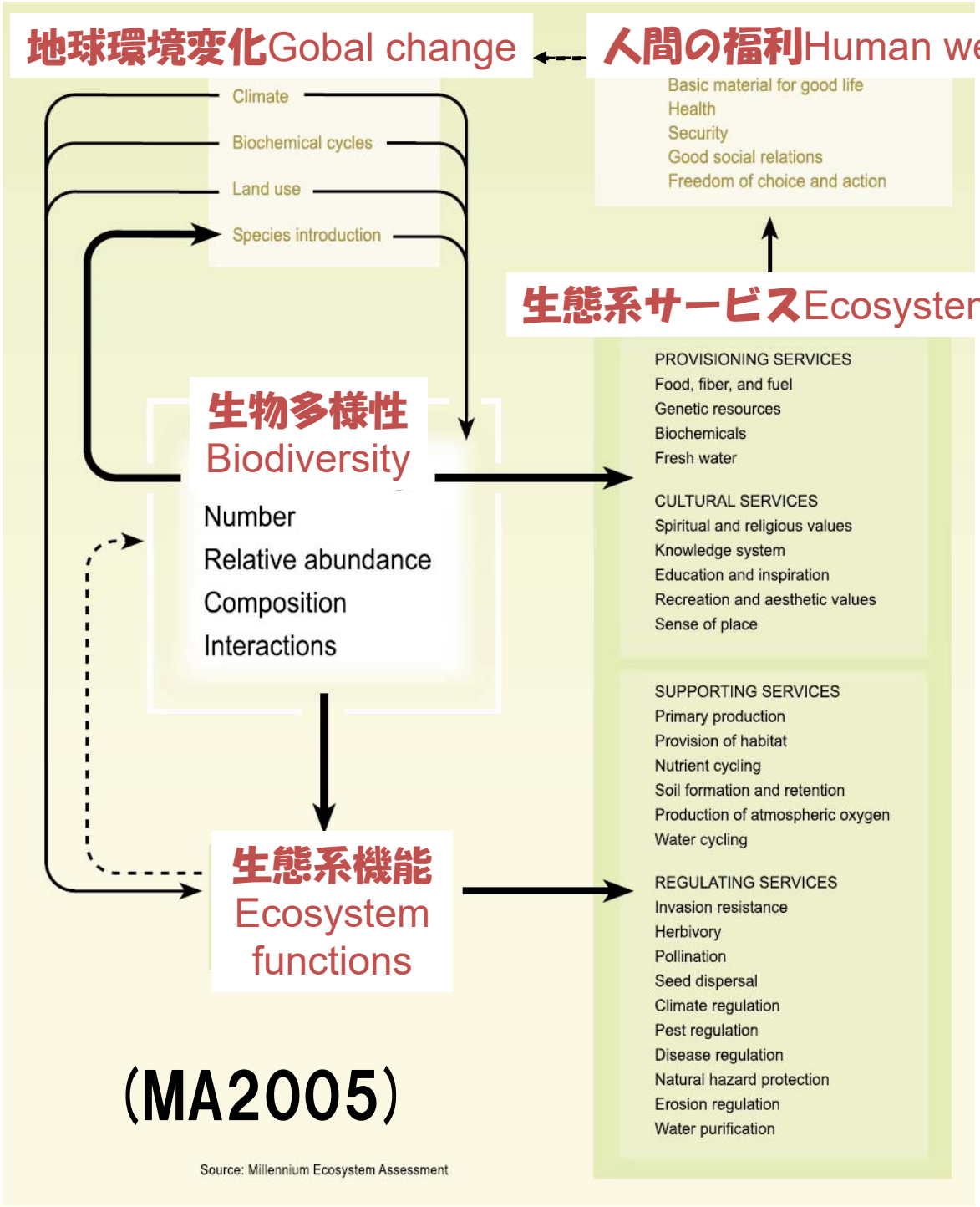
- The probability that the endpoint happens is usually uncertain.
- We usually calculate the risk under unverified assumptions and policy (scenario).
- We must describe what scenario we used!
- Risk = {Scenario, hazard, probability}

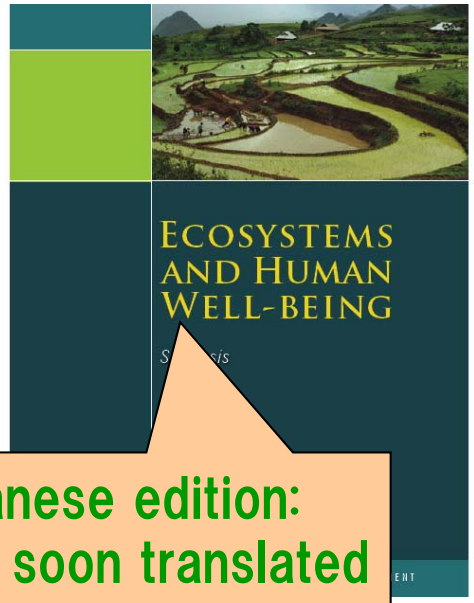
Risk analysis consists of:

- Risk **assessment**: to identify a risk, and to evaluate the magnitude of the risk.
- Risk **management**: to control the magnitude of risks under some actions or rules
- Risk **communication**: to inform and choose a desirable (or non-regret) policy under the knowledge of risks.

Environmental risk includes

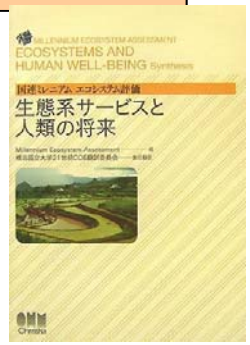
- Human health risk = increasing mortality of human or loss of “quality of life”
- Ecological risk = loss of biodiversity or ecosystem services, it may increase human health risk in future generations.
- Why do we consider eco-risk? ∵ We cannot directly account of impacts on well-being of our descendants. (中西準子「環境リスク論」)





Japanese edition: Coming soon translated by COE-YNU

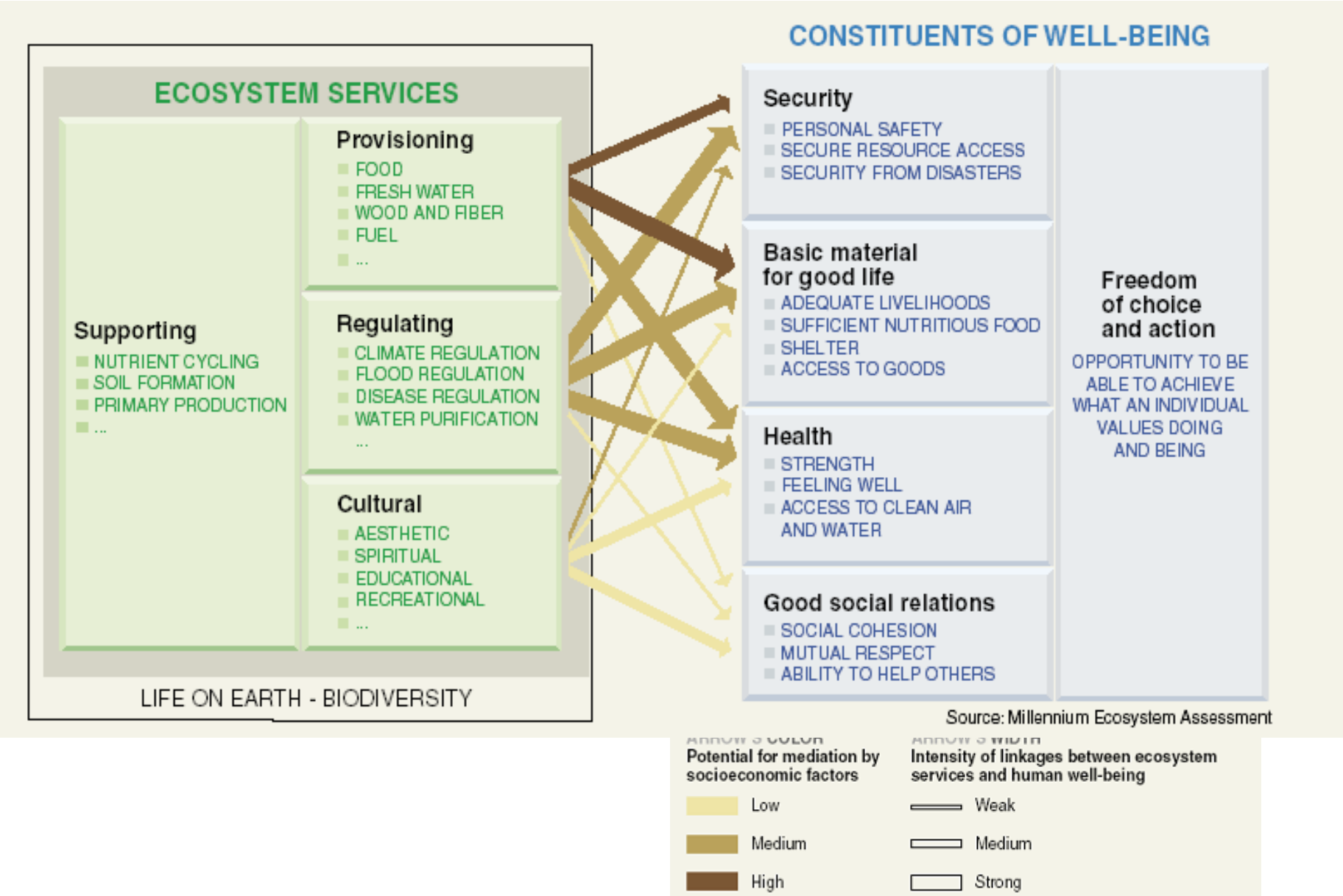
Why do we conserve the nature?



Because of intergene-rational sustainability =Our descendant can enjoy ecosystem services (Christensen et al. 1996)

Ecosystem services and well-being

(Millennium Ecosystem Assessment 2004)



http://www.ecolomics-international.org/headg_biosafety.htm

Prevention vs precaution

- **Prevention** is based on **certainties**: it rests on cumulative experience concerning the degree of risk posed by an activity (Russian roulette, for example, involves a predictable one-in-six chance of death).
- **Precaution** is used when scientific research has not yet reached a stage that allows the veil of **uncertainty** to be lifted.

http://risk.kan.ynu.ac.jp/matsuda/2006/060117.ppt

予防原則と統計学
Precautionary Principle (PP) and statistics

- **第1種の過誤：無用の対策を採る**
  Type I error: Doing unnecessary actions
- **第2種の過誤：採るべき対策を怠る**
  Type II error: Not doing necessary actions
- **科学は第1種の過誤を避ける（有意差5%）**
  Science usually avoids type I errors (5% rule).
- **予防原則は第2種の過誤を避ける（定量的・定性的評価基準がない）** PP avoids type II errors (no quantitative nor qualitative rule).

Two measures in risks

- Risk (type II errors)
  - Probability × hazard
- The weight of evidence (type I errors)
  - How certain is it?

  Do you use mobile phone in airplane? Why not?

http://risk.kan.ynu.ac.jp/matsuda/2006/060117.ppt

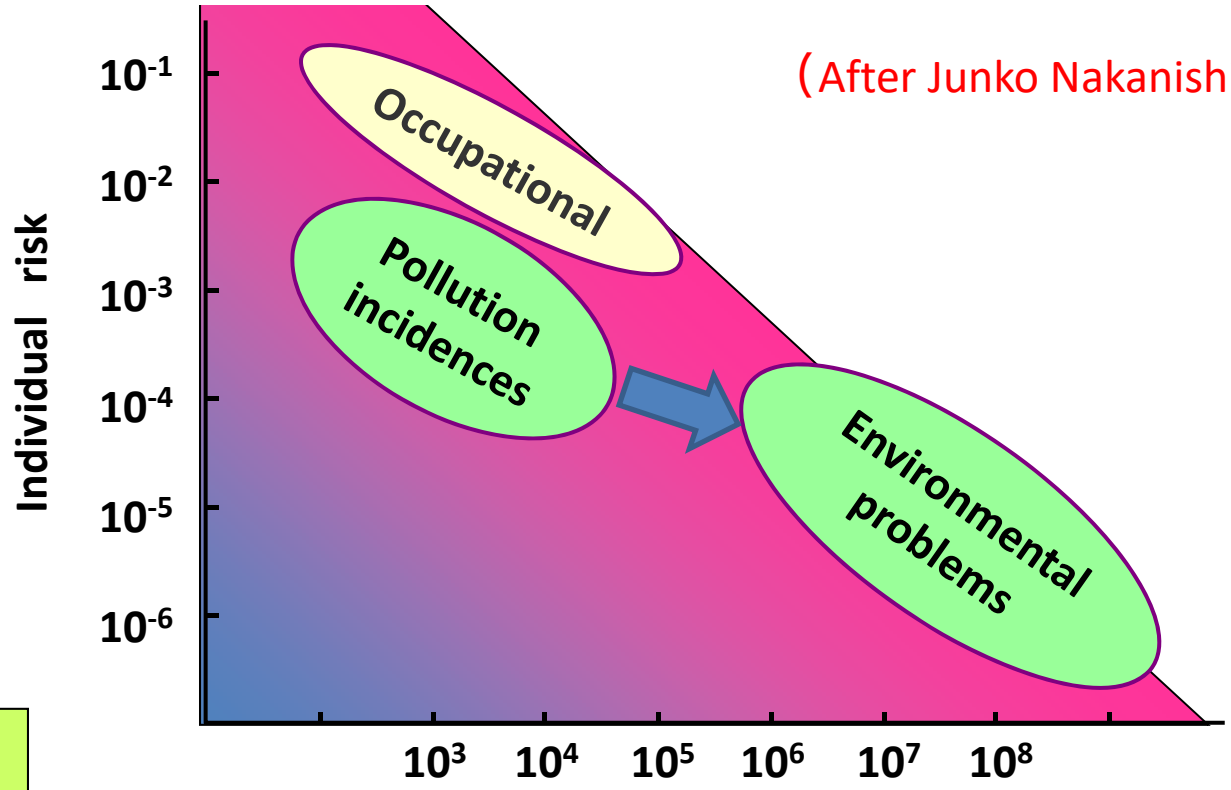
予防原則precautionary principle

- **環境を保護するため、予防的方策は、各国により、その能力に応じて広く適用されなければならない。深刻な、あるいは不可逆的な被害のおそれがある場合には、完全な科学的確実性の欠如が、環境悪化を防止するための費用対効果の大きい対策を延期する理由として使われてはならない。**
- In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

1992年リオ宣言第15原則 Rio Declaration Principle 15 http://www.unep.org/

Human Health Risk

Characteristics of the past pollution incidences and the recent environmental problems.



(After Junko Nakanishi)

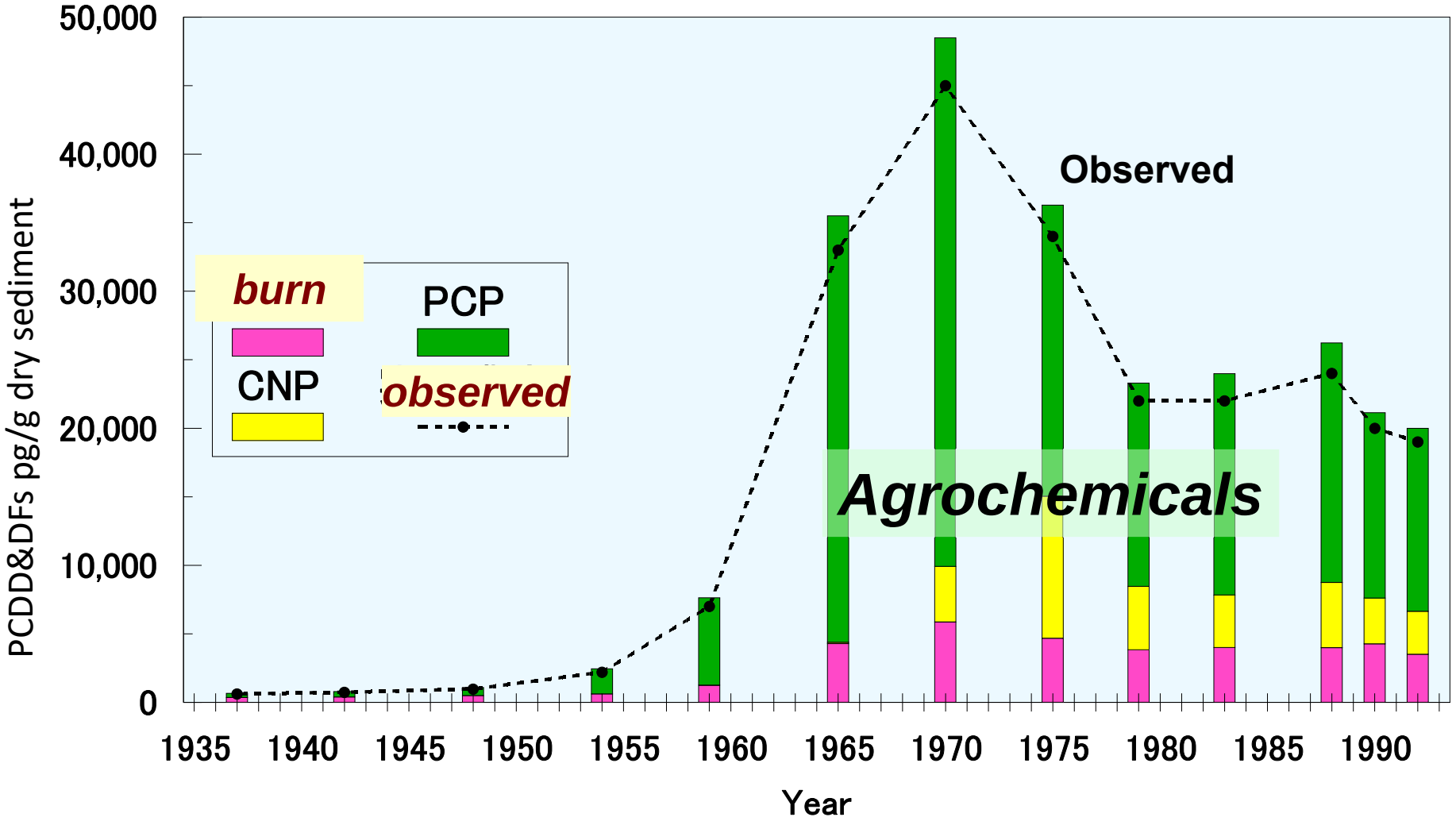
Ecological risk!

The per capute risk in the past was high, but the number of people affected was limited. The present per capita risk, with the newly-emerged environmental issues, is realtively small, while the number of people affected is big.

-The present risk is more ubiquitous, and is … unclear in nature.

益永茂樹氏

Source of dioxins in Tokyo Bay



Masunaga et al (2003) *Chemosphere* 53:315–324

Weekly intake of each fish

	Weekly intake of each fish (g)	concentration of methyl mercury (ppm)	Mercury intake from each fish (μg/week)
Intake from non-seafoods			11.9
sharks	10	0.35	3.5
sea bream		0.33	0.0
bluefin tunas	80	0.54	43.4
whales	5	0.12	0.6
shellfish	20	0.49	9.7
anchovy	160	0.03	5.3
mackerel	160	0.21	33.4
total	435		107.8
		total(μg/day)	15.4

(Souce: Japan Ministry of Health 2005, Nakanishi et al. 2003)

http://risk.kan.ynu.ac.jp/matsuda/2005/aquanet.htm

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Risk of mercury

	Mercury intake (μg/day)	% in Red blood cell (ppm)	Risk for adults	Risk for embryos
your case	**14.9**	0.024	1.4E-06	7.8E-05
Threshold for adults	25.0	0.038	1.1E-05	0.0005
Threshold for embryos	15.7	0.025	1.7E-06	9.5E-05
Average intake of Japanese	8.4	0.015	1.3E-07	7.6E-06
Average in 1960s	98.0	0.140	0.0013	0.0236
Minamata disease in 1960s	1250.0	1.753	0.2771	0.6709
Tuna eater (250g/day)	137.2	0.195	0.0036	0.048

(Source: Japan Ministry of Health 2005, Nakanishi et al. 2003)

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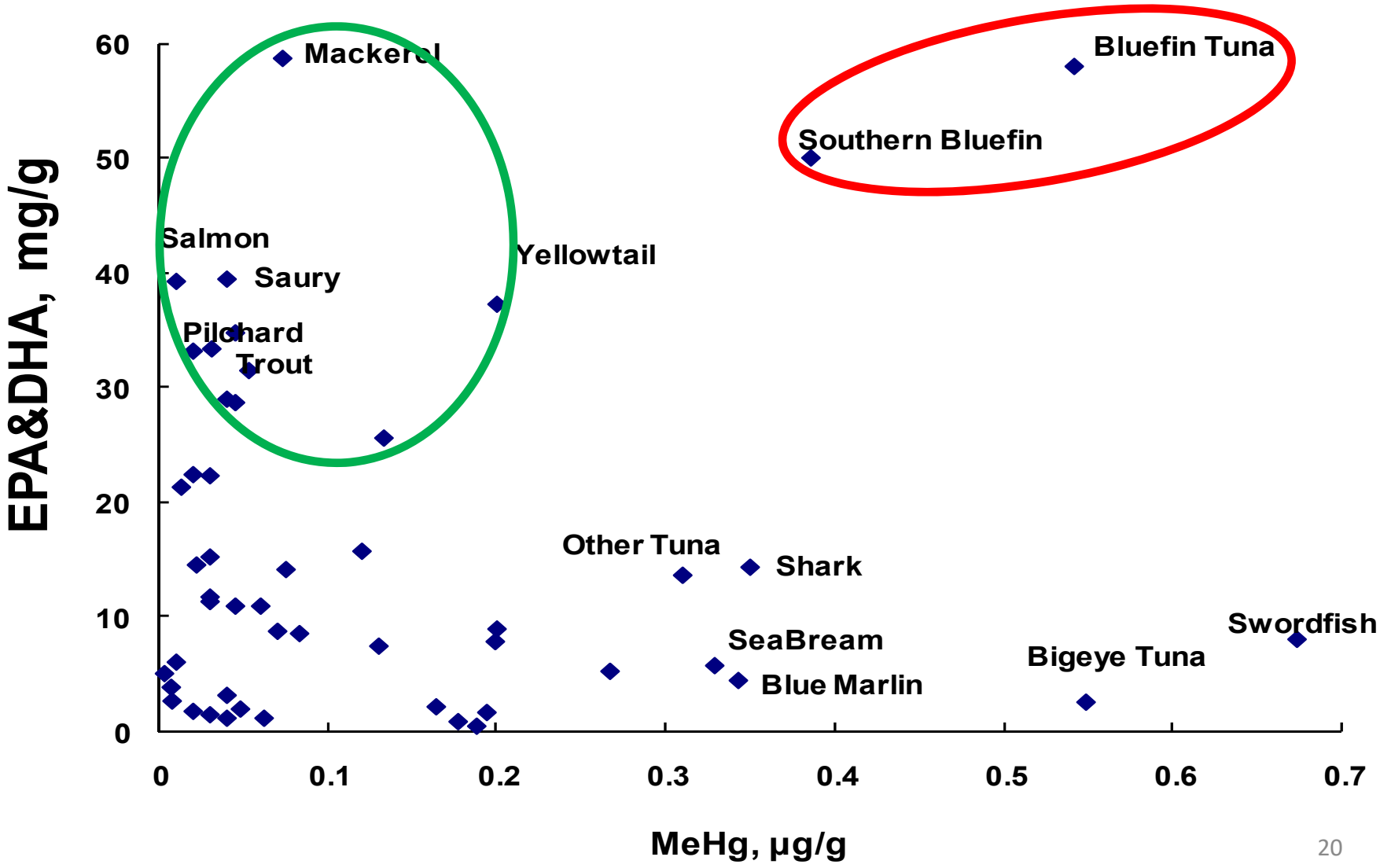
張瑛2009

PUFA/MeHg Concentration



Rodricks “Calculating Risks”

Fallacy of Zero-Risk

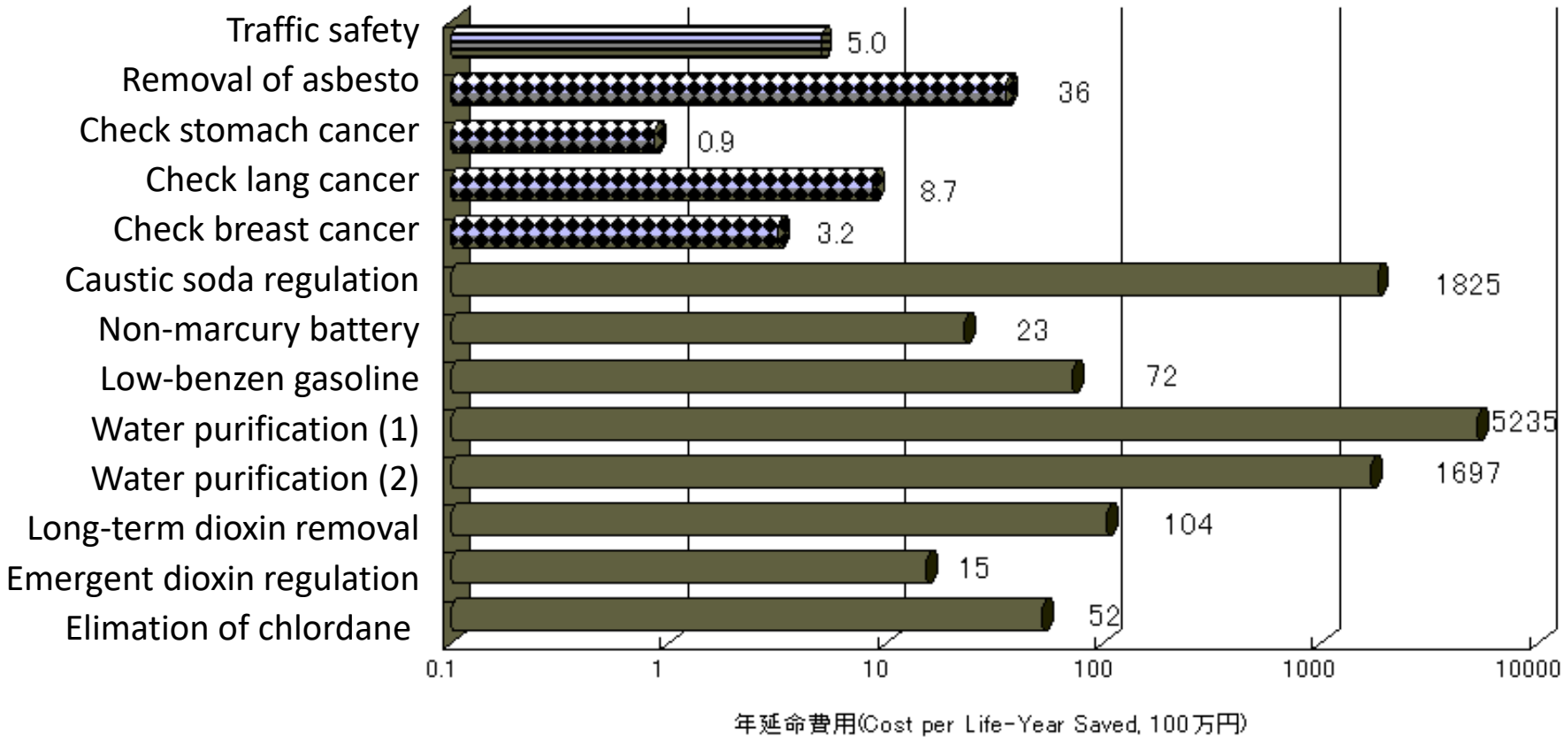
Risk factors	Mortality	リスク要因	死亡率
Motorcyclingバイク	2000	Rodeoロデオ	3
All factors全死亡要因	1000	Fire火事	2.8
Smoking喫煙	300	Trihalomethan etc	0.8
Cancer from smoking	120	Peanut butter 3spoons/day	0.8
Fire fighting消火活動	80	Beef steak 85g/day	0.5
Hung glider	80	Flood洪水	0.06
Coal mining炭鉱	63	Struck by lightening落雷	0.05
Farmwork農作業	36	Falling stars流星直撃	$<10^{-5}$
Automobile自動車	24		
The number of died person per 100,000 per year			
生涯リスクは上記の数字が（松田注:年齢，年代により）大きく変わらないとすれば約70倍したものとなる.			

Expected Loss of Longevity

- If cancer probability = 10^{-5} and 10 years life expectancy are lost, then
- Expected loss of longevity = 0.7 hours!!
- We can compare ELL between various sorts of risk factors.

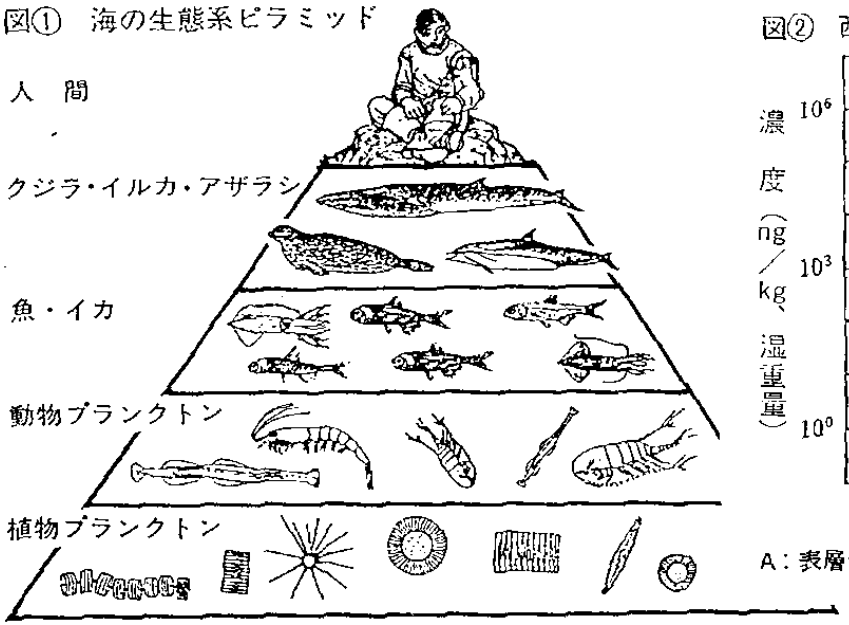
After A. Kishimoto's doctoral dissertation

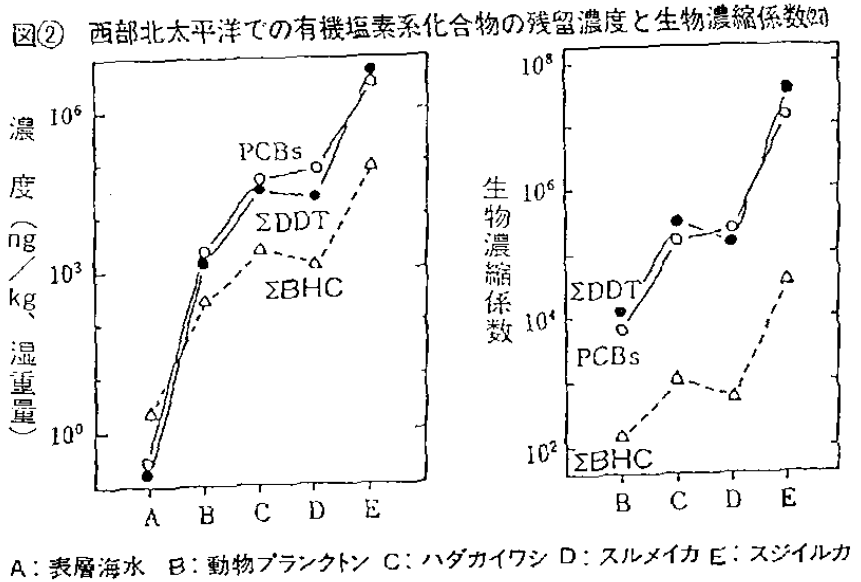
Costs of avoiding health risks



Biomagnification via Food chain
（Miyazaki N.『恐るべき海洋汚染』合同出版）

- Sea water, plankton, fish, marine mammals





Report

- Please find case that precautionary measures is not appropriately used, and explain the reason that you consider.
- 1-2 pages
- Send email to matsuda@ynu.ac.jp by tomorrow.