Estimating the Potential of Japanese Fisheries

Upside Bioeconomic Analysis

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In June 2018,
The Government of Japan proposed
Fisheries Policy Reform Plan with
the MSY-based management.

Our Motivation

What would
the potential gains & **outcomes**
of implementing
alternative policy strategies?

Motivation

Upside Bioeconomic Model

Data

Catch-MSY Model

Policy Strategies

Outcomes

Next

Upside Bioeconomic Model

to draw a future picture for Japanese Fisheries

PNAS

Global fishery prospects under contrasting management regimes

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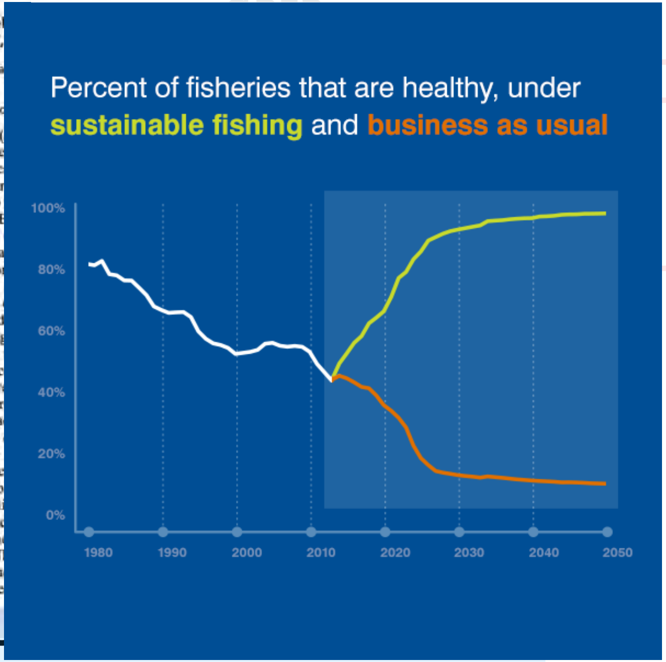
Data from 4,713 fisheries worldwide, representing 78% of global reported fish catch, are analyzed to estimate the status, trends, and benefits of alternative approaches to recovering depleted fisheries. For each fishery, we estimate current biological status and forecast the impacts of contrasting management regimes on catch, profit, and biomass of fish in the sea. We estimate unique recovery targets and trajectories for each fishery, calculate the year-by-year effects of alternative recovery approaches, and model how alternative institutional reforms affect recovery outcomes. Current status is highly heterogeneous—the median fishery is in poor health (overfished, with further overfishing occurring), although 32% of fisheries are in good biological, although not necessarily economic, condition. Our business-as-usual scenario projects further divergence and continued collapse for many of the world's fisheries. Applying sound management reforms to global fisheries in our dataset could generate annual increases exceeding 16 million metric tons (MMT) in catch, $53 billion in profit, and 619 MMT in biomass relative to business as usual. We also find that, with appropriate reforms, recovery can happen quickly, with the median fishery taking under 10 y to reach recovery targets. Our results show that commonsense reforms to fishery management would dramatically improve overall fish abundance while increasing food security and profits.

fishery recovery | fishery reform | rights-based fishery management | bioeconomic model

Recent advances in our understanding of global fishery status (1–4) provide a foundation for estimating the targets for, and potential benefits from, global fishery recovery. Although existing aggregate estimates make a compelling general case for reform (5, 6) new data, models, and methods allow for more

Significance

Costello et al., 2016



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to draw a future picture for Japanese Fisheries.

Data	Construct stock-level database from publicly available **detailed** landings data
Catch-MSY	Estimate MSY reference points (F/F_{MSY} and B/B_{MSY}) by applying Catch-MSY methods
Bioeconomic Policy Simulation	**a. Business as usual** **b. FMSY** **c. Economically optimal**
Outcomes	**Stock, Catch, Profit**

Data frame Construction Diagram

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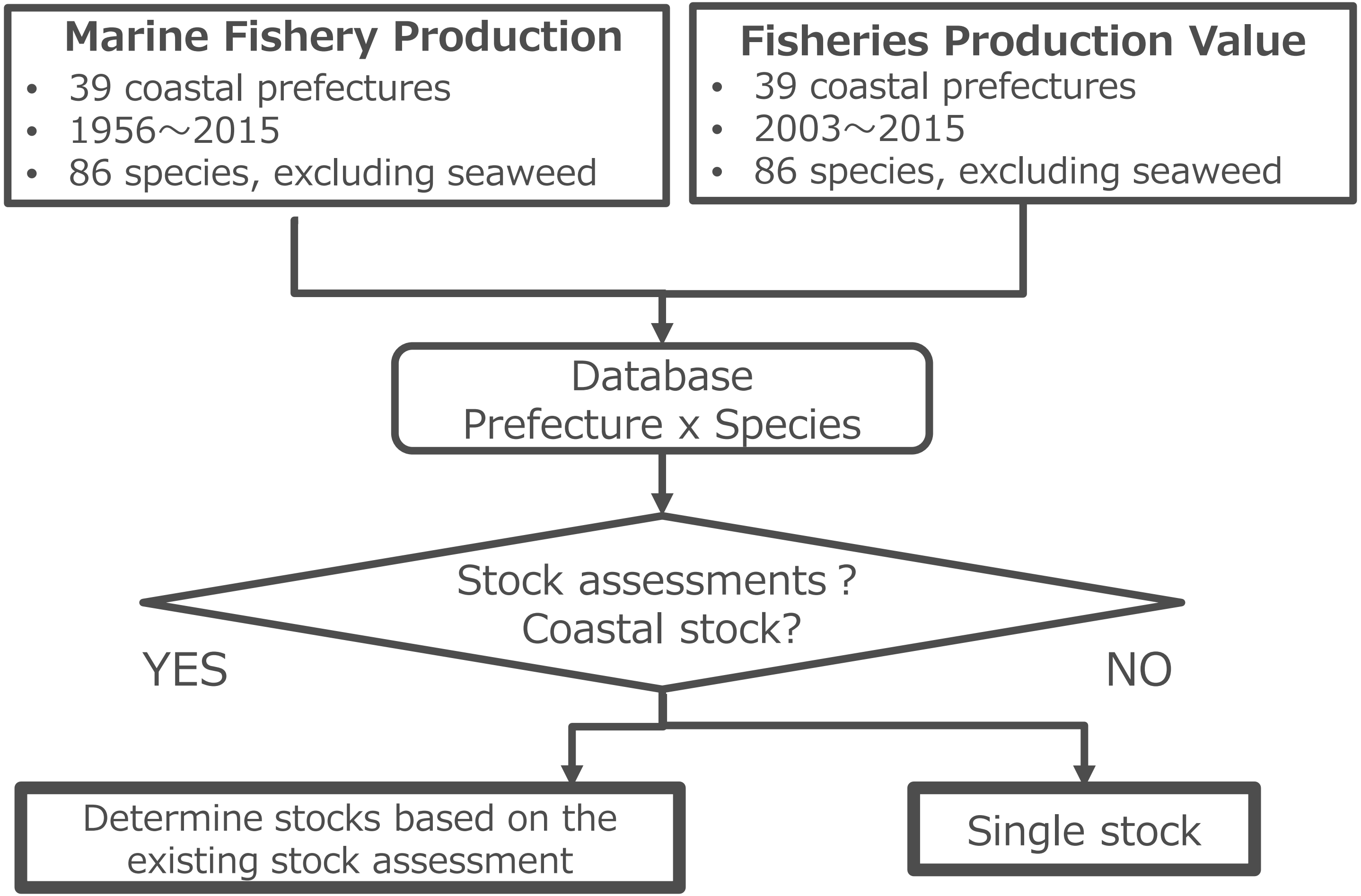

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- Production volume(catch)
- Ex-vessel Price

+ Resilience (c.f. *fishbase*)

+ Assumptions on relative size of initial and depleted stock

(c.f. Martell & Froese :2013 *Fish Fish*)

»

Estimated Parameters

MSY

g

F/F_{MSY}

B/B_{MSY}

Biological Model (Modified Pella-Thomlinson)

$$B_{t+1} = B_t + \frac{\varphi + 1}{\varphi} g B_t \left(1 - \left(\frac{B_t}{K}\right)^{\varphi}\right) - H_t$$

Economic Model

$$\max_{Harvest_1, Harvest_2, ..} \sum_{t=1}^{50} \frac{\text{Price x Harvest}_t - Cost}{(1 + Discount)^t}$$

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Policy Strategies

Business as Usual

a **status quo** scenario where fishing is conducted under constant and fishing mortality rates (F) at current levels

FMSY

harvest at the level of **Maximum Sustainable Yield**

Economically Optimal

an economically optimal management scenario in which fishing costs are reduced and prices increased to **maximize profits**

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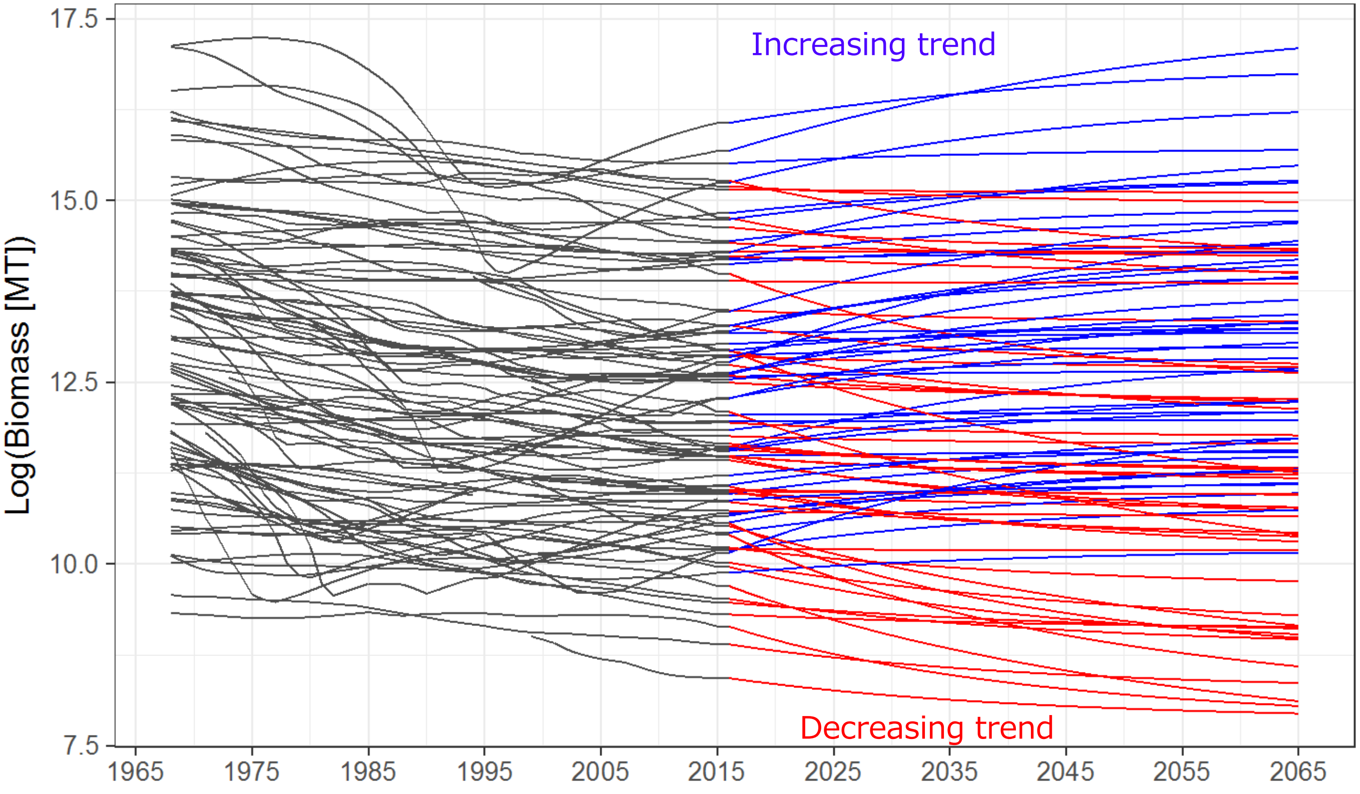
Outcomes

Biomass trajectories of single stocks under BAU



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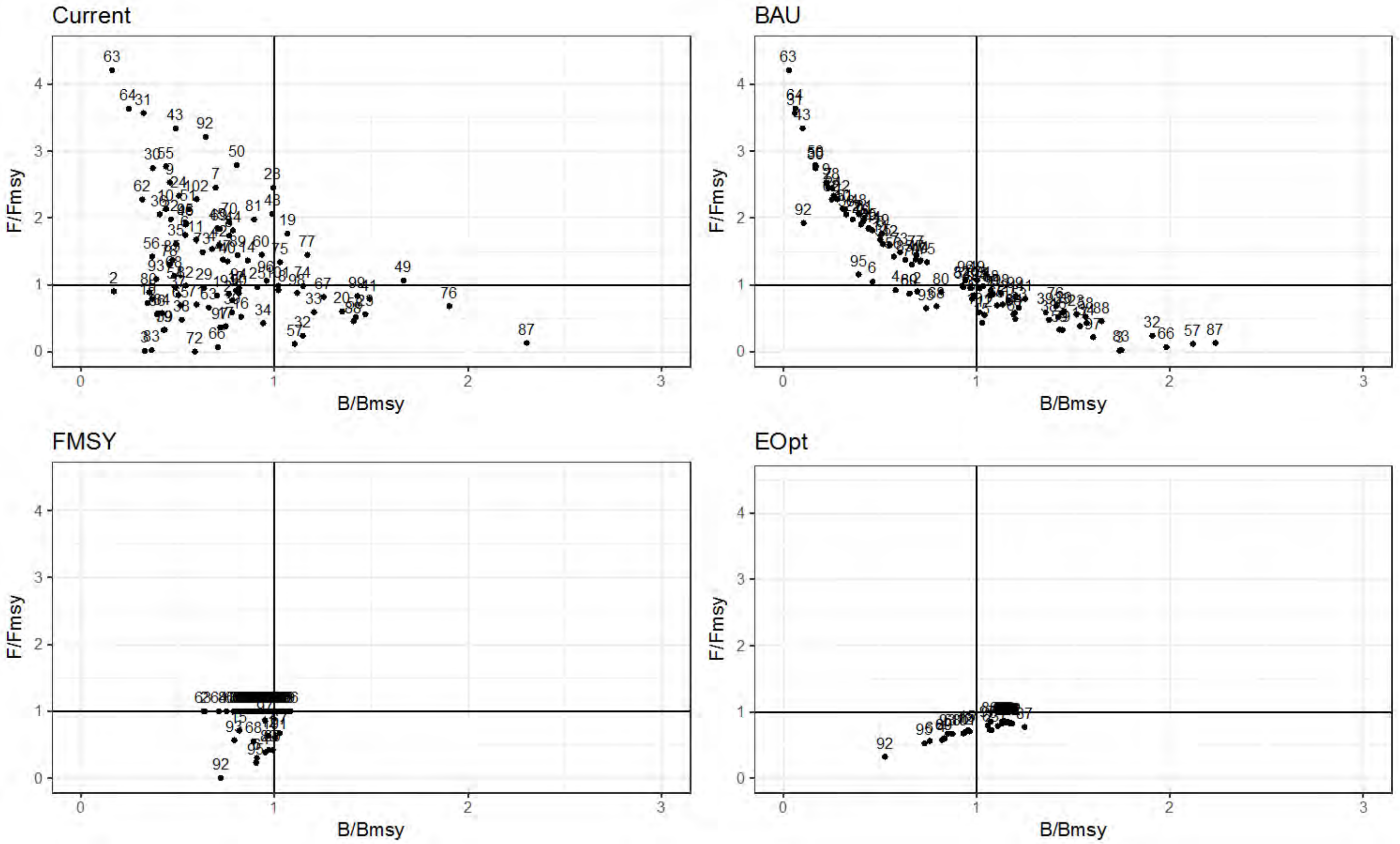
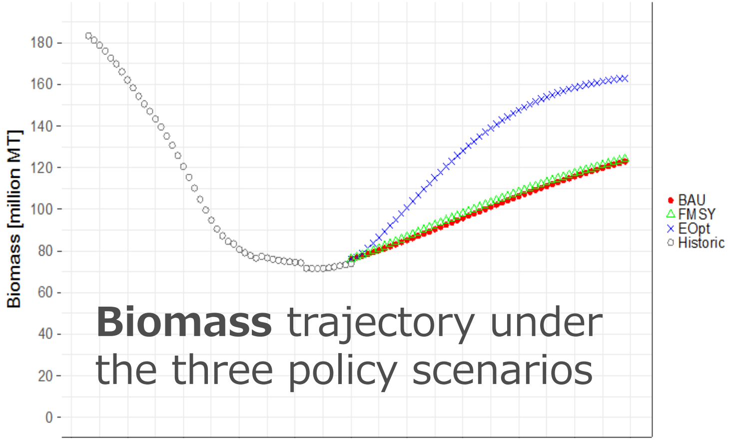
Outcomes

Kobe plot under alternative policy scenarios

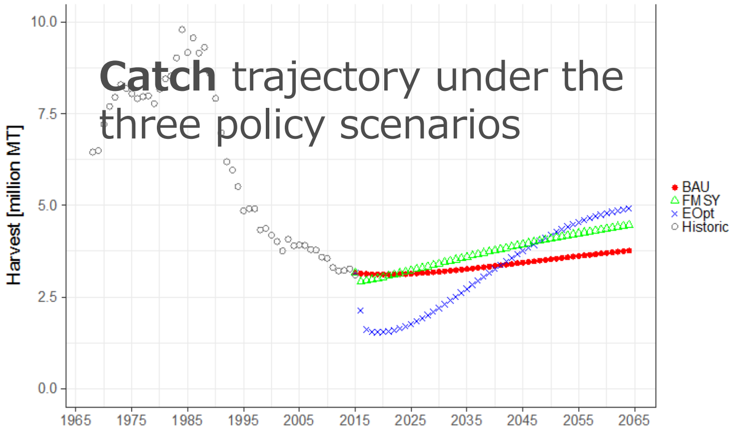


Outcomes

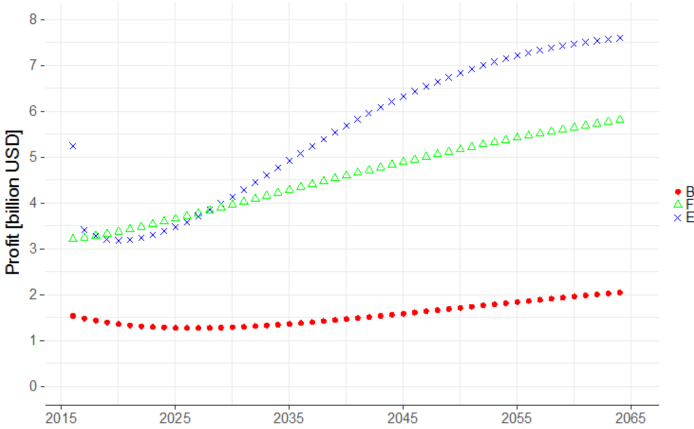
Trajectories toward 2065



Biomass trajectory under the three policy scenarios



Catch trajectory under the three policy scenarios



Profit trajectory under the three policy scenarios

Outcomes

Key findings

- Most of the stocks are currently over-exploited
- Adopting economically optimal management would
  - increase annual landings value by 5.5 billion USD
  - Increase biomass levels by 30%
- Little improvement in biomass stock levels if Japan follows FMSY policy

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Next Steps

Development for prefectures

Upside analysis for the prefectural level

Development as a policy tool for Climate Adaptation

Supporting tools for "Climate Adaption Act"

Integration with the Portfolio fisheries Projects

Development of portfolio fishing theory and policy to build resilience in Japanese multispecies fisheries

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Thanks!

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