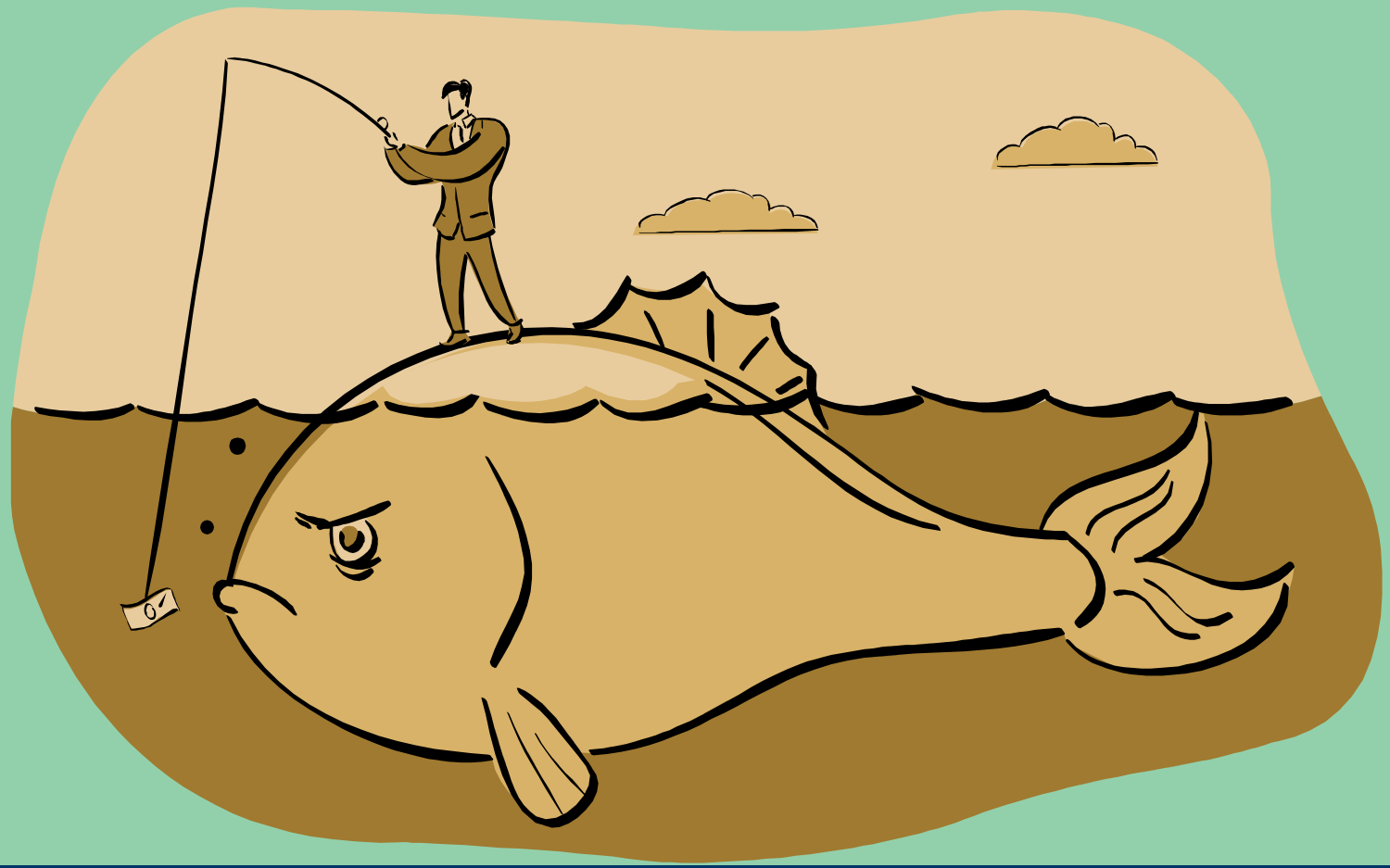


Hegemony and Shared Dominance in the World's Marine Capture Fisheries

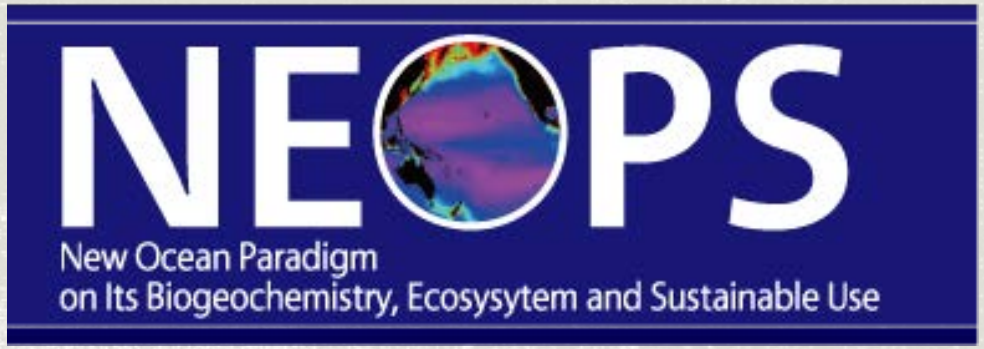
Yeosu, Republic of Korea (20 October 2014)

Robert Blasiak

Research Fellow, The University of Tokyo

NEOPS
New Ocean Paradigm
on Its Biogeochemistry, Ecosystem and Sustainable Use

NEOPS: Working towards deeper understanding of material cycling and ecosystem functions of the ocean



My Research Focus

- Generate game theory model to describe the potential for transboundary cooperation encompassing range of ocean ecosystem services (*megumi*)

- Specific focus on:
  - Areas beyond national jurisdiction
  - Pacific Ocean regions

Four Categories of Ecosystem Services

(defined in Millennium Ecosystem Assessment: 2005)

1) Supporting services (primary production)
2) Provisioning services (fish / minerals / etc.)
3) Regulating services (purification of water/air, carbon sequestration)
4) Cultural services (recreation, etc.)

Four Categories of Ecosystem Services

(defined in Millennium Ecosystem Assessment: 2005)

1) Supporting services (primary production)
2) **Provisioning services (fish)** / minerals / etc.)
3) Regulating services (purification of water/air, carbon sequestration)
4) Cultural services

Why choose fish as starting point for model?

1) Long recorded history of cooperation/competition in fishery stock management.
2) Availability of detailed catch data.
3) Call for coordination on transboundary fisheries management enshrined in UNCLOS.

Legal Regime

"Where the same stock or stocks of associated species occur within the EEZ of two or more coastal states, these states shall seek [...] to agree u[pon the measures necessary to coordinate] and ensure the conservat[ion] [...] LOS, 1982 Article 63

"...the par[ties] [...] negotiations with a view to arriving at agreement [...] they are under the obligation so to conduct themselves that ***the negotiations are meaningful***..." (ibid)

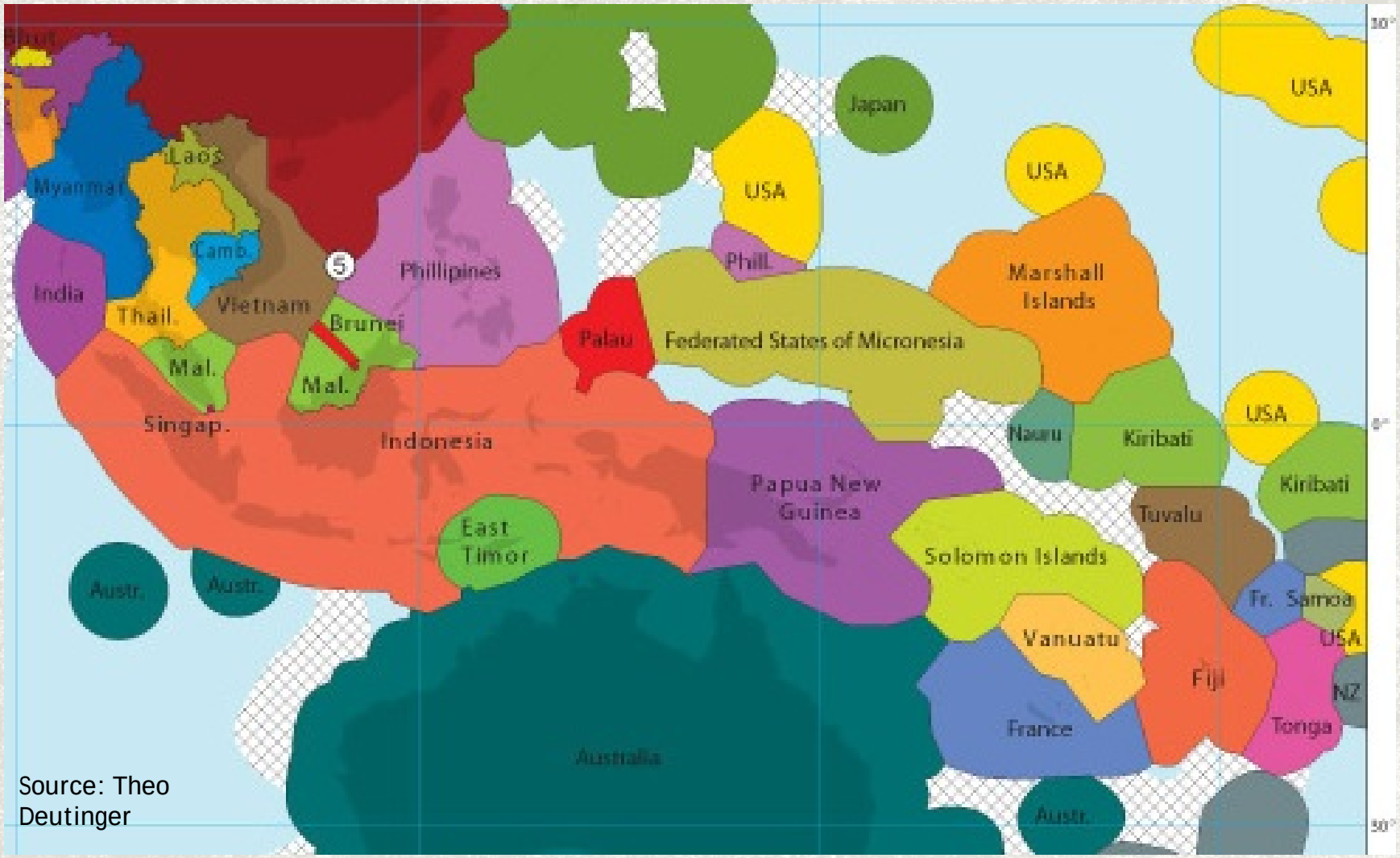
Obligation to talk, but...

no obligation to reach an agreement!

Exclusive Economic Zone (EEZ)

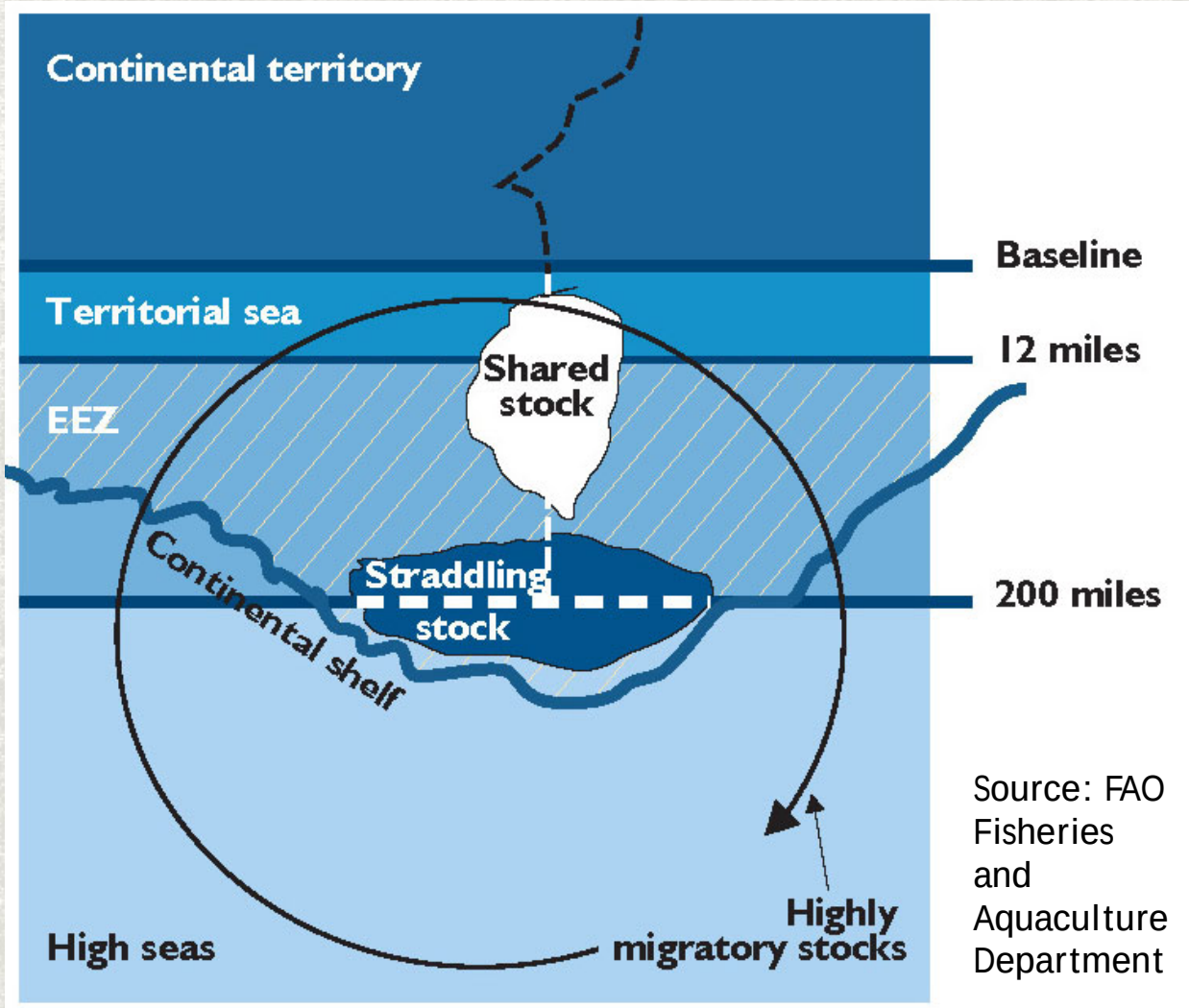
Source: Theo Deutinger

Exclusive Economic Zone (EEZ)



Source: Theo Deutinger

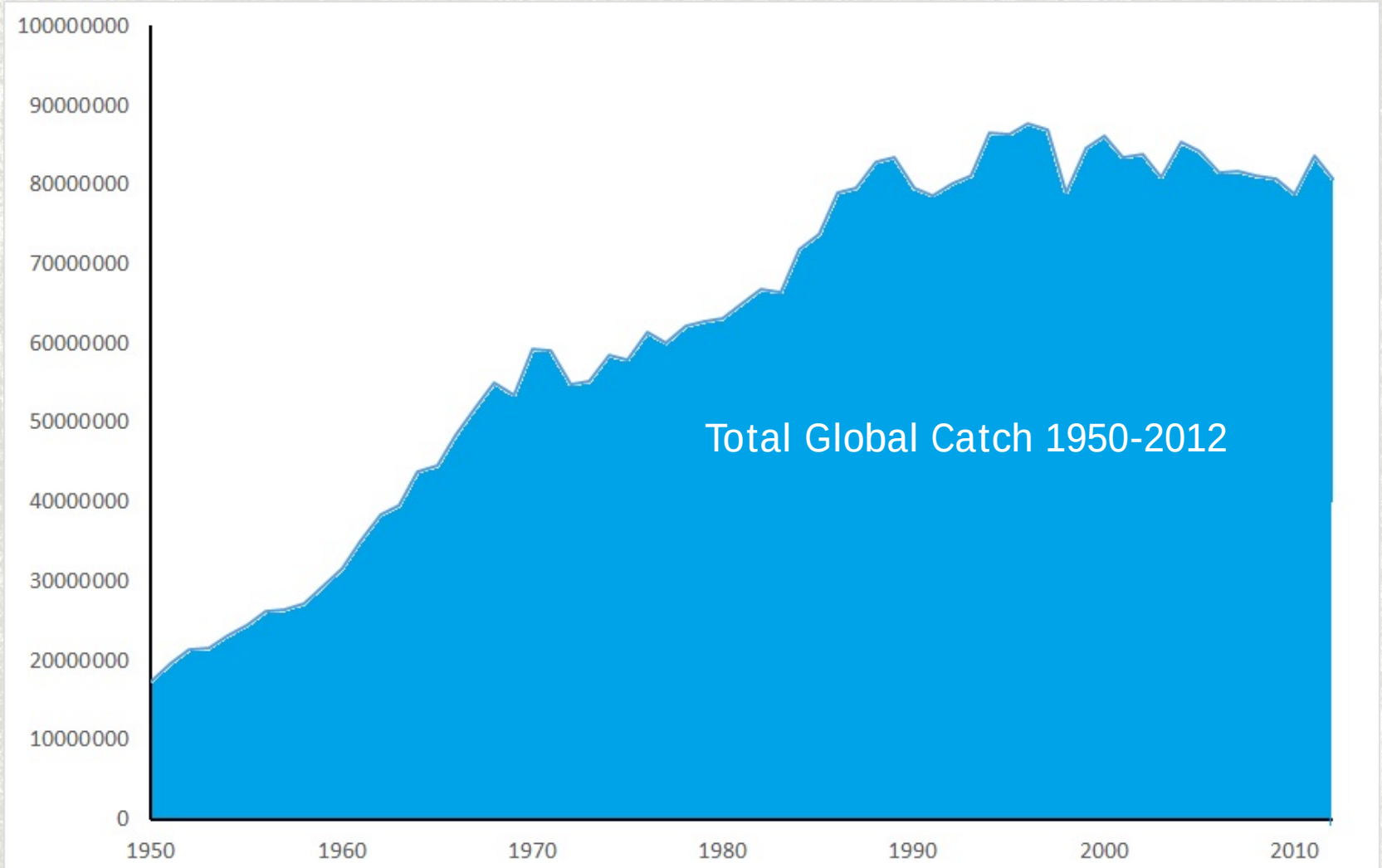
Straddling / Shared Stocks



Source: FAO Fisheries and Aquaculture Department

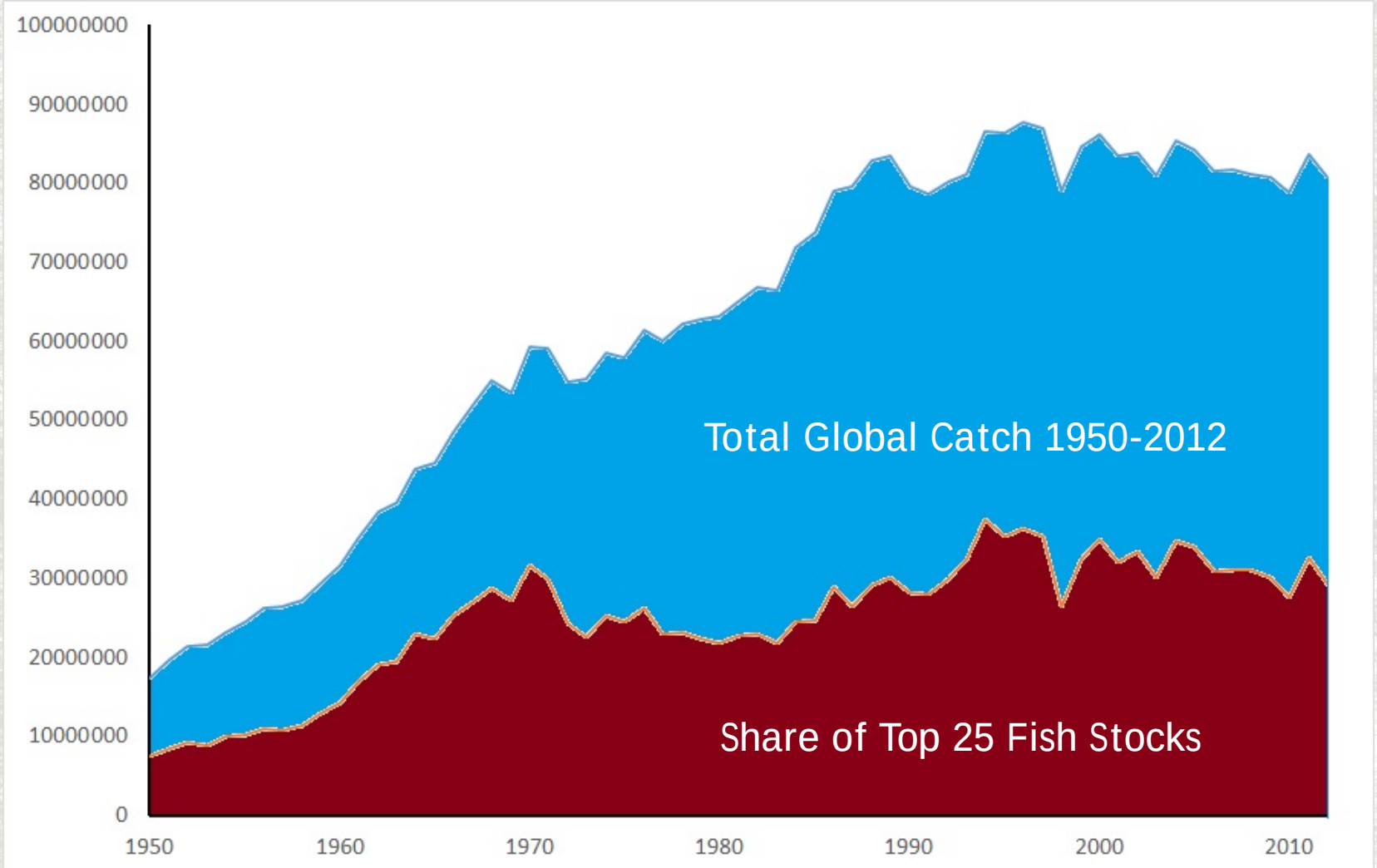
Marine Capture Fisheries (Global Levels)

(from FAO Catch Data)



World's 25 largest marine fish stocks

(approx. 40% of global catch)



Definitions and categories of “games”

Definitions

Game theory ➔ aims to understand strategic behavior/decision-making
“Players” ➔ entities engaging in strategic behavior (countries)
“Grand coalition” ➔ coalition including all players

Different Categories of Games

Category 1: Hegemonic single-player dominance
Category 2: Coupled two-player dominance
Category 3: Shared small-group dominance
Category 4: No dominance

Formal conditions for typology

Category 1 (hegemonic single-player dominance)

$$(1) \quad \sum_{i=1}^{19} x_{i,k1} > 0.8\left[\sum_{i=1}^{19} x_{i,k1} + \sum_{i=1}^{19} x_{i,k2} + \cdots + \sum_{i=1}^{19} x_{i,k\epsilon}\right]$$

Category 2 (coupled two-player dominance)

$$(2) \quad \sum_{i=1}^{19} x_{i,k1} + \sum_{i=1}^{19} x_{i,k2} > 0.9\left[\sum_{i=1}^{19} x_{i,k1} + \sum_{i=1}^{19} x_{i,k2} + \cdots + \sum_{i=1}^{19} x_{i,k\epsilon}\right]$$

Category 3 (shared small group dominance)

$$(3) \quad \sum_{i=1}^{19} x_{i,k1} + \sum_{i=1}^{19} x_{i,k2} + \cdots + \sum_{i=1}^{19} x_{i,k5} > 0.9\left[\sum_{i=1}^{19} x_{i,k1} + \sum_{i=1}^{19} x_{i,k2} + \cdots + \sum_{i=1}^{19} x_{i,k\epsilon}\right]$$

Category 4 (non-dominated systems)

$$(4) \quad 0.2\left[\sum_{i=1}^{19} x_{i,k1} + \sum_{i=1}^{19} x_{i,k2} + \cdots + \sum_{i=1}^{19} x_{i,k\epsilon}\right] > \sum_{i=1}^{19} x_{i,k\alpha} \; ; \quad \alpha \in N$$

$x_{k1} > x_{k2} > \cdots > x_{k\epsilon}$,

x reported catch in tons of a certain fish stock

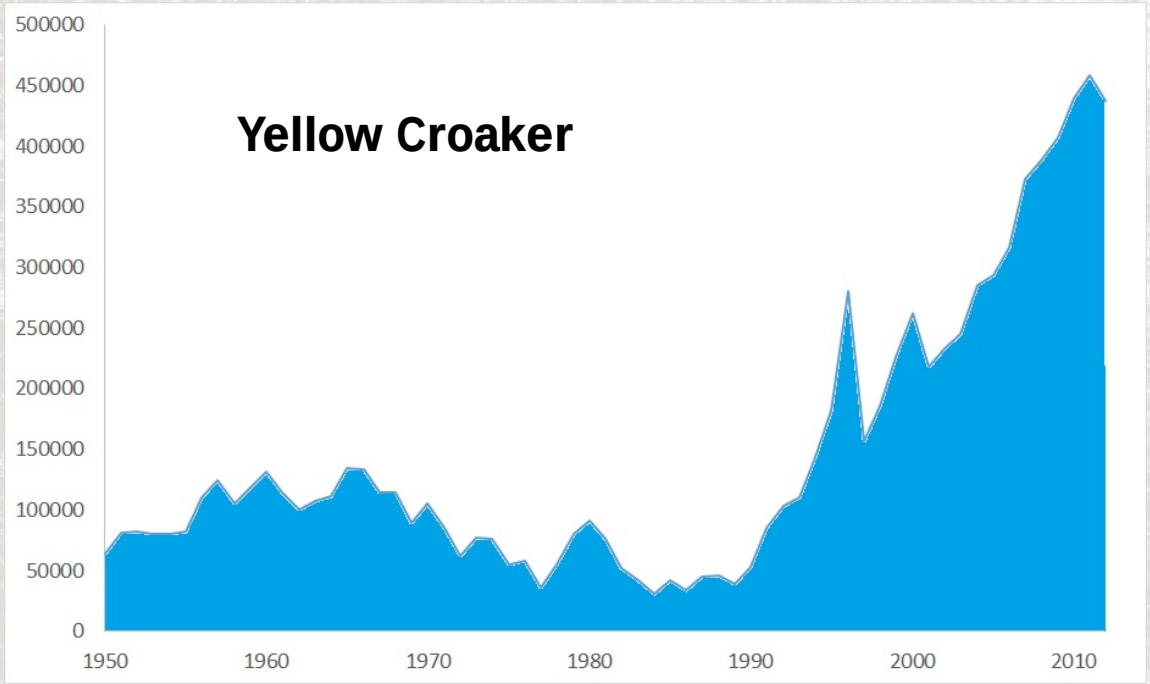
i one of the 19 FAO fishing areas

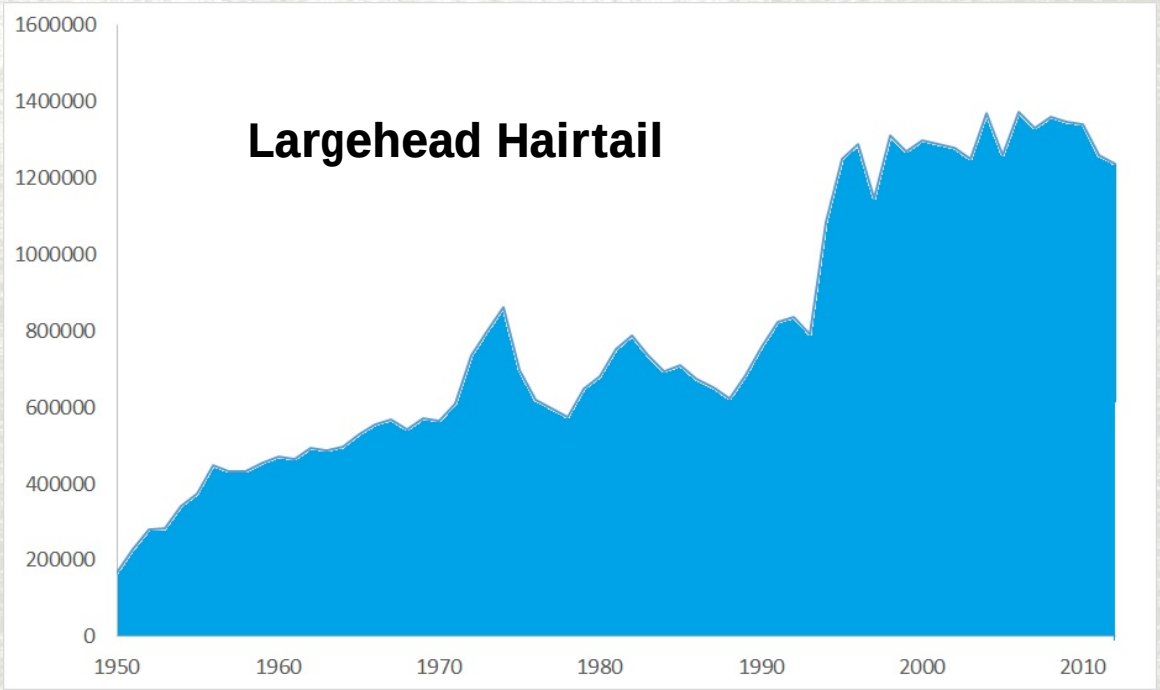
k country reporting its catch of this fish stock to FAO

Single-player dominated games

7 out of 25 species: (single country with >80% of catch)

Anchoveta, Largehead Hairtail, Araucanian Herring, Akiami Paste Shrimp, Gulf Menhaden, Indian Oil Sardine, Yellow Croaker

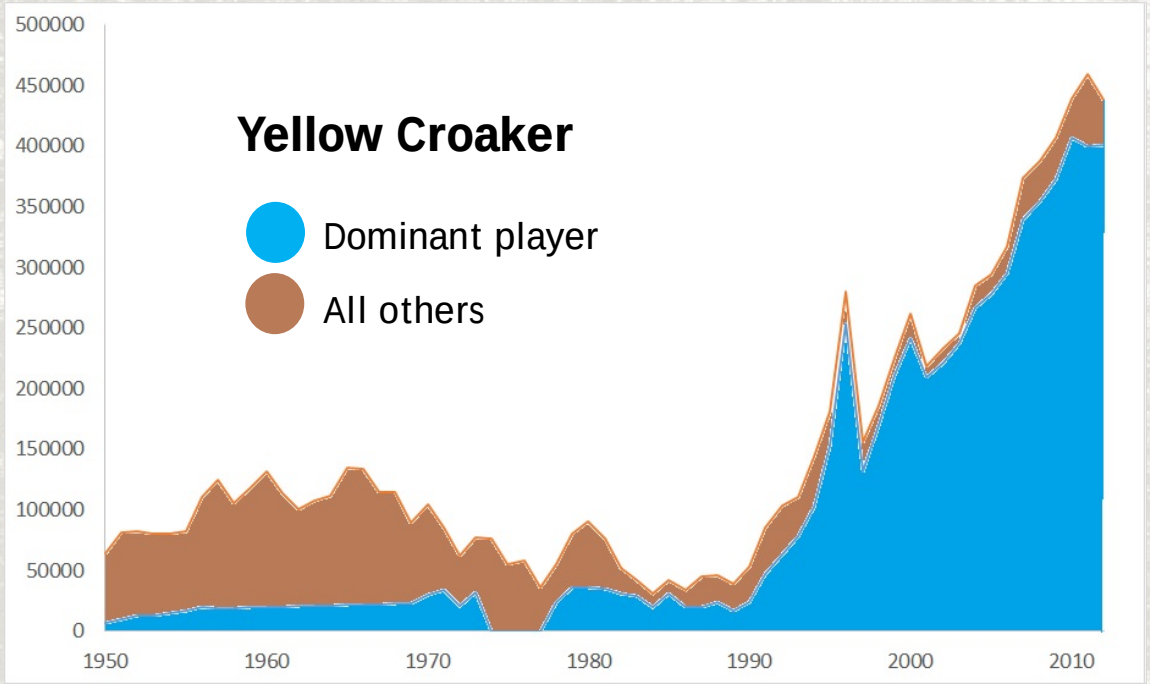


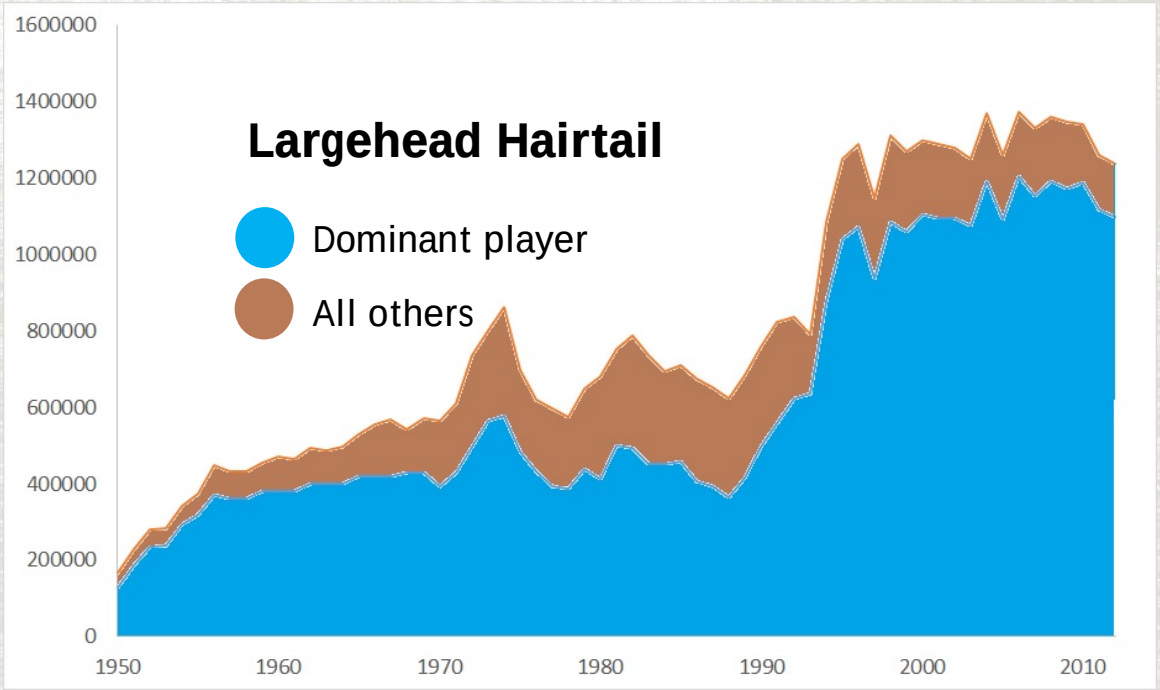


Single-player dominated games

7 out of 25 species: (single country with >80% of catch)

Anchoveta, Largehead Hairtail, Araucanian Herring, Akiami Paste Shrimp, Gulf Menhaden, Indian Oil Sardine, Yellow Croaker

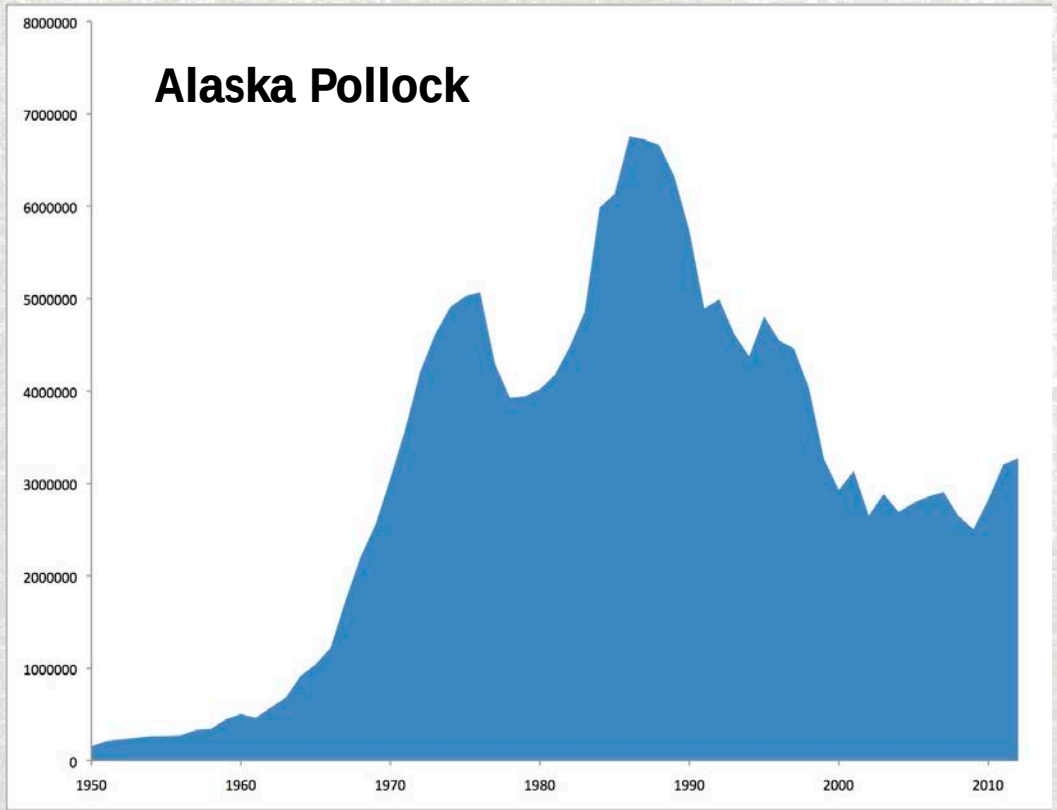


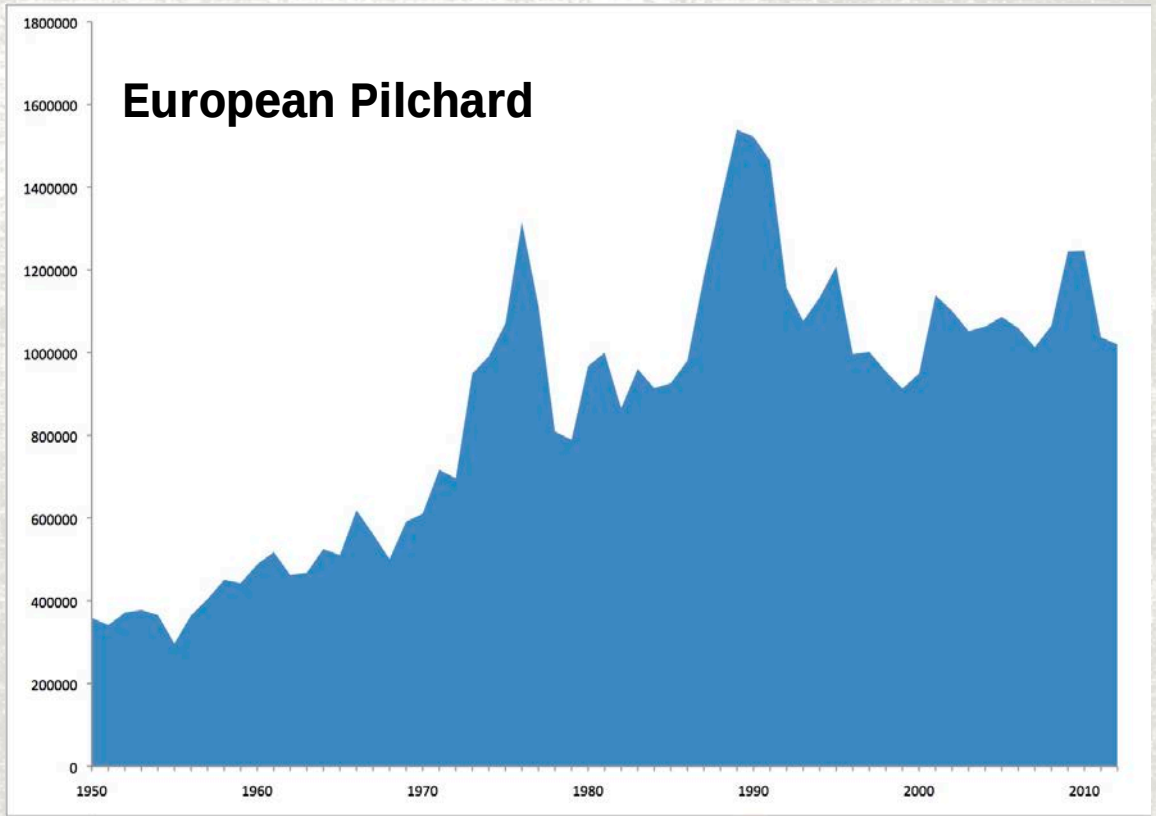


Two-player dominated games (coupled systems)

3 out of 25 species: (two countries with >90%)

Alaska Pollock, European Pilchard, Chilean Jack Mackerel

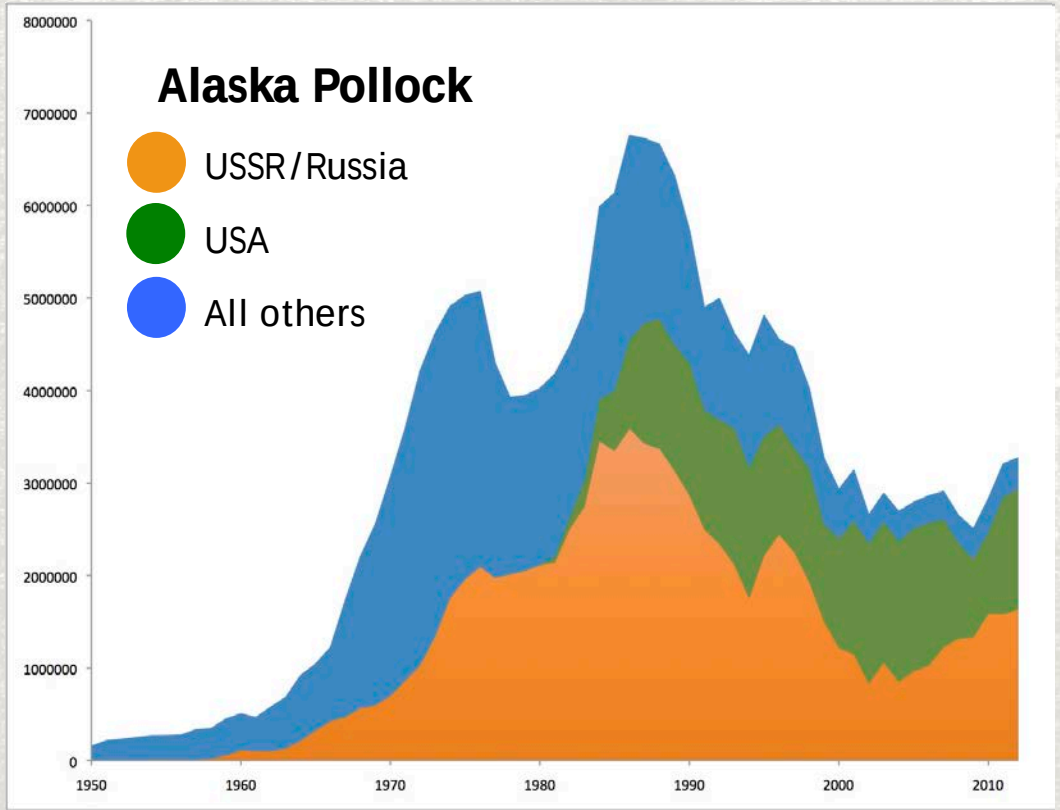


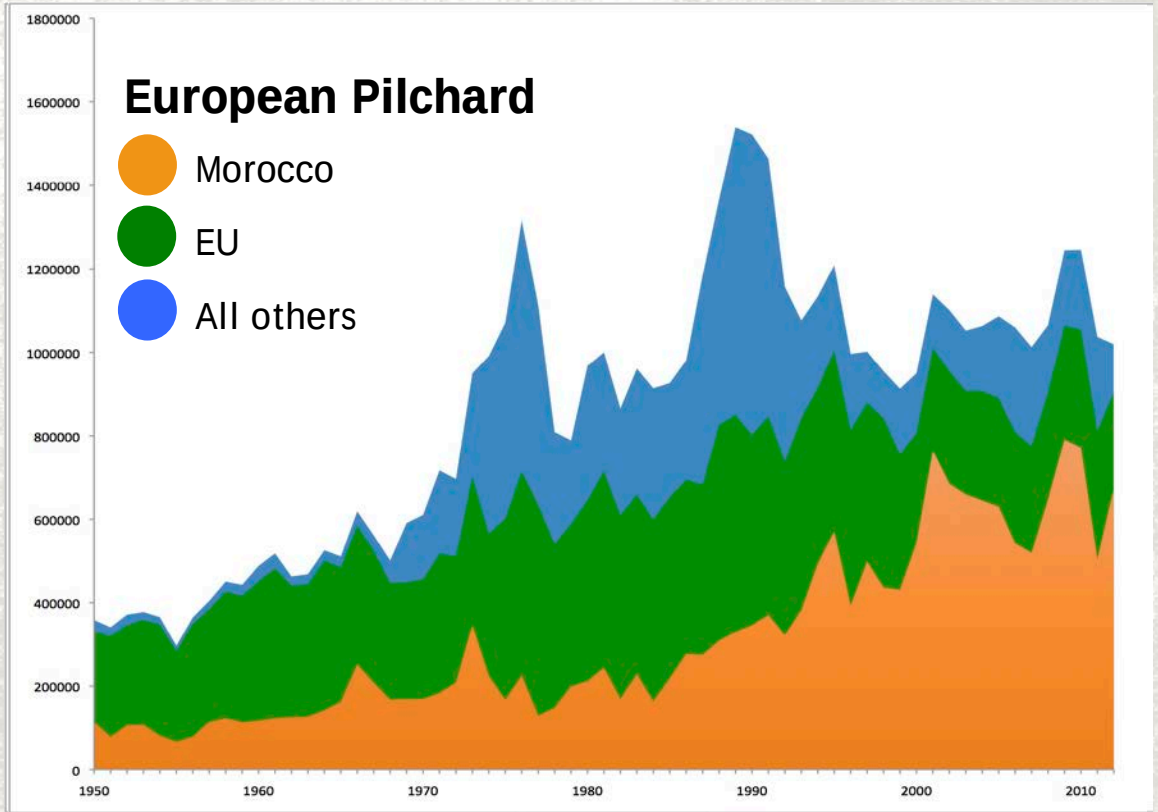


Two-player dominated games (coupled systems)

3 out of 25 species: (two countries with >90%)

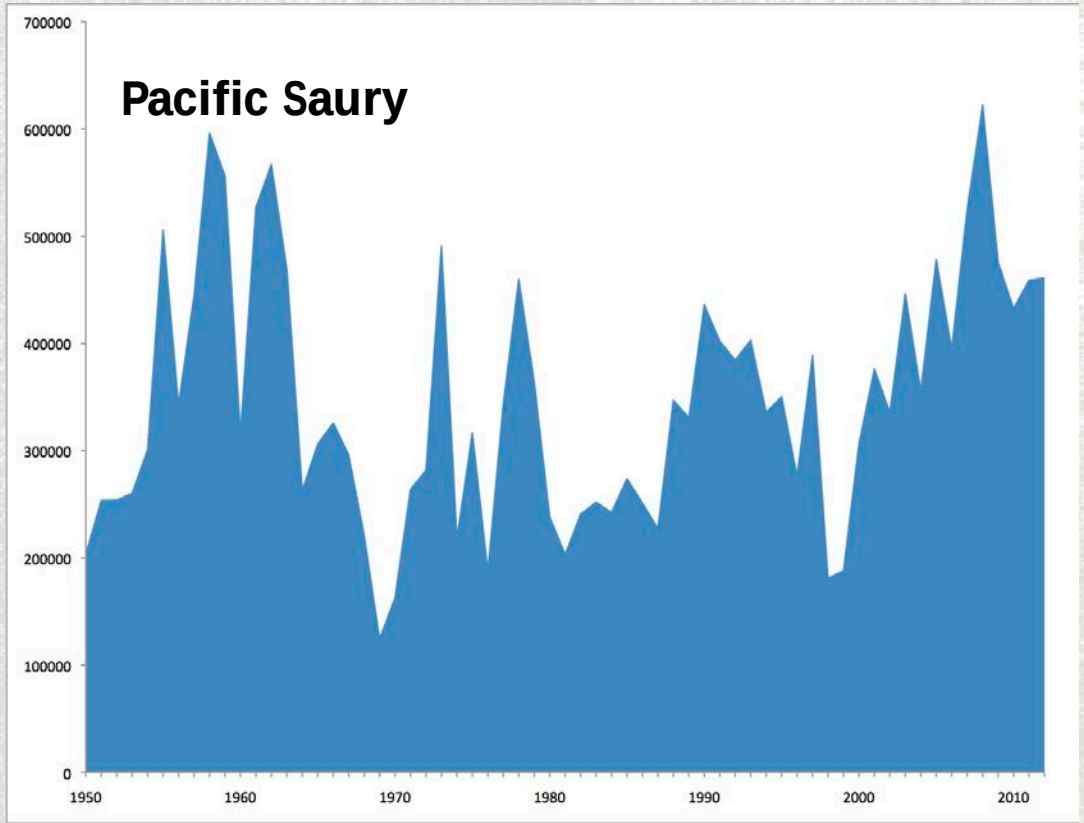
Alaska Pollock, European Pilchard, Chilean Jack Mackerel

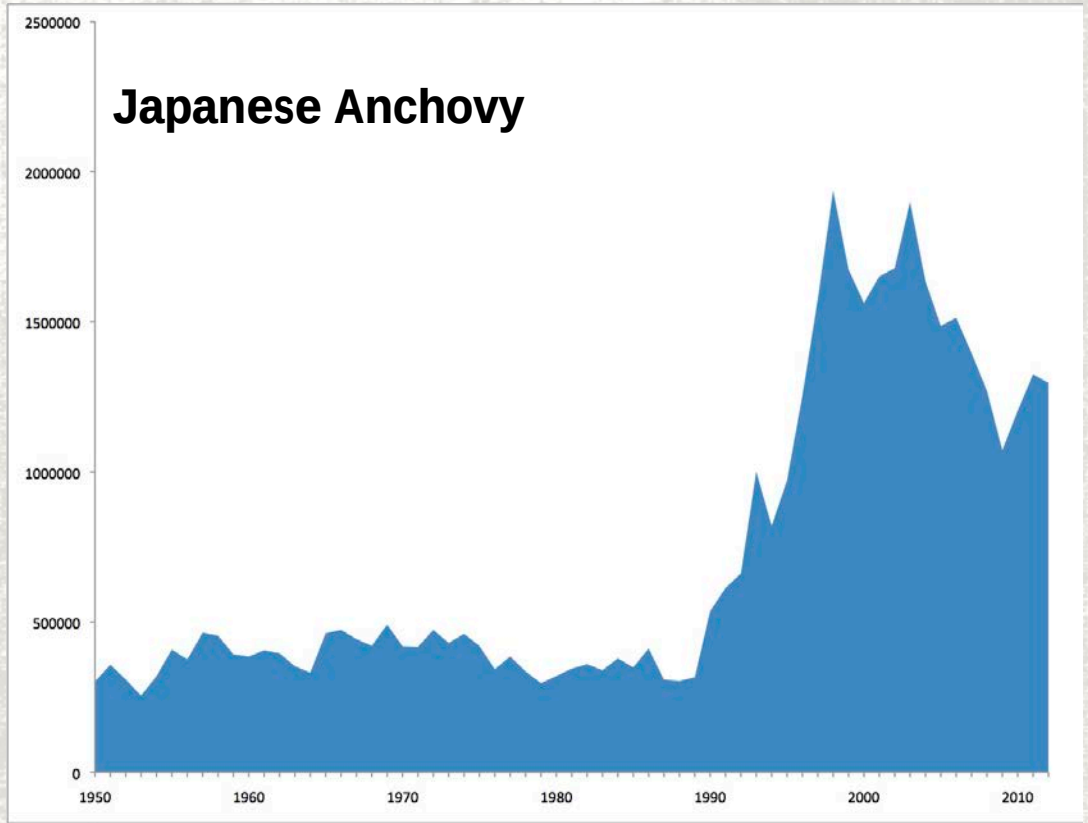




Multi-player system

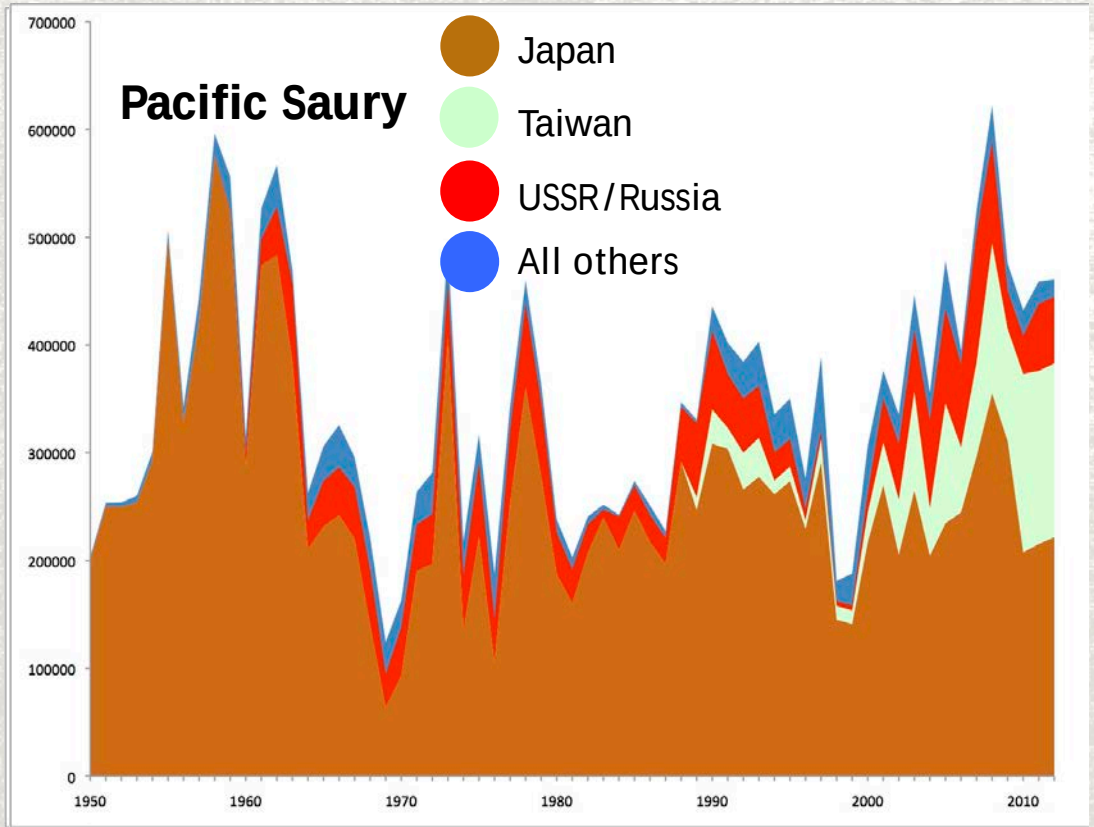
11 out of 25 species: (3-5 countries total >90%)

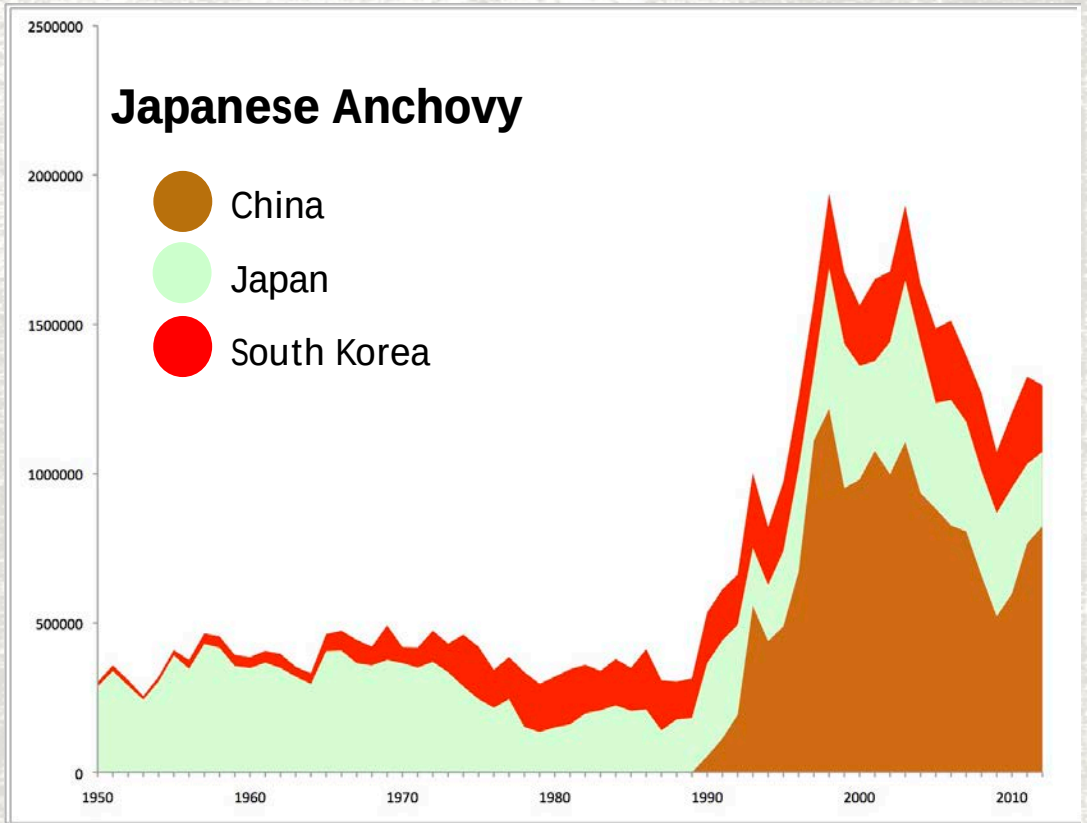




Multi-player system

11 out of 25 species: (3-5 countries total >90%)

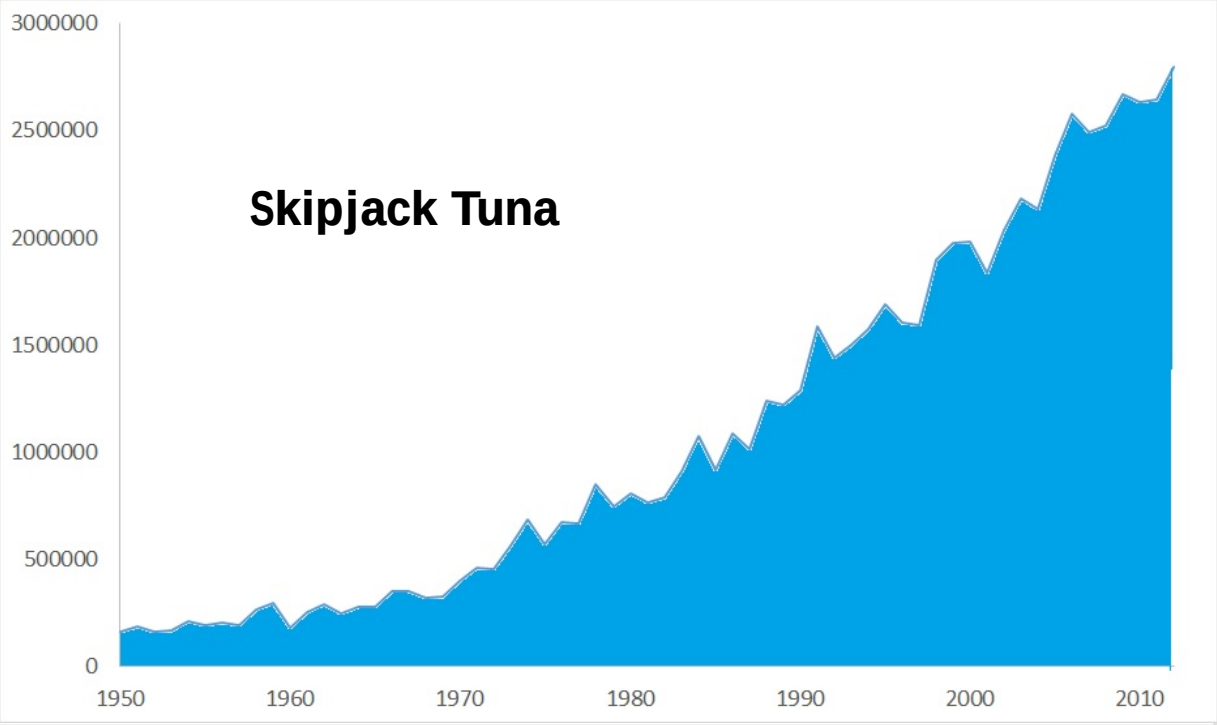


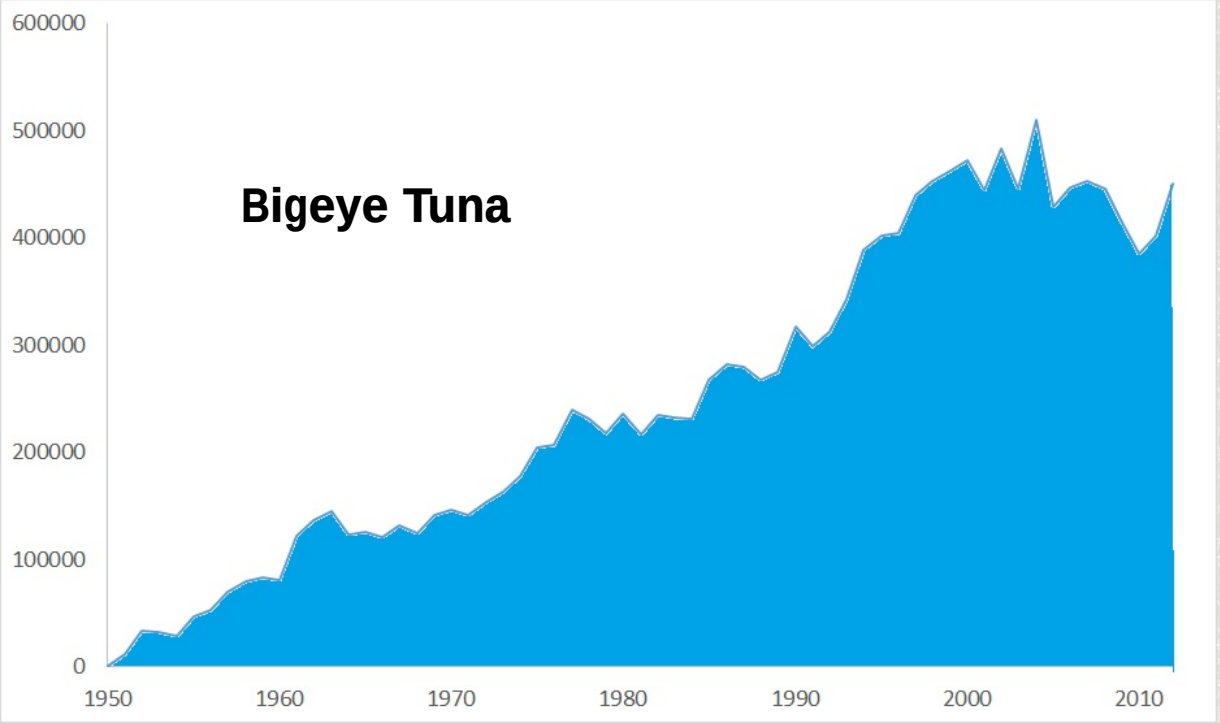


No dominance

4 out of 25 species: (all countries <20%)

Skipjack Tuna, Yellowfin Tuna, Bigeye Tuna, Chub Mackerel

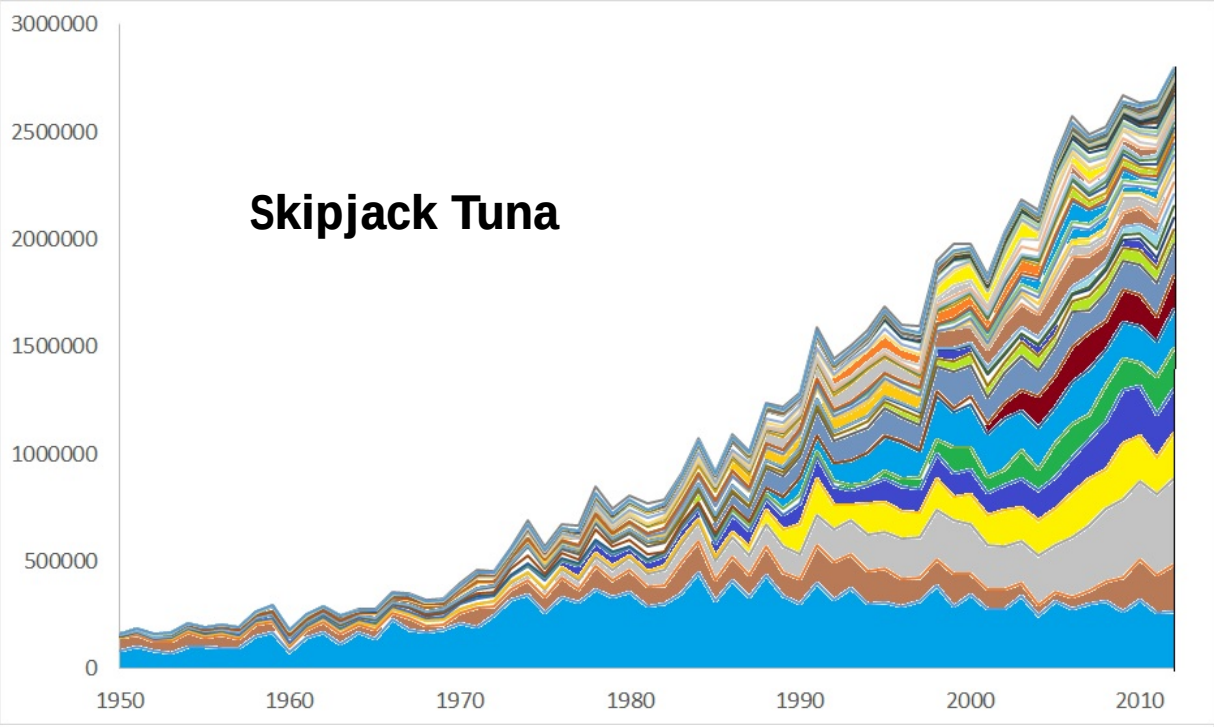


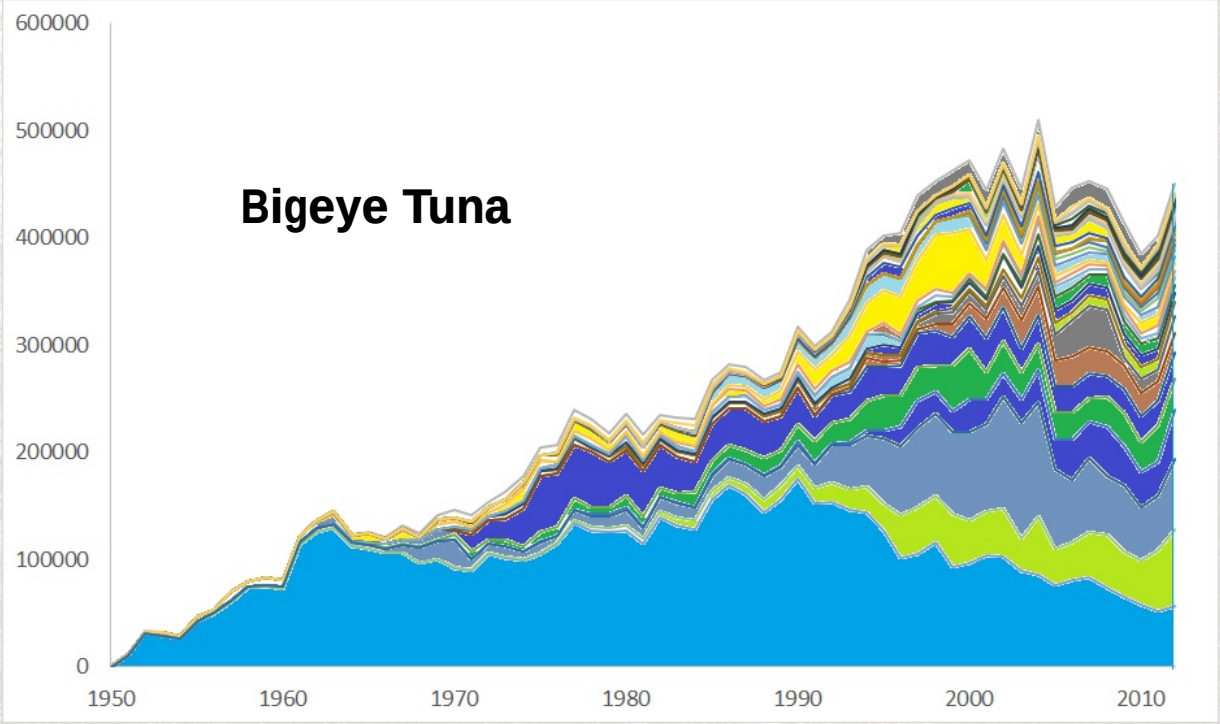


No dominance

4 out of 25 species: (all countries <20%)

Skipjack Tuna, Yellowfin Tuna, Bigeye Tuna, Chub Mackerel





Preliminary overview of 25 largest marine fish stocks

Type of system	# of stocks in top 25	Average # of players	Formal int. cooperative agreement?
Single-player dominated	7	7.4 players	0 / 7
Two-played dominated	3	15 players	2 / 3
Group dominated	11	14.8 players	8 / 11
No dominance	4	78 players	4 / 4

Preliminary overview of 25 largest marine fish stocks

Type of system	# of stocks in top 25	Average # of players	Formal int. cooperative agreement?
Single-player dominated	7	7.4 players	0 / 7
Two-played dominated	3	15 players	2 / 3
Group dominated	11	14.8 players	8 / 11
No dominance	4	78 players	4 / 4

Game theory models

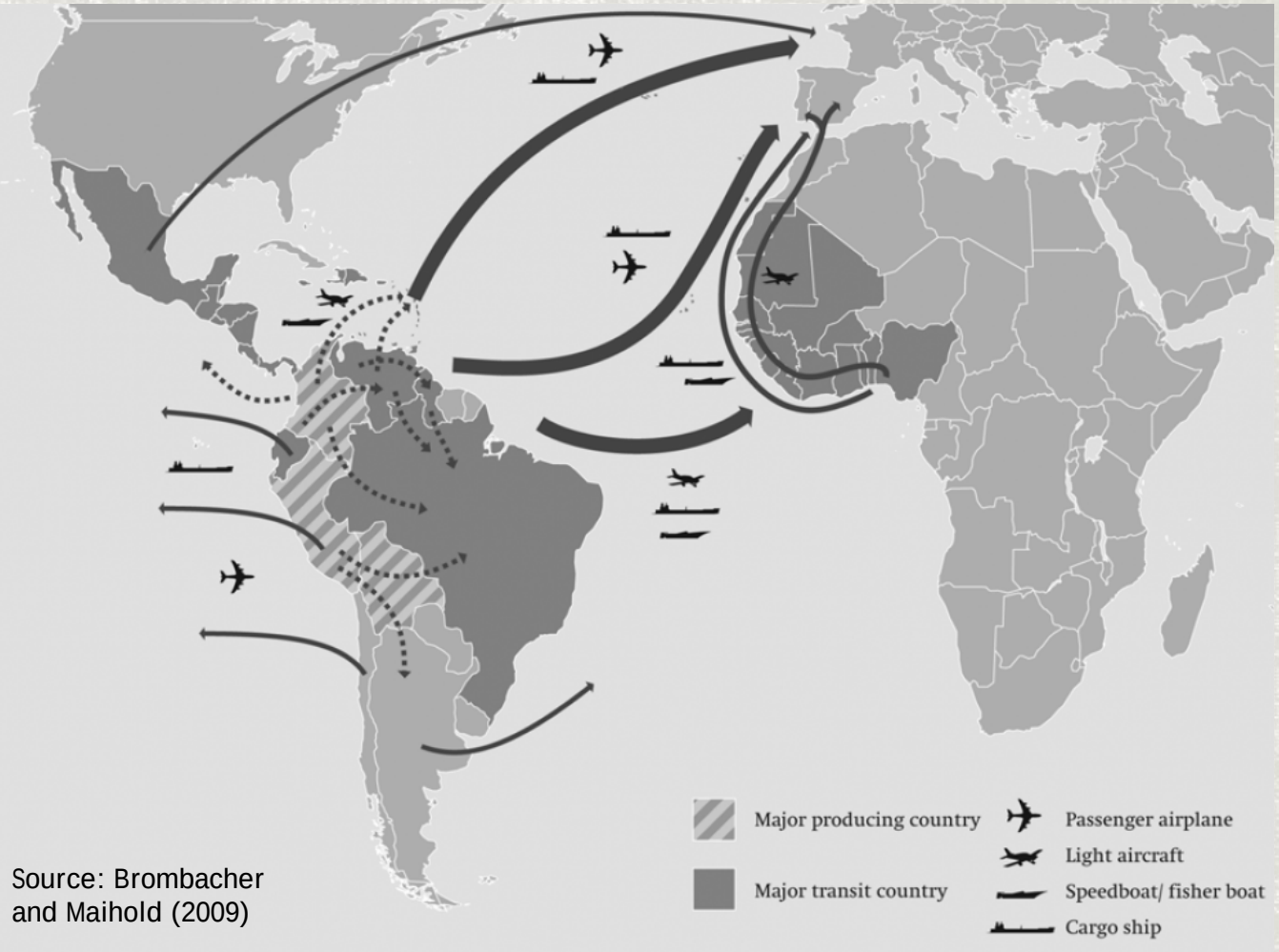
- Many models are highly pessimistic about "grand coalitions":
  - Predict instability and splintering/collapse of coalitions due to singleton (free-rider) behavior,
  - Predict competitive behavior leading to bionomic equilibrium (overexploitation, excess fleet capacity)

  (e.g. Kaitala and Lindroos 1998; Pintassilgo 2003; Kwon 2006; Pintassilgo and Lindroos 2008)

- Common assumptions: players are identical+ rational; full information (symmetric), following same management objectives

- De facto "veto power" suggested by Arnason et al. when one player dominates a fishery

Displacement (Balloon) Effects



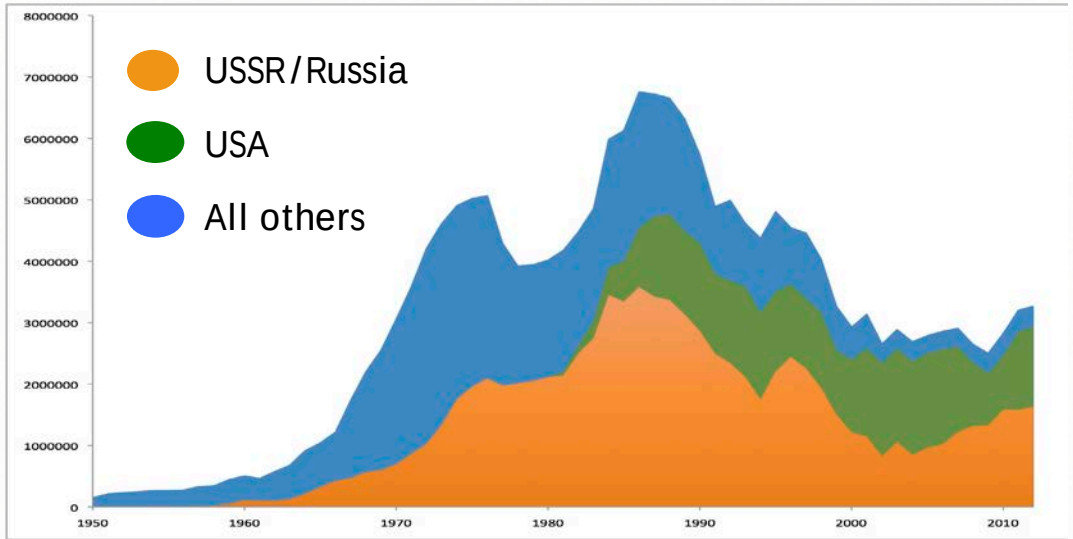
Source: Brombacher and Maihold (2009)

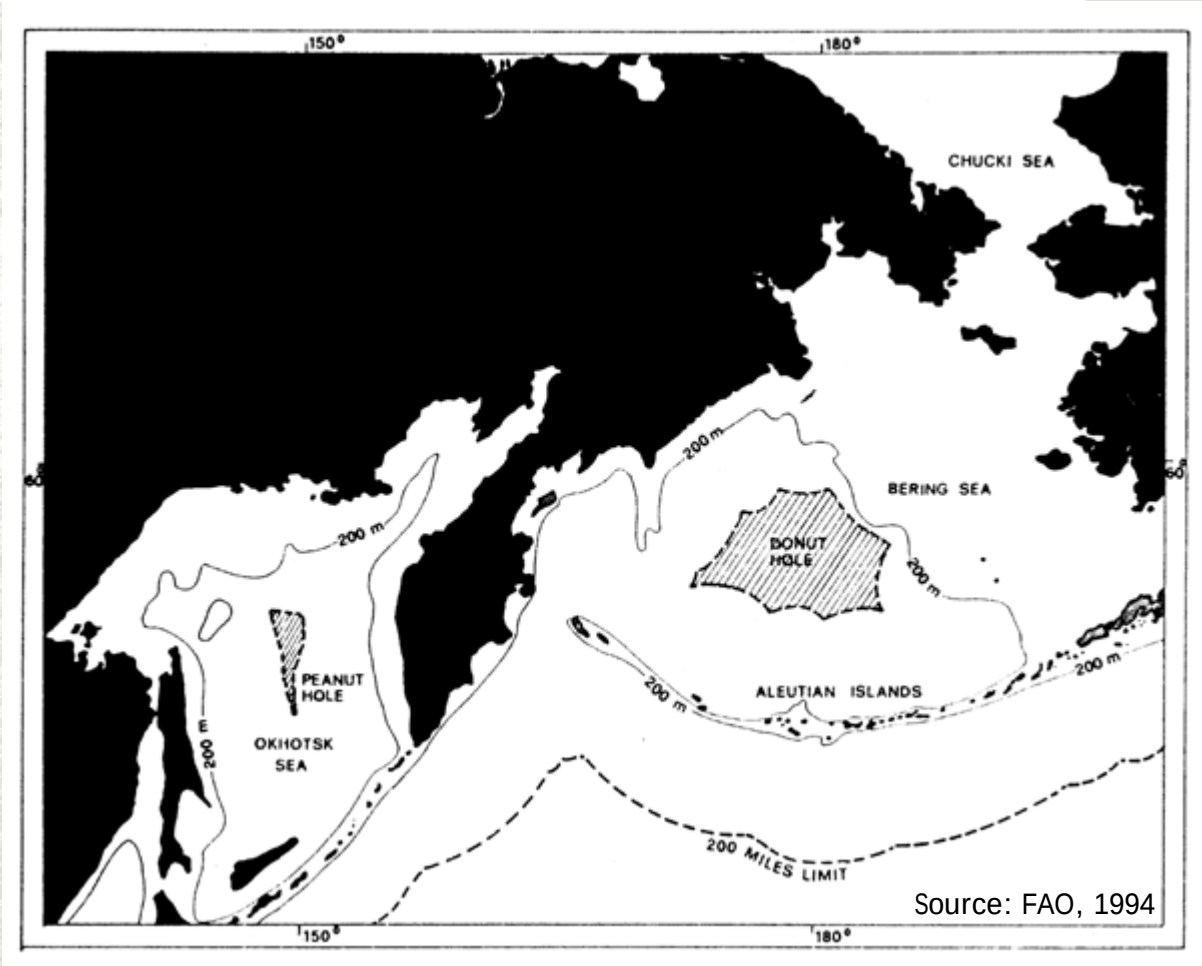
Shifts in Dominance – Institutional Balloon Effect

Alaska Pollock (Donut Hole)

Formalization of EEZ under UNCLOS → fishery largely contained in the EEZ of two players

Distant water fishing (DWS) squeezed into international waters of "donut hole"





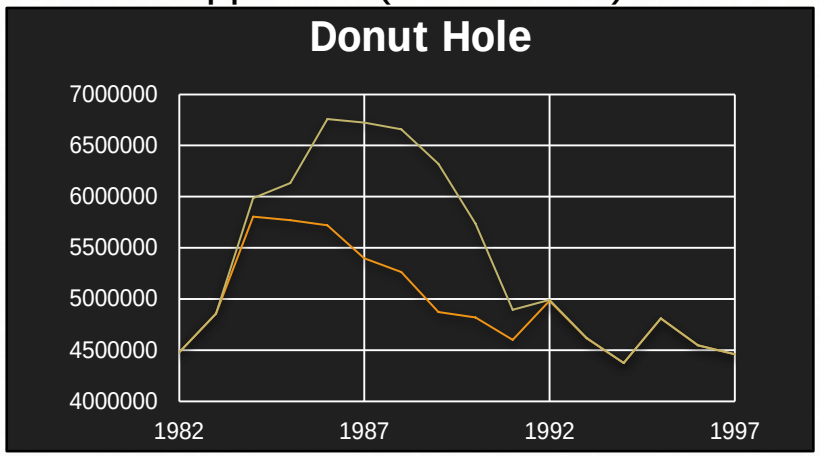
Shifts in Dominance – Institutional Balloon Effect

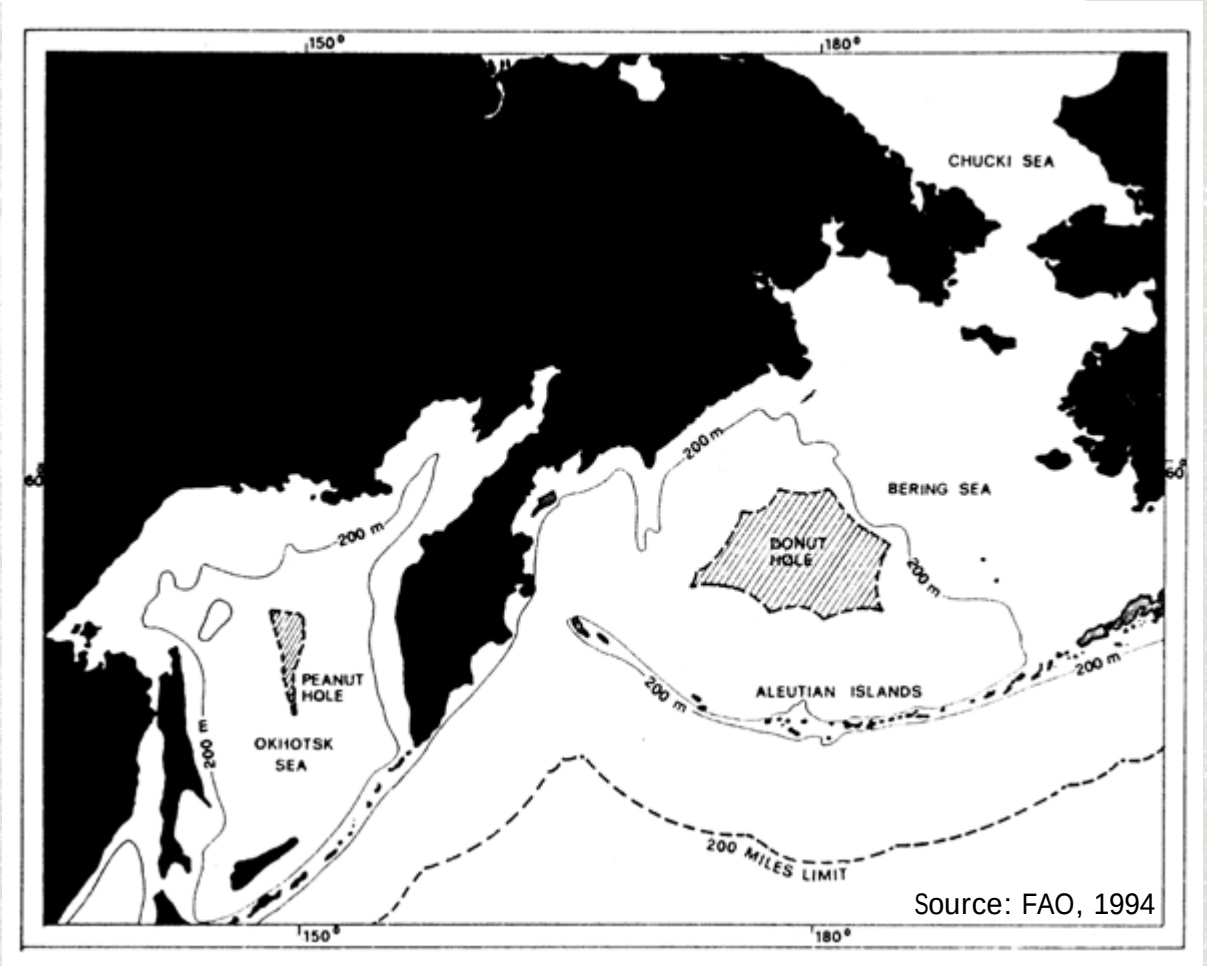
Alaska Pollock (Donut Hole)

Fishery split into two parts:
-Stable two-player game (within EEZ)
-Unstable multi-player game (beyond EEZ)

Decrease in annual catch from 1 million tons (late 1980s) to 22,000 tons in 1992 (beyond EEZ)

Moratorium declared in August 1992, but most of biomass has disappeared (Munro 1993)





Shifts in Dominance – Ecological Balloon Effects

Atlantic Mackerel

Quotas set by scientists at International Council for Exploration of the Seas (ICES)

(Climate change?) causing pole-ward shift in stocks

Share of Iceland increased in 2009 → unilaterally increased catch level from 115,000 to 130,000 tons

Faroe Islands then tripled quota up to 85,000 tons

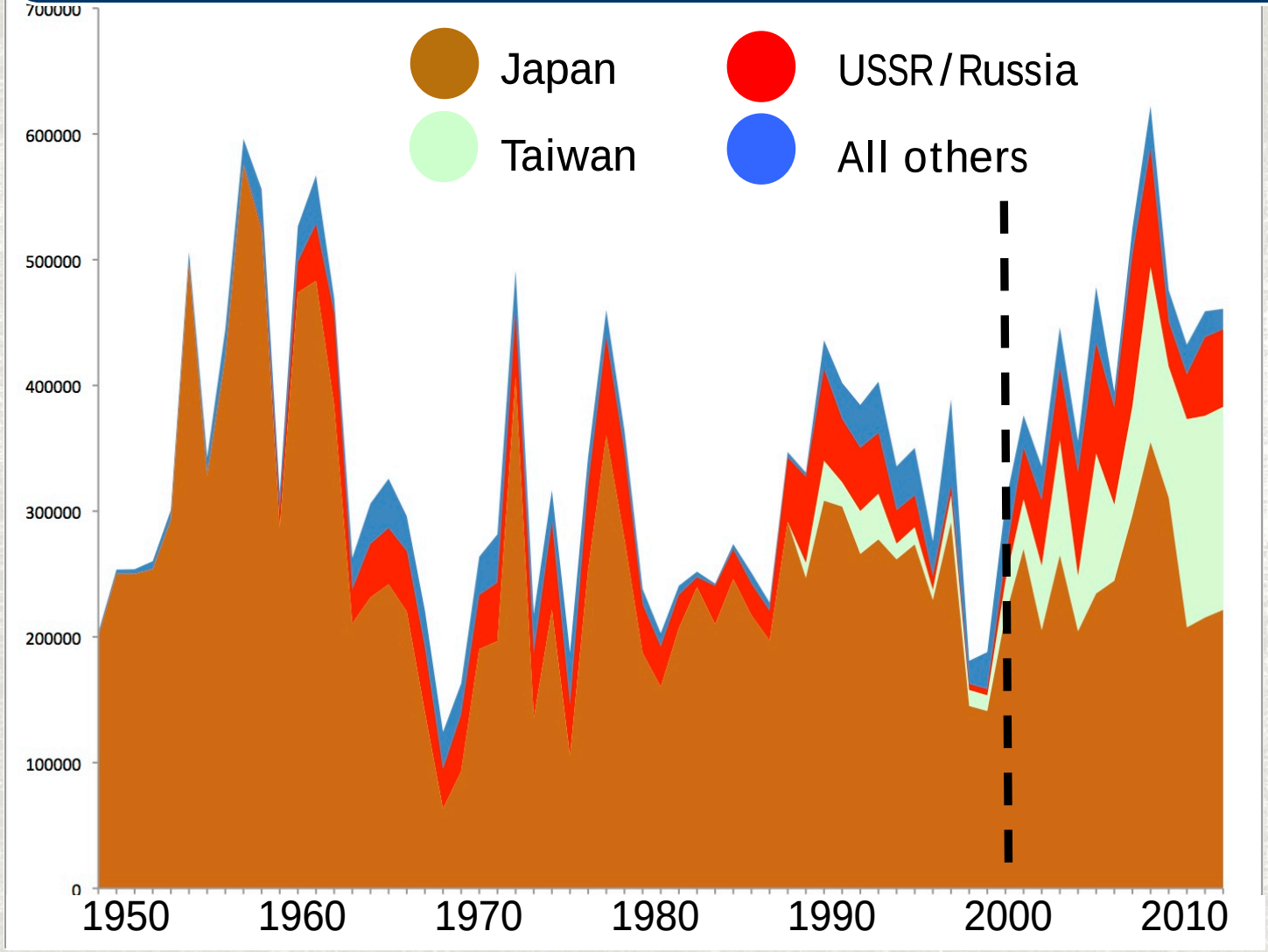
Has caused conflict across mackerel fishing states and illicit retaliatory behavior from fishers in other countries

Partial agreement reached earlier this year (Iceland excluded) – total announced quotas = 156% of ICES recommendation

Distribution of Atlantic Mackerel

Source: oceana.org

Shifts in Dominance – Pacific Saury



Reported catch of Pacific Saury illustrating a shift from hegemonic to shared dominance *(Source: FAO FISHSTAT 2014)*

Although hegemonic systems are characterized by a dominant player exercising a *de facto* veto power over cooperation, **shifts in dominance** can also yield **shifts in cooperative behavior**.

- For decades, Pacific Saury had the characteristics of a hegemonic system
- Shift over the past 15 years from hegemonic to small-group dominance has been mirrored by increasing focus on multi-state cooperation
- North Pacific Fisheries Commission negotiations recently expanded to Pacific Saury – entry into force predicted in 2015

Conclusions (and why is this useful?)

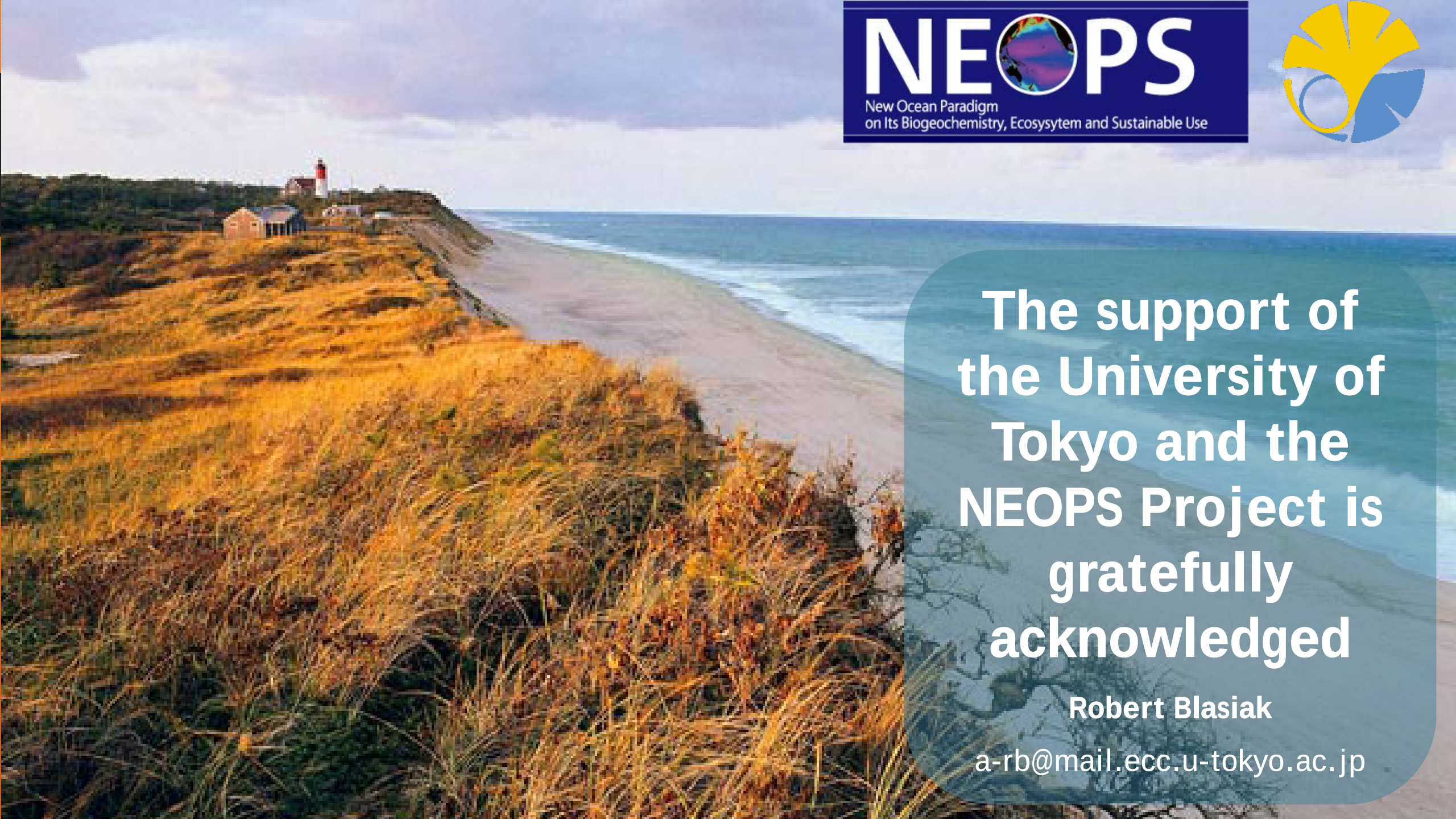
1. The de facto “veto power” suggested by Arnason et al. (2000) seems to characterize hegemonic systems, removing prospects of cooperation.
2. Suggestion that a larger number of players constitutes a lower possibility of cooperation seems unsupported (BUT…)
3. Shifts in dominance (e.g. hegemonic system → coupled system) can signal advantageous conditions for entering into negotiations on cooperative management.
4. The respective dominance of “players” in a fishery may be more important than the actual number of players or even the appearance of new entrants

Directions for further research

1. Current typology is based on catch data – incorporation of additional economic data is crucial (especially value of respective fisheries)

2. Ultimately, sustainable ocean management must encompass the entire range of *megumi* / ecosystem services (supporting, regulating, provisioning, cultural)
   - The values of provisioning services (fish in this case) are highly tangible and relatively easy to measure
   - Sustainable management of ABNJ, in particular, will require consideration of broader range of ecosystem services

3. Existence of cooperative agreements doesn't necessarily mean full compliance of all signatories



The support of the University of Tokyo and the NEOPS Project is gratefully acknowledged

Robert Blasiak

a-rb@mail.ecc.u-tokyo.ac.jp