

The Economics of Fishery and its Sustainability

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Outline

- Introduction
- 3 questions
 - 1. What is going on in the fishery?
 - 2. How can we explain what is happening by using Economics?
 - 3. What can we do to create a sustainable fishery?
- Conclusions

Introduction

- Economics deals with the allocation of scarce resources to different purposes.
- Natural Resource Economics deals with the allocation of scarce natural resources to different purposes.

Introduction



- Natural resources - classification

- Renewable resources

- display a significant rate of growth on a relevant economic time scale.
 - a resource with the capacity for reproduction and growth
 - Plants, animal populations, surface water, air.



- Non-renewable resources

- Exhibit no growth over time
 - Stocks of minerals: oil, coal, natural gas and metal such as copper, tin, iron, silver and gold.



- Note:

- Non-renewable/exhaustible/depletable resources
 - Not useful terminology
 - Renewable resources are exhaustible if harvested too much for too long + pollution + introduction of new species

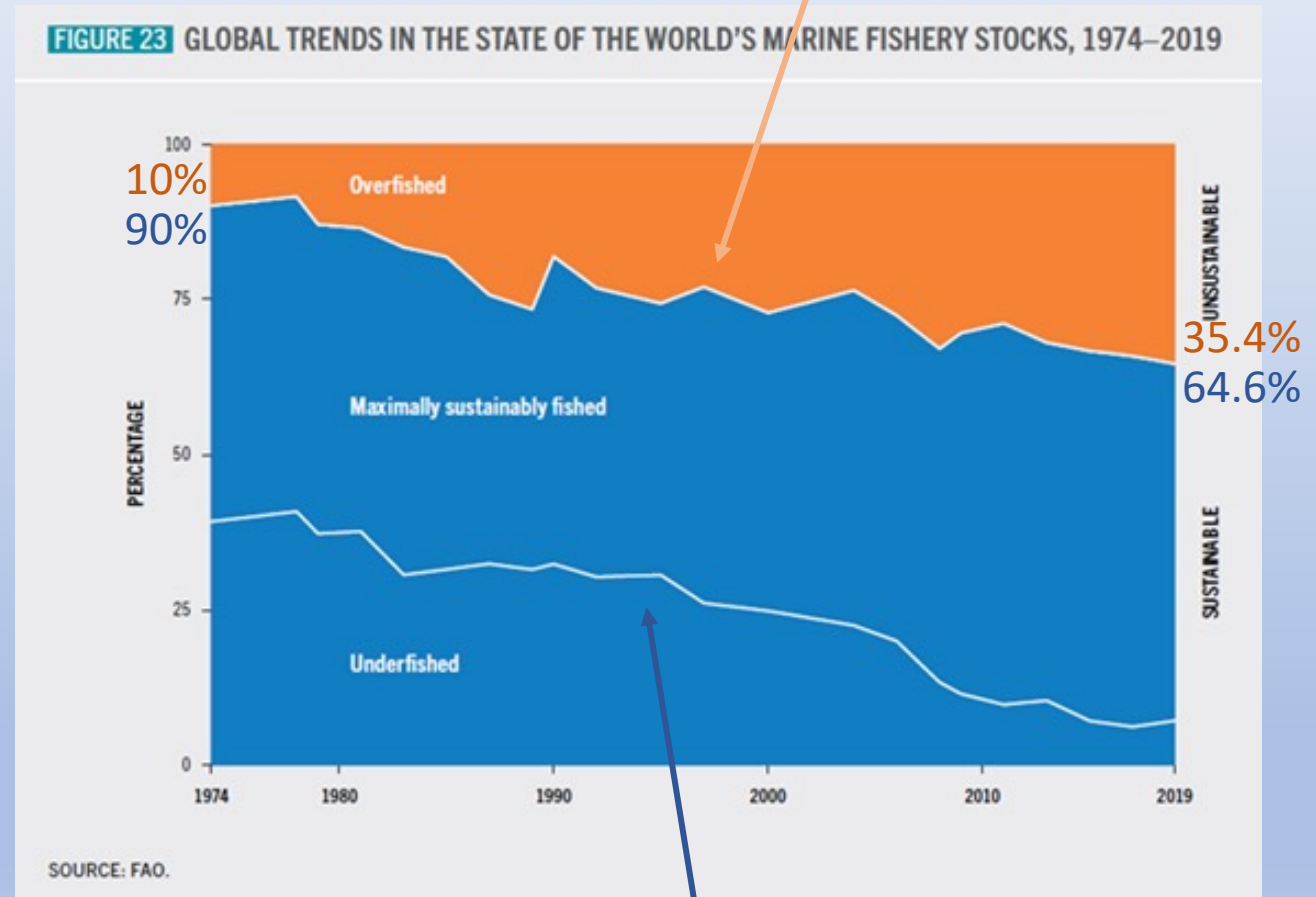
Introduction

- 3 questions
 - 1. What is going on in the fishery?
 - 2. How can we explain what is happening by using Economics?
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1. What is going on in the fishery?

- **Fish stock**
- **FAO (2022).**
 - Biological sustainability:
 - Harvest = fish growth → steady stock
 - Maximum sustainable yield:
 - largest catch that can be taken from a species' stock without reducing the size of the population.

Fish stock within a biologically unsustainable level



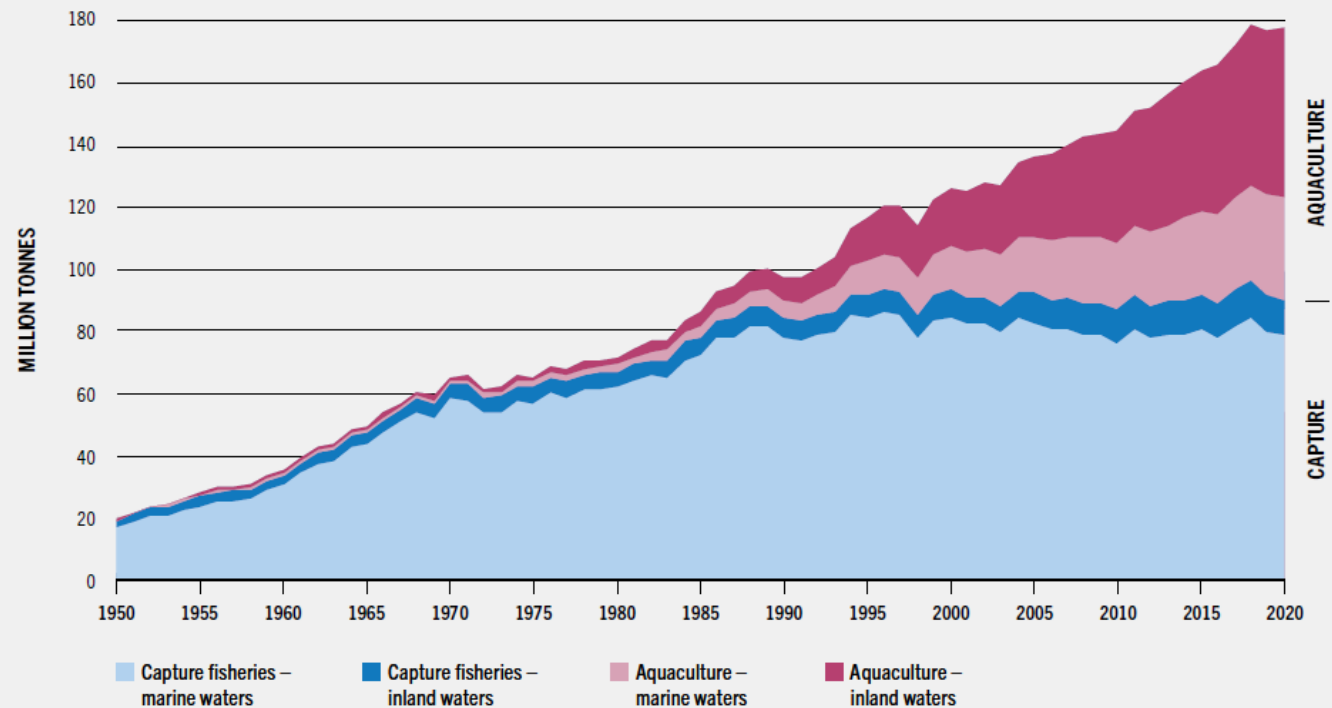
Fish stocks within biologically sustainable level

1. What is going on in the fishery?

- **Fish capture**
- **FAO (2022).**
- **Two possible reasons:**
 - Overexploitation of global fish stocks;
 - Reduced fishing effort.



FIGURE 1 WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



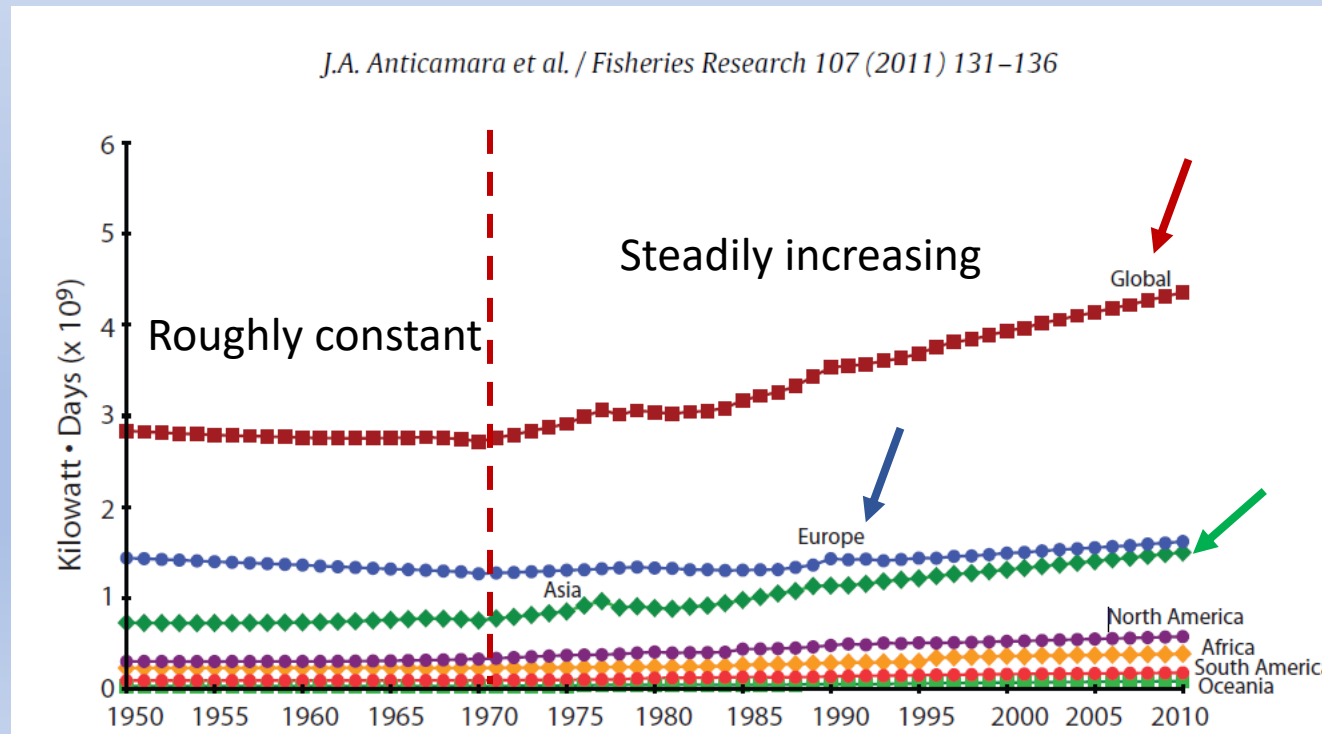
NOTES: Excluding aquatic mammals, crocodiles, alligators, caimans and algae. Data expressed in live weight equivalent.
SOURCE: FAO.

This trend could be underestimated !!

1. What is going on in the fishery?

- **Fishing effort**

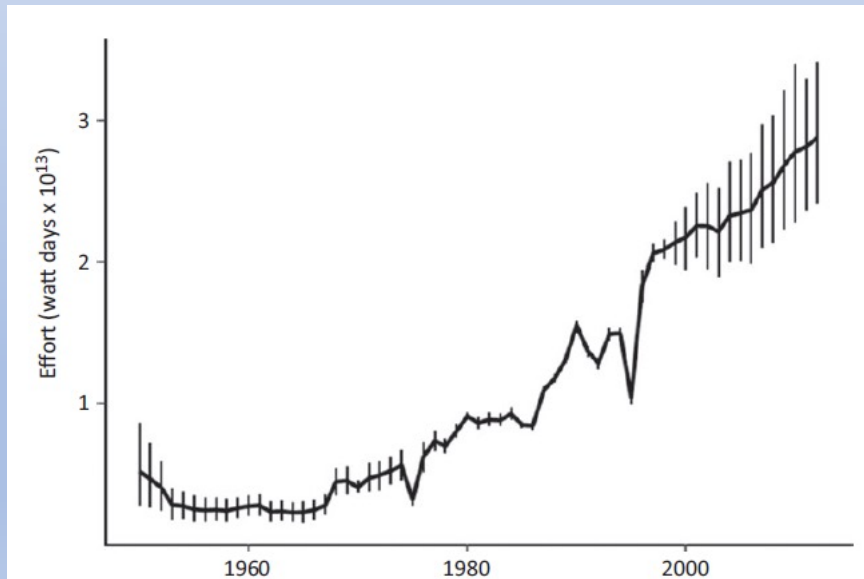
- Anticamara et Al. (2011): Global trends in fishing effort from 1950 to 2006.
 - Total engine power and number of fishing days in a year (kilowatt days).



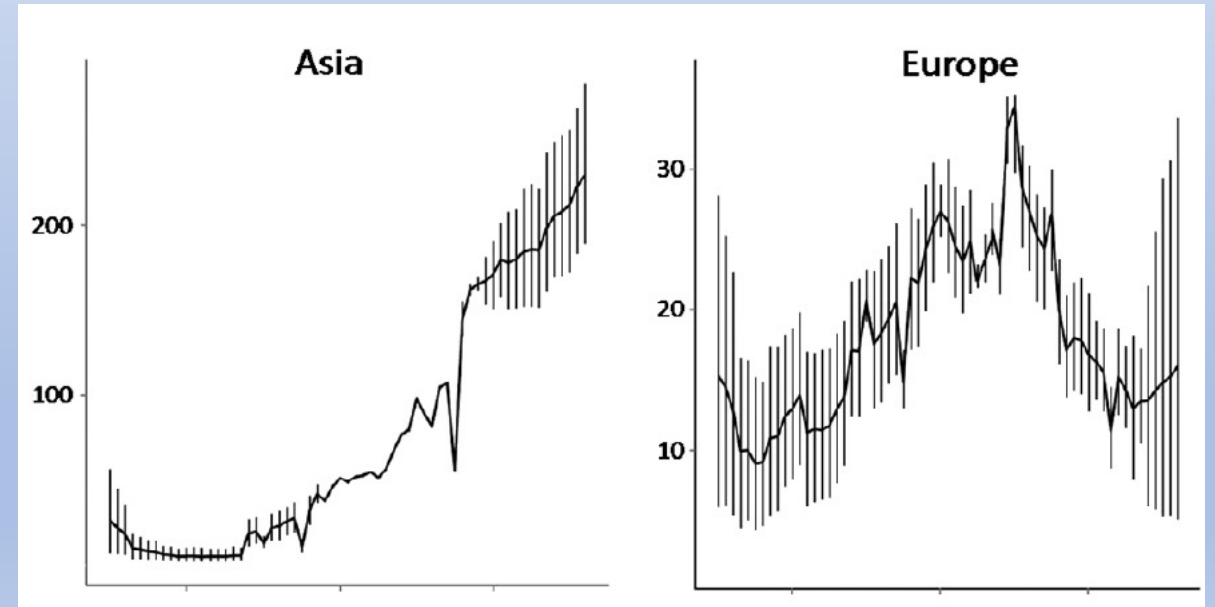
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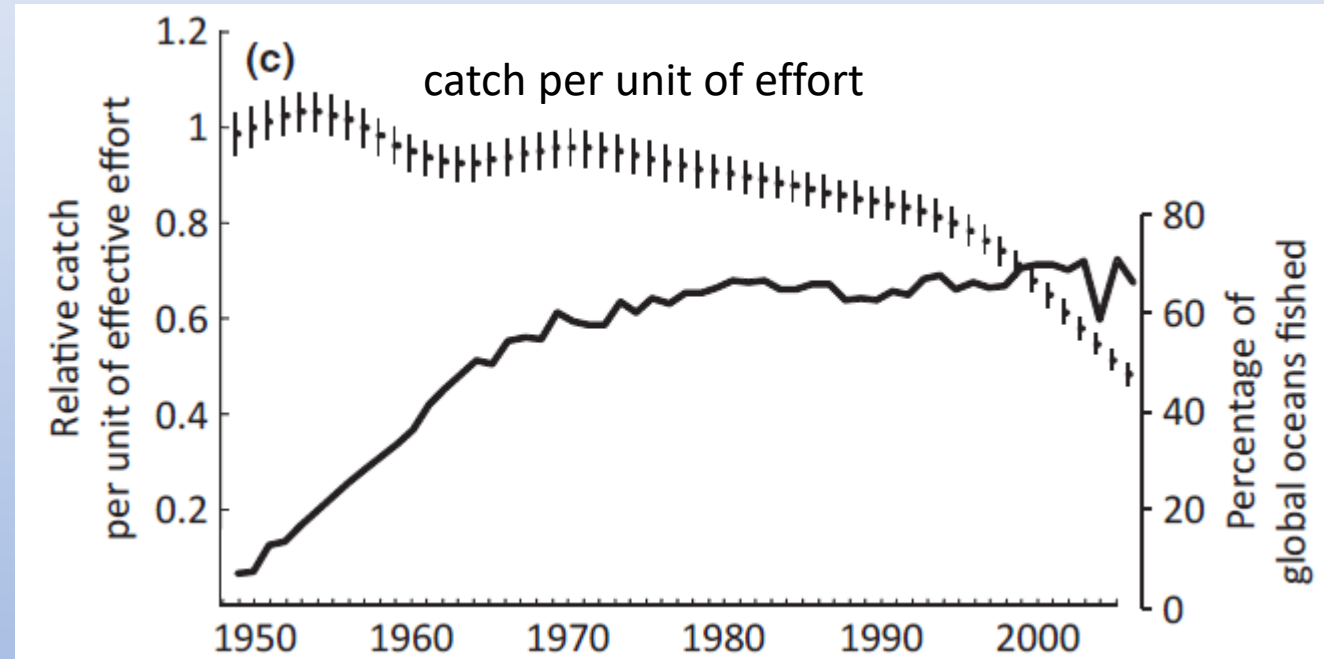


Effort (watt days x 10⁸)



1. What is going on in the fishery?

- **Catch per unit of effort**
- Watson et Al. (2013)
 - Effort:
 - Fleets fish all of the world's oceans;
 - Intensity of fishing effort has grown 10-fold for all countries on average;
 - power of fishing vessels
 - Implementation of new technology.
 - Catch:
 - 1950 - mid-1980s: increased;
 - mid-1980: started to stagnate;
 - late 1980: slowly declined.
- Catch per unit of fishing effort (CPUE) has decreased during this period.



Most likely explanation: limited available resource.

1. What is going on in the fishery?

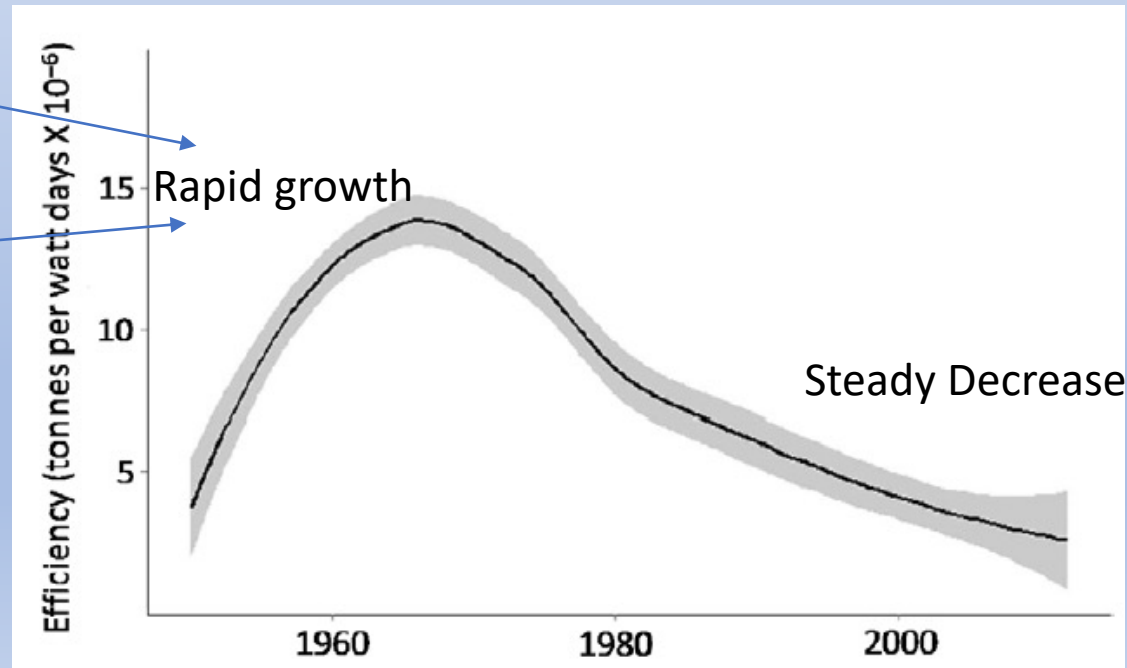
- **Catch efficiency**

- Bell et Al. (2017)

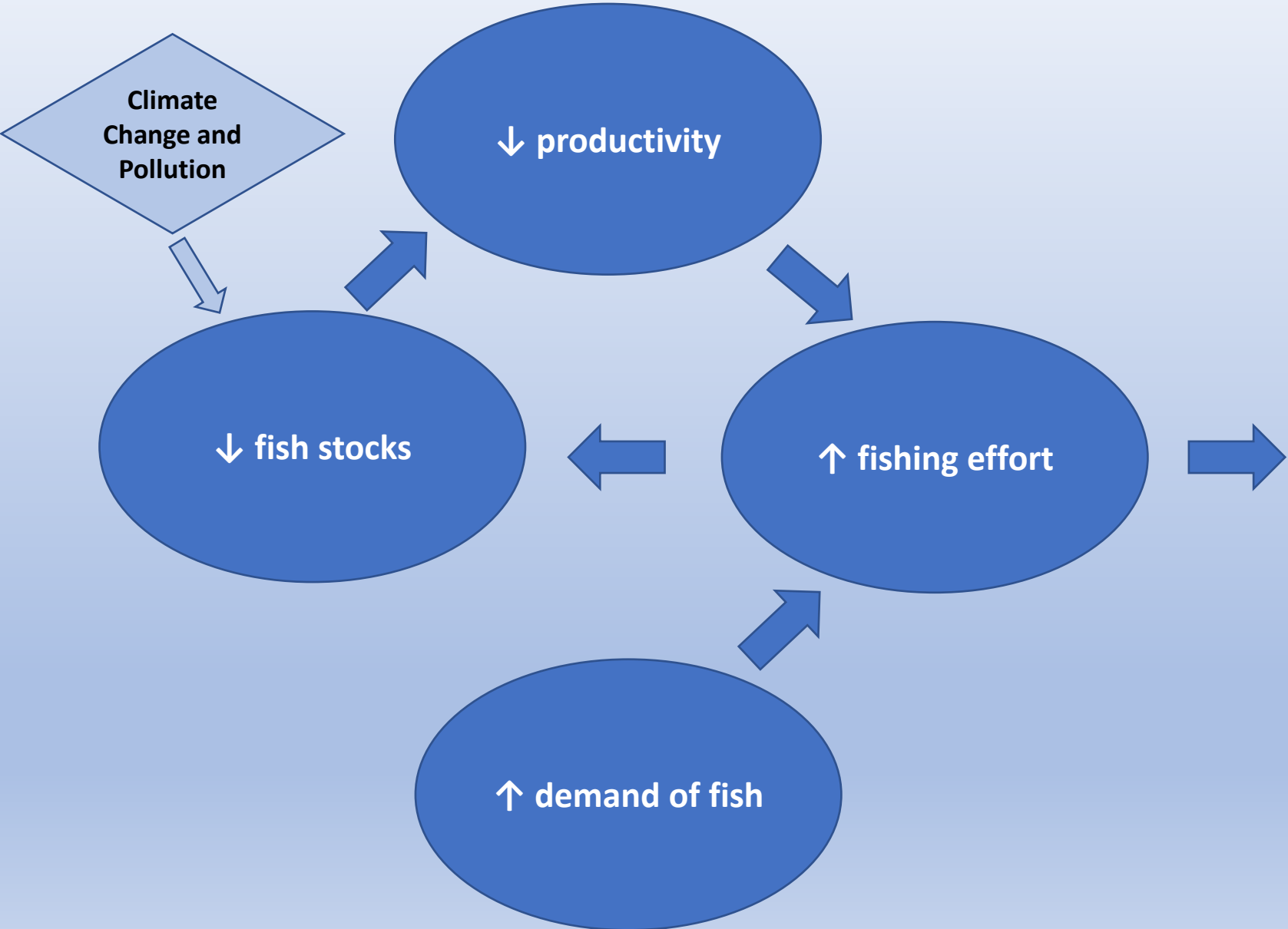
- tonnes of wild-caught marine organisms per watt days of fishing effort

Expansion into previously underutilized fisheries.

Technological development



Assessment



The sunken billions
World Bank and FAO (2009)
Economic loss of about \$51 billion in 2004
World Bank and FAO (2016)
Economic loss of about \$83 billion in 2012

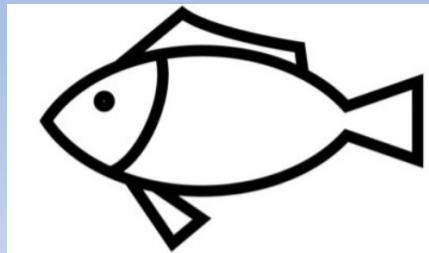
2. How can we explain what is happening by using Economics?

- A capitalistic approach.
 - Fishery: a type of 'real' capital.
 - Real capital: any asset that is capable of producing a stream of economic benefits to society over time.
 - Natural capital vs Man-made capital: endowment from nature.
 - Investing: process of increasing the stock of real capital
 - Fishery: harvesting tomorrow vs harvesting today – refraining/saving
 - Disinvesting: process of decreasing the stock of real capital
 - Fishery: harvesting today vs harvesting tomorrow

2. How can we explain what is happening by using Economics?

- Nature of the resource

	Property rights & Enforcement	Lack of property rights
	Excludable	Non-excludable
Rivalrous	Pure private goods: aquaculture cages.	Commons: Ocean fishery
Non-rivalrous	Club goods /Congestible resources: services provided by a private beach	Pure public goods: protection that comes from the ozone layer



Mobile

2. How can we explain what is happening by using Economics?

- Capitalistic approach + Rivalry + Non-excludability
 - there is no guarantee that tomorrow I will be the owner of any savings I do today
 - no one has an incentive to preserve the resource or to invest in its improvements.
 - everybody harvests the resource as much as possible and as soon as possible.

Tragedy of the Commons (Hardin, 1968)

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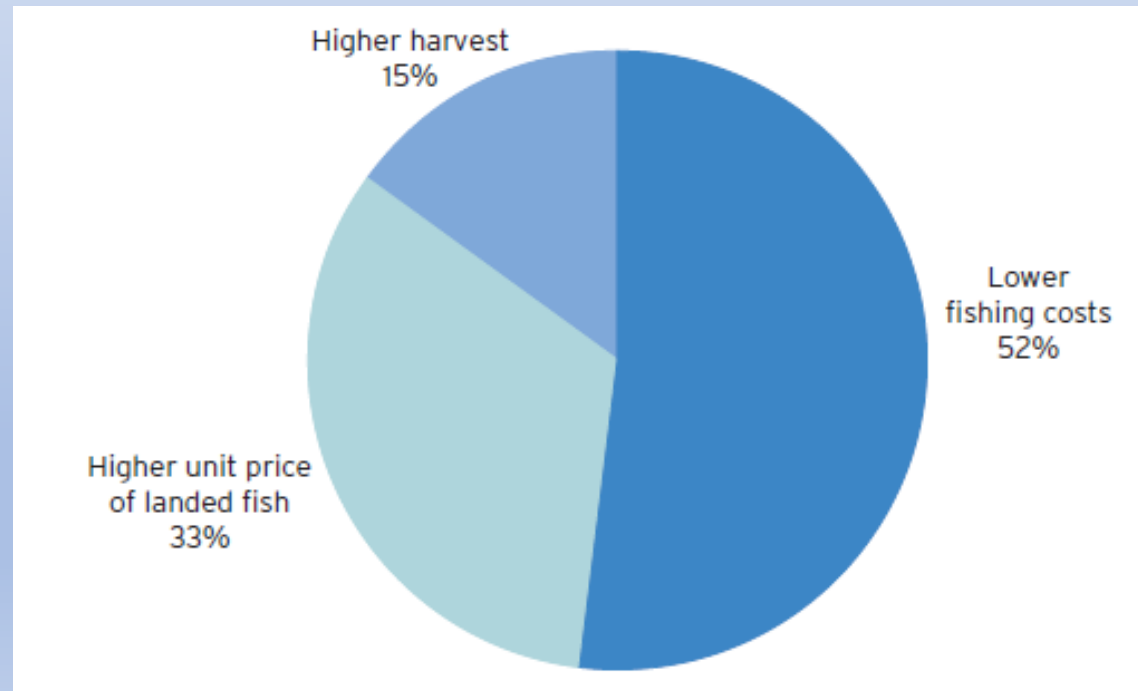
3. What can we do to have a sustainable fishery?

How do we recover the sunken billions?

- Main causes of lost benefits:
 - Depleted fish stocks.
 - Fleet overcapacity.
 - (too many fishers chasing too little fish).
- Main goals:
 - Rebuilding fish stocks.
 - Reduction in fishing effort.

3. What can we do to have a sustainable fishery?

- Not a moral problem
- Sources of economic benefits from moving to the optimal sustainable state for global fisheries.
 - World Bank and FAO (2016)

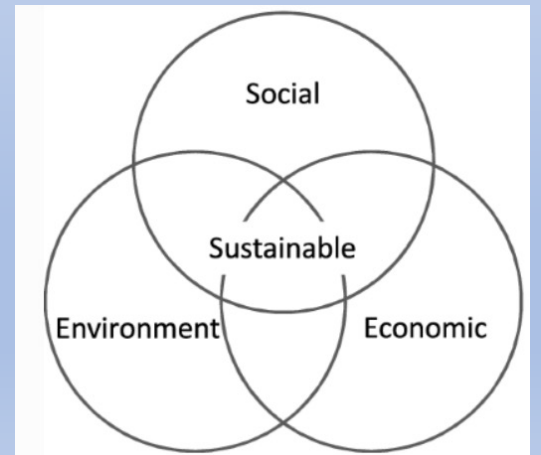


3. What can we do to have a sustainable fishery?

- Many policies
 - On High Seas (> 200nm): (voluntary) international environmental agreements
 - On Exclusive Economic Zones (< 200nm): governments' policies
 - Command and Control policies: mandatory regulations and/or restrictions on the behaviour of fishers.
 - Incentive-based instruments: creating incentives for individuals/firms to voluntarily change their behaviour.
 - On the consumer side: change the demand pattern

CONCLUSIONS

- Current management of marine resources has proven to fall short
 - Fish stocks at sustainable levels are decreasing.
 - Economic losses are increasing.
- Many policies at hand
 - Reducing effort.
 - Creating property rights.
 - Opening new markets.
- Keep in mind
 - No single policy is perfect.
 - Fishery policies should achieve a set of multiple objectives.
 - Biological, economic, social.



Possible solutions

- **Command and Control policies**

- Regulations aimed at reducing fishing effort.
 - Restrictions on the boat size or other capital equipment used by fishermen, limits on days of fishing permitted per boat.
- Restrictions aimed at controlling the qualitative nature of the catch (juvenile fish, by-catch and catch discards, and reducing environmental damage).
 - Restrictions on fishing gear and mesh or net size.

Possible solutions

- Moratorium

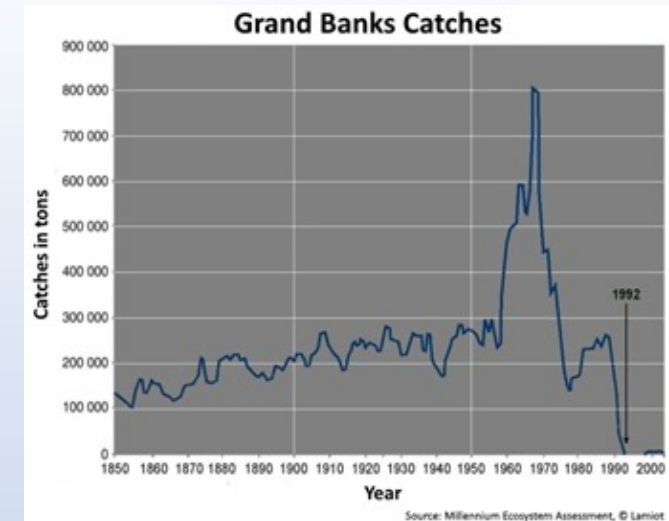
- Suspension of the fishing activity.
- Completely close of an overharvested fishery for a certain period.
 - Newfoundland and the Northern Cod moratorium (1992 – present)
 - 2-year moratorium

- Marine protected areas (MPA)

- Section of the ocean where a government has placed limits on human activity so that it does not damage the environment.
 - EU, USA, China

- Marine reserves areas

- No take MPA: area where fishing is not permitted.



Possible solutions

- Total Allowable Catches (TACs))
 - Upper bounds on the harvesting of a given species during any particular season or year.
 - (expressed in tonnes or numbers).
 - Management authorities monitor harvest, and when cumulative harvest reaches the TAC, the season is over.
- EU:
 - Total allowable catches (TACs)/fishing opportunities:
 - catch limits set for most commercial fish stocks.
 - set annually for most fish stocks (every 2 years for deep-sea stocks) based on scientific advice on the stock status from advisory bodies
 - https://oceans-and-fisheries.ec.europa.eu/fisheries/rules/fishing-quotas_en

Possible solutions

- **Incentive-based instruments**

- Individual Transferable Quotas (ITQs)

- Given an EEZ, identify the total allowable catches (TACs), apply a system of individual transferable quotas (ITQs).
 - ITQs: tradable rights to harvest a resource, permits to harvest a particular quantity of fish.
 - Without ITQ no fishing is permitted.
 - Allocation ITQs: auction; historic catches; equal sharing rules...
 - Each fisher can use or sell/lease her/his ITQ
 - High-cost producers sell; low-cost producers buy.
 - Problematic with highly migratory species.

Possible solutions

- On the consumer side: change the demand pattern
 - Public education campaigns can help consumers to become aware of the overexploitation of the fishery.
 - Ecolabeling can help consumers to identify products produced in a sustainable manner.
 - Certified products show a slightly higher market price. By accepting this price premium, consumers implicitly agree to pay for the fish they eat and the health of the ocean ecosystem. Consumer choices give the fishing industry a financial incentive to use sustainable methods.

Possible solutions

- Several ecolabelling and certification schemes in the fisheries sector
 - Different covers: bycatch issues, fishing methods and gear, sustainability of stocks, conservation of ecosystems, and even social and economic development.
 - Different sponsors: private companies, industry groups, NGOs, some combinations of stakeholders, governments.
- Too many labels?
 - Fishers and consumers.

1997, WWF



2008, Earth Island Institute



1990, Earth Island Institute

References

- Anticamara, J.A., Watson, R.A., Gelchu, A., Pauly, D., (2011) “Global fishing effort (1950–2010): Trends, gaps, and implications”, Fisheries Research, Vol. 107, pp. 131-136.
- Bell, J.D, Watson, R.A., Ye, Y., (2017) “Global fishing capacity and fishing effort from 1950 to 2012”, Fish and Fisheries, 18, pp. 489-505.
- Chu, C., (2009) “Thirty years later: the global growth of ITQs and their influence on stock status in marine fisheries”, Fish Fish., 10, pp. 217-230
- FAO (2022). The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome.
- Hardin, G., (1968) “8). "The Tragedy of the Commons". Science, 162, pp. 1243–1248.
- Watson, R.A., Cheung, W.W.L., Anticamara, J.A., Sumaila, R.U., Zeller, D., Pauly, D., (2013) “Global marine yield halved as fishing intensity redoubles”, Fish and Fisheries, 14, pp. 493 – 503



Durham
University

Beauty Contest

by Aleksei Chernulich



Jane Georgiana, Lady Seymour, Queen of the Tournament. Irvine, Ayrshire, Scotland, 1839





Durham
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Keynesian Beauty Contest


by Aleksei Chernulich




Investors profit by buying those stocks they think other investors will buy



Keynes, *General Theory of Employment,
Interest and Money*, 1936



It is not a case of choosing those [faces]
that, to the best of one's judgment, are
really the prettiest,...., those that average
opinion genuinely thinks the prettiest...



Let's run an experiment!



Beauty Contest Game aka Guessing Game

Choose a number between 0 and 100

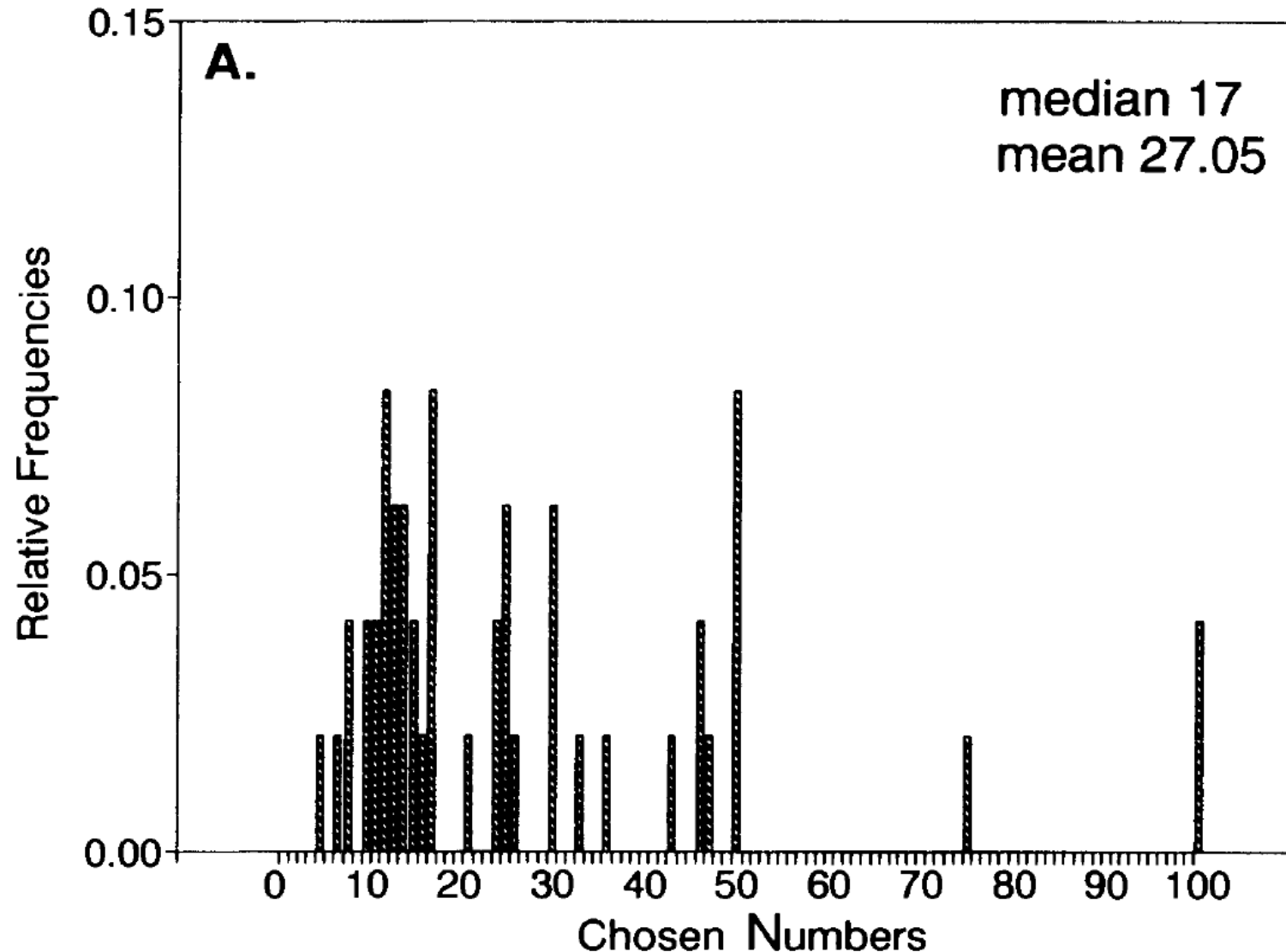
We then compute the average

You **win** if your number is closest to the half of the average :


$$\frac{\textit{average}}{2}$$




Nagel, Rosemarie. "Unraveling in guessing games: An experimental study." *The American Economic Review* (1995)




Keynes, *General Theory of Employment,
Interest and Money*, 1936



It is not a case of choosing those [faces]
that, to the best of one's judgment, are
really the prettiest, nor even those that
average opinion genuinely thinks the
prettiest...



Keynes, *General Theory of Employment,
Interest and Money*, 1936



...We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practice the fourth, fifth and higher degrees

