Plan of Action for the Management of Fleet Capacity in the IATTC: Transferable Day Credit System

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Workshop on Management of Fleet Capacity in the Antigua Convention Area

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Organization

- 1. Motivation: Why the Transferable Day Credit Scheme?
- 2. Take-Home Message: Why the Transferable Day Credit Scheme?
- 3. Basic Features of Transferable Day Credit Scheme
- 4. Overall Economic Impact of the Scheme
- 5. Allocation of PAES
- 6. Fair PAES
- 7. Economic Efficiency of Alternative PAES Allocation Rules
- 8. Equitable Impact of Alternative PAES Allocation Rules
- 9. Summary
- 10. Final Recommendation

1. Motivation

Ask Yourself Two Related Questions

- 1. How to reduce overcapacity?
- 2. What will you do when the time-area closures increases well beyond 72 days? Say 100?
- Transferable Day Credit Scheme addresses both questions.
- First step in multi-step, adaptive process
- Designed to minimize risk and uncertainty
- Scheme has similarities to DMLs (also a credit scheme)

1. Address Overcapacity

- First step in two-step Plan of Action to Reduce Capacity
- Create incentive-based management system to set stage for follow-up by vessel buyback programs
- Buybacks shown by Northern Economics to be profitable

2. Flexible, Year-Round Fishing

- Scheme allows year-round fishing
- Flexible because can fish when want to
- Increases daily vessel operating profit for most vessels
  - Especially multi-vessel companies
  - No vessel loses daily vessel operating profit
- Allows year-round supply of EPO-caught fish to processers
  - Reduces processor reliance upon more costly imports during long periods of year

2. Take-Home Message: Why the Transferable Day Credit System?

- Create incentive-based management system to set stage for follow-up by vessel buyback programs to reduce capacity
- Flexible, year-round fishing instead of long time-area closure
- Year-round supply of EPO-caught fish for processors
- Increase total vessel profits for fishery
- No individual vessel loses daily vessel operating profit, most gain daily vessel operating profit,
  - Especially multi-vessel companies
- Start with simplified pilot Scheme for 3 years and no restructuring of industry (e.g. no vessel exit) to minimize risk and uncertainty
- At end of 3 years, either revise Scheme and continue, or revert to existing.

3. Basic Features of Transferable Day Credit Scheme

3-Year Pilot Based Upon Effort

- Simplified 3-year pilot program to reduce risk and uncertainty
- Effort, not catch-based
  - Consistent with current effort-managed fishery
  - Keeping track of landings of yellowfin, skipjack, and bigeye by all purse seine vessels in all CPCs is dauting and costly task
  - Can eventually switch to more complex catch-based in future if you like

Features….(1)

- Based upon Resolution C-02-03
- Vessels eligible to fish under C-02-03 participate in Scheme
- Eliminate 72-day closure
- Vessels fish year-round
- IATTC Secretariat estimates Total Allowable Effort (TAE) for Management Year
- TAE ensures sustainability of yellowfin, bigeye, and skipjack stocks

Features….(2)

- Vessels through their CPCs are allocated Party Allowable Effort Shares (PAES)
- Other conservation measures retained
- U.S. vessels fishing in WCPO retain their single trip to EPO or receive PAES allocation
- Designed around three-year Resolution cycle

Definitions of Terms in Scheme

- Day: Any calendar day, or part of a calendar day, in a Management Year during with a purse seine vessel is in the waters under the jurisdiction of the IATTC outside of a port.
- Total Allowable Effort (TAE): Total nominal days for a Management Year.
- Proportional Allowable Effort Share (PAES): CPC's proportion (share) of Total Allowable Effort
- Party Allowable Effort (PAE): Allowed days in Management Year based upon PAES and TAE
- Management Year: Calendar year during Resolution Cycle
- Credit: Unused portion of a vessel's Party Allowable Effort during a Management Year.

Credits…1

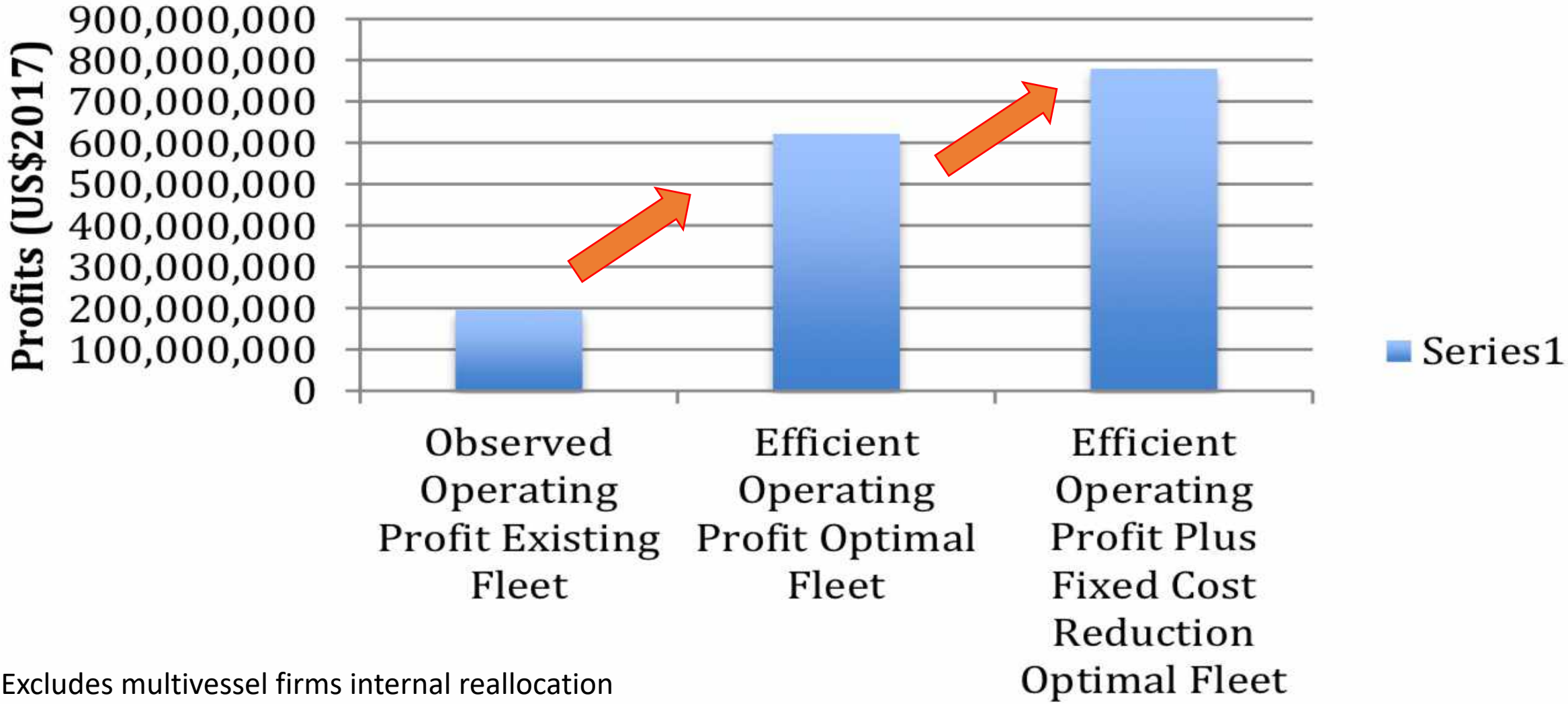
- Each Management Year, vessels through their CPCs, receive Party Allowable Effort Shares (PAES) which are multiplied by TAC to give Party Allowable Effort or simply Days
- Days are annual limits, much like Dolphin Mortality Limits
- Vessels can fish to this annual limit in a Management Year
- Any unused portion of Days is called a Credit

Credits…(2)

- Each Management Year, vessels must match catch with their limit of Days
- At end of Management Year, vessels must either increase or decrease credits to match their catch with their limit
  - Vessels with surplus of Credits can sell Credits to another vessel
  - Vessels with deficit of Credits purchase Credits from another vessel
  - Or if multivessel company, reallocate credits *gratis* among vessels
- Credit system is related to DMLs

4. Overall Economic Impact of the Scheme

Sources of Increased Profits



Excludes multivessel firms internal reallocation

Table 21. Wealth of Present Value of Fleet (US$2017)

Substantial potential wealth creation

Discount Rate	Existing Fleet	Optimal Fleet	
	Observed Operating Profit	Efficient Operating Profit	Efficient Operating Profit Plus Fixed Cost Reduction
5%	3,914,188,007	12,444,496,340	15,594,233,520
10%	1,957,094,003	6,222,248,170	7,797,116,760
15%	1,304,729,336	4,148,165,447	5,198,077,840
Note: Present value (*PV*) of an annuity *A* at discount rate *i* over an infinite time horizon: $PV = A/i$.			

Higher Vessel Profits Have Multiplier Effects Throughout Economy

- More employment and incomes through additional rounds of spending in the economy

Contrast Small CPC with Few Vessels vs. Larger CPC with More Vessels and Multi-Vessel Companies

- Larger CPCs probably gain the most
- More likely to have:
  - multi-vessel companies (where real profits are made)
  - processors that gain from year-round supply of EPO-caught fish to balance against exports
- Smaller CPCs less likely to gain as much – but still gain
  - Since less likely to have multi-vessel companies and processors
  - Expected gains are smaller compared to larger country
  - But no vessel loses and all can fish flexibly throughout the year

5. Allocation

Tetra Images/Corbis

Proportional Allowable Effort Share (PAES)

- Allocate first to CPCs and then to vessels
- $S_i = \frac{Days_i}{\sum_{i=1}^{N} Days_i}$ = Proportional Allowable Effort Share
- i = vessel i
- $Days_i$ = *vessel i's days* from PAES formula (more later)
- N = number of vessels
- Vessel *i*'s Party Allowable Effort in Management Year = $S_i * Total\ Allowable\ Effort$
- $0 < S_i < 1$ and $\sum_{i=1}^{N} S_i = 1.$

Worked Example of Allocation Formula

- Vessel average days over 2016-2018 = 200
- Total Allowable Effort in Management Year of 47,000 days
- Vessel receives Proportional Allowable Effort Share (PAES):

$$S_i = \frac{200}{47{,}000} = 0.004255$$

- Each year over a Resolution cycle, multiply PAES = 0.004255 by that year's TAE to give each vessel its Party Allowable Effort.

$$0.004255 * 47{,}000 = 199.985 \text{ rounded to } 200 \text{ days.}$$

Four Potential Allocation Formula…(1)

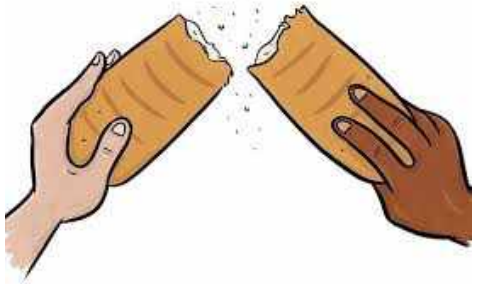
- 1. Average 3 Years:
  - Average historical days 2016-2018
- *2. Best X of Y*:
- The historical Days formula Best X of Y is each vessel's Days during 2014-2018 and chosen as:
  - Out of the most recent 5-year effort history, each vessel is allocated an average of its best 3 years of effort out of the most recent 5 years the vessel has been active on the regional vessel register.
  - The average 3 out of the most recent 4 years of effort if a vessel has only been active on the regional vessel register 4 out of the past 5 years.
  - The average 2 out of the most recent 3 years of effort if a vessel has only been active on the regional vessel register 3 out of the past 5 years.
  - The average 1 out of the most recent 2 years of effort if a vessel has only been active on the regional vessel register 2 out of the past 5 years.
  - A vessel active on the regional vessel register for 1 out of the past 5 years receives its effort for that one year.

Four Potential Allocation Formula…(1)

- 3. *Days/m^3 of Capacity*:
  - Days are directly proportional to a vessel's m^3 of capacity
  - Average days per m^3 of vessel's capacity over 2014-2018
- *4. Hybrid* of *Best X of Y* and *Days/m^3 Capacity* or simply *Hybrid*:
  - Vessels choose whichever is larger, Best X of Y Days or Days/m^3 of Capacity.
  - This Hybrid fourth formula compromises between historical Days and Capacity for PAES.

Proportional Allocation

- All allocated shares are proportions based on historical days and/or capacity
- Appropriate way to allocate for single homogenous divisible good that can be cardinlly measured by common metric – here days
- Satisfies other desirable properties of allocations
- Satisfies Aristotle's Equity Principle
- Allocated PAES are equitable by design *ex ante*

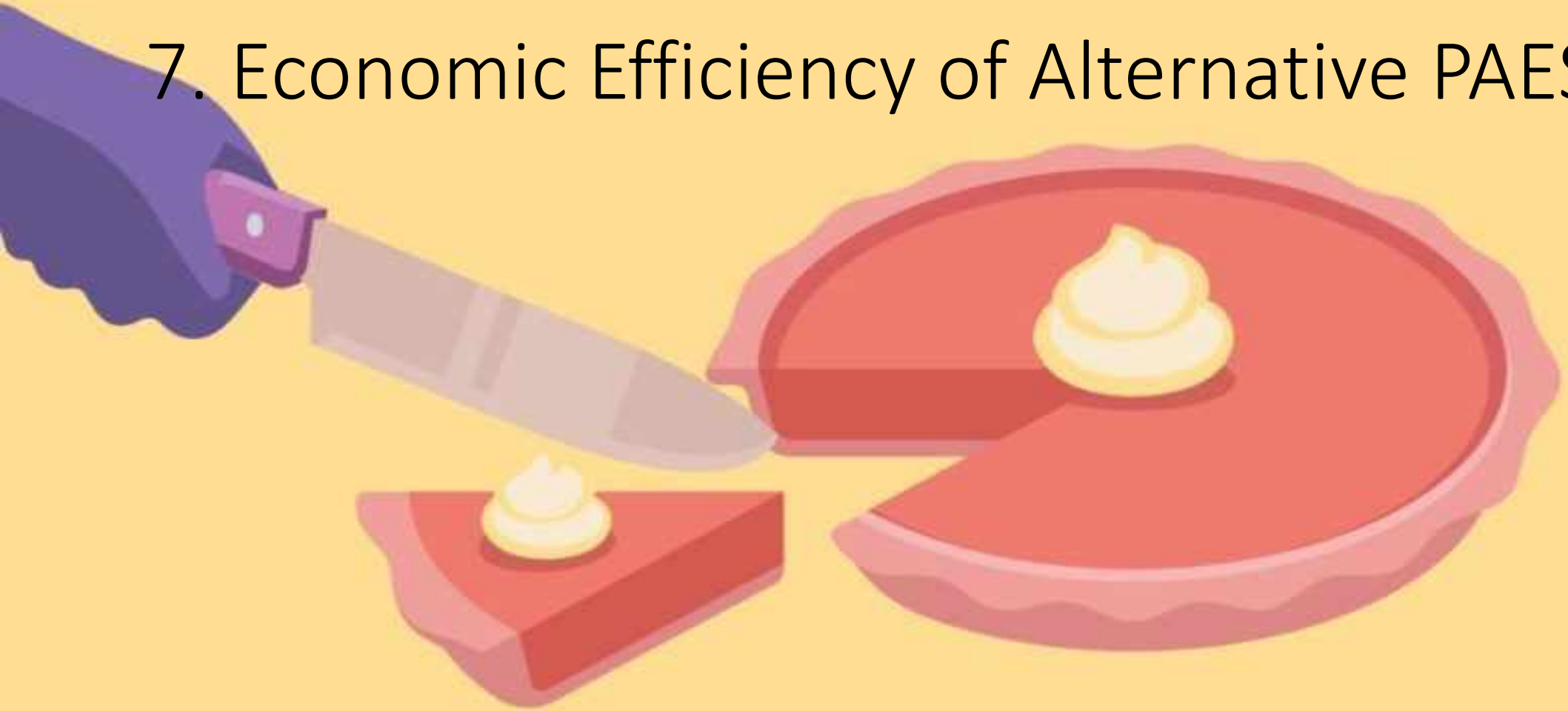


6. Fair Shares

What is a Fair Share?

- An allocation gives fair shares when claimants decide voluntarily, directly, and consensually.
- IATTC's voluntary consensual or unanimous decision-making process inherently gives fair PAES.

7. Economic Efficiency of Alternative PAES Rules



Economic Efficiency

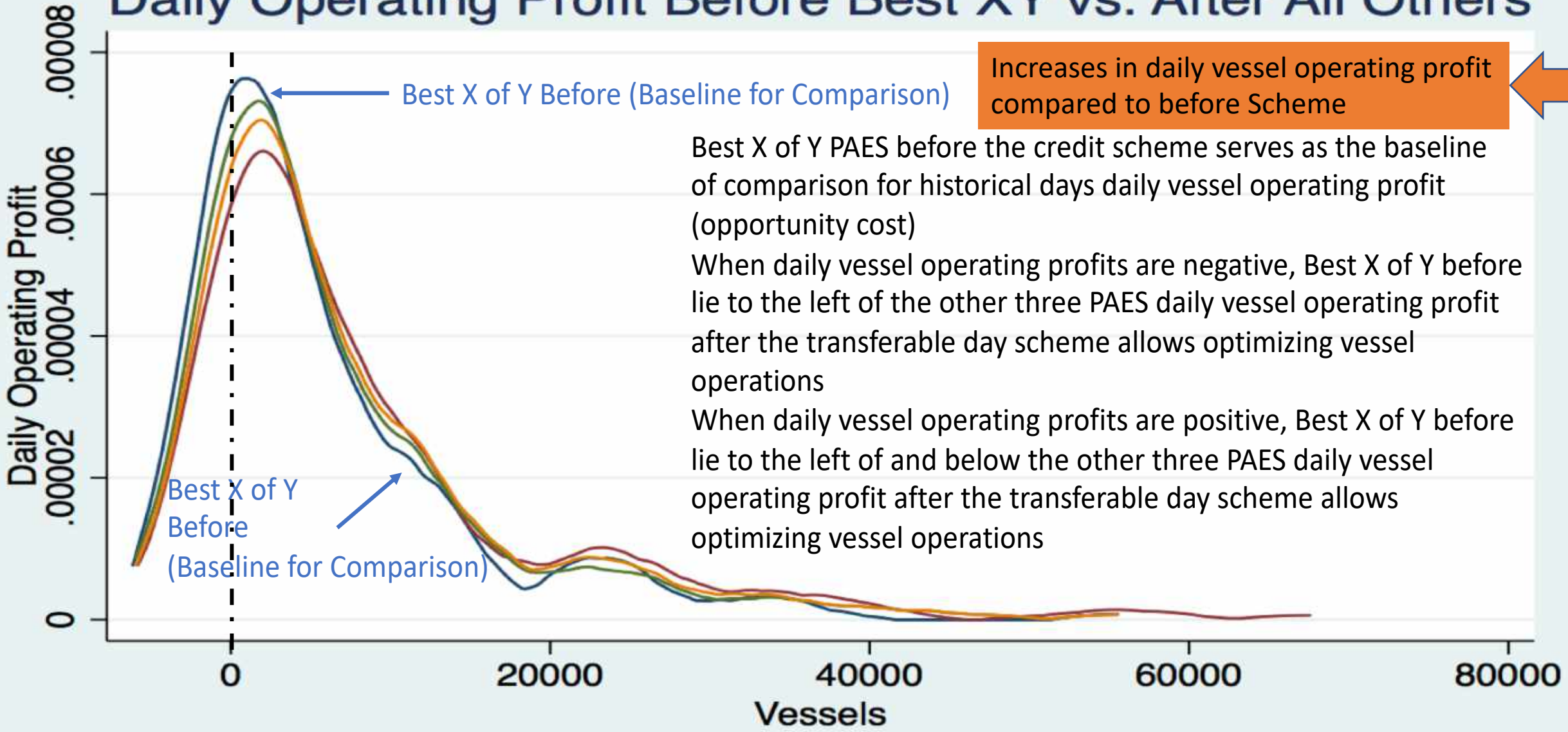
- All four PAES allocation formulae evaluated on basis of increasing daily vessel operating profit
  - By more efficiently using days after controlling for skipper skill
- Ranking of four PAES allocation formulae from highest to lowest daily vessel operating profit
- Ranked highest to lowest profitability:

1. Best X of Y
2. Hybrid
3. Average 3 Years
4. Days/m^3 Capacity

Decreasing Profitability

Type of PAES Allocation	Mean Daily Vessel Operating Profit (US$)	Rank of Profitability Highest to Lowest
Average 3 Years	7,097	3
Best X of Y	8,367	1
Days/m^3 Capacity	6,733	4
Hybrid	7,265	2

Daily Operating Profit Before Best XY vs. After All Others



Increases in daily vessel operating profit compared to before Scheme

Best X of Y PAES before the credit scheme serves as the baseline of comparison for historical days daily vessel operating profit (opportunity cost)

When daily vessel operating profits are negative, Best X of Y before lie to the left of the other three PAES daily vessel operating profit after the transferable day scheme allows optimizing vessel operations

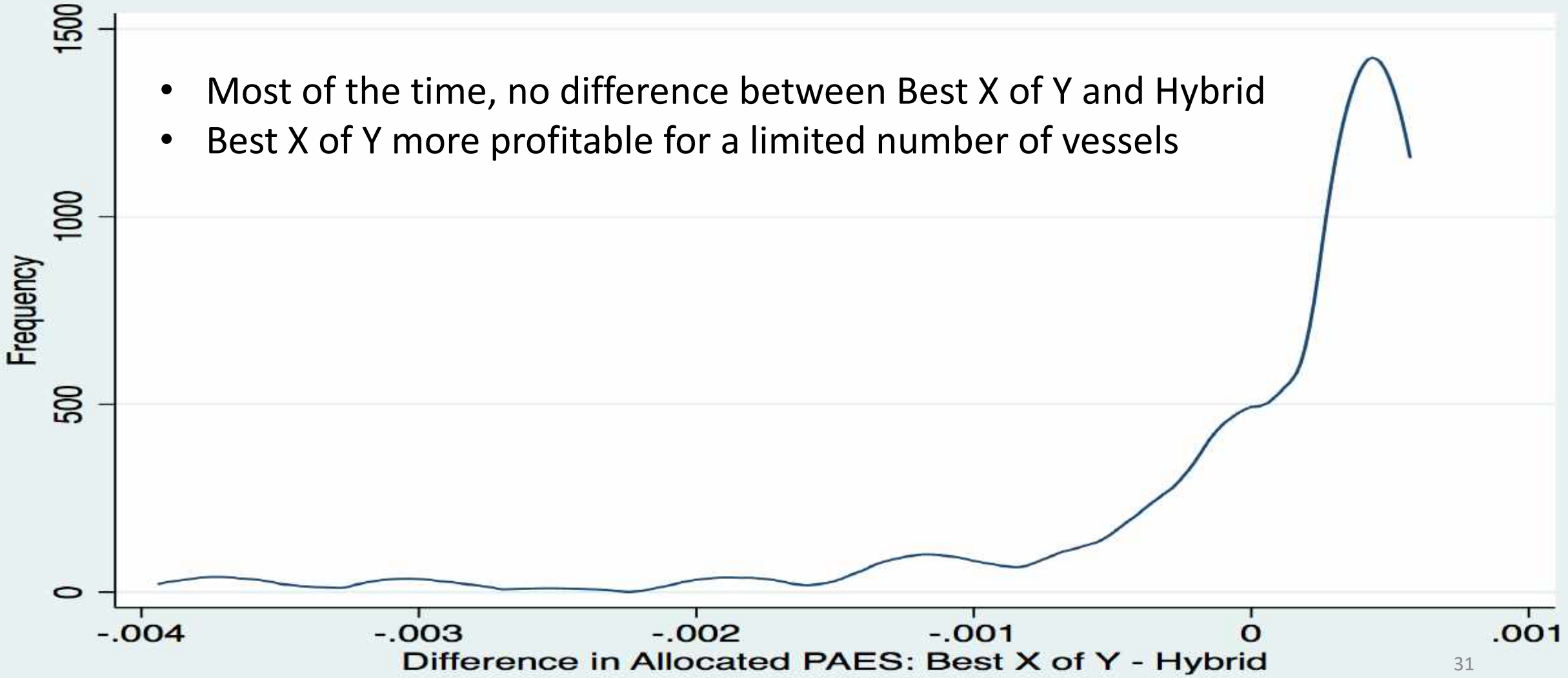
When daily vessel operating profits are positive, Best X of Y before lie to the left of and below the other three PAES daily vessel operating profit after the transferable day scheme allows optimizing vessel operations

Conclusions on Economic Impacts of Different PAES Allocation Rules

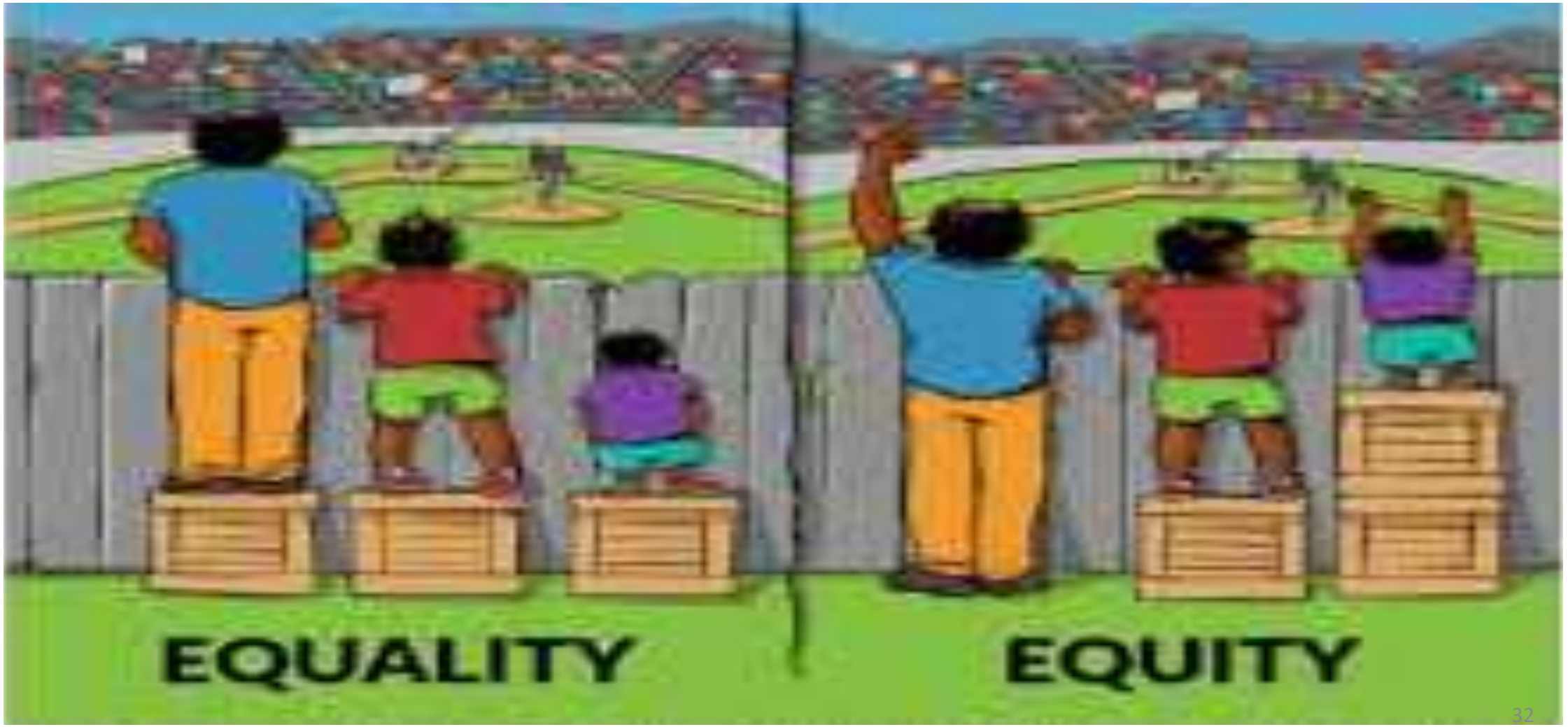
- No vessel loses daily vessel operating profit
- Some vessels do not gain in daily vessel operating profit since they were already efficient and could not improve further
- Excludes gains in daily vessel operating profit for multi-vessel companies
  - Biggest source of profit gains according to simulations
- Some vessels were making negative profits before Scheme
  - Their losses declined due to Scheme but still negative profits
  - Especially multi-vessel companies
- Now consider the two most profitable PAES allocation formulae
  - Best X of Y and Hybrid

Frequency Distribution of Difference in Allocated PAES: *Best X of Y - Hybrid*

- Most of the time, no difference between Best X of Y and Hybrid
- Best X of Y more profitable for a limited number of vessels



8. Equitable Distribution of Alternative PAES Allocation Rules



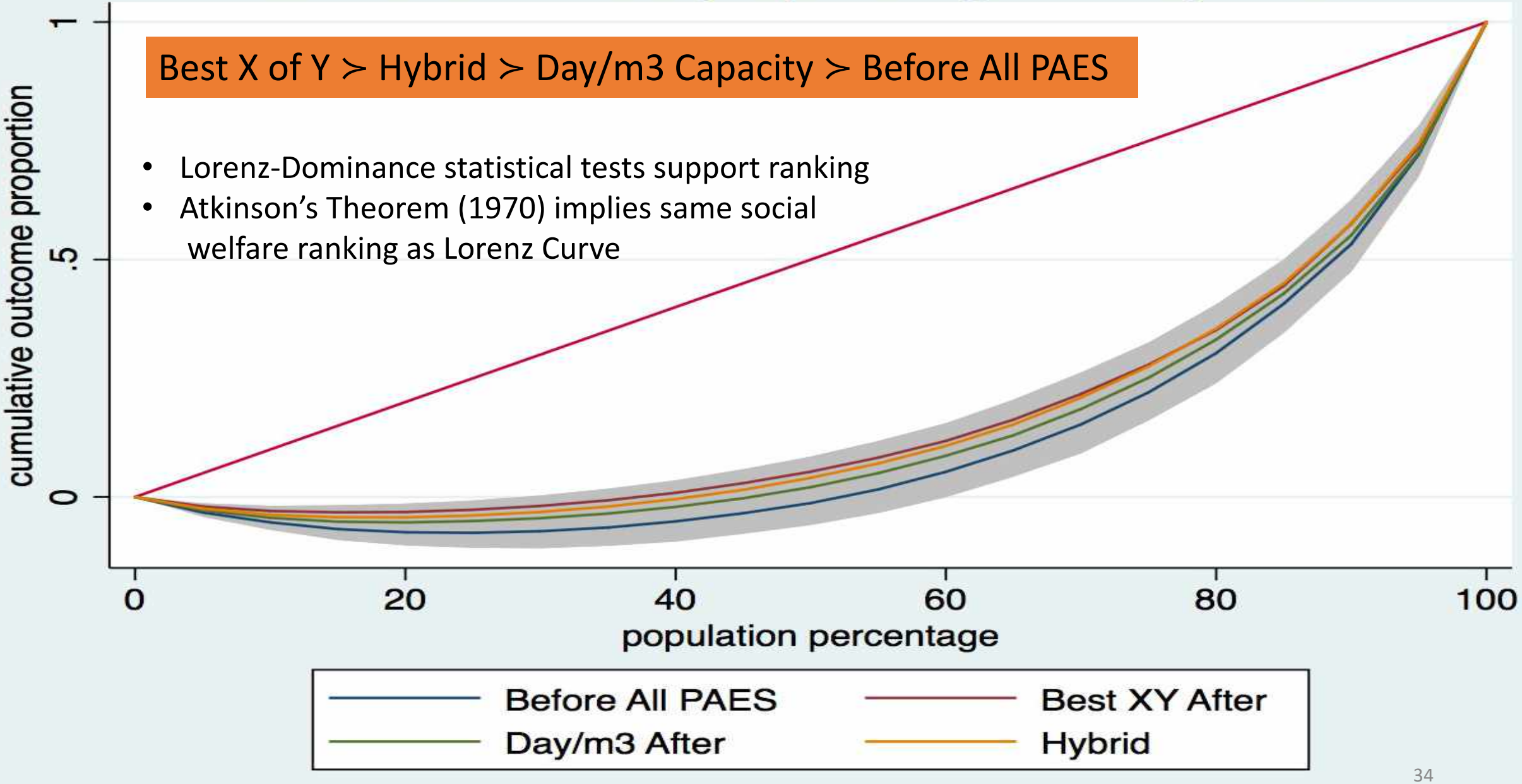
Equity = Distributive Justice for CPCs

- Evaluate all four allocations on basis of equity in impact for CPCs
- Gives distributive justice
- Different equity metrics give similar but slightly different answers
- Illustrate with Lorenz Curve

Lorenz Curve Daily Operating Profit by PAES

Best X of Y ≻ Hybrid ≻ Day/m3 Capacity ≻ Before All PAES

- Lorenz-Dominance statistical tests support ranking
- Atkinson's Theorem (1970) implies same social welfare ranking as Lorenz Curve



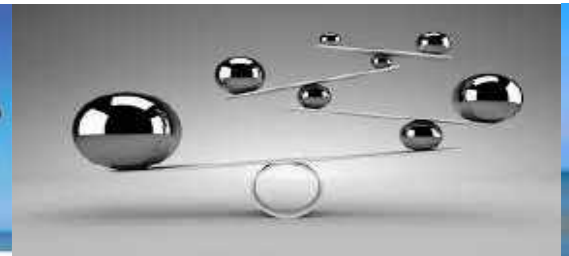
Conclusions on Equity of PAES Allocation to CPCs

- All four alternative ways to allocate PAES give a high degree of equity according to standard equity metrics.
- Ranking in equity (by different metrics) from highest to lowest equity:

Hybrid > Best X of Y > Average 3 Years > Days/m^3 Capacity

- Differences between different PAES formulae are statistically significant but very slight
- Narrow down to Hybrid and Best X of Y





9. Summary

No Vessel or CPC Lose Daily Vessel Operating Profit, Most Vessels and All Processors Gain

- Scheme increases overall profitability of fishery
- No vessels lose daily vessel operating profit
- Vessels in multi-vessel companies gain the most daily vessel operating profit
- Processors and their CPCs gain from year-round supply of EPO-caught fish they can balance against imports
- Some CPCs gain more daily vessel operating profit than others, but none lose

Summary of PAES Allocation Rules

1. All PAES formulae give fair shares
2. All four PAES allocation rules designed by most appropriate fair distribution rule with best properties: proportionality
3. All four PAES allocation rules give close rankings in equity of distribution
4. Best X of Y and Hybrid give best combination of economic efficiency and equity in distribution to CPCs (distributive justice)
5. Hybrid has added advantage of extra fairness and flexibility of choice

- Result is choice between two efficient, fair, and equitable allocation rules

10. Recommendations

Address Two Critical Issues

- Transferable Day Credit Scheme address two critical issues:
- 1. First step in two-part Plan of Action to Manage Fishing Capacity in the EPO
  - Second step is vessel buybacks
- 2. Gives flexible, year-round fishing and increased profitability for most vessels, especially those in multi-vessel companies,
  - Replaces 72-day (or longer) time-area closure
  - No vessel loses and majority gain in daily vessel operating profit
  - Processors gain from year-round supply of EPO-caught fish



Thanks!.....Questions ?