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Mitigation measures to reduce bycatches: an economic point of view in terms of ecosystem services

• HÉLÈNE GOMES

1. Introduction

General context

- Common dolphin bycatch [1], [2]



Illustration of common dolphin (*Delphinus delphis*) [3]

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- Bycatch mitigation measures [5]



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1. Introduction

Case study

- Spanish Basque fishery

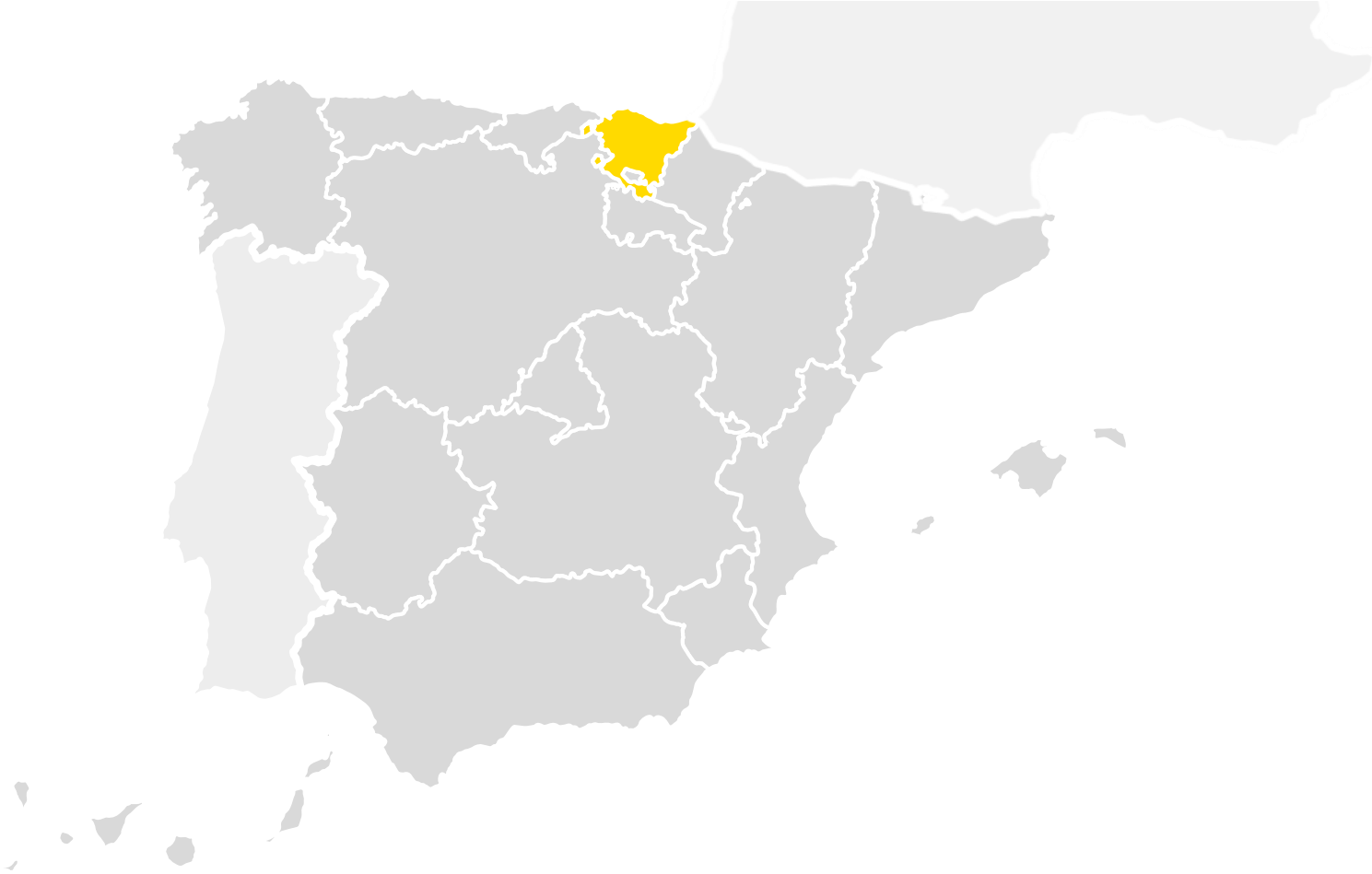


Map of Europe

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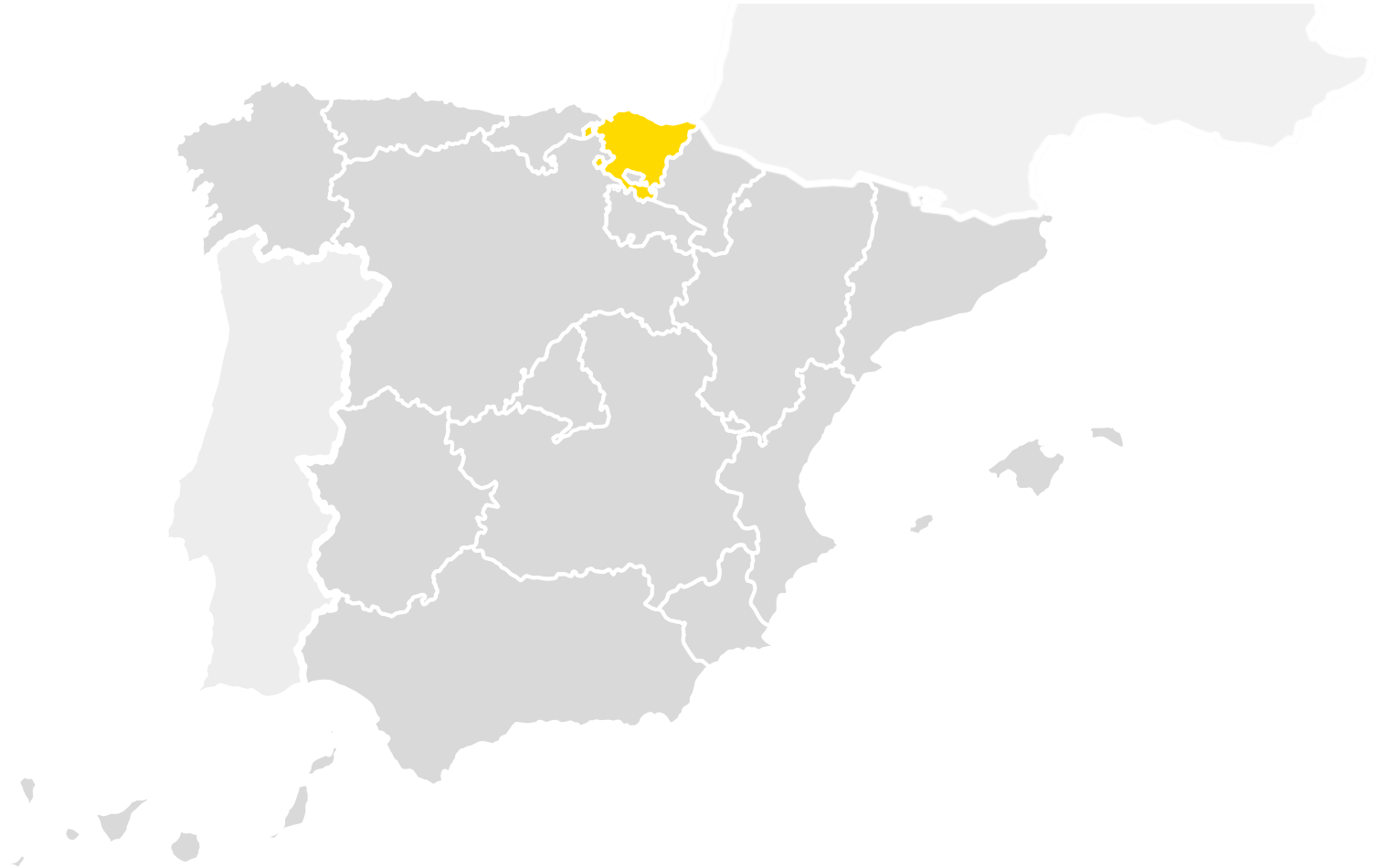


Map of Spain

1. Introduction

Case study

- Spanish Basque fishery
- 114 boats

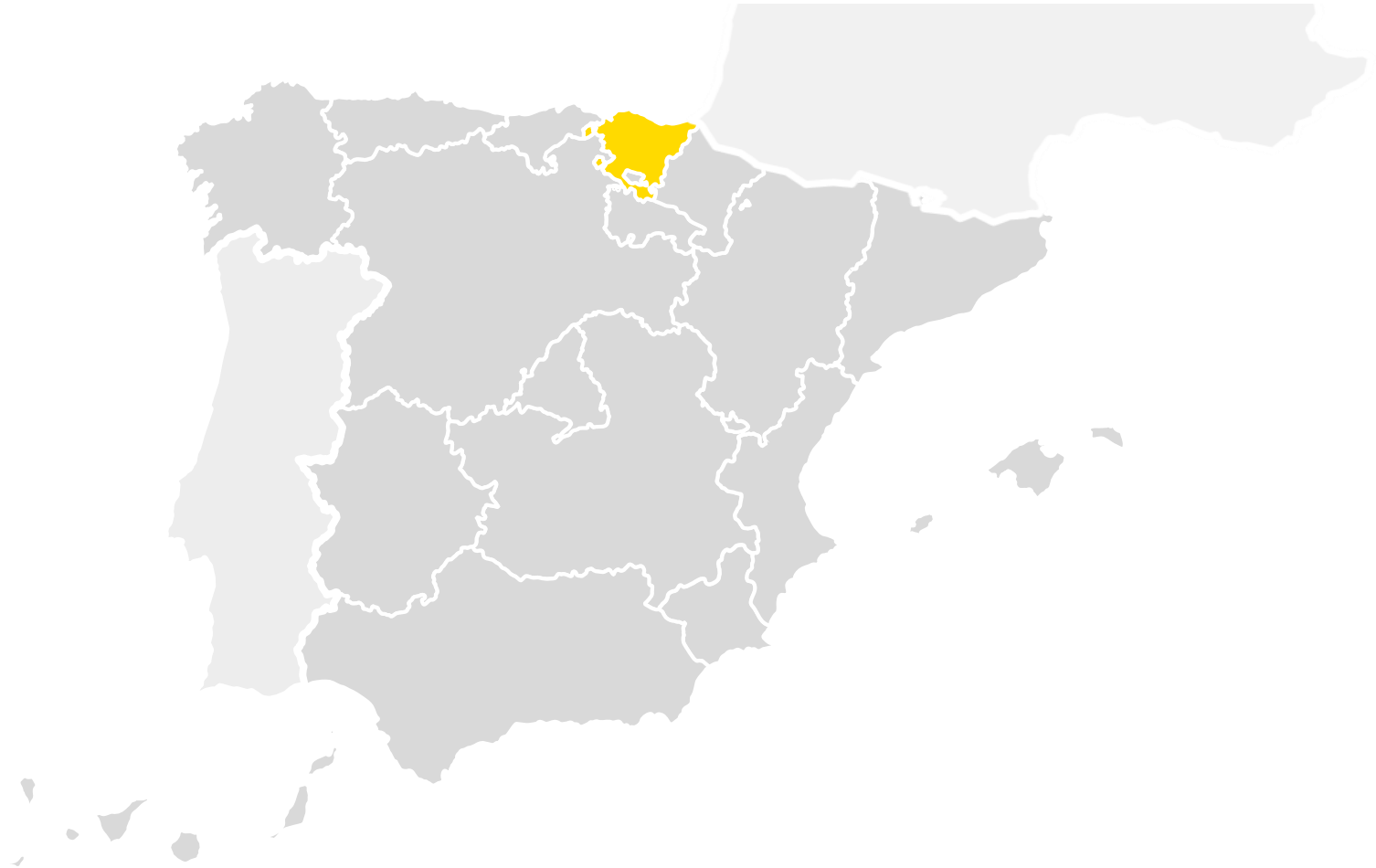


Map of Spain

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Case study

- Spanish Basque fishery
- 114 boats
- ≈ 40 million $\text{€}\cdot\text{year}^{-1}$

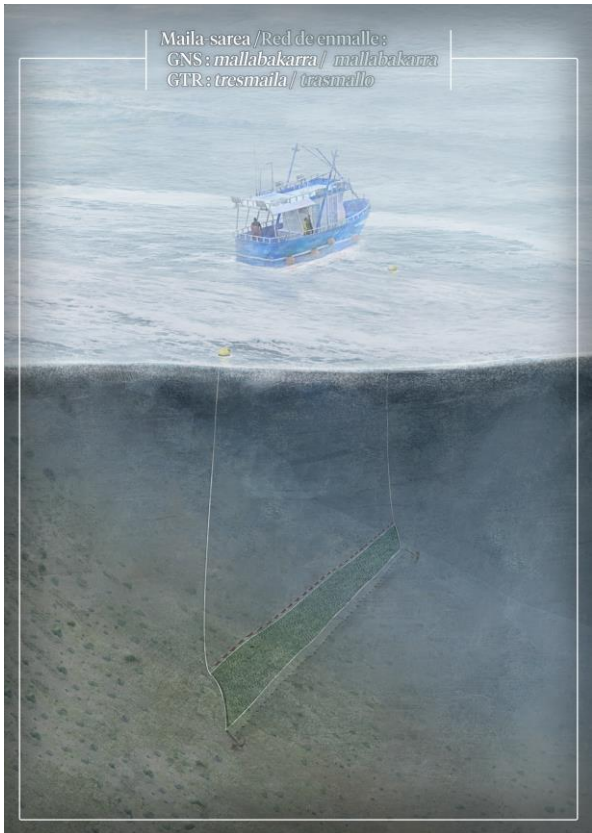
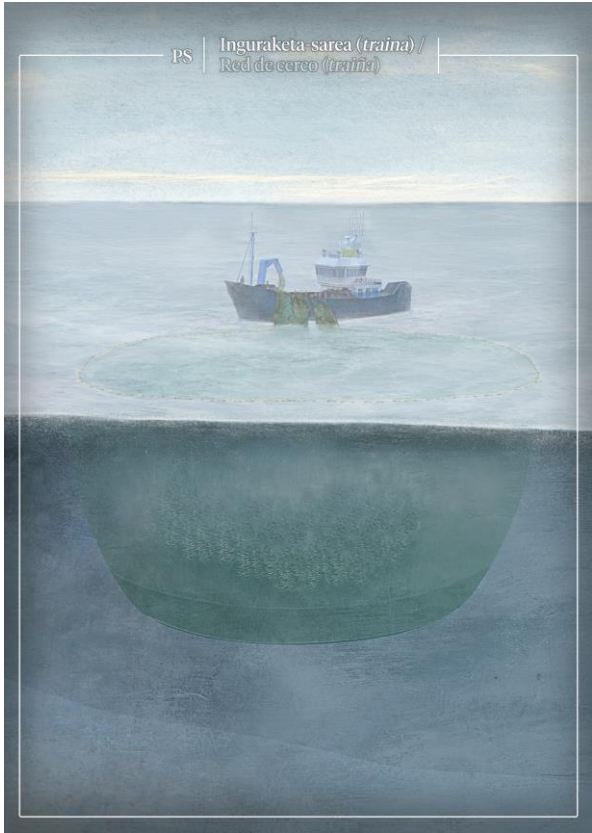


Map of Spain

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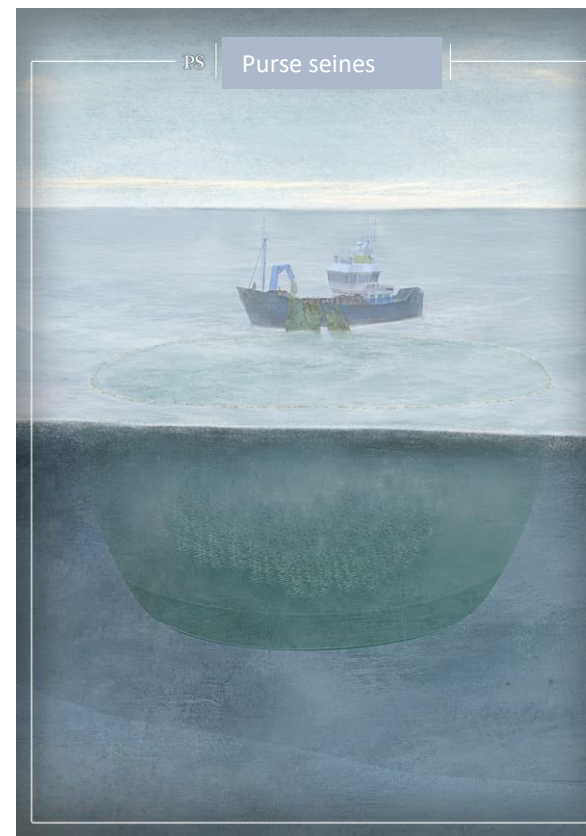
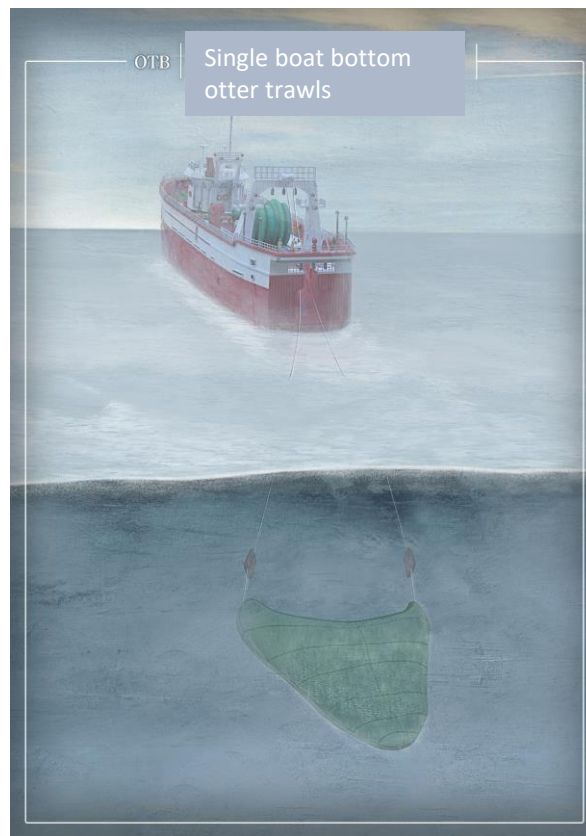
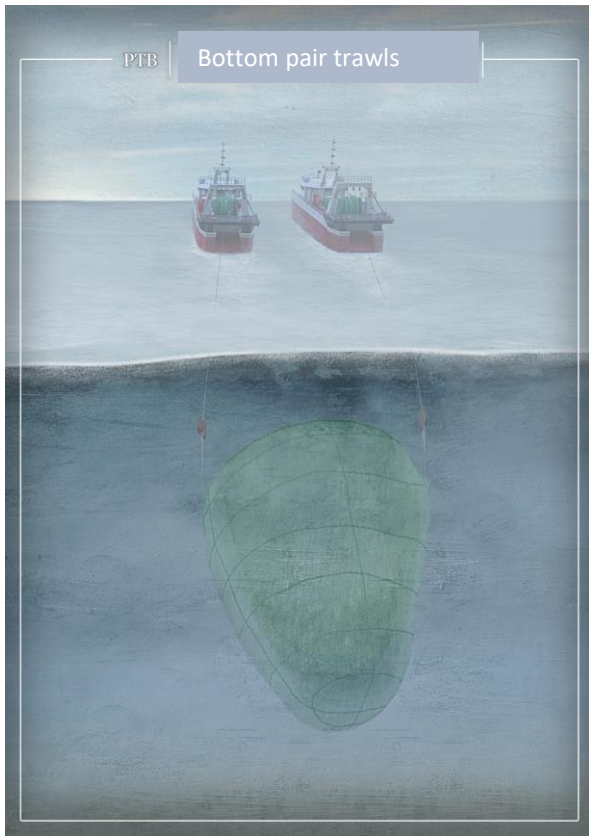


Illustrations of Basque fishing gears

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Illustrations of Basque fishing gears

2. Material and methods

Data

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- Fisheries: catches and effort per fishing gear (2020-2022)

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- Bycatch rate ^[1]

Fishing gear	GNS	GTR	OTB	PS	PTB
Bycatch rate (animals.days-at-sea observed ⁻¹)	0.008	0.013	0.004	0.018	0.154

[1] ICES, 2023

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- Pingers



Illustration of pinger [2]

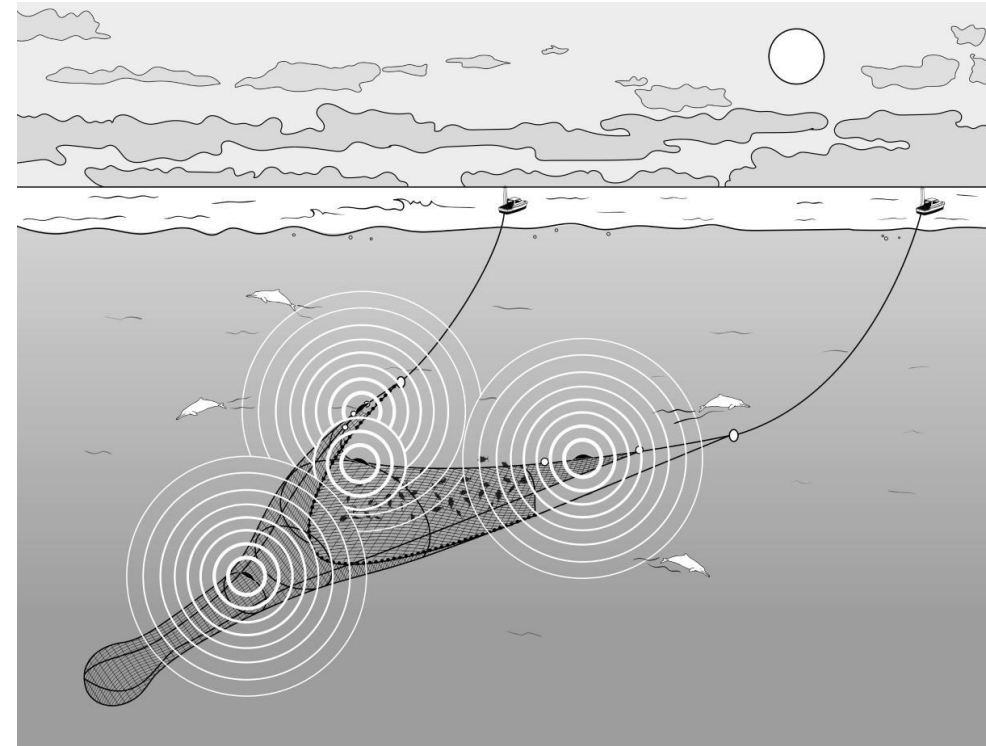


Illustration of how pingers work [3]

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[2] Puente et al., 2023

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FAO (2020-2022) ^[3]

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Scenarios

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Scenario	Closing period	Pinger on PTB
A	01/12-31/03	No
C	15/01-15/03	No
D	15/01-28/02	No
G	15/01-28/02 (excepted PTB)	Yes (all year)
H	15/01-28/02	Yes
L	15/01-15/03	Yes
M	01/12-31/03	Yes
N	01/01-31/01 & 15/07-15/08	Yes
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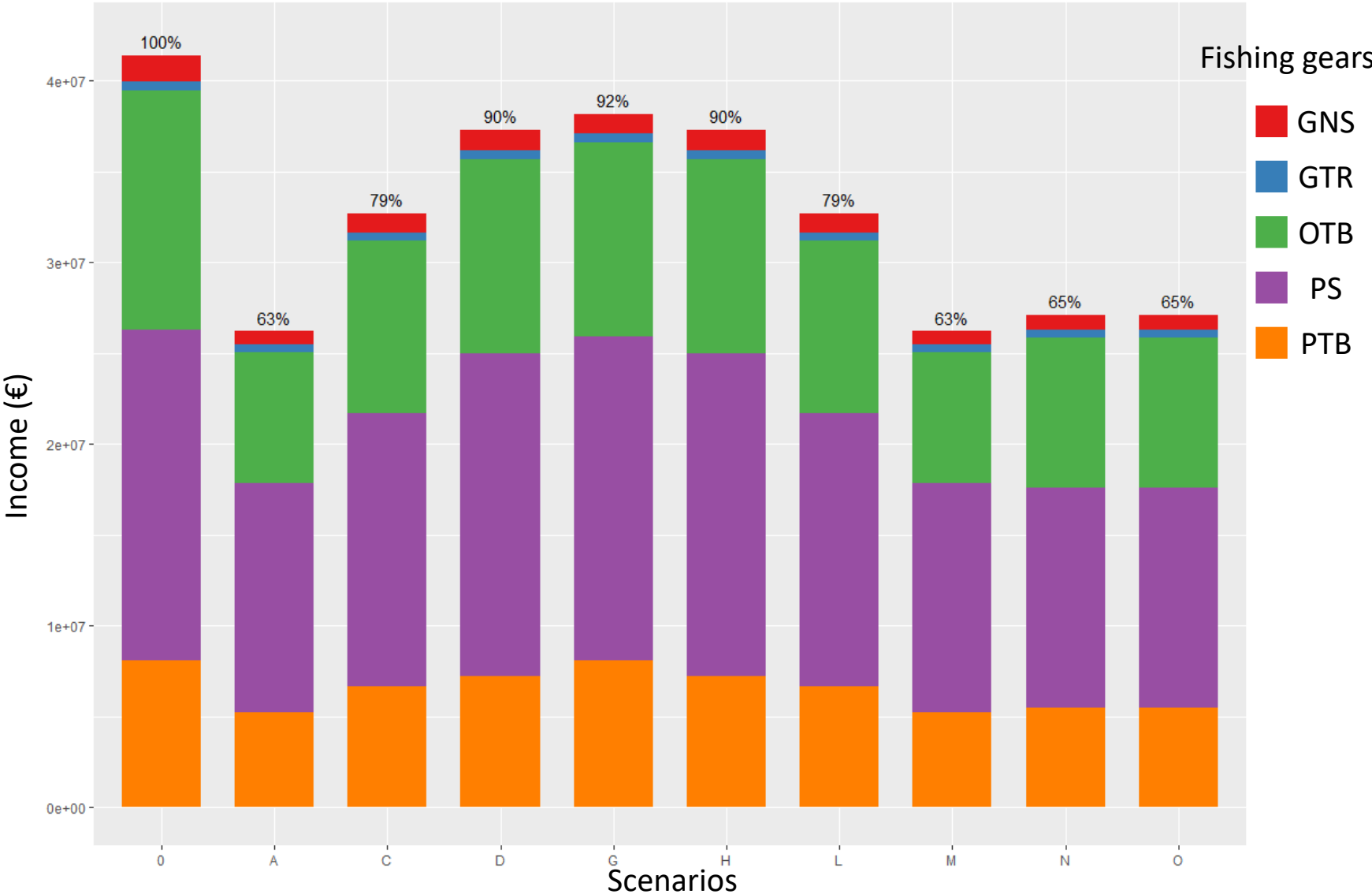
$$D_{fg,s} = \sum_{t_s=t_0}^T E_{ffg}(t_s) * r_{fg}$$

- Shadow price

$$pS_{fg,s} = \frac{(I_{fg,0} - I_{fg,s})}{(D_{fg,0} - D_{fg,s})}$$

3. Results

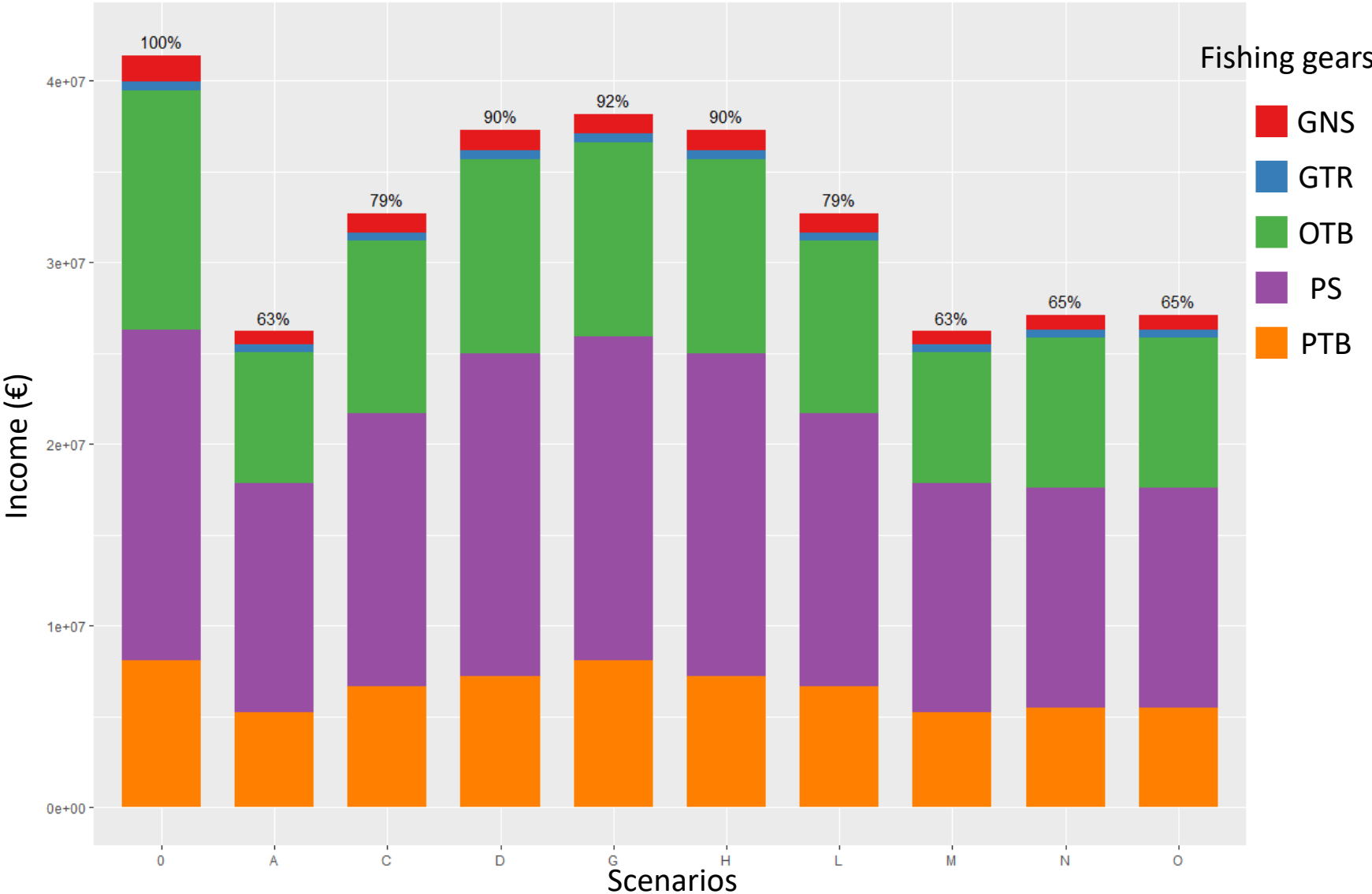
Fishery income



3. Results

Fishery income

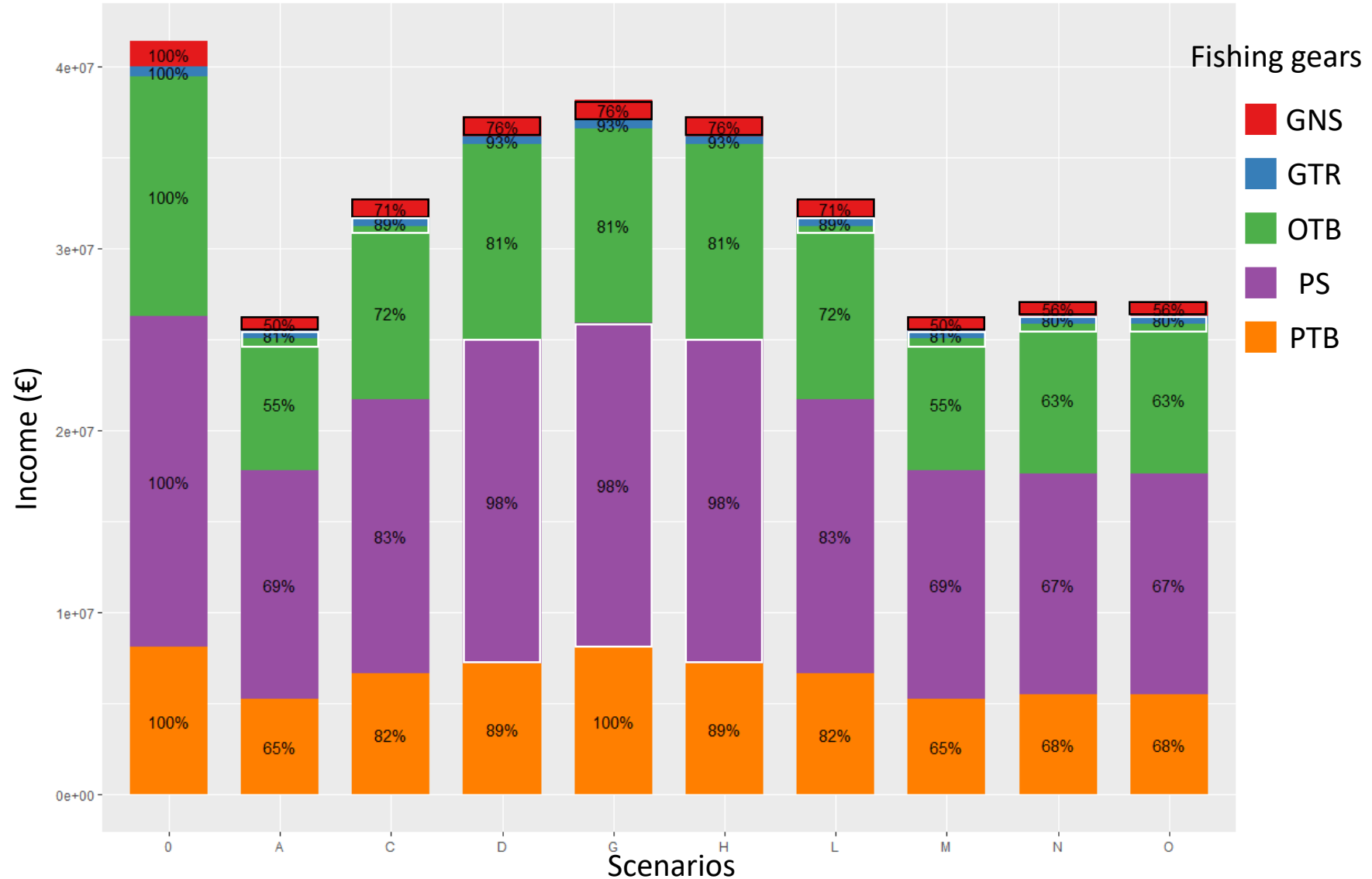
- Least: GTR
- Most: PS



3. Results

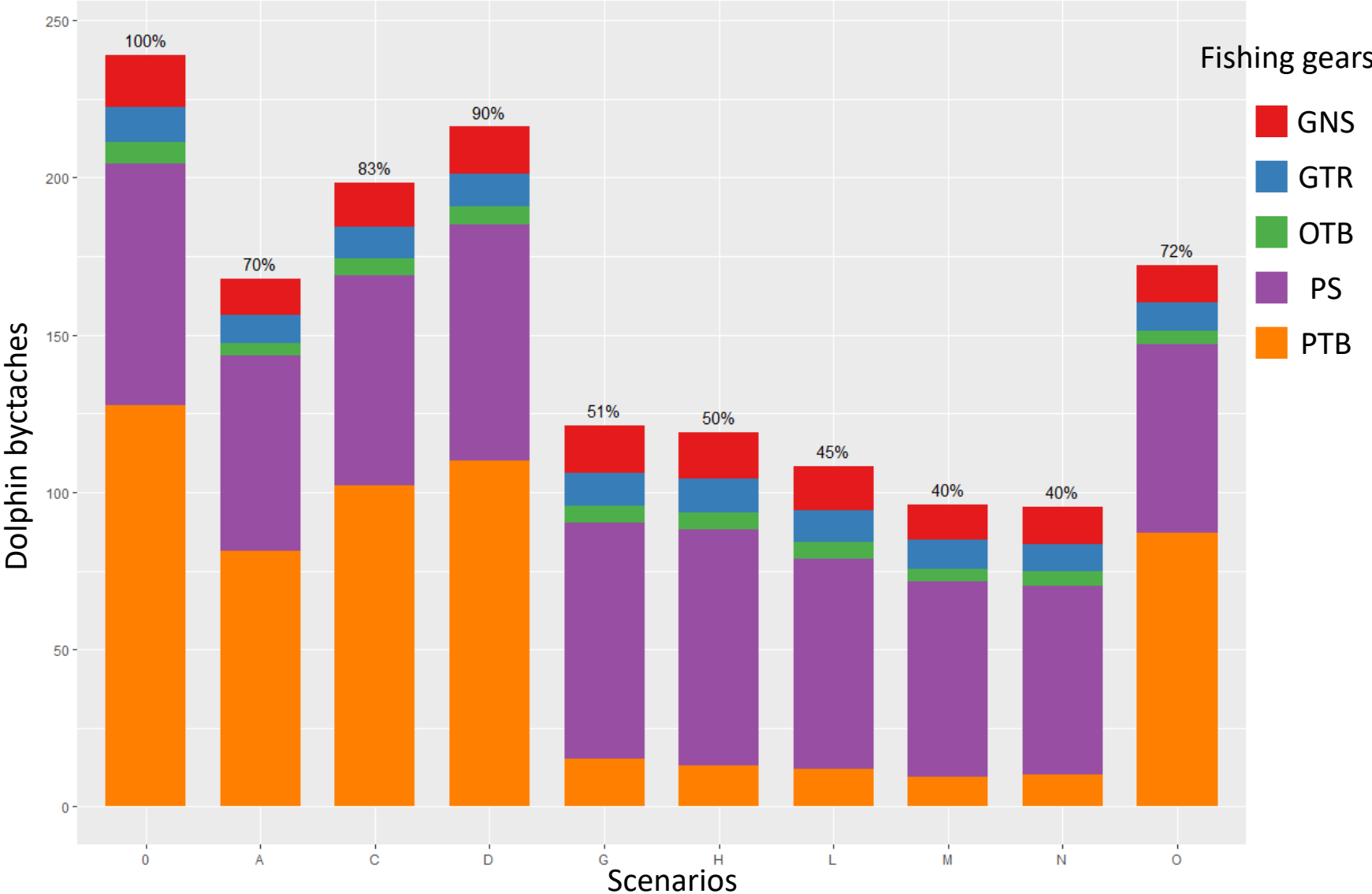
Fishery income

- Least affected: GTR/PS
- Most affected: GNS



3. Results

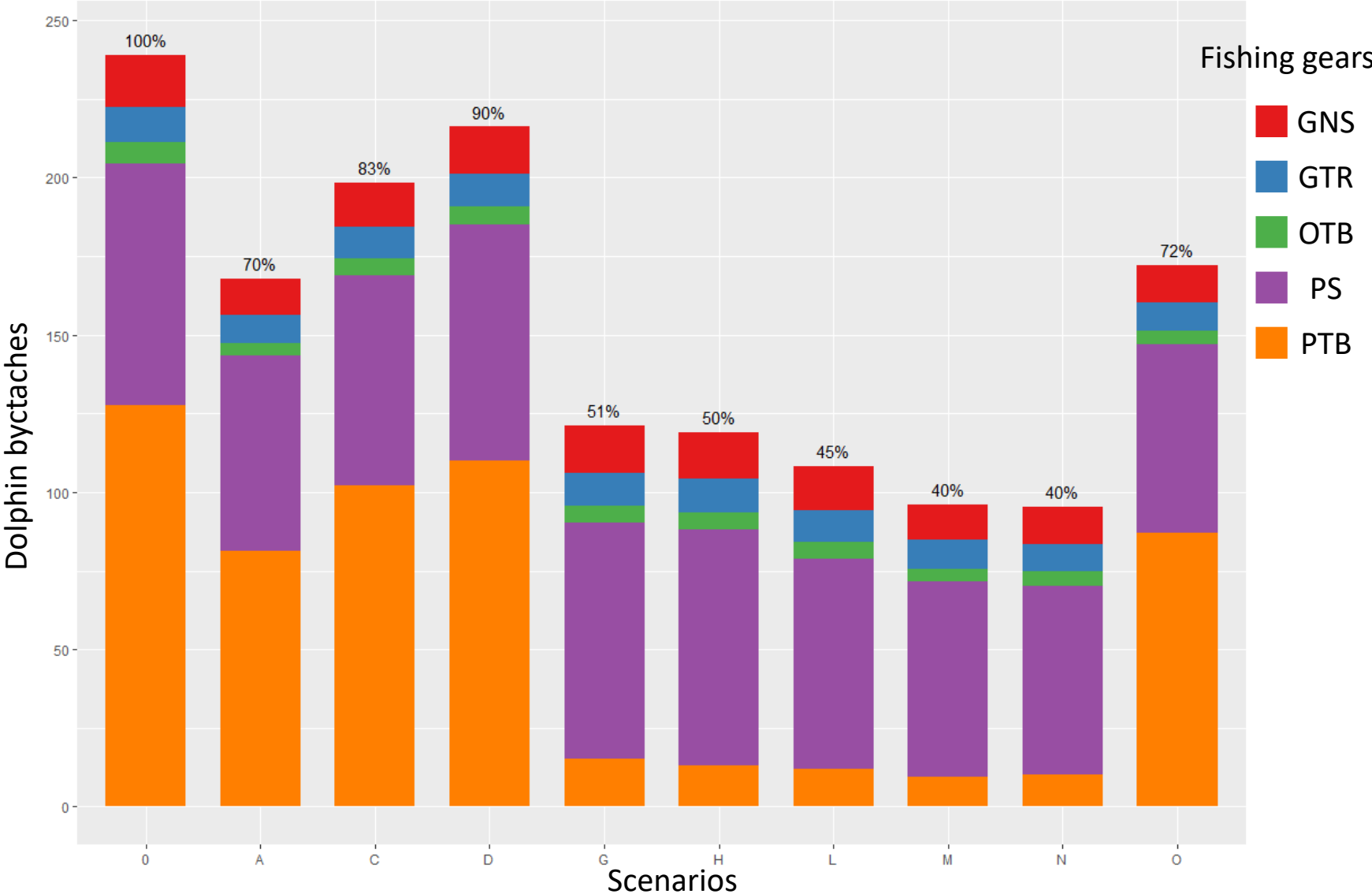
Dolphin bycatches



3. Results

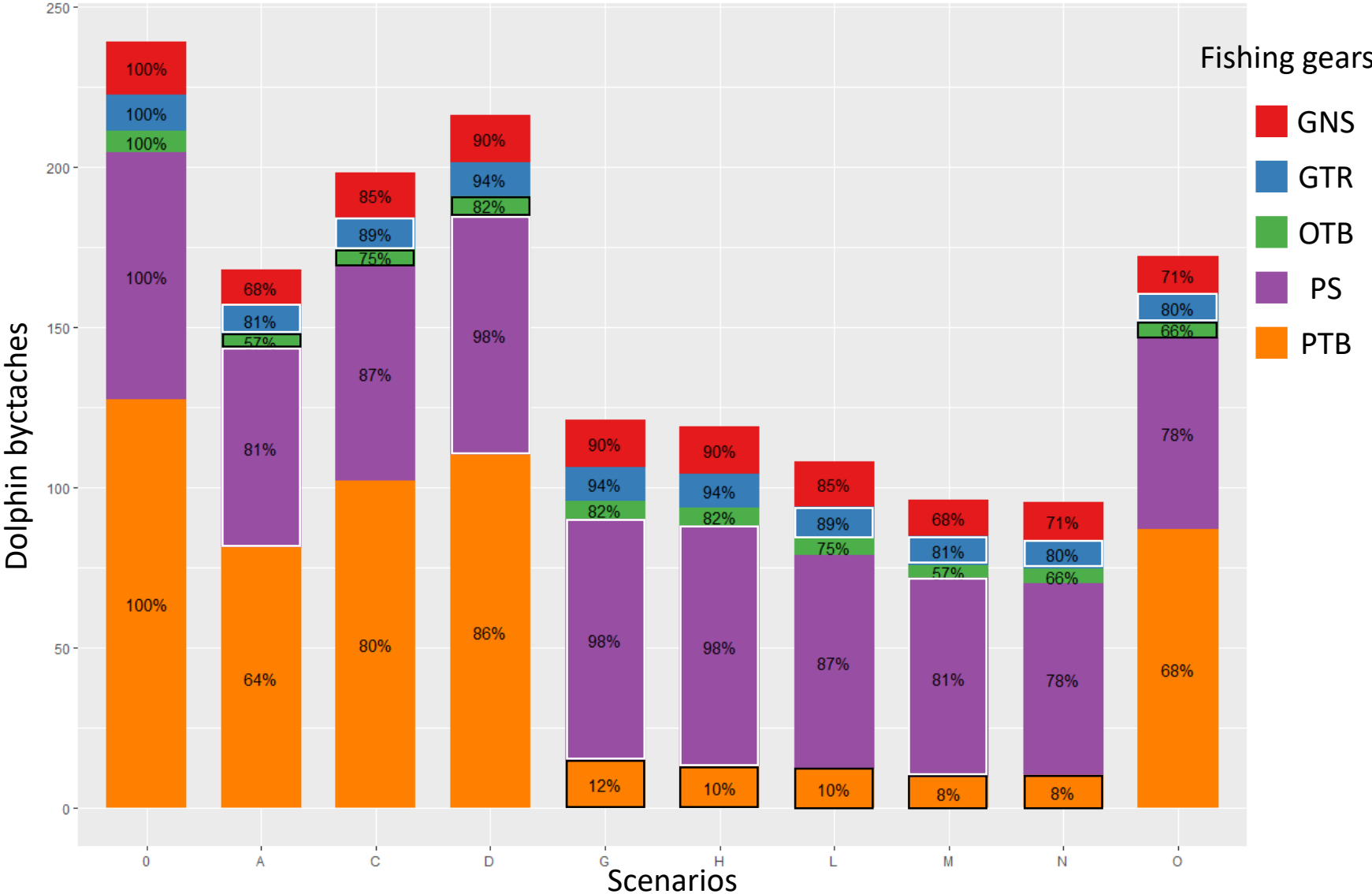
Dolphin bycatches

- Least: OTB
- Most: PTB/PS



3. Results

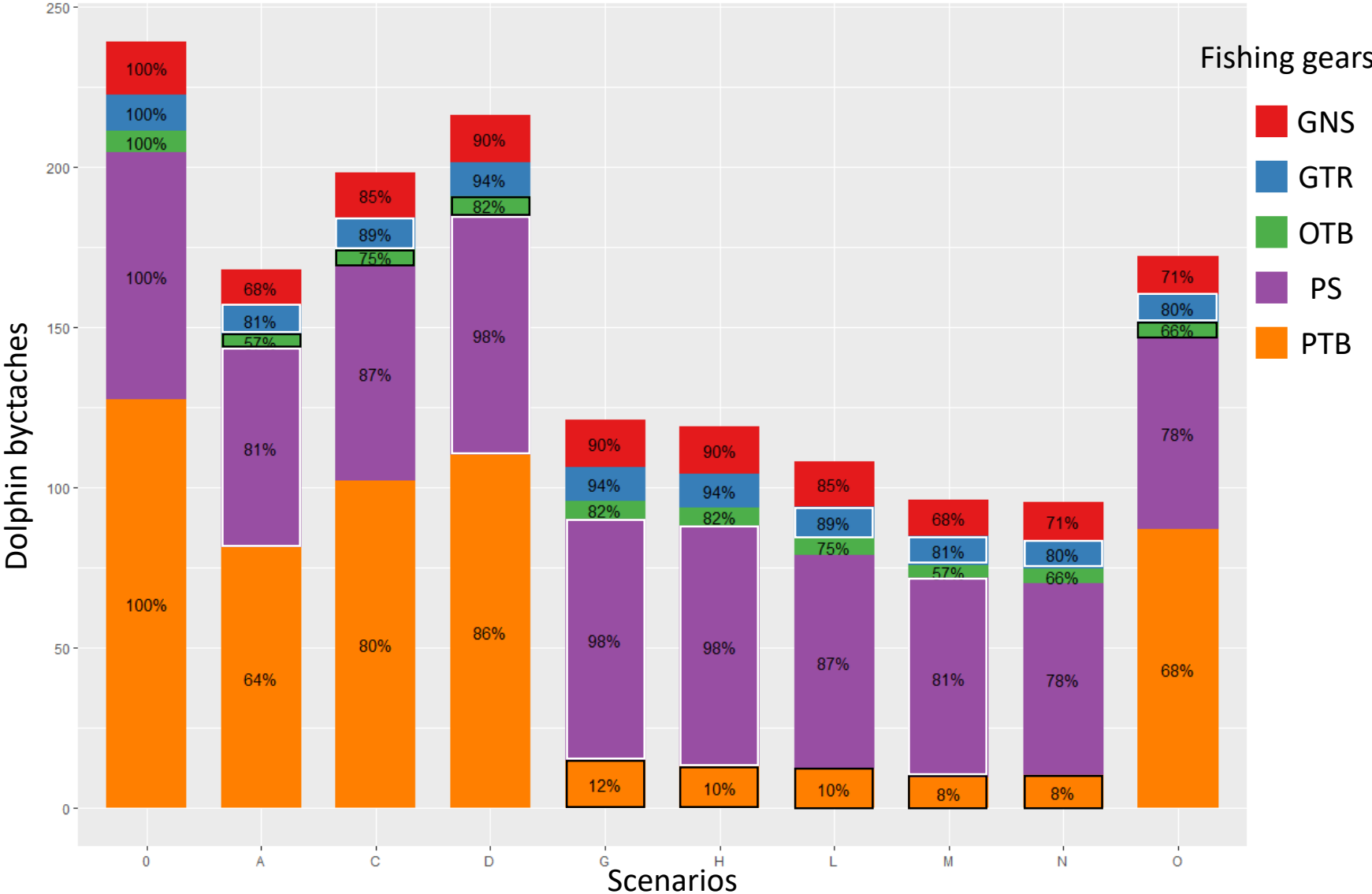
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Dolphin bycatches

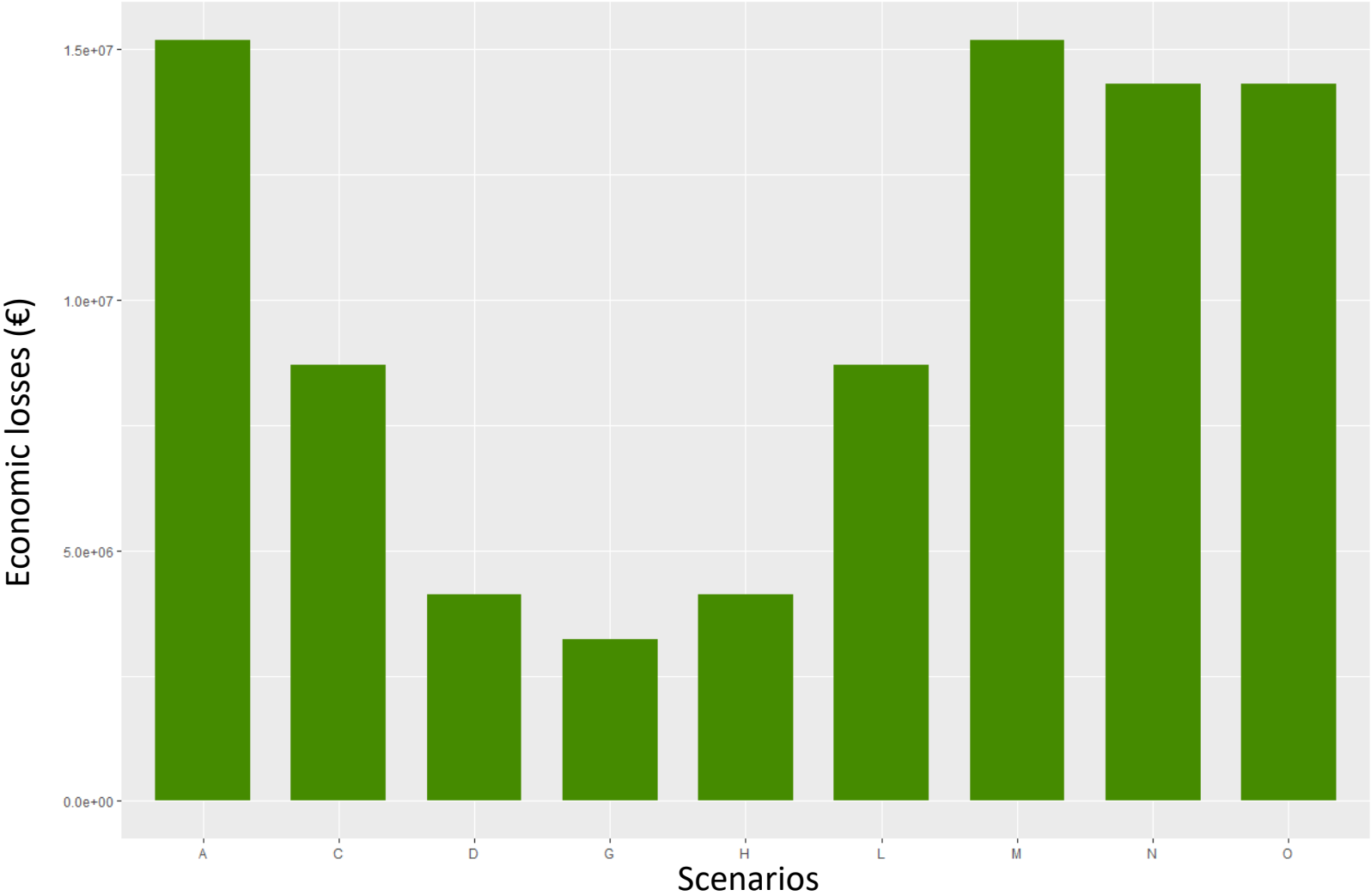
● Pingers



4. Discussion

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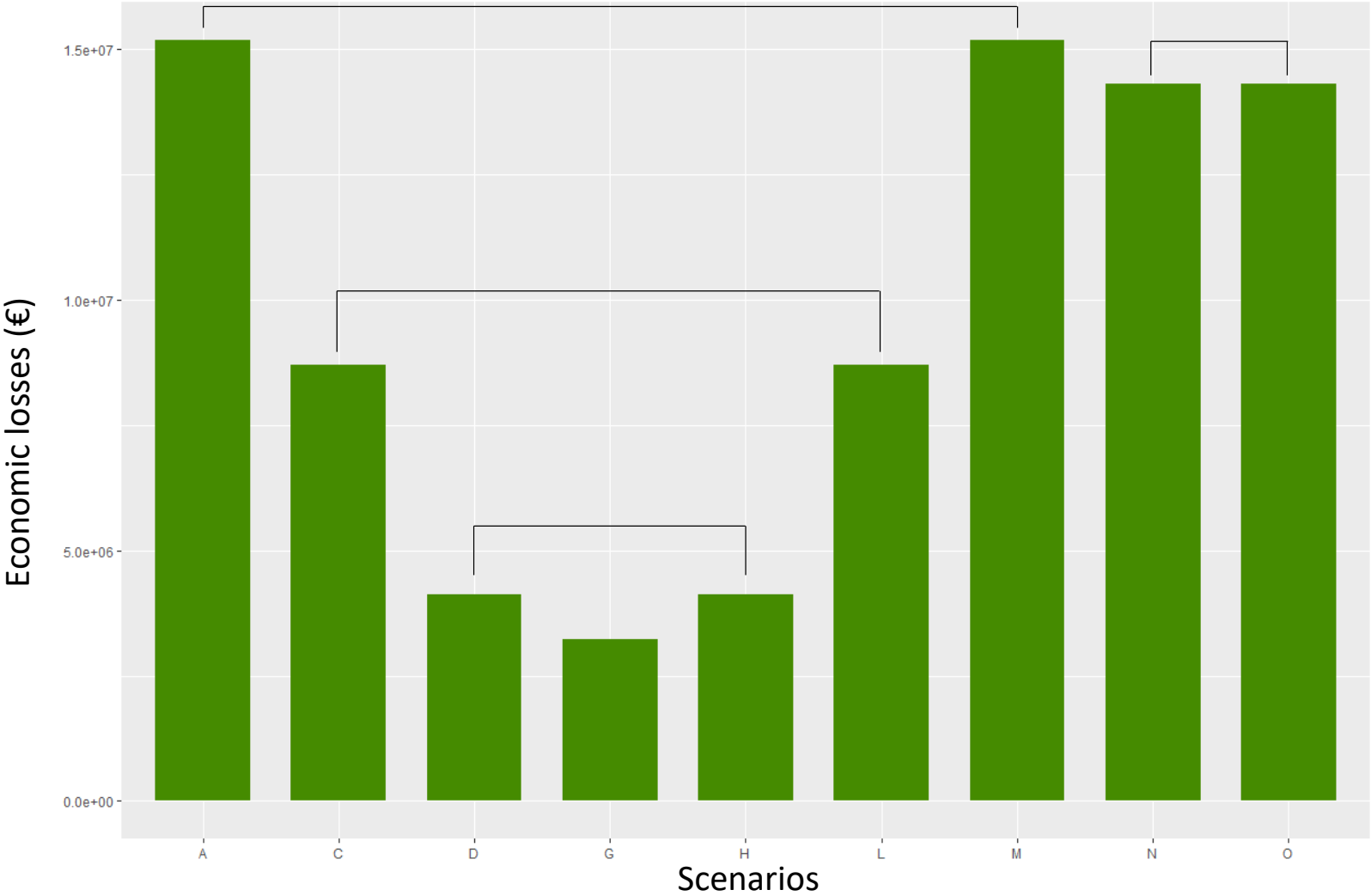
Economic losses



4. Discussion

Economic losses

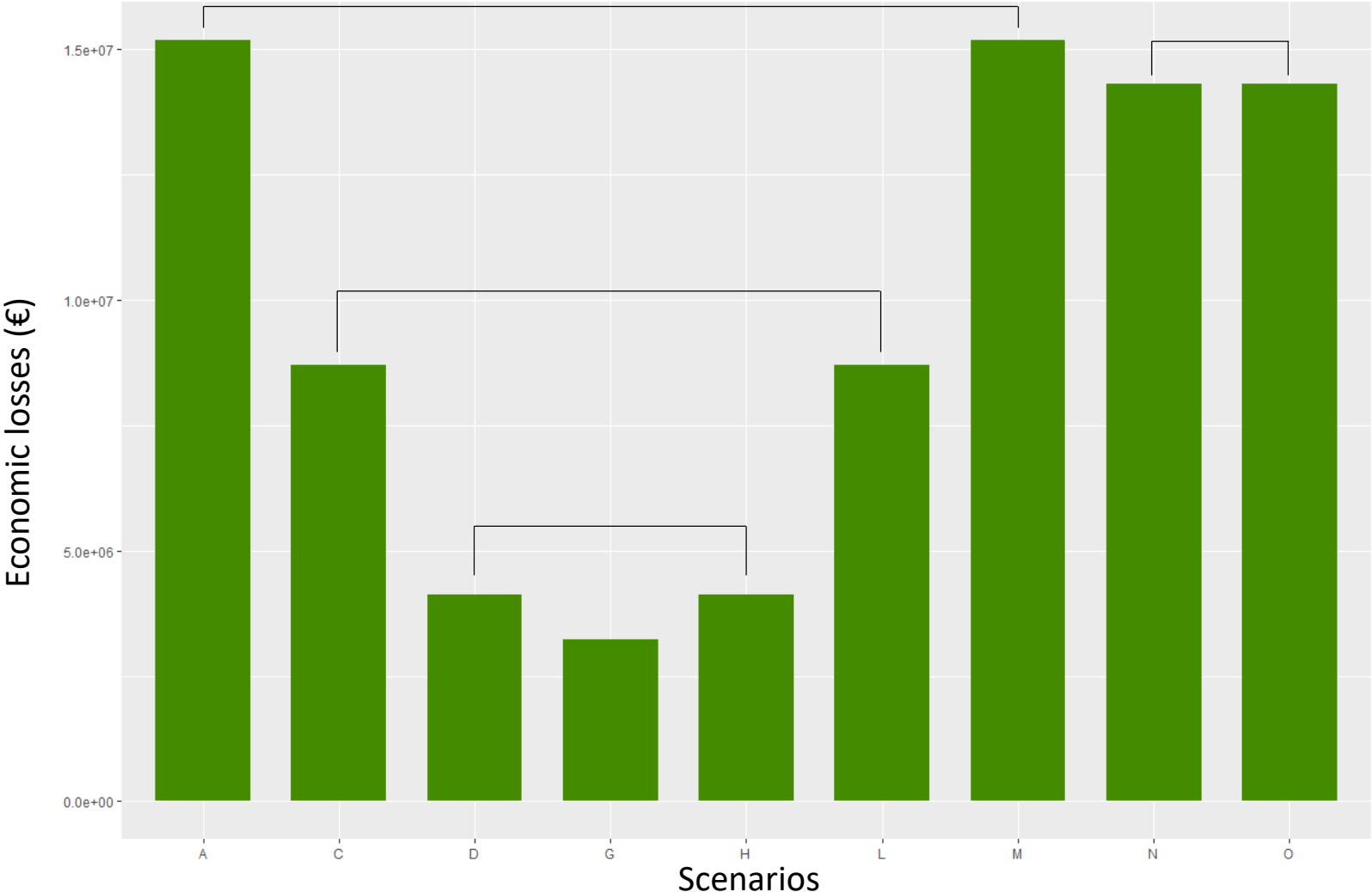
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Economic losses

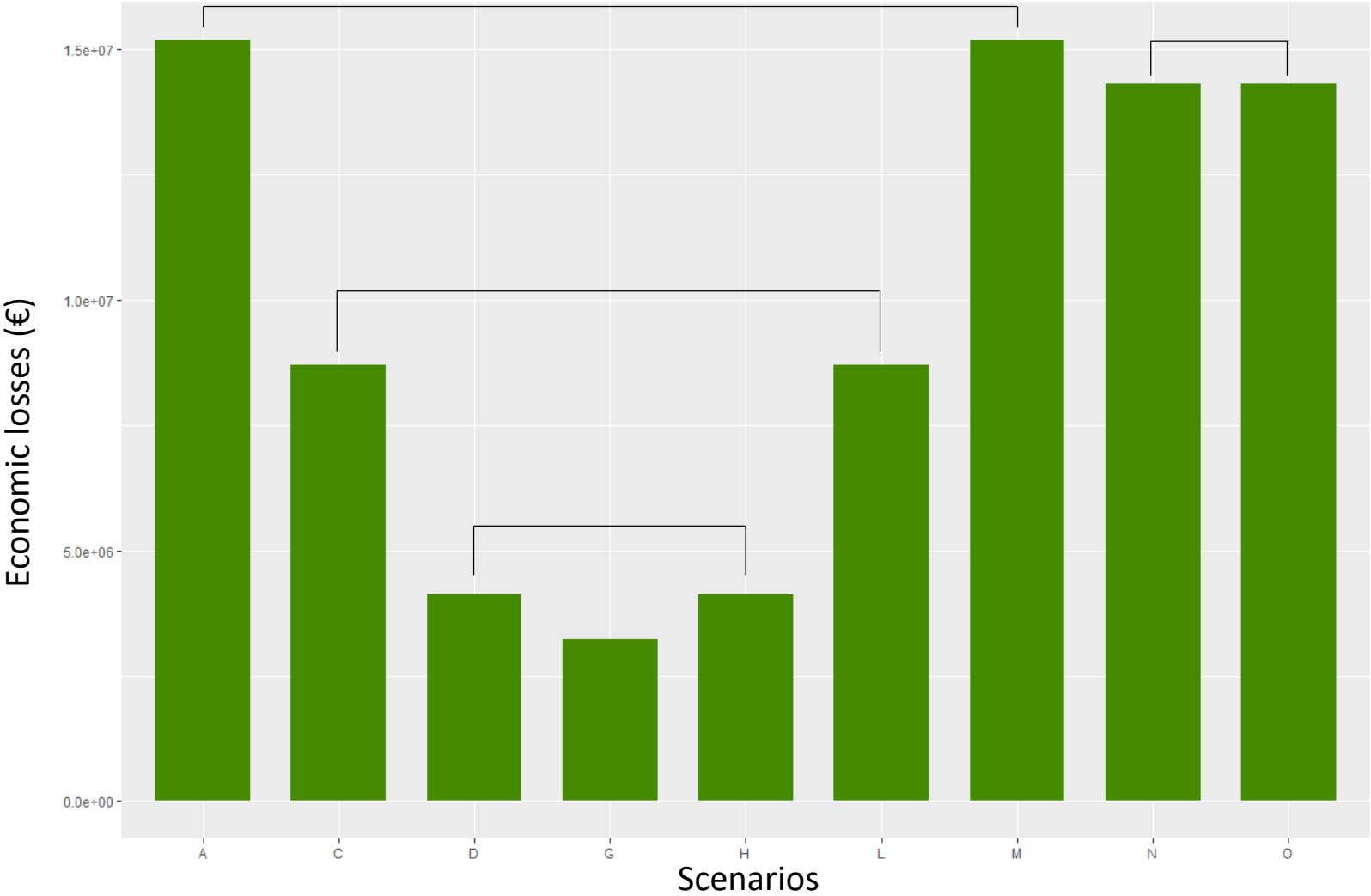
- Pingers
- Shorter closing period lower € losses



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Economic losses

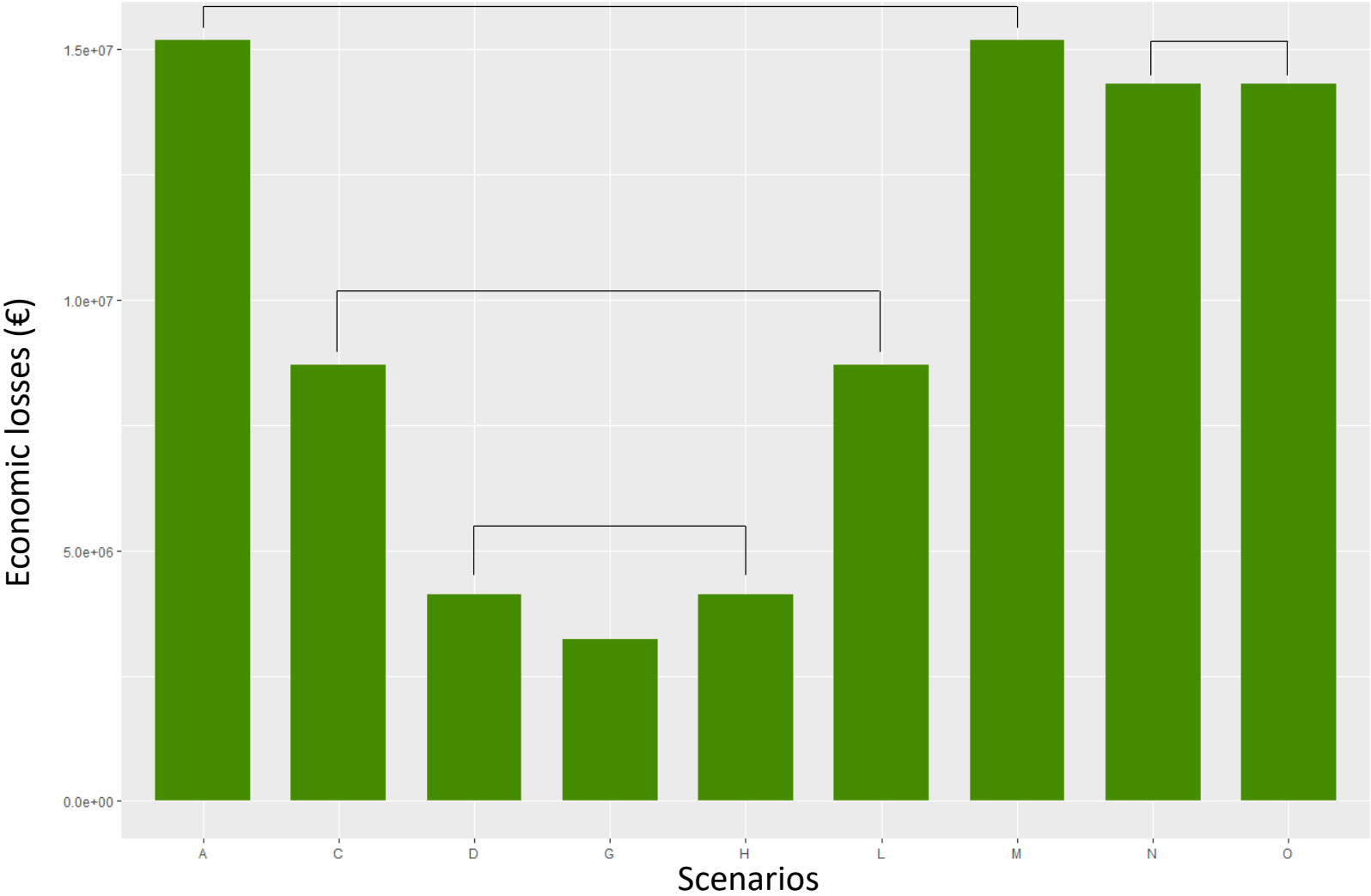
- Pingers
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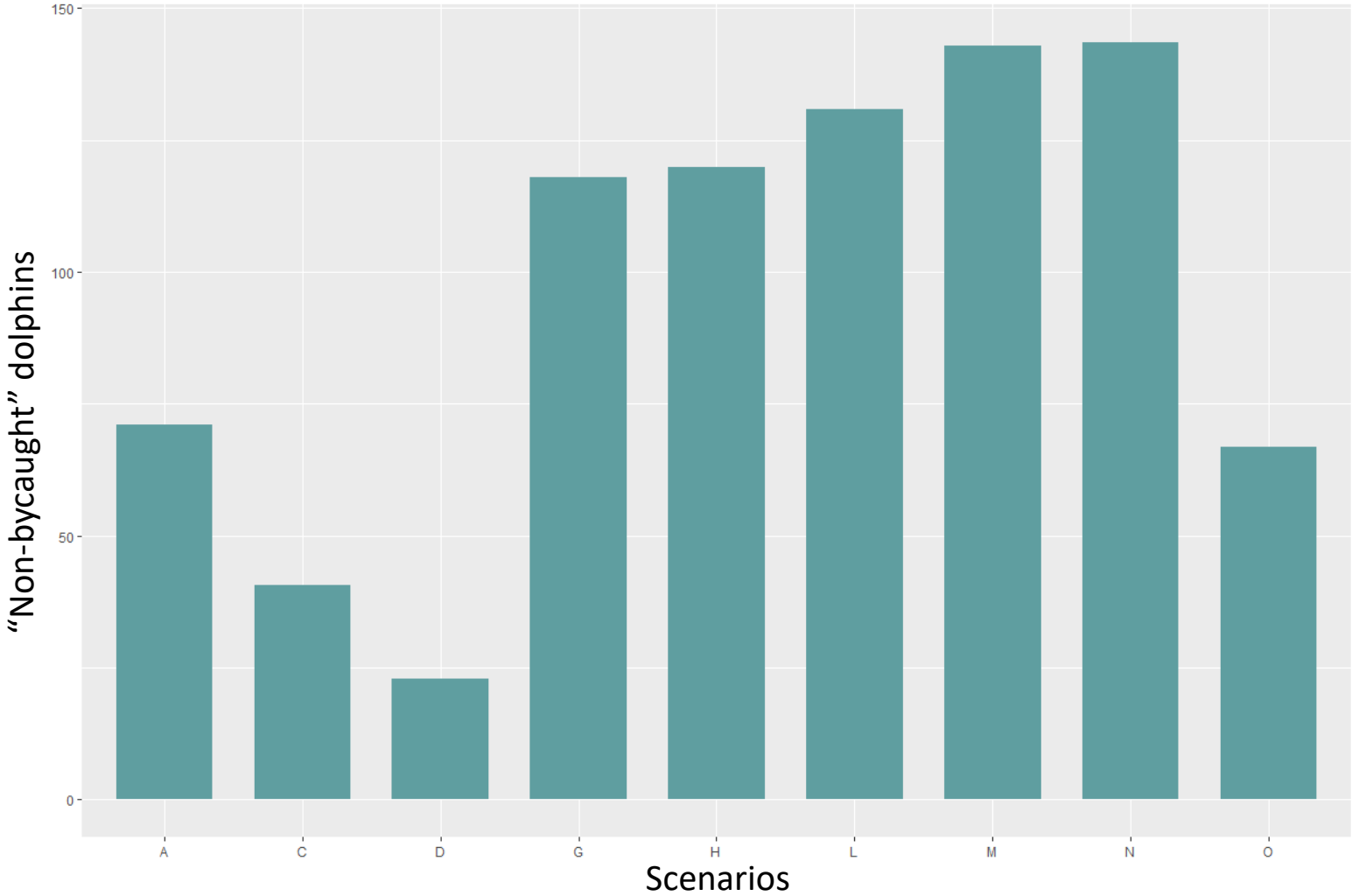
Economic losses

- Pingers
- Shorter closing period lower € losses
- Better € perf. in dec. than in the summer
- Scenario G



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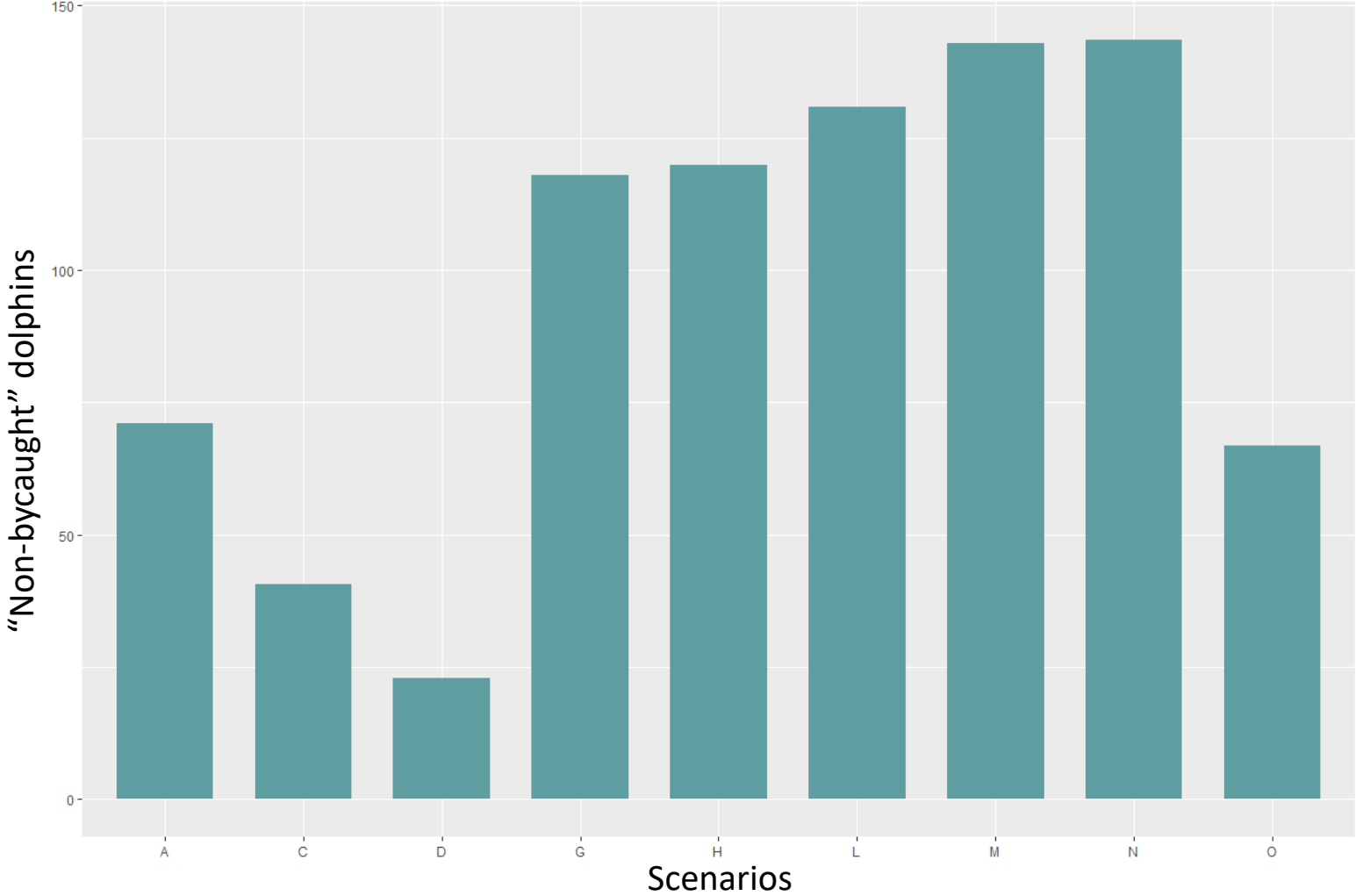
“Non-bycaught” dolphins



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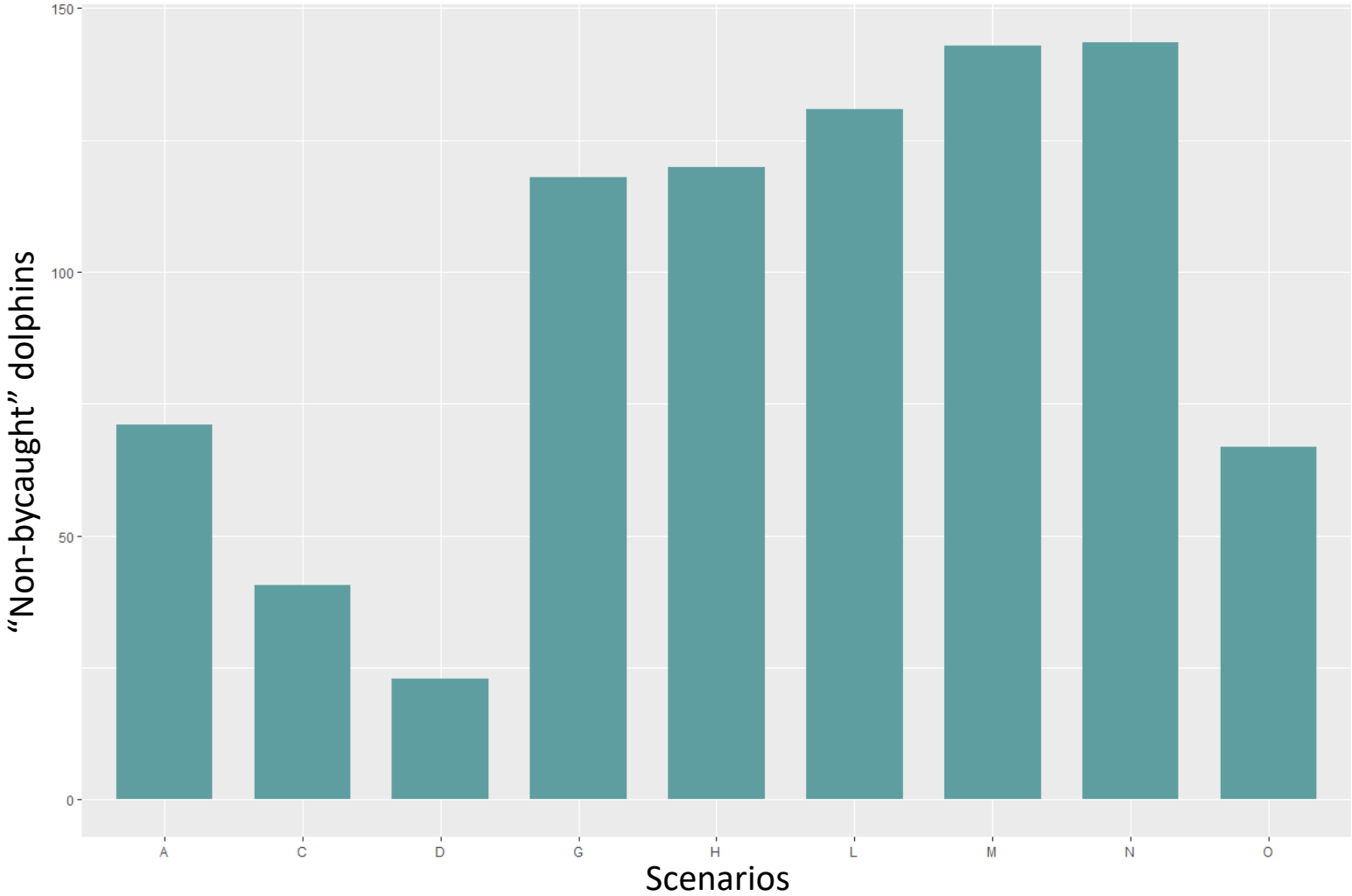
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“Non-bycaught” dolphins

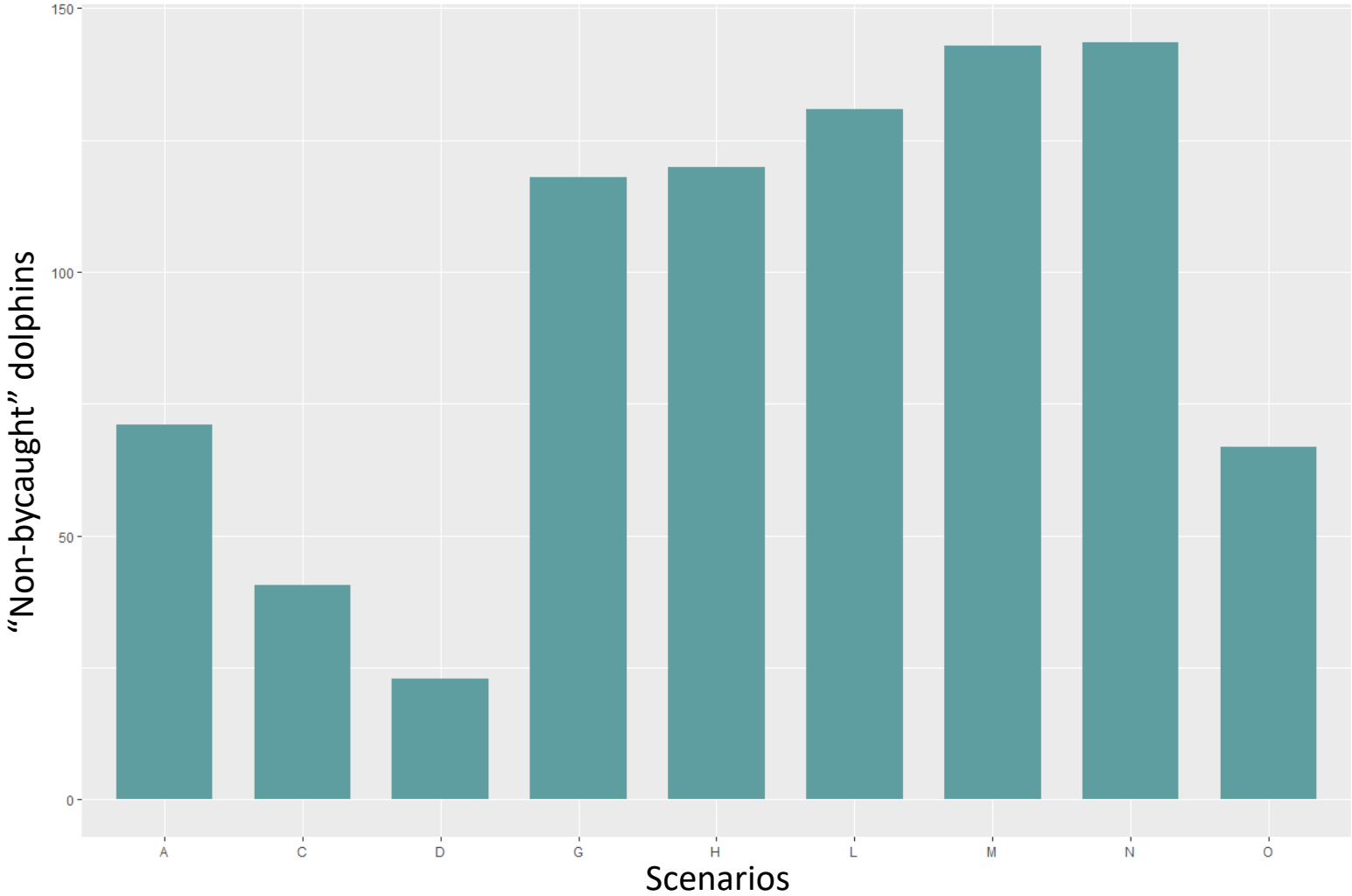
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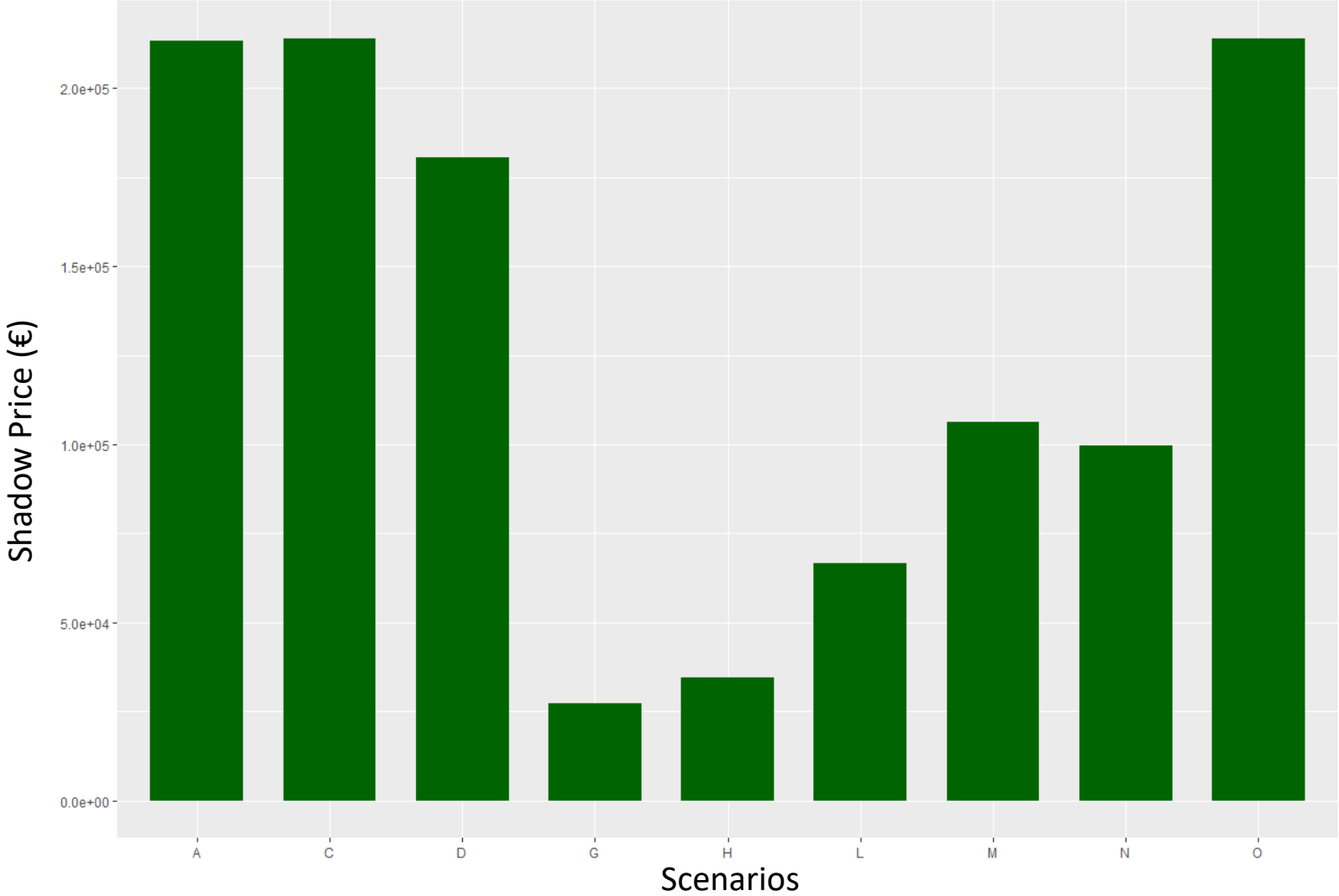
“Non-bycaught” dolphins

- Pingers
- Shorter closing period lower “non-bycaught” dolphins
- Scenario N



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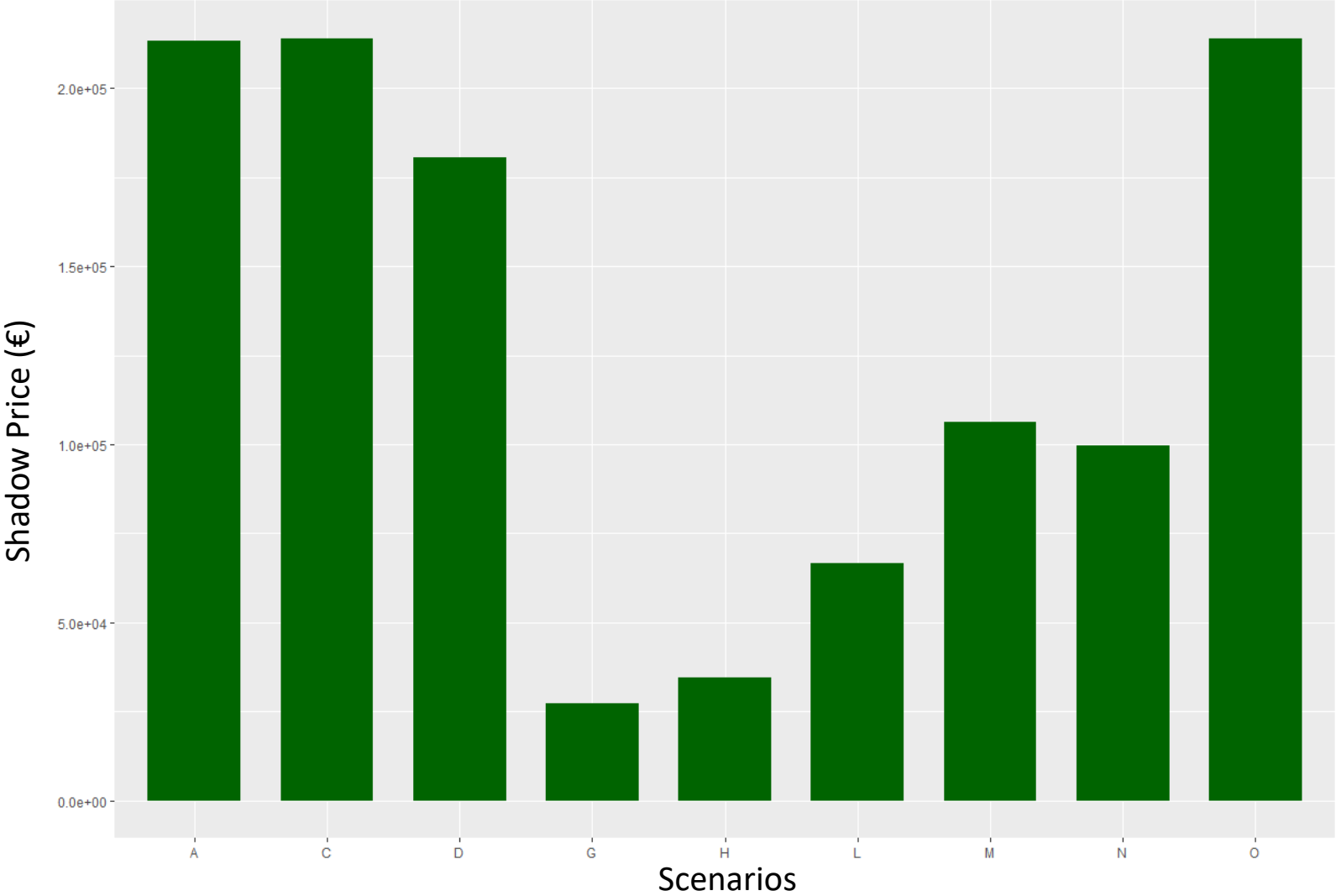
Shadow price



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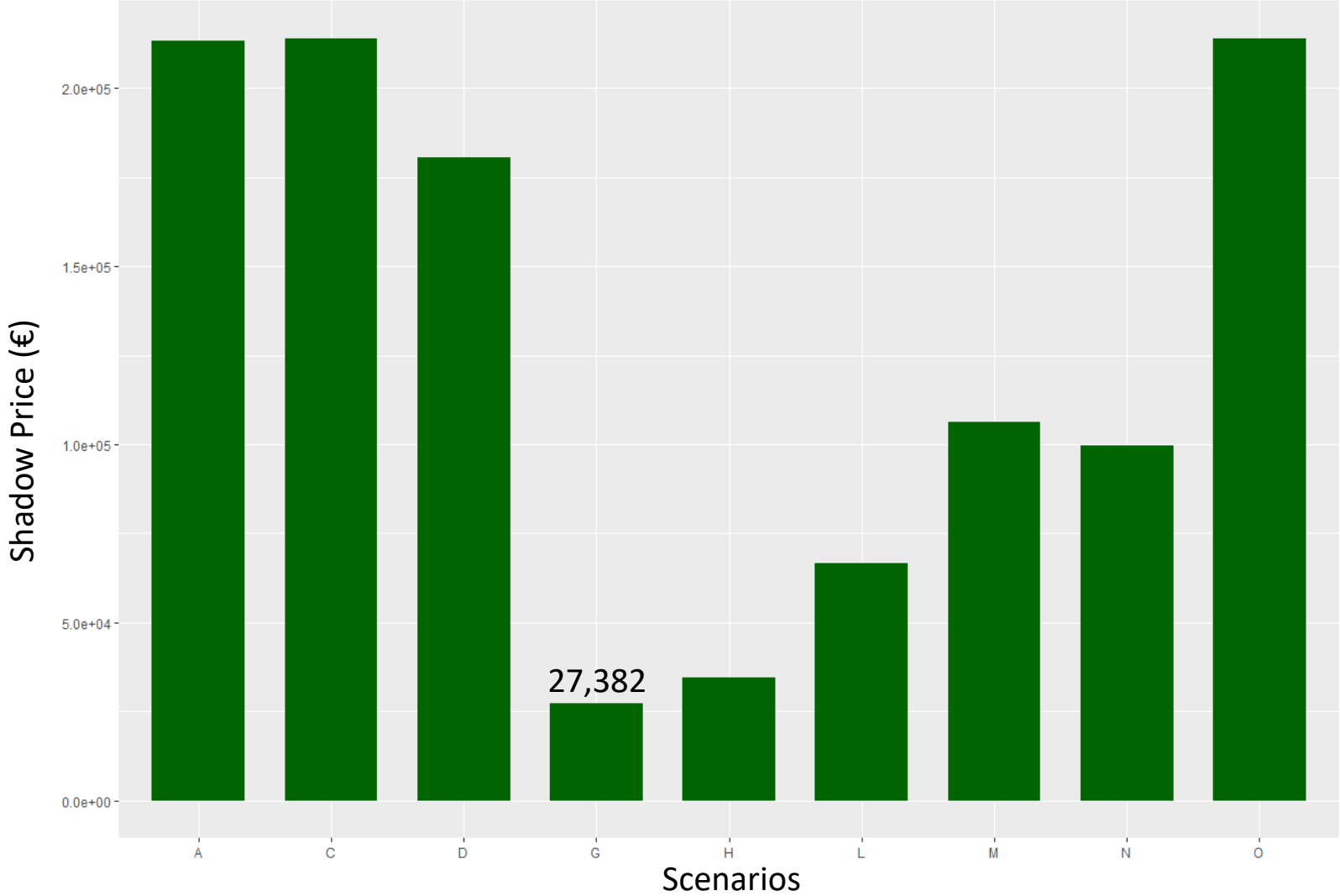
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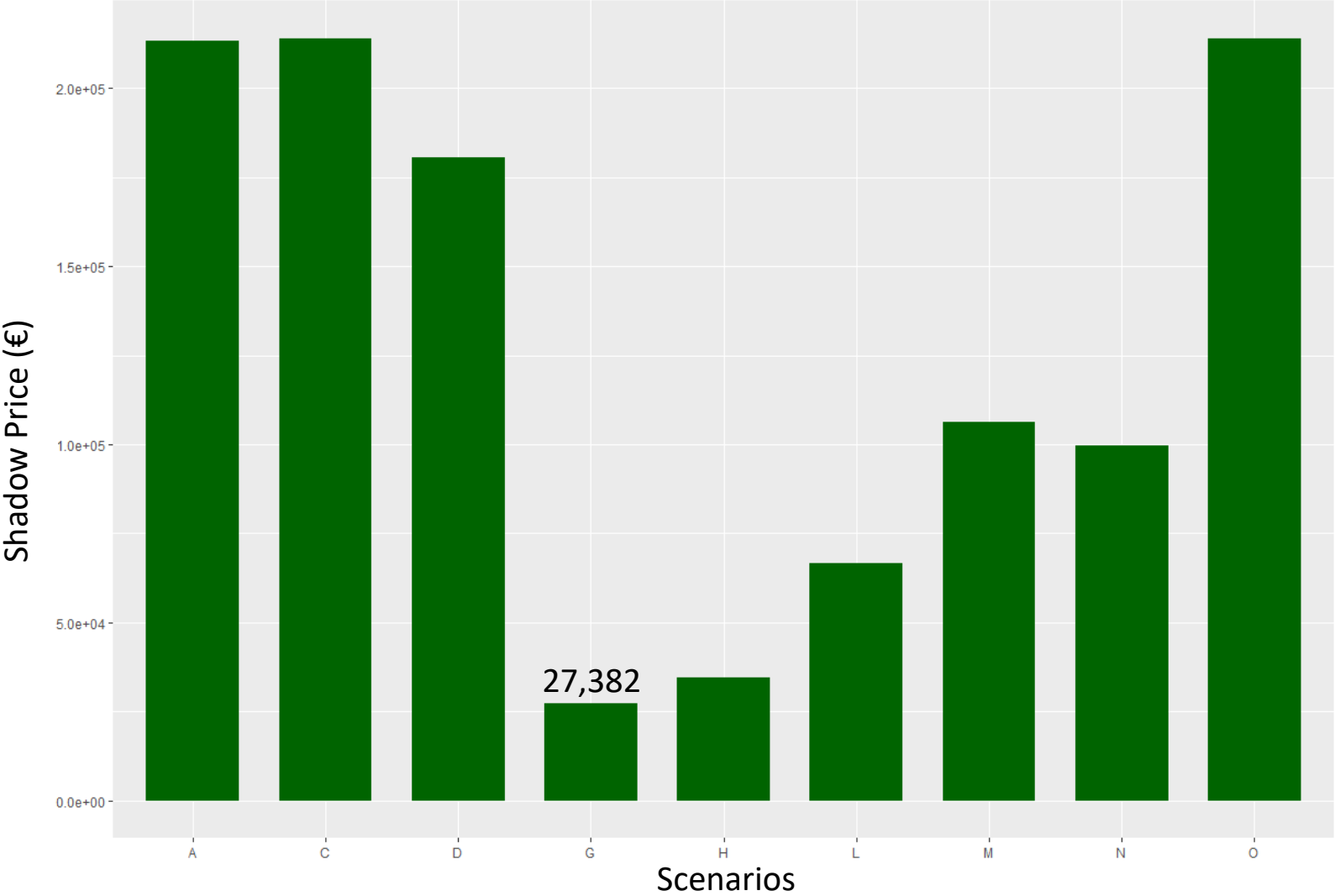
- Pingers
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Shadow price

- Pingers
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- $9,212 \pm 4,037\text{€}_{2021}$ [1]

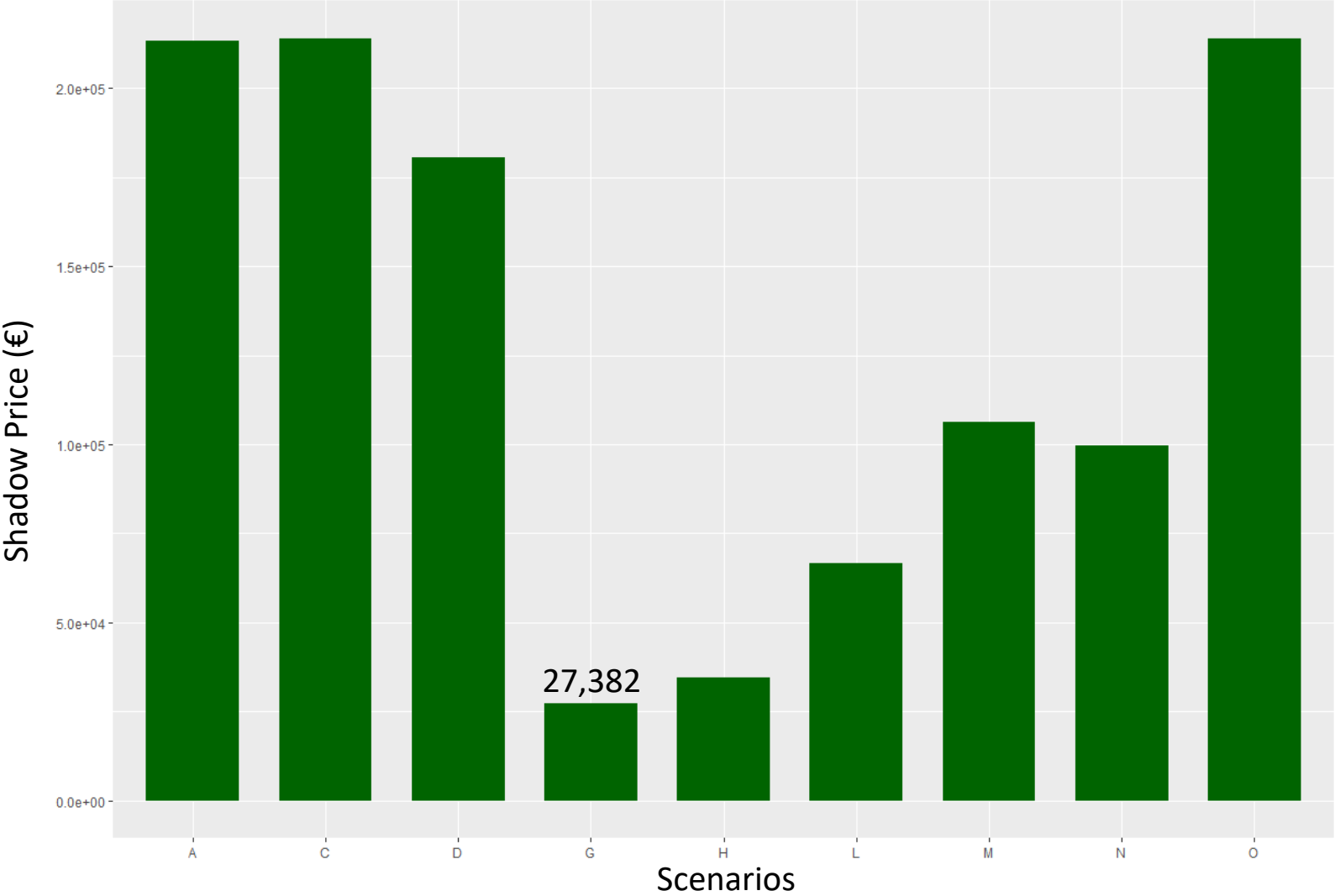


[1] Ouled-Cheikh et al., 2023

4. Discussion

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- $231,036\text{€}_{2021}$ [2]



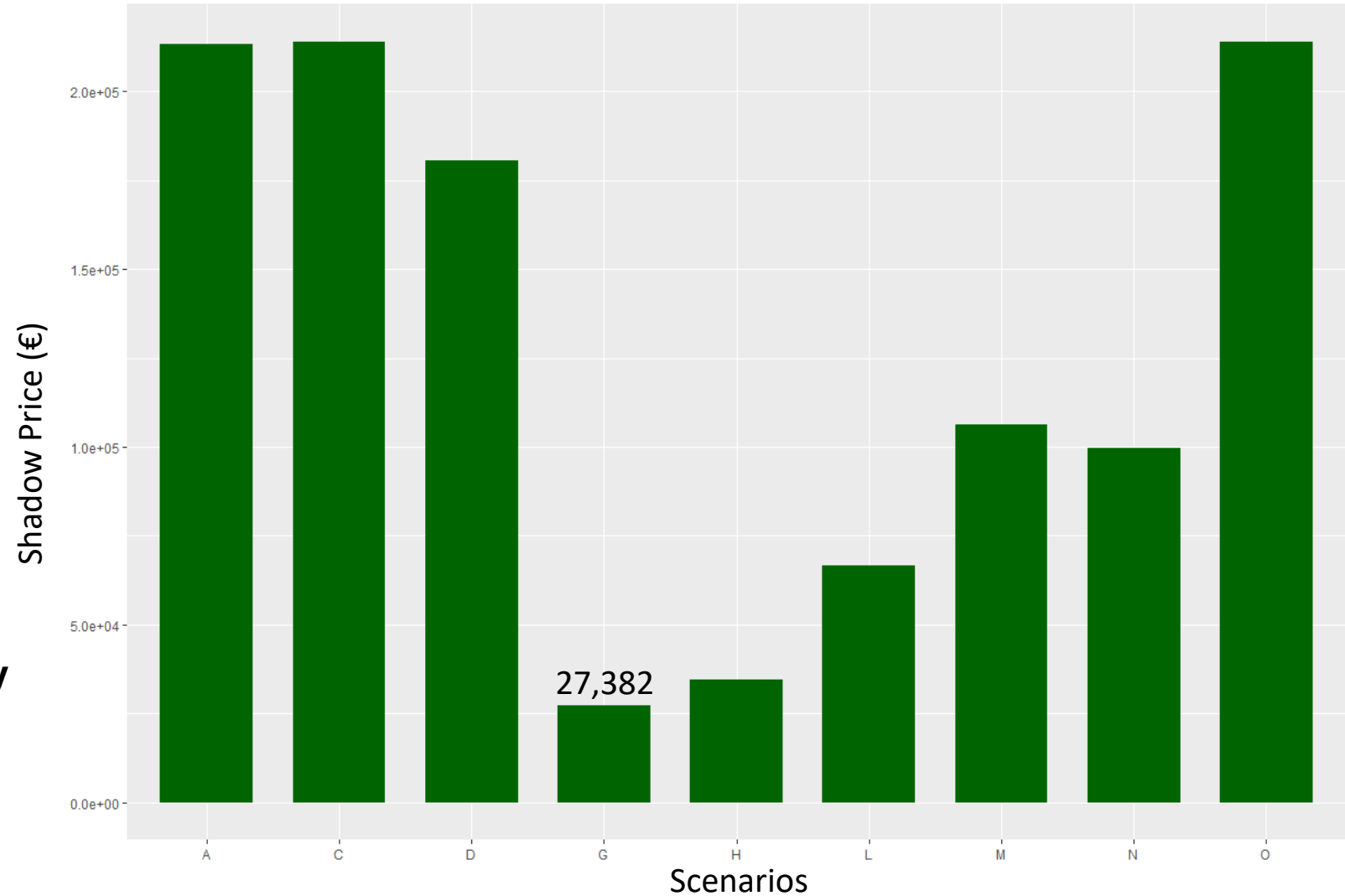
[1] Ouled-Cheikh et al., 2023

[2] Hoyt et al., 2014

4. Discussion

Shadow price

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Thank you for your attention

- Northridge, Simon P. 1984. « World review of interactions between marine mammals and fisheries ».
- Northridge, Simon P. 1984. 1991. *An updated world review of interactions between marine mammals and fisheries*. Food & Agriculture Org.
- Millennium ecosystem assessment, M. E. A. 2005. *Ecosystems and human well-being: Synthesis*. Vol. 5. Island press Washington, DC.
- ICES. 2023. « EU additional request on mitigation measures to reduce by-catches of common dolphin (*Delphinus delphis*) in the Bay of Biscay ». Report of the ICES Advisory Committee, 2023.
- Puente, Esteban, Leire Citores, Elsa Cuende, Iñigo Krug, et Mikel Basterretxea. 2023. « Bycatch of short-beaked common dolphin (*Delphinus delphis*) in the pair bottom trawl fishery of the Bay of Biscay and its mitigation with an active acoustic deterrent device (pinger) ». *Fisheries Research* 267: 106819.
- Gauffier, Ruth Esteban, et Renaud de Stephanis. 2023. « The non-consumptive economic value of wildlife: the case of three cetacean species ». *Scientia Marina* 87 (4): e077-e077.
- Hoyt, E., G. McGrath, M. Bossley, et T. Knowles. 2014. « Assessing New Zealanders' Willingness-to-pay to Protect the Endangered New Zealand Dolphin ». *Cephalorhynchus hectori*.



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