Marine Policy 117 (2020) 103886

Contents lists available at ScienceDirect

Marine Policy

journal homepage: http://www.elsevier.com/locate/marpol

Artificial upward trends in Greek marine landings: A case of presentist bias in European fisheries

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ARTICLE INFO

Keywords:
Combined fleets
Fisheries management
Catch
Catch-reconstruction
Mediterranean fisheries

ABSTRACT

According to the official landings as reported by the international databases for Greece, the declining trend of the Greek marine fisheries landings that had been continuous since the mid 1990s has been reversed during the last three years, with the total marine fisheries landings showing elevated values after 2016. We claim that this upward trend is an artifact that is attributed to the combined reporting of the landings of additional fleets since 2016 that had been separately reported before and resulted in 20–30% inflation of the landings. In 2016, the Greek statistical authorities included the landings of an extra fleet of 10,000 small-scale coastal vessels with engine horsepower lower than 20 HP together with the remaining coastal vessels, purse-seiners and trawlers whose landings formed the official reported Greek marine fisheries landings from 1970 to 2015. We acknowledge that this act of partial catch reconstruction improved the resolution of the landings and the officially reported values are now more realistic. However, the artificial, albeit inadvertent, inflation of the official Greek marine fisheries landings as they appear in international databases is a clear case of 'presentist bias' and may distort stock assessments and ecosystem modeling. As the currently misleading data stand, they are cause for substantial misinterpretation and analytical errors that can influence fisheries policy and have serious implications for fisheries management. We suggest that researchers should refrain from using the combined time-series and that a correction should be applied to the original time-series (1970–2015) to account for the entire coastal fleet.

1. Introduction

The recent reconstruction of global catches revealed that a large proportion of the total official catch statistics still remains unreported and that unreported catch mainly refers to small-scale artisanal and recreational fisheries, which are incompletely recorded or even omitted from official catch statistics on a global scale [1]. The underreporting or misreporting of marine catches and fishing effort may bias stock assessments and hamper fisheries management because a large proportion of the total biomass removed by fishing is not accounted for [1,2]. This, in turn, may influence national policies on fisheries [3].

In Greek waters, a fisheries data-poor area [4], the initial [5] and recent catch reconstructions [6] revealed several discrepancies, inconsistencies and dataset discontinuities prior to 1982 and an unreported catch that may exceed 30% of the officially reported landings. However, despite those inconsistencies and biases that are confined to the earlier years of the dataset (1970–1981) and several aggregations to higher taxonomic groups [7], the *modus operandi* of the Greek statistical authorities remained the same between 1982 and 2015 [8,9]. From 2016 onwards, the Greek statistical authorities reformed their reporting protocol by changing the number of species that are being recorded and by including the landings derived from small-scale coastal vessels with engine power lower than 20 HP (around 10,000 vessels) to the landings of the remaining coastal vessels, purse-seiners and trawlers. The landings of these fleets had formed the official reported Greek marine fisheries statistics from 1970 to 2015 [10] to the General Fisheries Commission for the Mediterranean (GFCM) and Food and Agricultural Organization (FAO) databases. This change that improved the reliability of reporting, is clearly stated in the 2016 Annual Bulletin of the Greek statistical authorities [11], which is available online: "*Until the reference year 2015, the survey covered the professional motor-propelled fishing vessels of 20 HP and over. From the reference year 2016 onwards, the survey covers all motor-propelled professional fishing vessels irrespective of their horsepower*". This statement, however, does not appear in international databases of GFCM and FAO and constitutes a clear case of 'presentist bias', a term that has been recently proposed in fisheries science to describe the overestimation of the present against the past [12]. It refers to an improvement in an official catch reporting system (such as an inclusion

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https://doi.org/10.1016/j.marpol.2020.103886
Received 27 September 2019; Received in revised form 7 February 2020; Accepted 9 February 2020
Available online 14 February 2020

of a previously unmonitored activity related to fleet, gear or region) that leads to an increase in recent reported catches without the corresponding past (unmonitored) catches being corrected for retroactively [3]. 'Presentist bias' is an inadvertent consequence of the effort most countries make to improve their national data collection and reporting systems and has already been reported to occur in Mozambique and Tanzania [3].

The objective of the present work was to point out the first case of 'presentist bias' in European fisheries that emerged from including the landings of additional fleets to the official fisheries statistics without accounting for the associated fishing effort increase, or without correcting these data retroactively to generate a full representative historical time-series. Such distorted time-series have serious implications for future stock assessments and policy development, as well as for ecosystem modeling and studies of climate impact on marine populations because they result in misinterpretation of fisheries trends.

2. Materials and methods

The annual catches of the Greek marine fishing fleet, expressed as live weight equivalent of landings, had been recorded for 66 species or groups of species (henceforth called taxa) since 1982 by the Greek statistical authorities (the current official name of the service is Hellenic Statistical Authority, HELSTAT) and published in annual bulletins (www.statistics.gr/en/). The HELSTAT dataset originally referred to the legal and reported offshore (trawlers and purse-seiners) and coastal fisheries (netters, boat-–seiners and longliners with engine horsepower greater than 20 HP) landings, excluding discarded, illegal and unreported catches, recreational and sport fishing as well as the catch of small-scale coastal vessels with engine horsepower lower than 20 HP [5]. Although the latter was partly recorded by another national statistical authority and was available only in Greek, it was not a part of the official Greek marine fisheries landings up to 2015 [5].

Up to 2015 the landings of four fleets (trawlers, purse–seiners, boat–seiners, small-scale coastal vessels with engine horsepower > 20 HP) were reported annually and their landings were acquired from the official HELSTAT annual bulletins since 1982. From 2016, onwards the landings of a fifth fleet (small-scale coastal vessels with engine horsepower < 20 HP) were added in the official Greek marine landings dataset and these data were also acquired from the official HELSTAT annual bulletins. In this work, the years 2016–2018 were split into landings of four and five fleets for presentation purposes.

GFCM records the annual landings of the Mediterranean and Black Sea fisheries stocks since 1970 on a country, species and subdivision basis whereas the FAO dataset begins in 1950 and differs from that of GFCM in terms of spatial division and species aggregation. Both FAO and GFCM catch statistics are available online and can be downloaded using the FishStat J software [13]. The equivalent to the HELSTAT dataset landings for Greece were downloaded from both FAO and GFCM databases for the same period of time for comparison with the original datasets. It should be noted here that the GFCM/FAO only include the landings per species or group of species of the HELSTAT, without any information on fleets and effort data [13].

The inclusion of all fleets in official Greek marine fisheries landings statistics is essential and a main target of catch reconstructions [1,3]. For this reason, a retroactive correction resulting from the inclusion of the landings of a fifth fleet (small-scale coastal vessels with engine horsepower < 20 HP) was applied to the entire dataset (1982–2018) here, following the catch reconstruction methodology [5,6]. Finally, the catch per vessel (CPUE) was estimated as landings (in metric tons) per vessel for the four and the five fleets aiming to reveal the impact of adding the landings of an extra fleet of around 10,000 small-scale coastal fishing vessels to the official marine fisheries landings time-series.

3. Results

The official Greek marine fisheries landings derived from the four fleets (trawlers, purse-seiners, boat-seiners and small-scale coastal vessels with engine horsepower >20HP), as they are reported by HELSTAT and adopted by GFCM and FAO datasets have been increasing up to the mid 1990s and declining from their historical maximum in 1994 (165,000 t) to 2012 when they stabilized around 60,000 t (solid line in Fig. 1). The landings of the four fleets continue to fluctuate around 60,000 t between 2016 and 2018 (dotted line in Fig. 1).

The inclusion of the landings of the around 10,000 vessels forming a fifth fleet (small-scale coastal vessels with engine horsepower <20HP) in 2016, inflated the official Greek marine fisheries landings in 2016, 2017 and 2018 by 28, 23 and 24%, respectively (dark grey area in Fig. 1). The retroactive correction of the five fleets follows the same fluctuation with that of the four fleets but the magnitude is higher (dashed line in Fig. 1). The landings in the FAO and GFCM datasets are slightly different in the earlier years and identical in the latest years compared to the HELSTAT dataset but exhibit the exact same trend up to 2015 and follow the five fleet dataset from 2016 onwards. Although what we present here is the effect of including an extra fleet on total Greek landings, the landings of individual species/stocks are equally distorted particularly those of the

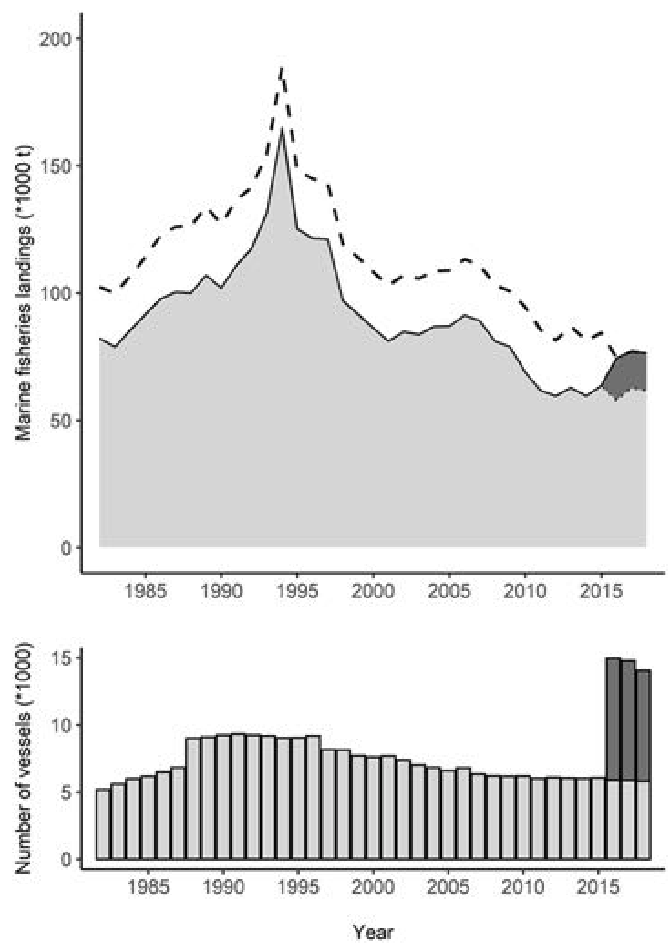

Fig. 1. The official Greek marine fisheries landings without (light grey area, four fleets) and with (dark grey area, five fleets) the small-scale coastal vessels with engine horsepower <20 HP that were added after 2016 and retroactive correction (dashed line) for 1982–2015 based on the recent catch reconstruction of Greek marine fisheries landings [5,6]. The dotted line shows the trend that the landings would follow under the pre-existing recording regime, i.e. if the fifth fleet was not included. The light grey bars indicate the annual number of vessels of the four fleets, while the dark grey bars represent the number of vessels of the fifth fleet, from which the respective landings were derived.

demersal fishes and invertebrates that are targeted by the small-scale coastal fisheries. The distortion is lower for small pelagic species targeted by purse-seiners.

The artificial inflation of including an extra fleet in the dataset also caused the abrupt dropping of the overall CPUE (defined as catch per vessel) to half of its previous values, from 10.5 t/vessel to around 5 t/vessel and resulted in a steeper decline of the CPUE trend of the Greek marine fisheries across the study period (solid trend line in Fig. 2) compared to the retroactively corrected time-series (dashed trend line in Fig. 2).

4. Discussion

The official Greek marine fisheries landings have been extensively used to assess the status of many stocks in the eastern Mediterranean Sea using catch-based methods [8,10] and surplus production models [14], in several ecosystem models in the area [15], to examine the effect of sea warming [16] and climate variability [17] on marine populations as well as the effect of fishing on marine ecosystems [10]. Given the data-poor status of the eastern Mediterranean fisheries and the gaps in the Data Collection Framework programme in Greece during the last 10 years, landings data are a valuable source of information for fisheries management.

The partial reconstruction with the inclusion of the landings of 10,000 additional small-scale coastal vessels is certainly an improvement of the monitoring system and bridges the gap between official statistics and the actual biomass of marine organisms removed by fishing. Therefore, although it is acknowledged as a very positive step forward, it is also the first documented case of presentist bias in European fisheries. The transition from a recording system of four fleets to a recording system of five fleets results in an artificial inflation of reported landings, which will certainly affect the scientific output of various disciplines and distort fisheries management [3]. Firstly, a real 20–30% increase in landings in three years time would imply that the fisheries regulations and the general management scheme in the Greek seas have been successful. However, all recent publications and assessments [10,14,18,19] highlight the overfished status of the Greek stocks and the need for less fishing, a condition that holds for most Mediterranean fisheries [10,14,20]. This clearly contradicts the additional fishing pressure applied to pelagic and demersal stocks, in excess of the legislated fishing period, as a result of “fishing in international waters” of the Greek fleet that practically allows trawlers and purse-seiners to operate all year round [21]. In addition, it has been recently reported that all species targeted by the fishing fleets are being overexploited in the Mediterranean Sea [22], with none of the Mediterranean stocks being sustainably exploited [23], including 98% of unassessed demersal stocks [24]. Secondly, the official landings are being used in stock assessments and are particularly important in catch-based methods for estimating stock status [25] and surplus production models for estimating fisheries reference points [26]. An artificial change of the catch trend in the last 2–3 years of the time-series will affect the reference points and the output of the stock status [27] and will influence national policy discussions on fisheries and fisheries management decisions [3]. Notably, in case these distorted data have already been used in the recent assessments of Greek demersal fisheries (performed in late 2018 but not publicly available yet), these assessments should be revisited. Thirdly, the inclusion of the landings of a coastal fishing fleet disproportionally affects the landings composition in favour of species caught by netters and long-liners. This, in turn, distorts the input to ecosystem models and to methods that rely on landings and are used to determine the effect of fishing (such as mean weighted trophic level of the catch [28]) and climate (such as the mean temperature of the catch [29]) on marine populations and ecosystems.

The total Greek marine fisheries landings can be rather easily corrected and updated to include the landings of the fifth fleet back to 1982 (dashed line in Fig. 1) because the data are available in the recent catch

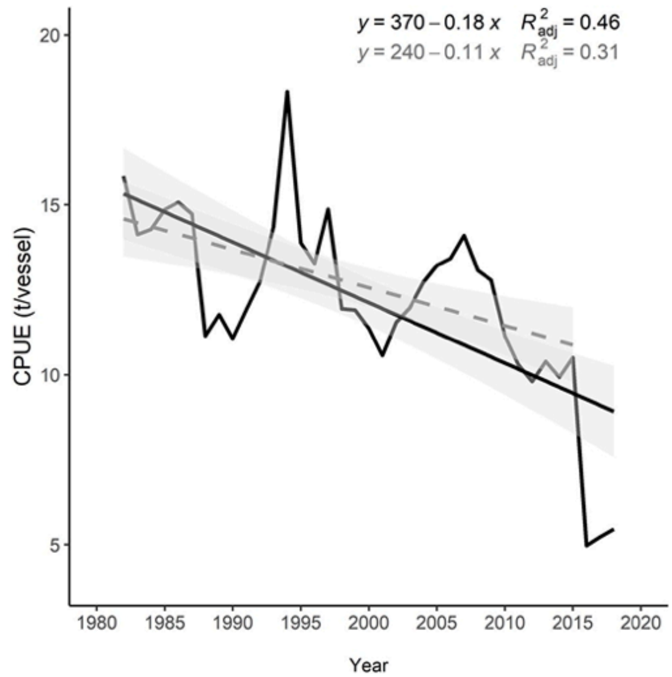

Fig. 2. The CPUE (tons of landings per vessel) based on the official Greek marine fisheries landings. The solid black trend line refers to the mixed dataset (four fleets for 1982–2015, five fleets for 2016–2018), whereas the grey dashed line refers to the corrected dataset (five fleets across the study period, i.e. reconstructed landings for 1982–2015, original landings for 2016–2018).

reconstruction [5,6]. However, the landings of individual taxa, which are used in stock assessments and ecosystem models, are harder to obtain and we suggest they are reported by fleet. In any case, reforming of a landings time-series by including an additional fleet of 10,000 coastal vessels requires that all users, especially international ones that use the GFCM/FAO datasets, should be clearly informed and given the opportunity to convert the two time-series so they have the same fleets throughout the dataset. We by no means imply that HELSTAT and GFCM/FAO should be blamed for doing something wrong or are deliberately misreporting catch statistics but this artificial inflation is an issue they, especially GFCM/FAO, should address.

In conclusion, we acknowledge that this act of partial reconstruction improved the resolution of the landings and is more realistic and close to the actual biomass removed from the sea, but the inflation of landings in international datasets has serious implications for stock assessments, ecosystem models and climate impact studies. We propose a retroactive correction of the original time-series (at least from 1982 to 2015) to account for the entire small-scale coastal fleet based on the recent reconstruction of marine fisheries landings of Greece [5,6], which already exists. GFCM/FAO should be urgently informed to correct the international records. Finally, we suggest users to refrain from mixing the two datasets because they will get unrealistic, even erroneous, results.

CRediT authorship contribution statement

Athanassios C. Tsikliras: Conceptualization, Methodology, Writing - original draft. **Donna Dimarchopoulou:** Investigation, Visualization, Writing - original draft, Writing - review & editing. **Androniki Pardalou:** Data curation, Formal analysis, Visualization, Writing - review & editing.

Acknowledgements

The authors acknowledge the support of Thalassa Foundation and would like to thank the Associate Editor Karyn Morrissey and two anonymous reviewers for their constructive comments and suggestions.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.marpol.2020.103886.

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