War, fish, and foreign fleets: The marine fisheries catches of Sierra Leone 1950–2015

Katherine Seto⁎, Dyhia Belhabib⁎, Josephus Mamie⁎, Duncan Copeland⁎, Jan Michael Vakily⁎, Heiko Seilert⁎, Andrew Baio⁎, Sarah Harper⁎, Dirk Zeller⁎, Kyrstn Zylich⁎, Daniel Pauly⁎

⁎ Correspondence to: 45 Mulford Hall, University of California at Berkeley, Berkeley, CA 94720.
E-mail address: katseto@berkeley.edu (K. Seto).

ARTICLE INFO
Keywords:
Artisanal fisheries
Catch reconstruction
Illegal unreported and unregulated (IUU) fishing
Industrial fisheries
Small-scale fisheries
Sierra Leone

ABSTRACT
In countries like Sierra Leone, where stock assessments based on fisheries-independent data and complex population models are financially and technically challenging, catch statistics may be used to infer fluctuations in fish stocks where more precise data are not available. However, FAO FishStat, the most widely-used time-series data on global fisheries 'catches' (actually 'landings'), does not account for Illegal, Unreported, and Unregulated (IUU) catches and relies on statistics provided by the national agencies of each member country. As such, reported FishStat data is vulnerable to changes in monitoring capacity, governmental transitions, and budgetary constraints, and may substantially underestimate the measure of extracted marine resources. In this report, Sierra Leone's total catches by all marine fisheries were estimated for the period 1950–2015, using a catch reconstruction approach incorporating national data, expert knowledge, and both peer-reviewed and grey literature. Results demonstrate that a substantial amount of marine resource exploitation is not represented in official statistics, and reconstructed catches represent more than 2.25 times the recorded FAO FishStat values. Notably, foreign fleets take the vast majority of industrial catch in Sierra Leone's EEZ, indicating that most of the resource catch and revenue is diverted to foreign companies and export markets. While foreign actors dominate the industrial sector, the small-scale sector represents the majority of domestic catch. Illegal fishing is also a substantial challenge in Sierra Leone, and extracts a large amount of the country's marine fish resources. Reconstructing catches in Sierra Leone also highlights the impacts of various historical events such as Sierra Leone's civil war and post-war reconstruction on the development of the fisheries sector. The results found in the reconstruction present a large discrepancy from FishStat data, with considerable implications for assessment of stocks and management of Sierra Leone's marine resources.

1. Introduction

The fisheries sector in Sierra Leone is critically important as a source of employment, income, and household nutrition in a largely underdeveloped country [1,2]. Though a relatively small country by African standards, Sierra Leone has an Exclusive Economic Zone of 104,850 km², of which 21,700 km² consist of continental shelf (www.searounds.org; Fig. 1). Situated within the Guinea Current, Sierra Leone's fisheries lie within one of the world’s most productive marine ecosystems [3,4]. Between 300,000–400,000 people are employed as workers, fishers, processors, and marketers in the fisheries sector [5,6], fish represent 75% of dietary animal protein for the country’s population, and 9.4% of Sierra Leone’s GDP is derived from fisheries [7,8]. Despite their importance, Sierra Leone’s fisheries have been less studied and are less understood than those of other countries in the region [9,10]. This is largely due to political upheavals following independence from British colonial rule in 1961. Weak governance and marginalization prompted several military coups that culminated in the 11 year-long Civil War from 1991 to 2002 [11,12]. During this time, the already poorly equipped fisheries science and
management institutions were unable to adequately operate, and the information on Sierra Leone's fisheries which did exist was largely destroyed during the conflict. The Civil War, though attributable to a combination of factors, was in large part driven by the wealth disparities generated by the exploitation of natural resources [13]. The conflict, emerging from a context of environmental degradation, also generated a tremendous amount of environmental destruction, and the country was ranked 162 out of 180 on the 2016 Environmental Performance Index [14]. Economically, Sierra Leone is also one of the poorest countries in the world, ranking 181 out of 188 countries included in the UN Development Program (UNDP) 2015 Human Development Report [15]. With a per capita gross national income (GNI) of $1780 USD and 59% of the population living in or close to severe poverty [16], fisheries provide a critically important and affordable source of protein and micronutrients for local populations [17].

In developed countries, fishery policies and management decisions are often based on robust data from fisheries-independent stock assessments and complex population models. However, in countries such as Sierra Leone, these techniques are impractical due to the high associated costs and technical demands; in such cases, catch statistics can serve to approximate potential trends in fish stocks where other data are not available [18,19]. FAO FishStat provides time-series data on global fisheries catches (actually 'landings') [20] beginning in 1950 [21]. The data rely on self-reported statistics provided to the Food and Agriculture Organization (FAO) by the national agencies of each member country [22]. However, since many countries do not have the capacity to monitor catches landed in remote or decentralized areas—such as those in artisanal or subsistence fisheries—FAO fisheries statistics have been shown to underestimate catch in most countries [20]. Catch statistics also do not account for Illegal, Unreported, and Unregulated (IUU) catches, and therefore may substantially underestimate the measure of extracted marine resources [23,24]. Variations in data gathering and reporting are also of particular concern in self-reported time series, as policy priorities, management approaches, and monitoring and enforcement capacity may change over time [20,25]. This is especially true for countries such as Sierra Leone, which have been persistently disrupted by civil conflict. Since these data are often used in formulating fisheries policy and management approaches, these underestimations may lead to inappropriate and detrimental policies and management measures [26].

Here, total marine catches by Sierra Leone within its Exclusive Economic Zone (EEZ) were re-estimated from 1950 to 2015. Estimates of foreign and IUU fishing are also included. The goal of this reconstruction is to provide a more accurate characterization of all marine fisheries sectors in the Sierra Leone EEZ, in order to understand the historical development of the sector and better inform policy and management measures.

2. Materials and methods

The catch reconstruction method utilized here followed the reconstruction approach described in Zeller et al. 2007 [18], as updated in Zeller et al. 2015 and Zeller et al. 2016 [27,28]. The Sierra Leone total catch reconstruction, including details not described here (e.g. full taxonomic breakdown of reconstructed catches), are fully documented in the technical report underlying the present study [29].

2.1. Human population data

Human population data from 1950 to 1959 was obtained from the Central Intelligence Agency (CIA) World Factbook 2011 [30]. Time series population data 1960–2015 were obtained from the World Bank Population Database [31]. Fishers’ censuses were conducted as part of the Sierra Leone national frame surveys in 1974, 1981, 1991, 2003, and 2009, from which it was possible to derive the percentage of artisanal fishers in the population at those anchor points in time. Linear interpolations were made between anchor point proportions, assuming similar proportions to population data.

2.2. Fisheries sub-sectors

The data that served as the reported catch data baseline for this study were extracted from the FAO FishStat database [21]. A thorough analysis of peer-reviewed, government, and non-government organization (NGO) publications, as well as other grey literature, enabled us to identify sectors with missing or incomplete information. To supplement this literature, local and scholarly expertise was sought in each of these fisheries sub-sectors, in order to formulate the best possible assumptions. Utilizing these sources, catches were then derived for 1950–2015, based on anchor points in the literature and knowledge-based assumptions.

2.2.1. Small-scale fisheries: subsistence and artisanal catches

2.2.1.1. Artisanal fisheries. For the early artisanal fishery, defined as small-scale commercial fisheries, very little data were available regarding catch, fish population, or fleet size, although several national data sources were identified from the 1970s onward [12,32–35]. While these national catch data were generally higher than those reported to FAO, consultation with local experts indicated that they were likely still low, considering the substantial limitations on monitoring and reporting during those years. With this in mind, catches from the small-scale sector were determined using estimated catch per unit effort (CPUE) rates, summarized in Appendix A Table 1, based on expert knowledge and national data [33,35,36]. Derived CPUE rates are considered very conservative in comparison to neighboring countries and in-country expert estimates [37,38].

2.2.1.2. Subsistence fisheries. Only scarce information is available regarding the subsistence aspect of marine fisheries in Sierra Leone, and what little there is pertains solely to inland or marginal fisheries (e.g. mudskippers) [12,39–41]. All available per capita consumption estimates were secondarily derived from FAO reported landings, and literature suggests that few if any studies have been undertaken to determine actual per capita intake of fish in Sierra Leone [1]. However, evidence suggests that marine fish caught in the artisanal fishery are
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات