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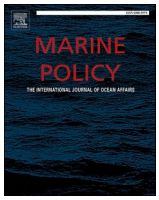

# Aligning fisheries terminology with diverse social benefits

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ABSTRACT

Globally, marine fisheries provide many societal benefits that are not reflected in the way that fisheries are categorized for management and reporting. This paper provides a systematic review of U.S. policy documents and peer-reviewed literature to identify potentially underrepresented fishing practices and communities associated with non-commercial fishing, i.e., fishing that is not clearly commercial or recreational. A wide range of terms were used for types of non-commercial fishing, and five underlying dimensions emerged: (1) fisher demographics; (2) fishery characteristics; (3) disposition of fish; (4) beneficiaries of fishing; and (5) reasons for fishing. Further examining fishing terms against disposition of fish revealed three classes of uncounted benefits: food systems, culture and heritage, and non-market economies. Subsistence fishing was one of the most prevalent terms and is broad enough to cover all three classes of uncounted benefits; but the strong association of the term with food and Indigenous cultures may mask other important social, cultural, and non-market economy contributions. Additional data are needed to evaluate the degree to which broader social outcomes are achieved equitably, especially as fishing communities experience more frequent disruptions to traditional markets and supply chains due to increased storms, wildfires, pandemics, and other disasters. More careful accounting of food systems, culture and heritage, and non-market economies is crucial to ensure fisheries provide the greatest benefits to the nation, evaluate the degree to which management goals and distribution of benefits are achieved equitably, and support resilience of fisheries and fishing communities in the face of climate change.

## 1. Introduction

### 1.1. (Mis-)alignment of types of fishing and societal benefits

Globally, marine fisheries provide many societal benefits, ranging from food, income, mental health, and well-being, to supporting local communities [1–4]. United States federal fisheries have also been found to support multifaceted societal benefits, which include sharing and gifting fish with friends and family and providing fish for community and cultural events [5]. These types of societal benefits are likely present across all regions managed by NOAA Fisheries, the US federal fisheries management agency (Fig. 1). However, not all of these societal benefits are reflected in the way that fisheries are categorized for management and reporting. For example, the law that governs federal fisheries management in the US (Magnuson-Stevens Fishery Conservation Act, MSA [6]) defines two types of fishing, commercial and recreational, which are managed as separate activities. Commercial fishing is defined as "…fishing in which the fish harvested, either in whole or in part, are intended to enter commerce or enter commerce through sale, barter or trade" [6, Section (3)(4)] and recreational fishing is "…fishing for sport or pleasure" [6, Section (3)(37)]. Each year, NOAA Fisheries reports on commercial and recreational fisheries in terms of volume and economic value of landings, economic performance of the fishery, and stock assessments that determine the sustainability of harvest practices given

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current stock abundance [7]. This approach foregrounds economic and ecological benefits but limits attention to other social and cultural benefits.

Perhaps in recognition of this gap, across NOAA Fisheries, the term 'subsistence' has emerged as a third category of fishing. This term is not yet defined in the MSA, and its regional use is inconsistent. For example, even on the NOAA Fisheries Subsistence Fishing webpage, three different terms are used, 'subsistence' in Alaska, 'non-commercial fishing' for the Pacific Islands, and 'Tribal fishing' on the West Coast [8]. In Alaska the term 'subsistence' has long been used in state management contexts and is defined in both Alaska-focused state [9] and Federal laws (Alaska National Interest Lands Conservation Act, ANILCA, [10]); however it remains absent from legislation in other regions. Efforts to re-authorize the MSA have attempted to add the term 'subsistence' as a distinct form of fishing since at least 2014, largely following definitions set forth in ANILCA [11]. Reauthorization has not been successful to date; however, there is growing recognition of the insufficiency of existing terminology, and adding a definition for 'subsistence fishing' remains central in proposed new bills, such as H.R.4690 - Sustaining America's Fisheries for the Future Act of 2022 [12].

Pacific Islands fishing communities have voiced dissatisfaction with the term recreational fishing since at least 1998, instead preferring the umbrella term 'non-commercial fishing' [5]. This has been formalized in policies for fisheries of the Western Pacific, which define non-commercial fishing as "…fishing that does not meet the definition of commercial fishing in the [MSA], and includes, but is not limited to, sustenance, subsistence, traditional indigenous, and recreational fishing" [13]. This definition specifies that 'non-commercial fishing' is broader than fishing for either recreational or subsistence purposes, but defines it primarily in contrast to what it is not (i.e., 'commercial fishing'). Many of the types of fishing listed in the definition of 'non-commercial fishing' have not been defined in US law or policy, or have been defined only in limited geographic areas [14]. Further, in the Western Pacific, the distinction between 'commercial' and 'recreational' fishing is not always clear-cut, suggesting a need for further examination [5]. In the rest of this paper, we use the term 'non-commercial fishing' in this broad umbrella way to refer to any type of fishing that is not purely commercial or recreational.

On the US West Coast, the term 'subsistence' is often associated with Tribal rights to fish reserved by various treaties [15]. Tribal fishing on the West Coast is an important part of the fishery and policy milieu, particularly in the Northwest, where treaty rights to fish highlight Tribal salience in fisheries management. Nevertheless, fisheries management that accounts for Tribal treaty rights is broader than 'subsistence,' since treaty rights govern harvest from Tribal "usual and accustomed areas" without specifying if these harvests are for traditional Tribal use and consumption, or for commercial sale.

In other regions of the US, little work has been conducted on non-commercial benefits of fisheries due to the association of subsistence fishing with Tribal communities, despite some important exceptions (see [16,17]). Narrowing in on urban non-commercial fishing, Ebbin [16] outlines the many unanswered questions for fishing that falls outside the two management categories, and goes on to state, "it is difficult to manage that which is not known" ([16], p.2). Boucquey's ongoing work on urban pier fishing has identified linkages to community well-being from multiple types of non-commercial urban fishing [17] in what she and co-author Fly term a "third place" between home and work [18].

There is a growing call in the US and internationally for improved data collection efforts that better reflect the complexities within fisheries sectors. In the EU, researchers identified gaps in recreational

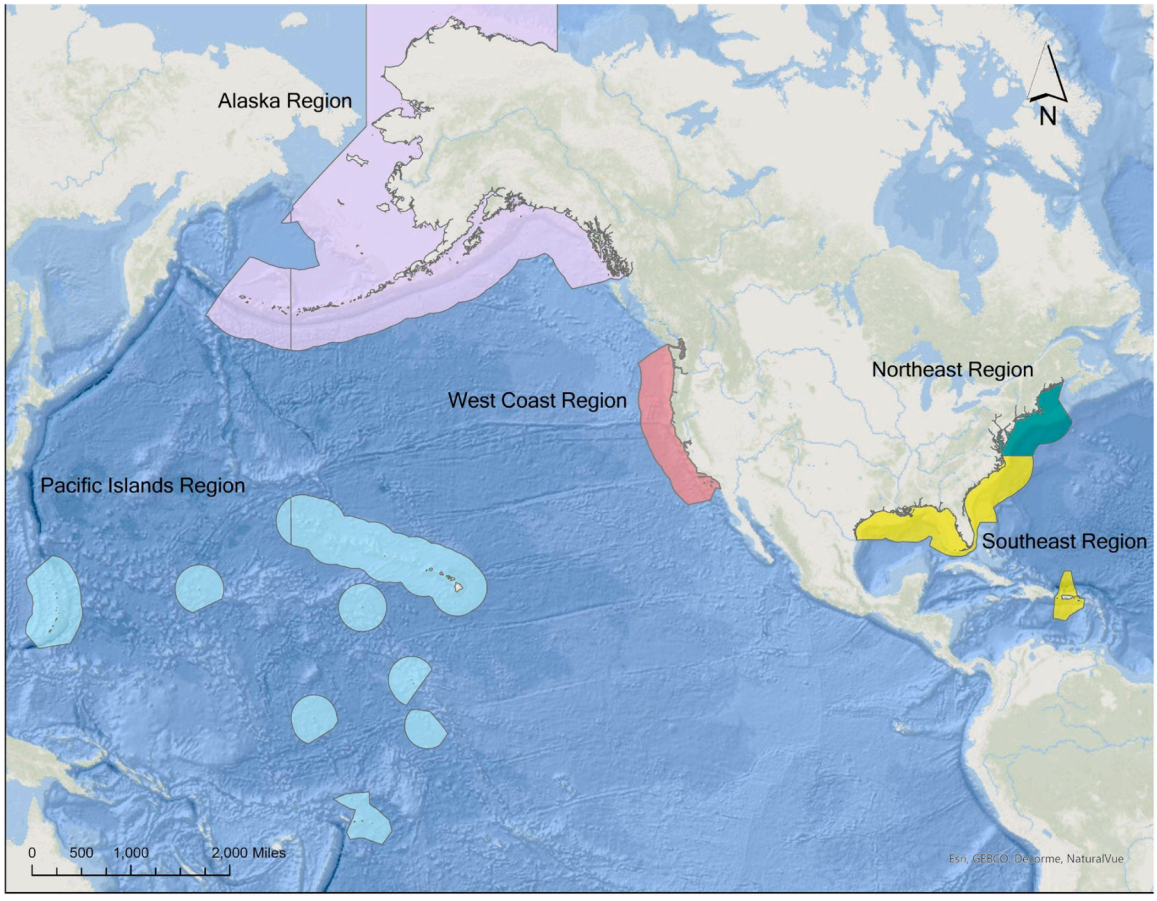


**Fig. 1.** Map of NOAA Fisheries regions. The colored areas indicate the extent of the Exclusive Economic Zone (US federal waters) managed by each NOAA Fisheries regional office.

fishing data collection that have direct implications for monitoring and management [19]. Other work in the EU documents increases in some types of small-scale fishing and declines in others [20]. This may suggest shifting management and data collection needs in response to changing social values and concerns. This work is in response to the call for inclusion of cultural heritage and social values in fisheries research to inform management [21].

International research on primarily small-scale fisheries has also grappled specifically with how to define the complexity of fisheries [4]. These efforts at definition are often linked with efforts to support equitable fisheries management, a growing focus of US fisheries management [22,23], and in particular to consider the impact of fisheries management and development on marginalized fishing populations [24]. For example, Berkes [25], citing Alaskan definitions, outlined an argument for using the term 'subsistence fishing' to describe non-commercial, local food fisheries in Canadian fisheries policy. Branch et al. [26] provide a deep dive into the process of defining 'subsistence,' 'artisanal,' and 'small-scale commercial' fisheries for the purpose of establishing marine fisheries management in South Africa. The authors identified complex linkages among sectors and management, science, and types of resources, illustrating that sector boundaries were not clear-cut. Thus, gaining clarity on definitions of 'non-commercial fishing' would be beneficial beyond US policy and management.

### 1.2. Impacts of (mis-)aligned management language

Language and other discourse are forms of social practice that shape the ways people think about and engage with the surrounding environment [27–29]. Specialized terms represent a cognitive view of the world that reflect peoples' experiences and knowledge [30]. Consistency and clarity in terminology and broader language is central to evaluating whether desired management outcomes are achieved and how policies or practices might need to be adapted to better accomplish them [31]. Mis-aligned or ill-defined language can be detrimental to fisheries management by not adequately including or quantifying relevant fisheries [32,33], not reflecting adaptations in fisheries institutions [34], not allowing certain fisheries to modernize [35], not reflecting the full benefits and meaning of certain fisheries [36,37], or focusing on the impacts of management on some indicators, while ignoring the effects on others [5].

The lack of clear definitions that can be applied across contexts may prevent fishery managers from assessing effectiveness and equity of management interventions. For example, inadequate definitions of fishing categories can lead to underreporting of catch, potentially leading to incomplete and inaccurate stock assessments. As Shumann and Macinko [32] state, "The problem is profound—we cannot know the scale of subsistence fishing activities if we do not know what activities the category encompasses" ([32], p. 706), a sentiment that resonates for all categories of fishing included under the umbrella of 'non-commercial.' Additionally, management frameworks that focus on economic performance and harvest sustainability will foreground economic and environmental outcomes, while deprioritizing other social well-being outcomes and the aspects of the fisheries that support them [38].

Similarly, viewing recreational fishing as purely for leisure often does not align with the full range of motivations and benefits of this type of activity. Quimby et al.'s [36] research on urban pier fishing in California found that half of the urban pier fishers surveyed ate or shared their catch with family and friends. As noted by Nyboer et al. [37] people who fish for sustenance often target similar species and have overlapping motivations as those who fish for fun. The authors argue that recreational fishing can be linked to food security; and the lack of data in 'recreational' and 'subsistence' fisheries may undermine effective monitoring and management strategies, particularly with respect to equitable access to resources under the pressures of climate change [37]. A binary economic/recreational accounting of multi-value fisheries can potentially lead to an underestimate of the benefits accrued from fisheries, and thereby an underestimate of the impacts of fisheries management decisions [5].

Like many fisheries management agencies, NOAA Fisheries seeks to provide the optimum yield of fish catch, which is defined as the "greatest overall benefit to the nation" [6, Section (3)(33)]. Economic and social data are also expected to be used to account for the importance of fishery resources to fishing communities [39] and maintain resilient ecosystems [40]. Extreme weather and climate events with great economic and societal impacts have increased dramatically since the 1980s, and costs of wildfires, severe storms, inland flooding and hurricanes are on the rise [41,42]. Fishing community resilience is increasingly important due to such climate driven disruptions, when maintaining diverse fishing strategies may be vital [43]. The recently released National Seafood Strategy also emphasizes the role of seafood in a climate-ready nation that meets nutritional needs [44]. Thus, our research sought to identify benefits from fishing that might be underrepresented under current research and management practices and what might be needed to bring them into policy and management.

## 2. Methods

### 2.1. Review of relevant NOAA laws and policies

The research team consisted of NOAA Fisheries social scientists who specialize in each of the five regions. The team first gathered relevant law and policy documents at the national and regional scale and developed a list of fishing terms related to 'non-commercial fishing' used in those documents. To do so, the documents and terms identified in previous work in the Pacific Islands Region on this topic were used as a starting point [5]. Social scientists and recreational fishing coordinators from other regions were part of that research and indicated that it would be useful to expand on that work nationally [5], which this work initiates. Based on team expertise on multi-sector fishing within their region, known additional terms were included in this initial compilation. These terms related to 'non-commercial fishing' concepts and legal and regulatory terminology associated with those concepts. Next, regional managers and scientists were consulted to identify the most recent versions of relevant policy documents for review, which could be regional in scope (e.g. the section of the Code of Federal Regulations pertinent to all fisheries of the Western Pacific) or site specific (e.g., the management plan for a specific Marine National Monument or Sanctuary). Finally, a cross-regional list was created that compiled the initial list of fishing terms mentioned across the law and policy documents [14].

### 2.2. Identifying relevant peer-reviewed literature

A Web of Science search was conducted to identify peer-reviewed literature that could shed light on how ideas related to non-commercial fishing are discussed outside of NOAA. The search included terms identified in law and policy documents, terms searched in Kleiber and Leong [45], and additional terms known to social scientists in each NOAA region via previous research and policy applications (e.g. terms such as "personal use" and "home pack" are used on some data collection forms although they are not mentioned in policy or management documents). A geographic parameter was included to return articles relevant to each region. The custom year range 1976–2021 was used. The year 1976 was chosen as the start date because that was the year when the MSA was enacted. Given the focus on manuscripts that were likely to describe the meaning of various fishing terms, searches were performed only within the Social Sciences Citation Index (availability: 1980–present), Conference Proceedings Citation Index—Social Sciences & Humanities (availability: 1990–present), and Book Citation Index—Social Science & Humanities (availability: 2005–present). All searches were conducted on 1–29-2021. See supplementary materials S1 for full search parameters.

Social scientists in each region reviewed the resulting regionally-specific manuscripts for relevancy. This included assessing whether the paper referred to the relevant geographical region and included content focused on the meaning of a particular fishing activity. Articles were excluded when the terms of interest were used only as category labels, for example studies that reported on the archaeological or biological content of recreational or subsistence catch, rather than the meaning associated with the terms. Articles that used the word "fisher" only to refer to statistical tests (e.g. Fisher's exact test) also were excluded.

### 2.3. Coding and policy and peer-reviewed documents

Qualitative data analysis software MAXQDA [46] was used for coding and analysis. For each region, social scientists coded the relevant peer-reviewed articles for terms used to label types of fishing and all aspects of meaning that were discussed. MAXQDA's autocode function was first used to quickly identify locations in the text that mentioned the terms used in the web of science search; however, terms were often used without any additional context and other fishing terms were introduced. Therefore, each paper was then manually coded, applying terminology codes only when terms and related sections of text included meaning. For fishing terms, codes were created for each word or set of words used as an adjective to describe a type of fishing, fishers, or fishery (for example, 'subsistence,' 'artisanal,' or 'small-scale'). If terms were not included in the original web of science search list, a new code for that term was created. Meaning was not inferred for term labels and grouping was only done for differences in spelling, e.g. 'small boat' and 'small-boat.'

Next, thematic codes were attached to the full passage of text that was needed to understand the relevant meaning [47]. Because of the interest in understanding all possible dimensions of 'non-commercial fishing' that might be important, inductive analysis was used to identify emergent codes driven by content of the texts. Categories of meaning that were considered included: the geographic location of interest, spatial extent of fishing, ecosystem conditions, characteristics of fishers, characteristics and scale of beneficiaries, characteristics of the fisheries, management regimes, economic model, and activity/benefits/and motivations. In many instances it was difficult to determine the author's intended meaning when discussing concepts, but we refrained from imposing meaning in our coding process and only coded passages where meaning was explicit. Common themes and codes, how best to organize them, and how to synthesize them into a common codebook were discussed iteratively and agreed upon by the research team throughout the coding process. All documents were then re-coded using a common codebook. The same parent code structure was retained across regions and new child codes that emerged that might be specific to each region were noted. Once the codebook for the peer-reviewed articles was finalized, the same process and codebook were applied to the law and policy documents, which were all coded by a single researcher for internal consistency (see supplementary materials S2 for final codebook).

Passages were not limited to formal definitions, but included any that explained rationale behind a term. For example a statement such as, "many small-boat fishers in Hawai'i and other island areas of the western Pacific consider themselves to be subsistence fishers, despite the fact that they may sell a portion of their catch and exhibit behaviors that suggest fishing is a viable means of recreation" includes the codes: small-boat fishing (TERM), subsistence fishing (TERM), subsistence THEME), sell fish (THEME), and recreation/leisure (THEME).

### 2.4. Data analysis

Frequencies of term codes were compared for each region for both the policy and peer-reviewed literature. Analyses were conducted separately for the two sets of documents to examine the degree to which terms used in policies reflect those used more broadly.

Attaching multiple codes to the same passage of text also allowed for comparison of co-occurrences, which are instances when the same codes are used together in one passage [48]. The author team explored co-occurrences of the various term and thematic codes for patterns. While the original codebook organized thematic codes into groupings that were assumed to be important to explore, the themes that occurred most frequently in the final coding structure did not necessarily follow the original groupings. In addition, due to the large number of themes and regional specificity, there often were not high enough frequencies of common co-occurring terms and themes to compare results statistically across regions. Therefore, the author team used a consensus-based qualitative approach to determine important groupings of themes that emerged as key dimensions commonly used to distinguish one type of fishing from another.

The disposition of fish was chosen to examine in greater detail because it is a dimension that can be measured directly and can serve as a proxy for many of the prominent dimensions that are more difficult to measure, such as motivations and importance. In addition, disposition of fish was the only dimension within the policy documents with enough data points to show meaningful patterns cross-regionally.

When analyzing the relationship between fishing terms and disposition of fish, each regional social scientist first examined all disposition codes for potential groupings. Some were obviously related via parent codes, while others had been listed separately but represented related concepts. Even though there were regional differences in the specific contexts, ten disposition categories emerged across the non-commercial fishing literature: food, cultural practices, gift/share, socially embedded practices, customary exchange, barter, trade, sell, catch and release, tournament/sport/trophy. Some of these were retained because they were currently represented in law and policy (customary exchange, barter, trade, sell, catch and release, tournament/sport/trophy).

Co-occurrences were then calculated for fishing terms and each of these ten categories, for each region. Overall frequencies of disposition codes were compared as well as the distribution of disposition codes by type of fishing.

## 3. Results

### 3.1. Documents and fishing terms

All policy documents that were identified were retained for analysis. For the peer reviewed documents, a large proportion used the terms only as category labels with no explanations or were excluded for the other reasons outlined in the methods. While higher numbers of papers were returned for regions in the continental US, a larger proportion were retained for analysis in Alaska (AK) and the Pacific Islands (PI, Table 1).

#### 3.1.1. Fishing terms in policy documents

The largest numbers of both policy documents and terms for types of fishing occurred in the Pacific Islands (Fig. 2). The Pacific Islands documents mentioned 14 types of fishing, whereas the second most frequent region, West Coast (WC), only mentioned 8. The order of frequency for the remaining regions are Alaska (7), Southeast (SE, 4), and Northeast (NE, 3). Only five terms were mentioned in the national documents.

'Recreational fishing' was used by far the most frequently, with 59

**Table 1**
Number of papers returned in the Web of Science search and number and percent retained for analysis, by region.

| | PI | AK | WC | SE | NE |
|---|---|---|---|---|---|
| Number of papers returned in Web of Science search | 102 | 237 | 334 | 301 | 306 |
| Number of papers retained for analysis | 38 | 135 | 50 | 92 | 27 |
| % of papers retained for analysis | 37 % | 57 % | 15 % | 31 % | 9 % |

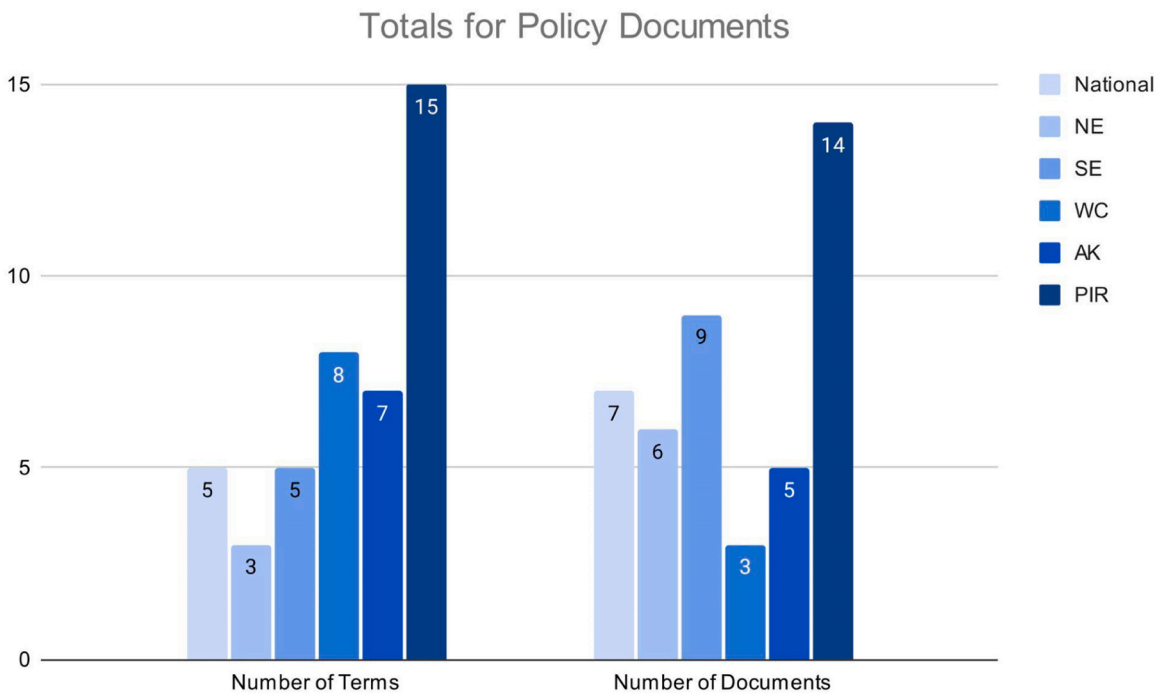


**Fig. 2.** Number of fishing terms and policy documents by region, ordered east to west.

total mentions across 31 documents. This is unsurprising since it is the one term defined at the national law and policy level on par with commercial fishing, and therefore is often used to refer to any fishing that is not obviously commercial. The next most frequent term 'subsistence' only occurred 37 times across 12 documents, and the rest of the terms occurred far less frequently.

Fig. 3 shows the breakdown of the number of documents that mention terms other than recreational, by region (see supplementary materials S3 for raw data). 'Non-commercial,' 'traditional,' and 'subsistence' were general terms that appeared in the greatest number of documents. Another set of terms centered around heritage, including 'customary,' 'cultural,' 'artisanal,' and 'community-based.' Other groups of terms referred to fishing by the location where it occurred, scale of fishing, and specific target. The 'general' terms appeared across almost all regions. The other terms were almost all used in Pacific Islands documents, but less frequently in others. Outside of the 'general'

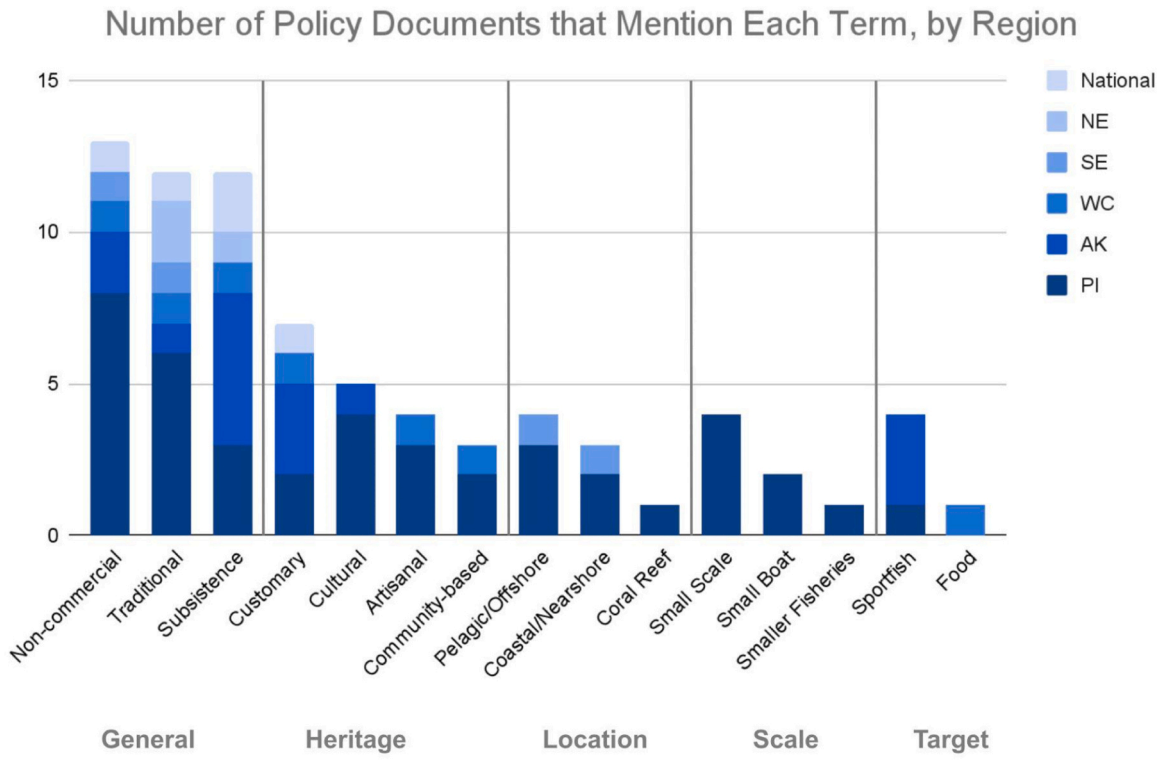


**Fig. 3.** Number of policy documents that mention each term, by region and grouped by theme.

terms, the group that included the highest diversity of terminology across all regions were those terms related to 'heritage.'

With respect to the total number of times terms were mentioned (Fig. 4), 'subsistence' was used the most frequently, with 37 mentions for all regions. In addition to the Pacific Islands, a large number of these instances were in papers about Alaska. The next most frequently mentioned term, 'traditional,' had only 16 mentions.

The groupings followed a similar pattern as the number of documents using each term, with 'heritage' terms again having the most regional representation.

#### 3.1.2. Fishing terms in peer-reviewed literature

Within the peer-reviewed literature, the greatest number of papers were returned for Alaska and the Southeast; however, as with the policy documents, the Pacific Islands included the greatest number of terms related to non-commercial fishing (Fig. 5).

A total of 43 terms appeared in at least one document across the entire dataset. Fig. 6 illustrates the distribution of terms that were mentioned in peer-reviewed documents at least 10 times. 'Recreational fishing' was included in this figure to illustrate that 'subsistence' is more prevalent than 'recreational fishing' in the peer-reviewed literature, especially in Alaska, but across other regions as well. A larger number of terms related to the 'heritage' grouping also were present. The terms start to indicate the association of 'non-commercial fishing' with nearshore, cultural heritage practices, occurring at a smaller scale for food as well as sport.

The term 'subsistence' was mentioned by far the most frequently across all regions (n=356), almost double the number of the next most frequent ('recreational,' n=187), and over three times more than any other of most prevalent terms ('small-scale' n=89, 'coastal/nearshore' n=86, Fig. 7). This was largely due to papers addressing subsistence in Alaska. Further, in all regions except the Pacific Islands, it was the only term other than 'recreational fishing' with substantial enough usage to examine in greater detail. All other terms occurred fewer than 35 times for all other regions combined, which did not provide enough examples of thematic codes to infer meaning.

### 3.2. Emerging non-commercial fishing dimensions

In-depth coding revealed five main dimensions that characterize non-commercial fishing (Table 2, see supplementary materials S2 for full codebook). Prevalent themes within each dimension reinforced concepts that emerged in the previous analysis of fishing term groupings:

1. **Fisher Demographics:** Codes used to describe demographics of non-commercial fishers largely reflected on characteristics of Indigeneity, vulnerability, and race, ethnicity, and culture (supplementary materials S2, tab 'Characteristics of Fishers).
2. **Fishery Characteristics:** Codes related to non-commercial 'fishery characteristics' focused on the types of species targeted, and fishing materials and methods especially gear types and vessel attributes. Whether preferred, required by policies, or used out of necessity, these materials and methods often limited activities to coastal or nearshore waters and were related to the species targeted, e.g. nearshore or reef fish. One other attribute of non-commercial fisheries was that in two regions they were characterized as "data poor".
3. **Disposition of Fish:** This code referred to how catch was used, which was also often specified in contrast to 'commercial' and 'recreational' fishing. For example, regardless of label, almost all descriptions of fishing that could be considered non-commercial included some provision for selling fish, however authors were often clear that profit should not be the primary motive. Further, many of these dispositions were used to describe non-market economies operating separately or in tandem with market economies. 'Disposition of fish' is rarely tracked at this level of detail, but our dataset included a number of examples of how this dimension could be measured.
4. **Beneficiaries of Fishing:** Beneficiaries were specified in terms of whether fish were kept or shared and how broadly within social and community networks or different types of markets. Many papers in

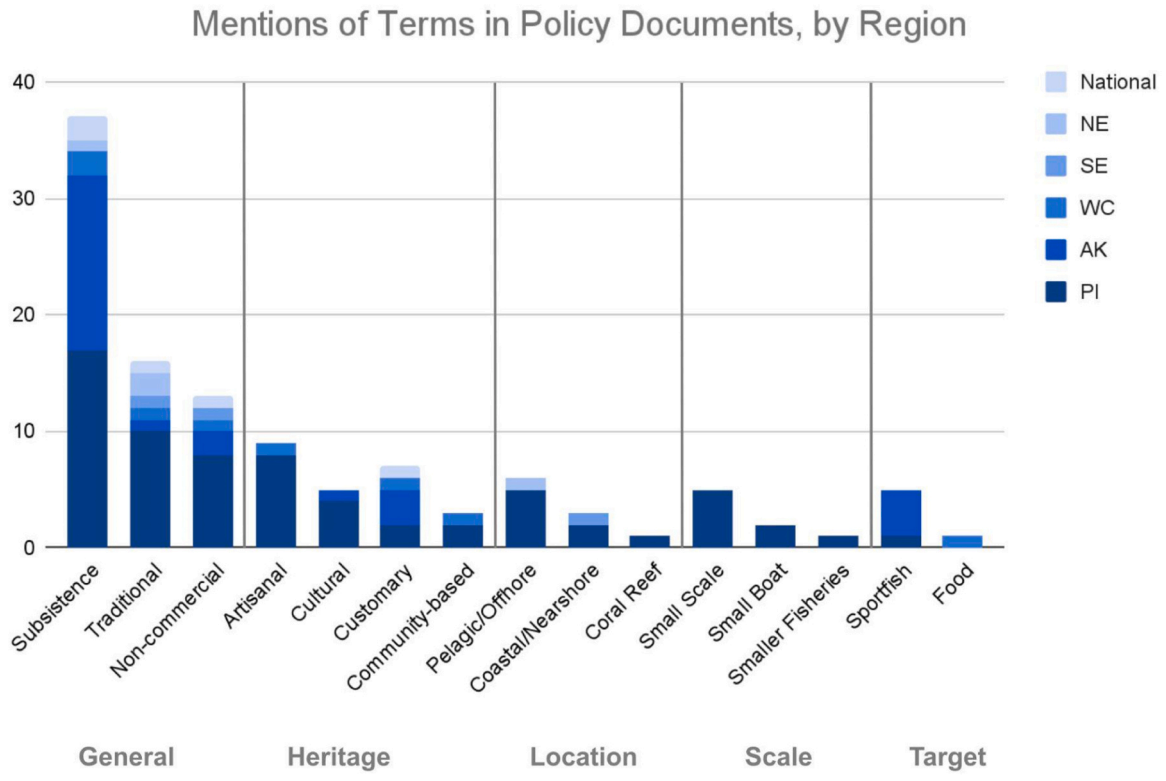


**Fig. 4.** Number of times each term was mentioned in the policy documents, by region and grouped by theme.

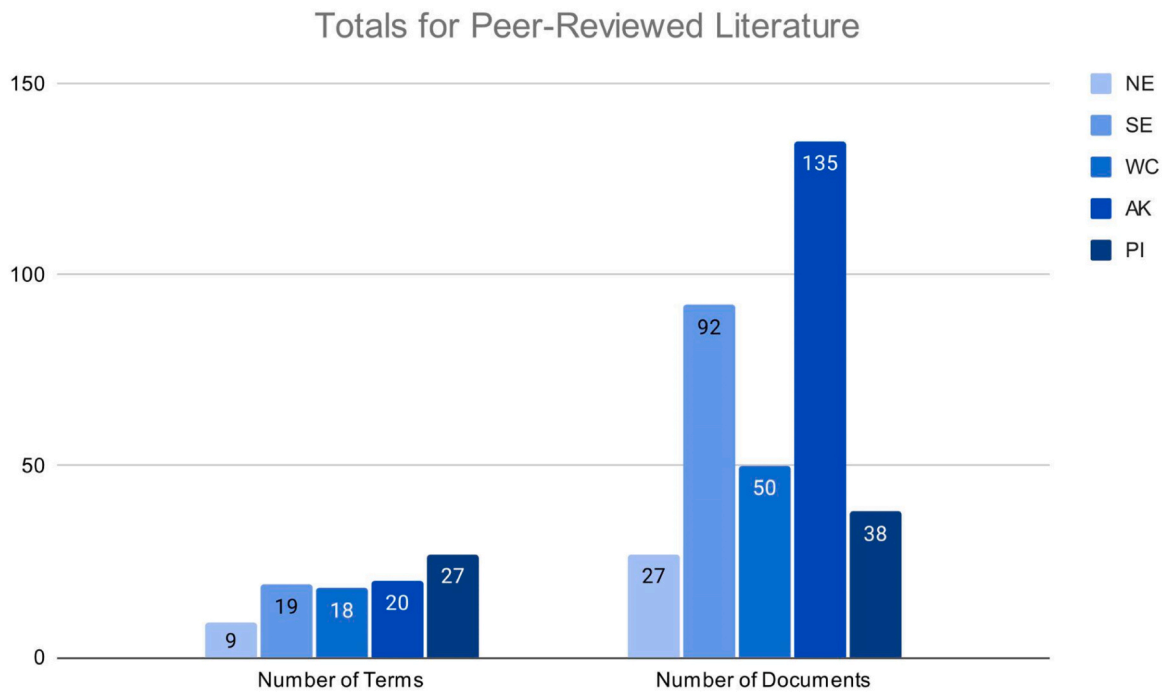


**Fig. 5.** Number of fishing terms and peer-reviewed articles by region, ordered east to west.

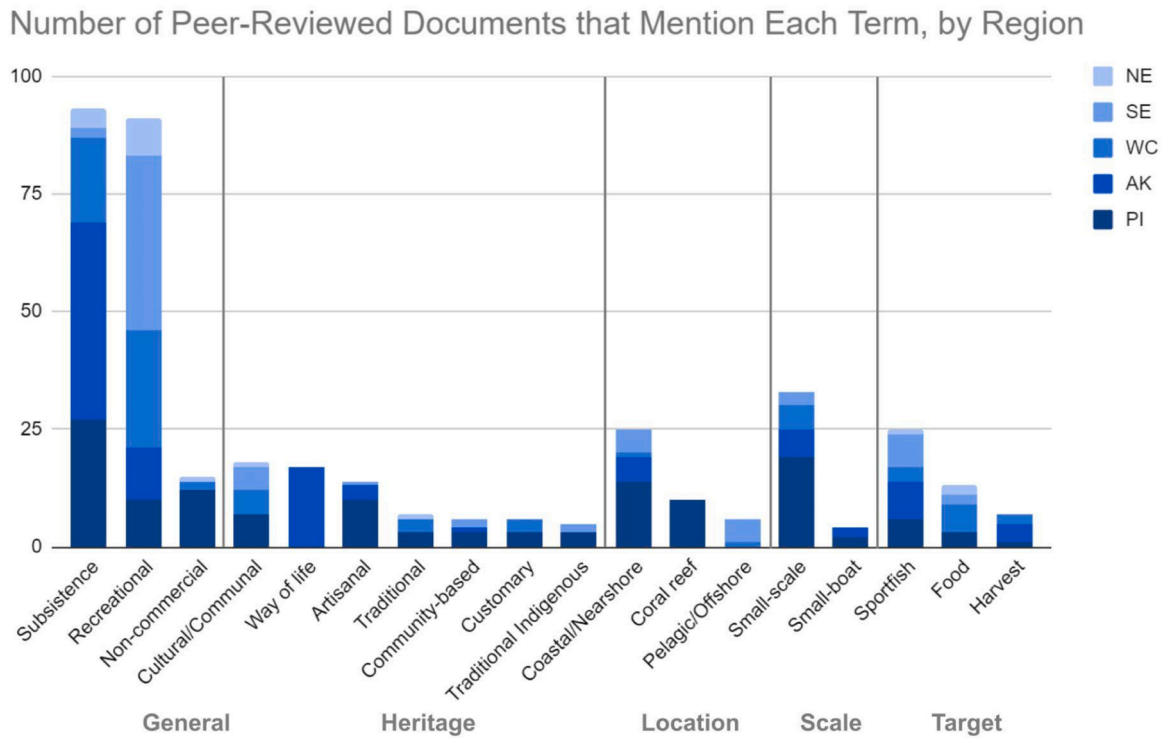


**Fig. 6.** Number of peer-reviewed documents that mention each term, by region and grouped by theme.

the dataset emphasized sharing or gifting within fishers' households or with family and friends and local communities, while formal larger markets were mentioned largely in contrast to direct beneficiaries within these social networks.

5. **Reasons for Fishing:** This dimension generated the largest variety of codes that were the most difficult to disentangle. They represented a wide range of activities, perceived benefits, motivations for fishing, and relationships with fish, but it was often unclear which type of meaning was intended by authors. Understanding this dimension was often the main purpose of the peer-reviewed manuscripts (as reflected in our search criteria), unlike policy documents which only included brief definitions, if any.

Four of the five dimensions identified are currently underutilized in US fisheries management. Only fishery characteristics are currently used, and the range of codes reflect common regulatory mechanisms. Of

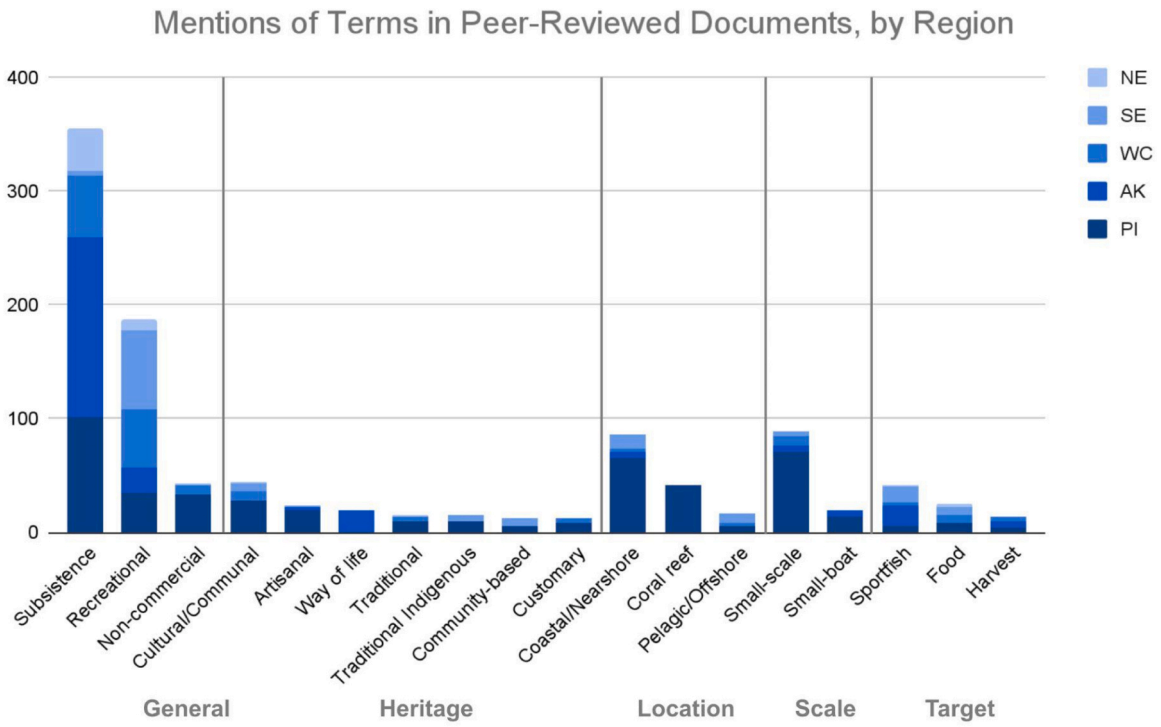


**Fig. 7.** Number of times each term was mentioned in the peer-reviewed literature, by region and grouped by theme.

**Table 2**
Dimensions of non-commercial fishing, definitions, range of codes, and measurement considerations.

| Dimensions | Description | Range of Codes | Measurement Considerations |
|---|---|---|---|
| **Fisher Demographics** | Characteristics of the people who fish. | Indigeneity, vulnerability, race, ethnicity, culture, residency, income, age, gender etc. | Underutilized. Metrics would help determine how well fishing communities reflect the general public, and whether certain groups are over- or under-represented, or affected differently by management actions. |
| **Fishery Characteristics** | Characteristics of fishing methods and materials. | Species targeted, gear used, vessel attributes, economic input and constraints, catch amount, data availability. | Frequently used. Management measures often focused on species, gear, and vessels. |
| **Disposition of Fish** | What happens to the fish that are caught. | Food, cultural events, religious purposes, gift/share, barter, trade, sell (including limits on the amount sold), catch and release, trophy. | Underutilized. Metrics would broaden understanding of the full benefits of fishing to the nation, e.g., for food security and food sovereignty, strengthening social networks, and maintaining cultural traditions. |
| **Beneficiaries of Fishing** | People who benefit from fishing. | For personal or household use, friends and family, local communities, or sale in markets. | Underutilized. Metrics would help assess the reach and distribution of fishery impacts. |
| **Reasons for Fishing** | Meanings associated with uses and relationships between fishers, beneficiaries, and fish. | Recreation/fun, food security, social cohesion, community resilience, maintain fishing knowledge, cultural continuity, spirituality, heritage and identity, reciprocity, livelihood, recover costs, additional income. | Underutilized. Most cannot be measured directly, but could be documented via surveys. Regulations based on motivations or importance would be difficult to enforce. |

the underutilized dimensions, the reasons for fishing are also difficult to measure directly. It also would be difficult to formulate management and regulations based on many of the social outcomes represented in this dimension, such as identity or spirituality. However, the degree to which some of these outcomes are achieved may be reflected in the disposition of fish, i.e., how the fish are used. Therefore, more detailed analysis was conducted on disposition of fish.

### 3.3. Co-occurence of terms with disposition of fish

The dominant disposition codes in both policy and peer-reviewed documents represent social benefits that are currently not measured well or consistently. These were labeled 'uncounted benefits.' Dispositions that explicitly included any sale of fish were labeled 'commercial,' based on the legal definition of commercial fishing, although for fisheries in the Western Pacific 'customary exchange' is defined as a type of 'non-commercial fishing' that may include cost recovery through monetary reimbursements [13]. Commercial dispositions were still present in the materials analyzed despite the focus of this study being on fisheries that were explicitly understood as non-commercial. 'Catch and release fishing' or fishing for 'tournaments, sport, or trophies' were considered 'recreational' dispositions within the materials, based on the definition that associated this term with sport or pleasure. However, these dispositions were rarely mentioned. Collectively, the dispositions identified reflect the importance of food systems, culture and heritage, and non-market economies.

#### 3.3.1. Policy documents

As with the overall use of terms, the Pacific Islands Region had the widest distribution of fishing terms linked to disposition types compared to the other studied regions (Fig. 8, see supplementary materials S4 for raw data). Alaska showed the next greatest diversity of terms, followed by the West Coast. The Southeast and Northeast had few if any terms linked to disposition codes in the policy documents. By far the most disposition codes were noted in the 'uncounted benefits' category, which was most prevalent for the Pacific Islands and Alaska. Fewer

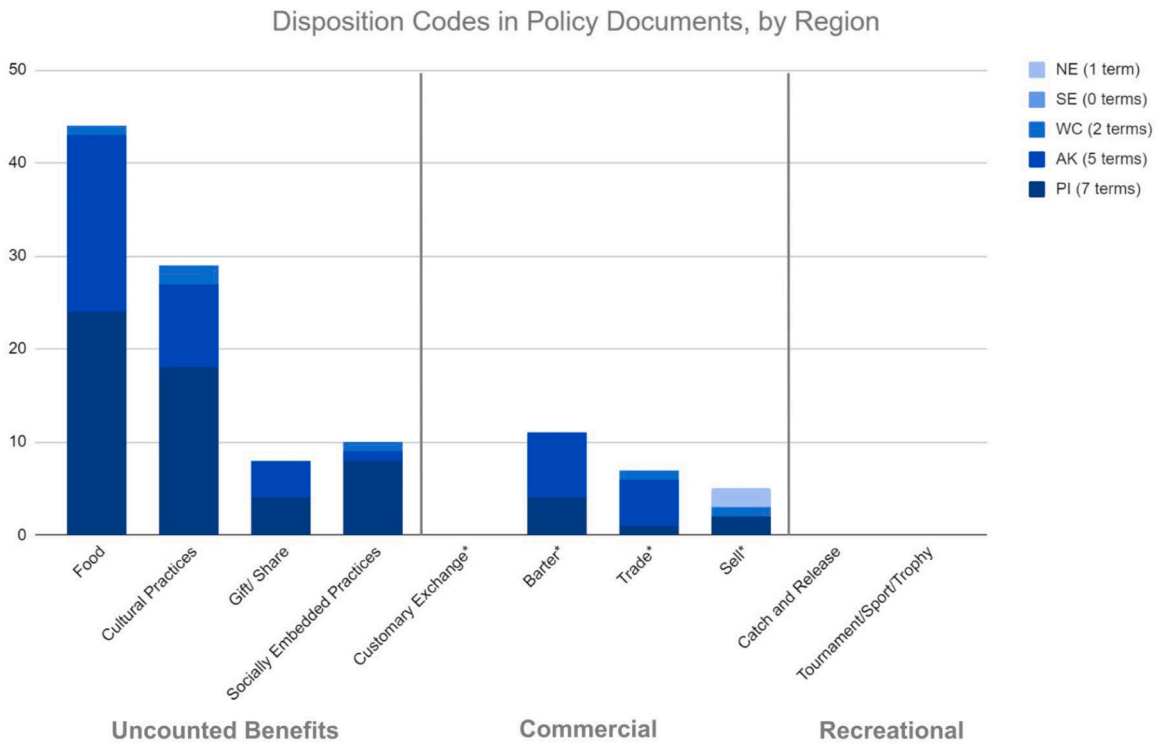


**Fig. 8.** Disposition codes in policy documents, by region. Asterisk (*) denotes terms defined in law or policy.

instances of 'commercial fishing' were noted, and there were no instances of 'recreational' dispositions.

In the Pacific Islands policy documents, 'subsistence fishing' was the most frequently mentioned type of fishing that included dispositions (n=20) and was predominantly associated with 'food,' and then 'cultural practices.' The next most frequent type of fishing, 'traditional fishing' (n=13) was more strongly associated with 'cultural practices.' Other types of fishing did not reveal strong patterns, although they all co-occurred with at least four different disposition codes.

For Alaska, 'subsistence fishing' had a much higher frequency of mentions with disposition than any of the other types of fishing (n=31), and nearly half of those (n=14) were associated with 'food.' The 'food' category had the highest frequency in Alaska (n=19) overall, followed by 'cultural practices' (n=9) and barter (n=7).

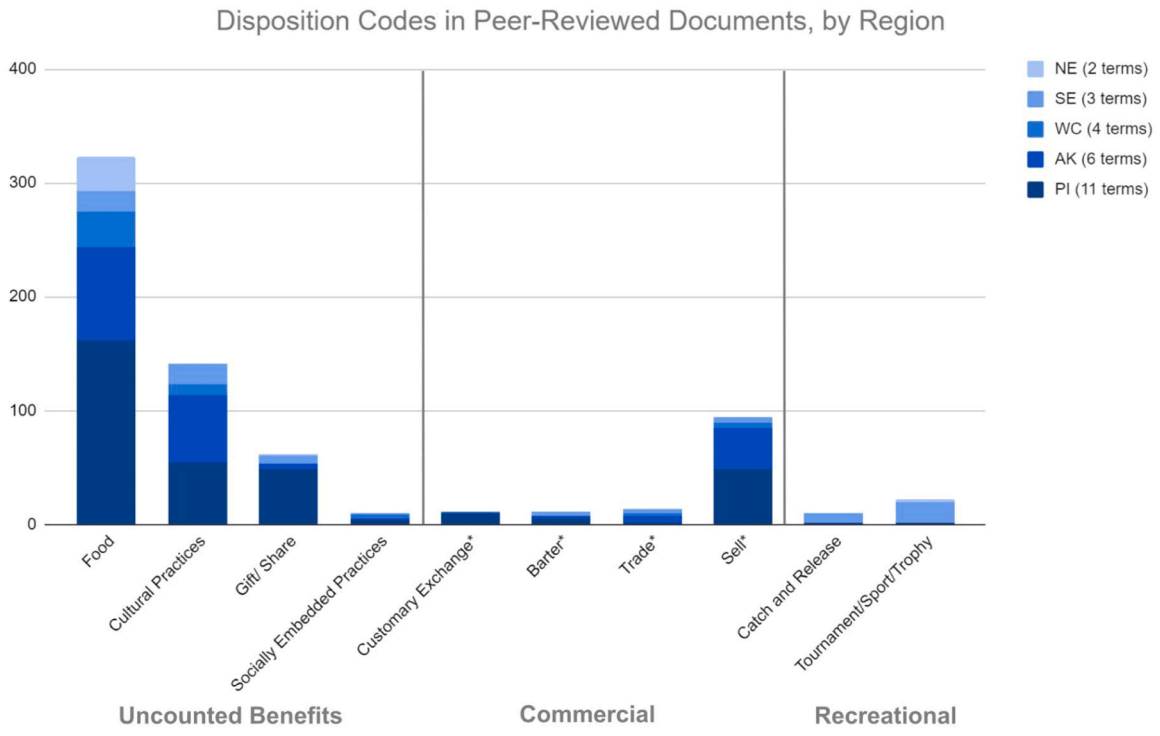


**Fig. 9.** Disposition codes in peer-reviewed literature, by region. Asterisk (*) denotes terms defined in law or policy.

The West Coast Region had fewer mentions of fish disposition, and most were associated with 'subsistence fishing.' This was the only fishing category associated with any disposition, aside from 'recreational' which was only coded once, for 'selling.' No non-commercial fishing terms were coded with dispositions at all in the Southeast region, and in the Northeast region, the only fishing term that co-occurred with a disposition was 'recreational fishing,' which was coded twice with 'selling.'

### 3.3.2. *Peer-reviewed literature*

The peer-reviewed literature in the Pacific Islands Region again had the most mentions of dispositions related to types of fishing (Fig. 9, see supplementary materials S4 for raw data). The emphasis on 'uncounted benefits' was even stronger in the peer-reviewed literature, where both the dispositions of 'food' and 'selling' fish within non-commercial activities were emphasized.

In the Pacific Islands, all of the disposition codes were represented, including 'selling.' By far, the most mentioned disposition was 'food,' with 162 mentions co-occurring with some type of fishing. 'Cultural practices' (n=54), 'gifting/sharing' (n=48), and 'selling' (n=49) were the next most frequent codes. The rest of the codes had lower representation, n=10 ('customary exchange') or fewer. For terms, 'small-scale' and 'artisanal' fishing showed less of a range of disposition codes, and more emphasis on 'selling' than other fishing terms. This is reflected in quotes such as '"artisanal' and 'small-scale' fisheries are defined as including small, semi-commercial or non-commercial vessels as well as shore based non-commercial and semi-commercial fisheries"[49, p.279]. 'Recreational fishing' was the only fishing term that included the two dispositions associated with leisure activities (i.e., 'catch and release,' 'tournament/sport/trophy').

Alaska showed the next highest diversity of terms associated with dispositions of fish. However, as with the policy documents, the vast majority of mentions were dispositions related to 'subsistence fishing.' Like the Pacific Islands, almost all of the disposition categories were represented in 'subsistence fishing,' with the highest mentions for 'food' (n=82), 'cultural practices' (n=59), and 'selling' (n=35).

Peer-reviewed literature for the West Coast reflected a primary emphasis on 'food' as a disposition category (n=31). References to 'cultural practices' (n=10) and 'trade' (n=6) also appeared as important disposition categories, although with less frequency. The literature on fishing that is not commercial in nature tended to focus on Tribes, which is reflected in the intersection of 'cultural' as a top fishing term (n=8), and 'cultural practices' as a top disposition category (n=10).

In the Southeast, by far the greatest disposition types were related to 'recreational fishing' (n=62). However, unlike other regions, 'recreational fishing' also included all disposition types except 'cultural exchange,' especially 'tournament/sport/trophy' (n=18), 'cultural practices' (n=18), and 'food' (n=18).

The Northeast had the fewest types of fishing terms as well as the fewest mentions of disposition. 'Subsistence fishing' was most prevalent of all terms (n=31), and almost always associated with 'food' (n=29). The only other type of fishing associated with disposition was 'recreational fishing' (n=3), which was associated with 'tournament/sport/trophy' (n=2) and 'food' (n=1).

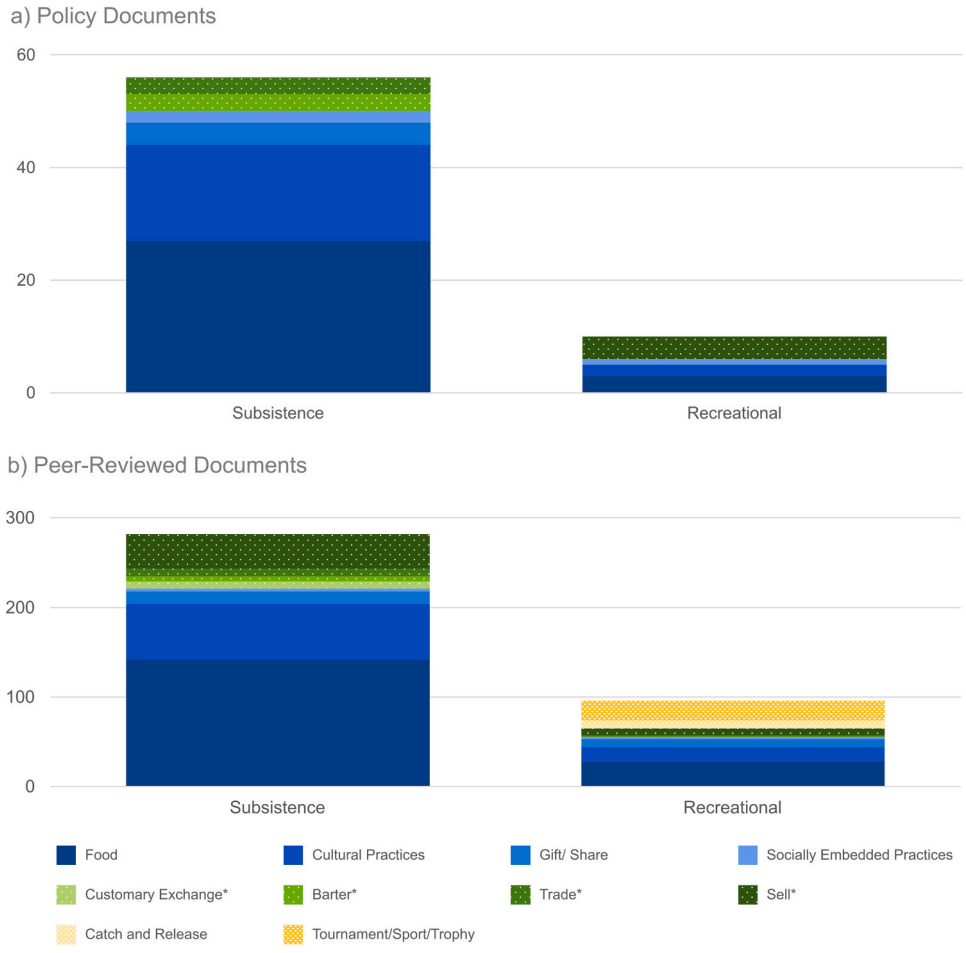


**Fig. 10.** Disposition codes for subsistence and recreational fishing in (a) policy documents and (b) peer-reviewed documents. Asterisk (*) denotes terms defined in law or policy.

### 3.4. Disposition codes associated with subsistence and recreational fishing

'Subsistence' and 'recreational' fishing were the only two types of fishing that occurred across all regions in the peer-reviewed literature and most regions in the policy documents. Both types of fishing were associated with almost all disposition codes, with 'food' and 'cultural practices' the most prevalent for both the policy and peer-reviewed documents (Fig. 10).

Even though the types of fishing examined were only those considered non-commercial, 'selling' was still present, especially for 'subsistence fishing' in the peer reviewed literature for Alaska (n=28). The two 'recreational' disposition codes were rarely present and only associated with 'recreational fishing' in peer-reviewed documents, most strongly in the Southeast, especially 'tournament/sport/trophy fishing' (n=18). This category was only noted four additional times, twice in the Pacific Islands, and twice in the northeast. 'Catch and release' was also more prominent in the Southeast (n=8); otherwise the term was only mentioned twice in the Pacific Islands.

While disposition of fish represents many of the motivations and benefits that are more difficult to measure, it does not capture the full meaning encompassed within a type of fishing. For example, within 'subsistence fishing,' disposition codes included 'barter,' 'trade,' 'sell,' 'customary exchange,' 'socially embedded practices,' 'gift/share,' 'cultural practices,' and 'food.' These dispositions reflect diverse motivations, social needs, seasonality, and networks. The range of dispositions within one term highlights the variety and social complexity of fishing practice beyond the scope of this paper. Therefore, we also qualitatively examined all thematic codes associated with these two terms in the policy documents and peer-reviewed literature in each region, as a starting point for future discussions.

#### 3.4.1. Thematic analysis of recreational fishing

'Recreational fishing' was the most frequent type of fishing mentioned in the policy documents in all regions except Alaska. In general, there were very few codes associated with 'recreational fishing,' i.e. there were few clarifying statements that explained meaning along with use of the term. The codes that were associated with 'recreational fishing' largely related to leisure, fun, and "getting away" or "spending time on the water." Charter fishing was often identified within the text, as well as limited vessel size or gear. There was comparatively minimal mention of lifestyle importance and social motivations, as well as some mention of cultural identity, continuity of traditions, economic survival, and personal use. When characteristics of the people who fish or beneficiaries of fishing were mentioned, they were described as communities with long fishing traditions, but this included both Indigenous and non-Indigenous demographics. Fish were kept for personal use, distributed to friends and family, and played a role in local economies.

In the peer-reviewed literature, 'recreational fishing' was the second most frequently used term, and appeared across all regions, especially in the Southeast where it was also the predominant term used. In the Southeast, 'recreational fishing' referred to both urban and rural communities at local scales. It was also applied to both nearshore and offshore environments, and therefore occurred in both Federal and State waters. 'Recreational fishing' spanned all races and age groups and both tourists and residents. While a large portion of the recreational fishing economy is derived from tourism, immigrant communities and cultural minorities were also identified as heavily engaged in recreational fishing. It was noted in all states of the Southeast Region but is more limited in Puerto Rico and the US Virgin Islands. In this region, there were many specific categories within 'recreational fishing,' related to targeted fishing for specific species. For charter captains, 'recreational fishing' is their primary source of income and was largely described as consistent with a market economy, with a small subset representing an informal or gift economy. Motivations spanned the entire spectrum, including for consumption, sharing, use in celebrations and gatherings, for fun or leisure, or releasing the fish. Other fishers target fish for sport and try to catch "trophy fish." Many fishers reported fishing as a multi-generational hobby. Recreational fishing also used the whole range of vessel and gear types and was predominantly associated with conventional management. Many papers discussed discontent of recreational fishers towards agency or council actions in the South Atlantic and Gulf of Mexico. Only a small percentage is supportive of the current management regime.

The region with the next most frequent mentions of 'recreational fishing' was the West Coast. 'Recreational fishing' in the peer-reviewed literature of the West Coast was described in both state and federal waters, and included both vessel-based fishing and pier-based angling, as well as digging for shellfish. Some of the literature was particularly attentive to recreational fishing impacts connected to major environmental events, including a marine heatwave event and major harmful algal bloom in 2015. The term was associated with codes for 'food security' and 'food consumption,' in part because some of the literature examined the relationship between 'recreational fishing' and 'subsistence fishing' in urban settings, and therefore featured codes for cultural minorities and vulnerable populations as well. 'Recreational fishing' was also frequently associated with codes for perceptions of governance as the literature addressed management in the context of 'recreational fishing.' In terms of motivations and benefits, the term was associated with social codes that included 'lifestyle importance,' 'social cohesion,' 'well-being,' and 'psychological needs' and not at all, it is worth noting, with 'fun' and 'time and the water.'

The documents on the Pacific Islands included almost as many mentions of 'recreational fishing' as the West Coast. However, few codes were associated with the term, and most of them were associated with 'leisure,' 'fun,' 'getting away' or 'spending time on the water,' 'spending time with friends and family,' and 'catch and release' or 'tournaments.' 'Tourists' and 'charter fishing' were each specifically mentioned once. However, 'food consumption' and 'subsistence' were also mentioned, as well as 'selling fish to cover expenses.'

Alaska had even fewer mentions of 'recreational fishing.' The only codes that co-occurred with the term were 'characteristics of fishers,' with one instance of 'Native,' and one for 'resource-dependent.' The term co-occurred with the term 'subsistence fishing' three times. Papers in the Northeast hardly even mentioned 'recreational fishing.' Co-occurring codes were related to 'fun,' 'fishing for sport,' 'not fishing for food,' 'survival,' 'culture,' and 'tradition,' but these each occurred only once.

#### 3.4.2. Thematic analysis of subsistence fishing

'Subsistence fishing' was the second most frequently used term in the policy documents, primarily due to the Pacific Islands and Alaska regions. It was mentioned only two or fewer times in each of the other regions. In the Pacific Islands the co-occurring codes were mostly related to the 'beneficiaries of fishing,' which included 'local communities,' 'villages,' 'households,' 'local economies,' 'friends and families,' and 'personal use.' 'Communities with long fishing traditions' and 'Indigenous communities' were specified, as well as 'poor' or 'resource-dependent' communities. The next largest cluster of codes related to food, consumption, and survival. A smaller set of codes focused on cultural events, cultural identity, continuity of traditions and customary practices. The same clusters were prevalent in Alaska and the National documents, although with a more even distribution and some mention of 'barter' and 'trade.' The West Coast also had few co-occurring codes. 'Customary practices' occurred twice. 'Consumption,' 'trade,' 'spending time with friends and family,' 'socially embedded practices,' and 'beneficiaries' at the community, personal use, and friends and families scales each occurred once. The term 'subsistence' did not appear in any of the Southeast policy documents, and in the Northeast, the only co-occurring code was the term 'recreational fishing.'

In the peer-reviewed literature, 'subsistence' was by far the most frequently used term. It was mentioned more often than 'recreational fishing' for all regions except the Southeast. It was mentioned the most

in Alaska, where it is defined in both federal and state law, and in that region 'subsistence' was the only term used frequently enough for detailed analysis at all. In Alaska, 'subsistence fishing' was associated with people described as 'Alaska Natives,' 'Indigenous Peoples,' and 'Alaska residents.' 'Beneficiaries' were not always noted, but when they were, they included 'personal' or 'household use,' 'friends and family,' 'residents or villagers,' 'communities,' and 'local economies.' Within the literature, communities were described as heavily resource-dependent and maintaining fishing traditions that have endured across generations. While livelihoods were mentioned in some contexts, there was also emphasis on fishing activities as not commercial, linked to shared values, and representing a particular way of life. This was also reflected in codes that identified a 'hybrid economic model,' often characterized as a mixed subsistence economy, which was outside a conventional market-based economic model but not fully cash-free. 'Food,' 'selling,' and 'cultural practices' were heavily emphasized as dispositions. There were examples of economic dispositions of fish used to support non-economic and culturally relevant dispositions related to subsistence. Motivations included broader social and cultural benefits such as social cohesion, cultural identity, cross generational connection, and sharing Indigenous or Local Knowledge.

In the Pacific Islands, 'subsistence fishing' was associated with nearshore or coastal communities, which were predominantly characterized as rural or Indigenous. Catches were generally kept for personal and household use, but also for families and social networks and communities more broadly. When the management regime was discussed, it was most often in the context of 'customary management.' This theme was associated with many diverse codes for aspects of economic models that were outside of the formal market economy. These codes also appeared frequently. Similarly, papers in this region emphasized that fishing was not for commercial or profit motives. As reflected in the disposition codes, fish were often discussed as a food source. The next most frequent use was for 'cultural practices,' which was related to gifting or sharing fish, as well as 'customary exchange.' In addition to these dispositions, 'subsistence' was also associated with survival and having material needs met, strengthening social networks, and other general cultural benefits, such as cultural obligations, continuity of tradition, spirituality, and identity.

Within the literature of the West Coast region, 'subsistence' was also a salient term. The term was often used in the context of Indigenous and Tribal fishing and fishers, and was related to culturally important practices. 'Subsistence' was described in both historic and modern terms and associated with a range of species and coast-wide locations. A distinct set of literature, however, focused on vulnerable populations, cultural minorities and immigrant communities. Catches were both retained at the personal and household level and used for food and direct consumption.

In the Northeast, 'subsistence fishing' was only coded in four papers, but it was discussed with some frequency in each paper. The spatial extent was noted as rural and shore-based. Fishers were characterized as 'vulnerable,' 'resource-dependent,' 'poor,' 'cultural minorities,' 'immigrants,' and 'Indigenous.' Beneficiaries of fish included 'household,' 'friends and family,' and 'villages.' Characteristics of the fishery included targeting specific species, using private boats, as well as for-hire/party boats. Low governance capacity, conventional management with bag and size limit, and exclusive property rights (quotas) were also noted. A number of codes related to economic or commercial motives, including 'livelihood,' 'economic survival,' and 'trade' or 'exchange.' However, motivations were also noted as 'recreational/leisure,' and not being commercial. Survival and many aspects of food consumption including 'food security,' 'nutrition,' and the 'economic value of meals' were also noted. Gifting or sharing fish as well as general cultural and traditional benefits were also mentioned.

The Southeast mentioned 'subsistence fishing' least of all. It was associated with rural communities and local scales and primarily with nearshore fishing activities in state or territorial waters. The focus was on Indigenous or Native fishers, although it included all races, and mostly older or middle-aged populations who were holders of Indigenous or Local Knowledge. It was associated with consumptive use of fish for traditional or customary practices and cultural events and was seen to play a key role in lifestyle importance and sense of place. 'Subsistence fishing' was predominately noted as secondary income, for bartering, exchanging, or trading, or to keep for personal or family use. It was mostly discussed in Puerto Rico, the US Virgin Islands, Louisiana, North Carolina, and Florida's Gulf. It was associated with economic models that encompass all aspects of an informal economy (e.g., gift economy, subsistence economy) and also market economy in poorer areas (e.g., Louisiana, Puerto Rico, US Virgin Islands). The management regime was mostly discussed as conventional, although one alternative approach was discussed in the US Virgin Islands. 'Subsistence fishing' was described as multi-geared and targeting multiple species. Subsistence spearfishing was discussed in Puerto Rico and the US Virgin Islands.

## 4. Discussion

### 4.1. Providing the greatest benefits to the nation

This study's examination of the terminology, language, and discourse around 'non-commercial fishing' revealed that the focus of US fisheries management does not account well for important benefits to society. The terms used across the dataset suggest concepts that are underrepresented by the legally defined terms 'commercial' and 'recreational' fishing. This diversity is reflected somewhat in the policy documents, but even more in the peer-reviewed literature. Given that public policies are shaped by institutional and cultural norms and should reflect the broad public interest [50], this mismatch indicates that further examination of the degree to which NOAA Fisheries policies reflect current societal practices, preferences, and standards is warranted. Further, the variance in frequency and diversity of terminology across regions suggests a need for greater attention to regional drivers of policy and research emphases. For example, the Pacific Islands had the widest range of terms in both policy and peer-reviewed literature. The proliferation of terms reflects that practitioners have been actively questioning definitions of 'non-commercial fishing' in this region for a number of decades (e.g., see [51,52]). In Alaska, fisheries management adopted a third management category of 'subsistence,' as formalized in the federal subsistence law that has been in place since 1980. This addition is in response to the strong reliance and long history of subsistence fisheries in Alaska. In contrast, the Southeast region has a large, well established recreational fishing community and lobby, which then influences management interests and research needs.

Both the terms themselves and the themes associated with them converged around important classes of social benefits, which can be summarized as food systems, culture and heritage, and non-market economies. Food systems involve not only meeting nutritional needs, but also encompass food sharing networks, traditional or cultural foods, and customary management of local foodways, all of which were present to some degree in all regions in this study. Increasingly, food systems literature also addresses the importance of equitable food access (and for whom), as well as the types of available foods, and the rights to determine food production through the lens of food security, food sovereignty, and food justice [24,53]. The expansion of terms related to fishing heritage and disposition categories related to cultural practices also revealed the importance of fishing in maintaining cultural identity and vitality across management sectors. For many fishers, the impetus to fish is cultural, which has been voiced in American Samoa as "Fish is culture" [54, p. 386]; and there are numerous examples of the linkages among culture, identity, and fishing across the globe. In this study, social and cultural benefits were also framed within the construct of non-market economies, in direct contrast to market or commodity economies. Also described as gift, subsistence, or community economies; these forms of exchange play important roles across fishing sectors

reflecting the social complexity of fishing practices and contributions to community well-being [55–57]. In some instances, substantially larger proportions of catch contribute to non-market economies via food security, community sharing, and cultural practices than commercial purposes, as has been seen for nearshore fishing in Hawai'i [58,59].

These concepts are generally not assessed for the two national fisheries categories of 'commercial' and 'recreational;' however they are all commonly associated with the concept of 'subsistence,' which was also the predominant term identified in this study. This suggests that adopting a broad definition of 'subsistence,' similar to that used in Alaska policies, and suggested in the most recent bill proposed to reauthorize the MSA [12], could improve fisheries management and monitoring through greater inclusion of the many forms of 'non-commercial fishing.' However, for regions outside of Alaska, the term 'subsistence' was often linked predominantly with either food, poverty, or Indigenous cultural benefits, but not a combination of these or other concepts. This tendency may mask the relationships between these other social benefits and non-market contributions, or imply that the term is only relevant to either poor or Indigenous populations. In addition, studies have shown that people who meet criteria for subsistence activities may not see themselves as poor or food insecure [17], further alienating under-represented fishers rather than including them.

Non-commercial fisheries demonstrate complex non-linear dynamics that may not fit well with public policies based on linear, economic assumptions [50]. Fishing practices can be flexible in motivation and means, and what begins as an economic activity may shift to include community needs, personal identity, or opportunity, or vice versa. In light of this fluidity, rigid governance systems are inherently limited. Moving beyond binary terminology reflecting only work or leisure, however, may be a good first step in accounting for broader social benefits. Thus, it will be important to further examine how fishery managers may better acknowledge and affect the uncounted benefits to ensure fisheries are managed to provide optimum benefits to the nation, especially food production (as emphasized in the MSA [6, Section (3)(33)]).

### 4.2. Evaluating management outcomes

For the two types of fishing currently managed under the MSA, 'commercial fishing' is defined only by specific dispositions of fish (economic gain), while 'recreational fishing' is defined only by specific motivations (sport or pleasure). As a result, three of the dimensions identified in this study ('disposition of fish;' 'beneficiaries of fishing;' and 'reasons for fishing') are not consistently measured. Not only does this ignore the social outcomes of fishing, including social benefits, equitable distribution of benefits, or unintended consequences; but this also holds consequences for sustainable fisheries management. Sustainable fisheries management relies on stock assessments informed by the best available science. Counting only those fish that fall within 'commercial' and 'recreational' fisheries provides an overly narrow estimation of fish stocks and fishers' needs. This could have implications for stock assessments if fish caught for other purposes are not documented [5,17,31,36,55].

Of the five dimensions of fishing identified in this study, 'reasons for fishing' included some of the most important concepts distinguishing 'non-commercial fishing' from 'commercial fishing.' The codes within this category represent the important meanings and benefits of fishing, which include both tangible outcomes such as food security, and intangible outcomes such as cultural identity, and sense of place. Yet, common regulatory levers include harvest control rules and gear and spatial restrictions, and it is therefore challenging to effectively regulate around motivations. Given this challenge, the authors identify a possible pathway toward greater accountability of social benefit. Social benefits could be measured through a range of social science methodologies, for example social psychological surveys, ethnography, or affect measure through self-reporting. These types of metrics may require more labor and resources to track on a regular basis which could result in a greater burden on the public, although there is substantial value in better understanding the underlying range of motivations and values related to fishing. Given these constraints, disposition of fish was analyzed as a proxy to represent some of the important core elements of the dimension 'reason for fishing.' In this analysis, disposition of fish caught recreationally were infrequently mentioned, which may be due to NOAA's definition of 'recreational fishing' reflecting motivations (sport or pleasure) rather than disposition. Further, regulation of recreational fishing for most of the US is allocation based; once the allocation of quota for recreational purposes is set, what happens to the fish is not tracked, suggesting there is no value of fish caught recreationally beyond the permit purchase. This reflects NOAA Fisheries' emphasis on monetary value of fish but does not account for any of the other values of fish. Better documenting dispositions could improve understanding of fishery contributions to food systems, cultural and heritage, and non-market economies. Some dispositions are already included in non-commercial fishing surveys in the Pacific Islands, which could be expanded to include the full range of dispositions identified here. Other regions could use this model as a starting point to explore the suite of possible dispositions and social benefits. While this study focused on 'non-commercial fishing,' commercial fisheries are also beginning to track the amount of fish kept for personal use, and there is interest in better understanding the social contributions of these fish in alternative economies, human well-being, and community resilience [55].

Finally, this study reveals the potential for evaluating the equitable distribution of fisheries benefits and identifying underserved communities, a growing priority for NOAA Fisheries [22,23]. Improved understanding of the full suite of benefits and who receives them would facilitate equitable management processes that address possible environmental justice implications. There is also the opportunity to broaden and coordinate existing fisheries surveys. Information about fisher populations, identity, and motivations is not consistently collected in existing surveys of fishers or fishing communities. Adding questions on these topics and coordinating efforts across NOAA Fisheries regions would extend the benefits of ongoing regular information collections. Often these under-represented types of fishing cross state or territorial and federal waters. The need for cross-jurisdictional understanding of these fisheries, the species, and the fishing communities that depend on them is an opportunity to build on and strengthen existing partnerships with state and territorial agencies to ensure that fisheries management accounts for what counts to fishing communities. Additional social science is necessary to collect primary social and cultural data to ensure best available science informed policy that supports equitable distribution of both benefits and burdens of fisheries management.

### 4.3. Supporting fishing community resilience

The uncounted benefits identified in this study are foundational to human well-being [17,60], especially healthy and resilient seafood systems [24,53]. The benefits of fish as an important food source across local, regional, and national scales are well documented. Bennett et al. [61] argue for a greater emphasis on fish as food within policy-making to underscore the importance of fisheries for food security. In addition, previous work in the US has identified cultural subsistence and values as important across regions of NOAA Fisheries; however they did not tease apart the cultural and social aspects of fishing [5]. This study revealed that, while these aspects to fishing were often connected, there were distinctly different cultural and social contributions to community well-being. For example, sharing networks have been identified as key social indicators of community resilience in the face of disaster events, as well as important resources that support cultural identity and cohesion [62]. One fish harvest may support a suite of social benefits including food security, community resilience, shared cultural identity, and increased social capital [24,55,56]. Many of these concepts were expressed in this study via gifting and sharing fish for various purposes,

and the ability of fishers to switch between market and non-market economies was documented as an important strategy during the COVID-19 pandemic when global trade was disrupted [43,63,64].

Such disruptions may become more common as extreme weather and climate events increase in frequency and magnitude, as has been documented for costs of wildfires, severe storms, inland flooding, and hurricanes [41,42]. Resilient systems can withstand and recover from these types of perturbations, and the rapid restoration of fisheries activities after a disaster can fast track a community's recovery [65]. Yet, until recently, food systems were largely absent from resilience and disaster planning [66]. The role of 'blue foods' (fish, shellfish, plants and algae from fishing and farming in marine and freshwater ecosystems) has been underrepresented in global food systems assessment in general, and data on the role of marine fisheries in disaster resilience is sparse [65,67,68]. Further exploration of how policies or management may be modified to sustain fisheries for food systems, culture and heritage, and non-market economies is a needed step in improving NOAA's contributions to a climate-ready nation and supporting fishing community resilience.

## 5. Conclusion

This study demonstrates that the terms 'commercial' and 'recreational' fishing as defined in the MSA are not adequate to describe the full range of reasons people fish or benefits to fishing communities and society. This situation risks undercounting the degree to which fisheries management results in the greatest benefits to the nation, the goal of optimum yield. 'Subsistence' as defined in federal subsistence law in Alaska and considered for the MSA reauthorization is broad enough to cover all the other categories identified in this study. Such a broad definition would allow for flexibility in developing appropriate regional and site-specific regulations. However, the strong association of the term with food and Indigenous cultures may mask other important social contributions and non-market economy aspects. Thus, care should be taken to ensure that all dimensions of 'non-commercial fishing' are adequately considered, especially the other social benefits and small-scale sales that may be downplayed in people's minds by the term 'subsistence.'

At the 9th World Fisheries Congress in March 2024, conference organizers asked attendees "What is the first word that comes to mind when you think about fish?" The top three responses were food, culture, and life (Abigail Lynch, pers. comm. April 5, 2024), which aligns with the results in this study. The relationships between fishing and food systems, culture and heritage, and non-market economies have been under-represented so far in agency management. NOAA Fisheries would benefit from additional data for demographics, disposition, and beneficiaries of fishing to more fully acknowledge the diversity of ways that people fish and benefit from fishing and assess the degree to which these benefits are equitably distributed. With the federal government's current emphasis on equity and environmental justice, the time is ripe to focus on these under-represented types of fishing and their role in sustaining fishing communities, especially as a way to diversify fishing economies in times of stress. Aligning terms or management practices with these relationships has implications for the ability of NOAA Fisheries to meet the mandate of ensuring the greatest benefits to the nation from fisheries management, evaluate the degree to which management goals are achieved equitably, and ensure resilience of fishing communities in the face of climate change.

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## CRediT authorship contribution statement

**Kirsten Mya Leong:** Writing – original draft, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Rebecca J. Ingram:** Writing – review & editing, Formal analysis. **Danika Kleiber:** Writing - review & editing, Methodology, Conceptualization. **Sofya Hoshaiah Long:** Writing – original draft, Methodology, Formal analysis, Data curation. **Anthony Mastitski:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Karma Norman:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Changhua Weng:** Writing - review & editing, Methodology, Formal analysis, Data curation. **Sarah Wise:** Writing – original draft, Methodology, Formal analysis.

## Data Availability

Data are contained in the supplemental materials for the paper

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2024.106377.

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