Marine Policy 96 (2018) 36–43

Contents lists available at ScienceDirect

Marine Policy

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

Resurrecting the public record: Assessing stakeholder participation in Alaska's fisheries

Meagan Boltwood Krupa*, Molly McCarthy Cunfer, S. Jeanette Clark, Emily O'Dean

National Center for Ecological Analysis and Synthesis, University of California, 735 State Street, Suite 300, Santa Barbara, CA 93101, USA

ARTICLE INFO

Keywords:
Fisheries governance
Fisheries management
Natural resource management
Stakeholder analysis
Stakeholder participation
Recreational fisheries
Commercial fisheries
Subsistence fisheries
Personal use fisheries, public processes, public participation, archival documents

ABSTRACT

Stakeholder participation is lauded as a key component of successful fisheries management, but few studies have characterized and assessed this participation. Using integrated data digitization and coding methods, this paper tests out a new method to analyze archived management proposals submitted to Alaska's Board of Fish and explores whether this approach can be used to assess stakeholder participation and success rates in Cook Inlet, Bristol Bay, and Southeast Alaska from 2000 to 2015. This pilot study asks the question, "Are there differences in user participation and success rates across the three regions during this time period?"

1. Introduction

Every three years, the Alaska Board of Fish (Board) calls for regional fisheries management proposals, inviting the public to directly participate in fisheries governance. The Alaska Department of Fish and Game's (ADFG) website refers to the Board's public process as "among the most open regulatory processes in Alaska if not the nation" [7]. Anyone can submit a proposal and provide written or oral testimony on any of the proposals, which constitute potential regulatory changes and are accessible in an online proposal book [8,9]. Proposals are logged by Board staff and recorded in the meeting documents, which are stored online and archived at the State, Library, Archives, and Museum (SLAM) in Juneau. Each proposal contains valuable information about stakeholder demographics, affiliations, interests, and positions on allocation disputes. Alaska's inclusion of stakeholders in its decision-making process began in 1959, decades before researchers, managers, and politicians began advocating for increased stakeholder involvement in fisheries management.

There is now general agreement that the historical failure to include the major stakeholders in meaningful decision-making is one of the causes of the current crisis in world fisheries and a weakness of the fisheries management process [16,17,24]. The advantages of involving stakeholders in natural resources management decision-making include: facilitating common understanding, establishing trust, resolving/avoiding conflicts, increasing stakeholders' responsibility and accountability, enhancing the legitimacy and acceptance of management policies and decisions, increasing the likelihood of rules and regulation compliance, stimulating innovation, encouraging social learning, integrating different types of knowledge, and contributing to more effective enforcement of rules [11,14,33].

With the rise of public involvement in natural resource management comes the need for an analysis of these processes. The definition of "success" needs to include far more than just the existence of public participation in decision making. Much attention has been given to improving stakeholder participation in the fisheries management process [19,30,31]. Studies have investigated participants' experiences in collaborative fisheries management in Canada [18] and Southeast Asia [29]. Leite and Pita [26] catalogued and characterized participatory fisheries management arrangements within the European Union. Similarly, Evans et al. [21] conducted a meta-analysis of co-management implementation in twenty-nine developing world case studies. In the related field of coastal zone management, Buanes et al. [13] studied the saliency and legitimacy [27] of stakeholder engagement in Norway. None of these studies analyze the effectiveness of this process or examine participation trends over time.

In an era of increasing stakeholder participation in natural resource management, the effectiveness of the actual stakeholder engagement mechanisms has received far less attention. Stakeholder communications tell

* Corresponding author.
E-mail addresses: megkrupa@gmail.com (M.B. Krupa), jclark@nceas.ucsb.edu (S.J. Clark).

https://doi.org/10.1016/j.marpol.2018.07.010
Received 5 March 2018; Received in revised form 17 July 2018; Accepted 17 July 2018
Available online 31 July 2018

an important chapter in the story of fisheries management by providing a clear pathway to characterize and assess public participation in the governance process. In Alaska, the Board's public process is celebrated as one of the key factors in the State of Alaska's fisheries management success, but no one has investigated the process and quantified its results. Very little has changed in the Board's public participation process since it was first introduced in 1959, but Alaska's landscape has been changing. Tarbox and Bendock [32] showed that the increasing urbanization of Alaska parallels the increasing urbanization of the Columbia Basin in the Pacific Northwest. Similar to the experiences of communities in the Pacific Northwest, numerous decision makers are individually struggling to manage Alaska's freshwater fisheries as the effects of urban development increase. Stream channelization, dams, pollution, and riparian habitat loss constrict and even extinguish fish runs in Alaska.

Alaska has a relatively sophisticated stakeholder participation process in place; but this doesn't mean that the system is perfect. There may be opportunities to make the process even better. Until the system is assessed, all claims of its successes or failures merely aggravate the contentious fisheries and further divide participants into winners and losers. By investigating the strengths and challenges of stakeholder engagement in the Board of Fish process, it may be possible to improve management across sectors, regions, and agencies.

Although a considerable amount of work has been done on the inclusion of public participation in natural resource management, what is missing from the discussion is a quantitative approach to analyze the effectiveness of these processes. Many of the existing stakeholder participation studies rely on semi-structured interviews (e.g., [28,15,34]), which may fail to assess the impact (i.e., success rates) of participation in governance. This paper builds upon the demonstrated need to characterize stakeholder participation by suggesting a more direct approach. Using integrated data gathering methods, this research seeks to understand approaches to fisheries management, and the regional differences affecting the implementation of and public participation in the fisheries management systems. The collection, digitization, and coding of stakeholder communications produces a wide range of analyses and tells the story of fisheries governance over time. An Alaskan case study of three regions demonstrates our methods and presents analyses.

Proposals from the three regions of Bristol Bay, Southeast, and Cook Inlet, Alaska from 2000 to 2015 were chosen for a pilot study because of 1) the regional, economic, and social importance of their fisheries, 2) the contrasts in their urbanization, and 3) relative differences in the importance of subsistence, personal use, recreational, and commercial fishing (Fig. 1). The Cook Inlet region is highly urbanized and encompasses over 50% of the state's population. Cook Inlet fisheries are notorious for their fierce competition within a relatively short season. Southeast Alaska is scarcely populated, with just 72,000 people scattered over a landscape nearly the size of Maine. Southeast's year-round fisheries are more diverse and less contentious than Cook Inlet. Bristol Bay is the least complex fishery of the three regions, composed almost entirely of a thriving salmon fishery dominated by nonresident commercial fishermen, nonresident sport fishermen, and resident subsistence fishermen. Bristol Bay is also the least populated of the regions.

The research began with two questions relating to proposals across the three regions over fifteen years: 1) Is there a significant difference in the number and type of stakeholders? and 2) Is there a difference in proposal success rates? Early into the coding and analysis process it became apparent that the dataset provided answers to many more questions, some of which provided invaluable information for not only fishery managers but also the stakeholders. Some additional research questions that demonstrate the utility of this approach will therefore be provided in the discussion.

This dataset reflects the complexity and largeness of Alaska's most popular and contentious fisheries. To provide context for this analysis, Alaska's current fisheries governance system and the case study's three regions are briefly described before outlining the methods and results.

Fig. 1. Regional Map of Alaska. Source: Christine Brummer, UAA.

2. Alaskan fisheries governance

The North Pacific Fishery Management Council proposes regulatory measures to the U.S. Secretary of Commerce who then delegates regulatory responsibility to the National Marine Fisheries Service for waters from 3 miles to 200 miles offshore. The Board of Fish, and the Alaska Department of Fish and Game (ADFG) regulate fisheries in state-waters, from inland waters to 3 miles offshore. The U.S. Fish and Wildlife Service (USFWS) has a role in the management of freshwater fisheries on federal lands and manages some freshwater subsistence fisheries throughout Alaska. ADFG fishery managers make management decisions regarding conservation. The Board primarily handles management decisions regarding the allocation of fisheries, but is also tasked with communicating with the public and determining conservation measures. This split is generally celebrated as a successful tool to remove the issue of allocation from managers and politicians in the public arena. The seven Board members, which represent a broad array of fishing groups and other interests, are appointed by the Governor and confirmed by the legislature. Members are appointed based on their "interest in public affairs, good judgment, knowledge, and ability in the field of action of the board, and with a view to providing diversity of interest and points of view in the membership" [8].

To support regional participation in the Board process, the State of Alaska established local fish and game Advisory Committees (AC) when the Board process was created in 1959 (Fig. 2). The committees have no regulatory authority but provide valuable local expertise to the Board. Each of the 84 ACs is comprised of 9–15 members and holds one to six annual meetings. The AC meetings are supported by the State through the attendance of area biologists and travel coordination. The State funds one AC representative to attend their regional Board meeting. In total, over 900 members volunteer their expertise in the AC system.

The Board considers proposals to changes in the regional allocation of fisheries every three years or "out of cycle" if an immediate problem arises. Out of cycle proposals frequently occur within contentious regions, such as Cook Inlet, and can disrupt meetings outside of their region. The three-year cycle proposal process begins with a call for proposals through a standard proposal form (Appendix A). In addition to describing the proposed action, each form requires the stakeholder to list the impacts to other user groups, which is a recognition that most of Alaska's fisheries are already fully allocated. Stakeholders can choose to

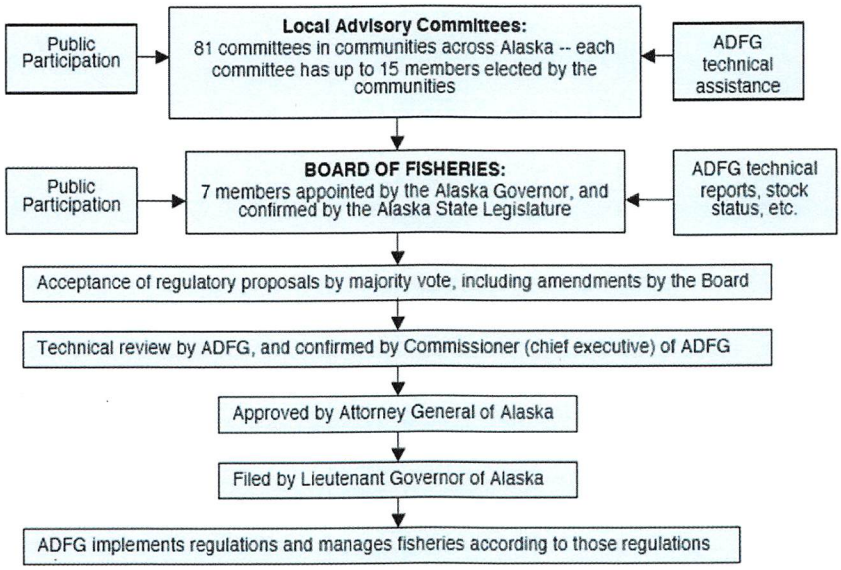

Fig. 2. Alaska Board of Fisheries Regulatory Process [22].

Table 1
Action by Area Contingency Table.

	Bristol Bay	Cook Inlet	Southeast	Cook Inlet, Bristol Bay, Southeast	**Totals**
C	78 (14.05%)	153 (9.909%)	302 (21.12%)	56 (24.45%)	**589**
C/A	63 (11.35%)	159 (10.30%)	191 (13.36%)	40 (17.47%)	**453**
F	199 (35.86%)	525 (34.00%)	474 (33.15%)	66 (28.82%)	**1264**
N/A	215 (38.74%)	707 (45.79%)	463 (32.38%)	67 (29.26%)	**1452**
Totals	**555**	**1544**	**1430**	**229**	**3758**

fill in the form or address the specific questions in another document. Proposals are accepted in person, by mail, and online. The proposals are then compiled and distributed by Board staff and subjected to public review and comment. The Board individually discusses each proposal at the Regulatory Meetings and decides on implementation. Anyone is welcome to submit proposals and testify during the regulatory meeting.

The Board's four to six annual regulatory meetings generally occur from October through March in communities around the state. In its consideration of proposed changes to fisheries regulations, the Board uses biological and socioeconomic information from ADFG, public comments, and guidance from the Alaska Department of Public Safety and Alaska Department of Law [8]. The Board is tasked with a very large job in a very large state with diverse communities and unique fisheries. To give the reader an understanding of the scope of the Board's duties, the paper will begin with a description of the regional fisheries.

3. The regional fisheries

3.1. Bristol Bay

Bristol Bay, Alaska is the size of the state of Ohio and located in southwest Alaska. Dillingham (2016 population estimate, 2364) is the largest community in the Bristol Bay region. The Yup'ik and Dena'ina are the predominant Alaska Native cultures present in the Nushagak and Kvichak River watersheds. These are two of the last intact, sustainable, salmon-based cultures in the world [20]. This subsistence-based way of life has existed for at least 4000 years, with salmon constituting approximately 52% of the subsistence harvest [20].

The commercial and sport fishing opportunities in the Bristol Bay area are the focus of the local culture and a primary source of income for many families [12]. The Bristol Bay watershed supports all five species of salmon found in North America: Chinook (*Oncorhynchus tshawytscha*), sockeye (*O. nerka*), coho (*O. kisutch*), pink (*O. gorbuscha*), and chum (*O. keta*). Bristol Bay is home to the largest sockeye fishery in the world, with approximately 46% of the average global abundance of wild sockeye salmon. Between 1990 and 2009, the annual average inshore run of sockeye salmon in Bristol Bay was approximately 37.5 million fish [20]. Annual commercial harvest of sockeye over this same period averaged 25.7 million fish. Chinook salmon returns to the Nushagak River are consistently greater than 100,000 fish per year and have exceeded 200,000 fish in 11 years between 1966 and 2010, frequently placing Nushagak River Chinook runs at or near the world's largest. Aside from commercial salmon, Bristol Bay supports a commercial herring fishery, as well as a red king crab fishery. Bristol Bay also supports non-salmonid sport fish species, such as rainbow trout (*O. mykiss*), Dolly Varden (*Salvelinus malma*), Arctic char (*S. alpinus*), lake trout (*S. namaycush*), Arctic grayling (*Thymallus arcticus*), northern pike (*Esox lucius*), and humpback whitefish (*Coregonus pidschian*) [2].

3.2. Cook Inlet

Chinook, sockeye, and coho salmon are among the most commonly fished species in Cook Inlet [1]. The region is divided into two

Table 2
Action by Group Contingency Table.

	AC	ADFG	Association	BOF	Business	Government	Hatcheries	Individual	Tribe/Village Council	**Totals**
C	47 (11.55%)	357 (68.00%)	55 (7.891%)	13 (31.71%)	7 (11.67%)	7 (21.88%)	16 (36.36%)	82 (4.336%)	5 (8.197%)	**589**
C/A	60 (14.74%)	103 (19.62%)	89 (12.77%)	14 (34.15%)	3 (5.000%)	7 (21.88%)	11 (25.00%)	156 (8.260%)	10 (16.39%)	**453**
F	140 (34.40%)	10 (1.905%)	239 (34.29%)	7 (17.07%)	16 (26.67%)	12 (37.50%)	4 (9.090%)	811 (42.89%)	25 (40.98%)	**1264**
N/A	160 (39.31%)	55 (10.48%)	314 (45.05%)	7 (17.07%)	34 (56.67%)	6 (18.75%)	13 (29.55%)	842 (44.53%)	21 (34.43%)	**1452**
Totals	**407**	**525**	**697**	**41**	**60**	**32**	**44**	**1891**	**61**	**3758**

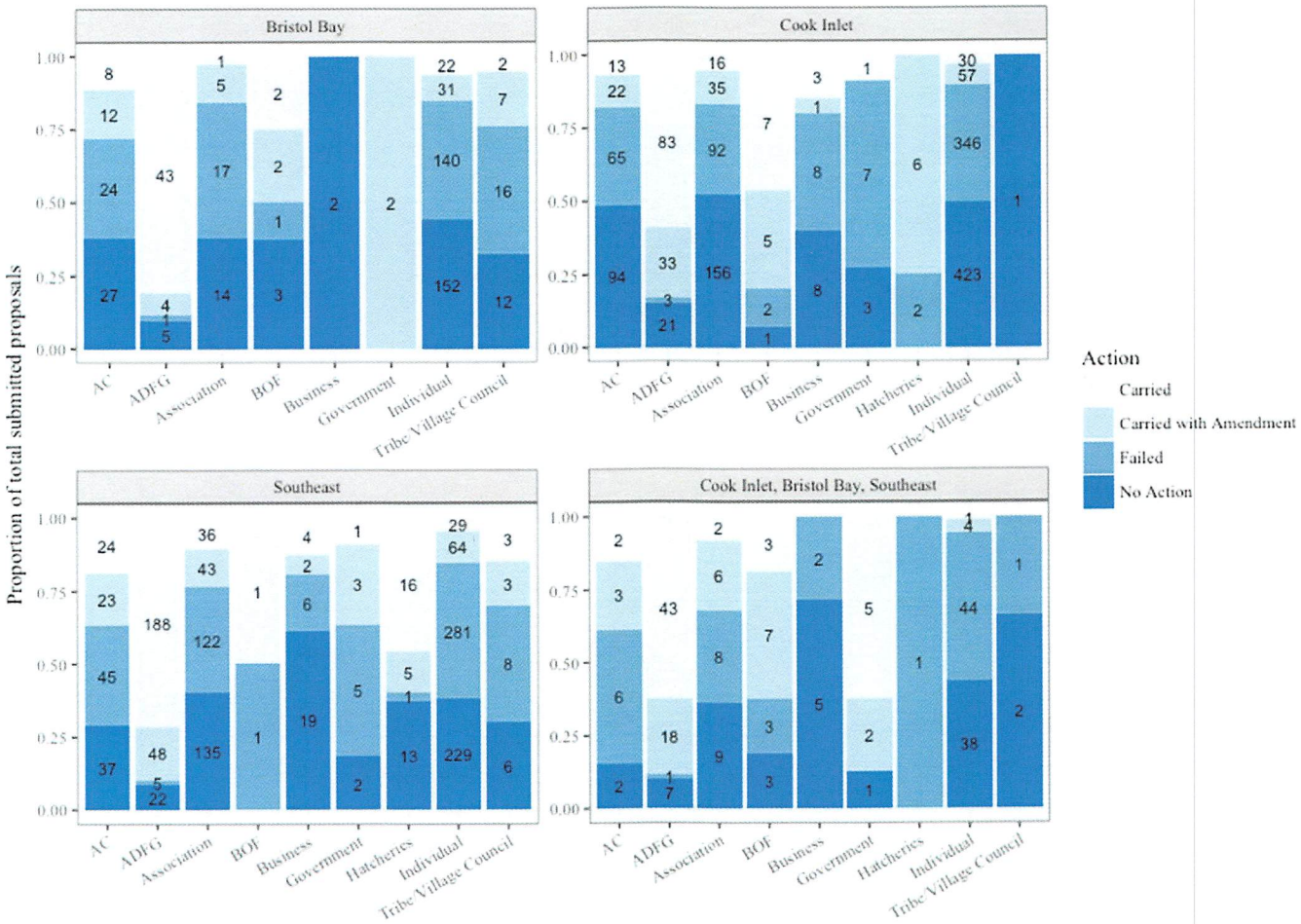

Fig. 3. Proportion of submitted proposals by group and region.

management areas: the Upper Cook Inlet Management Area (UCIMA) and the Lower Cook Inlet Management Area (LCIMA). The most commonly fished species have the most complicated management structure, which is housed in a total of four offices. UCIMA has offices in Anchorage, Palmer, and Kenai/Soldotna, and LCIMA has an office in Homer.

3.2.1. *UCIMA: sport fish district*

The UCIMA Sport Fish management area encompasses approximately 35,000 square miles and supports all five species of Pacific salmon. Most sport fisheries in the UCIMA are easily accessible by road or jet boat, with the exception of the remote West Cook Inlet Unit (WCI) waters accessible only by boat or aircraft [3]. WCI supports the Tyonek Fishery, which is the only Chinook salmon subsistence fishery in Upper Cook Inlet. In East Cook Inlet, the glacial Kenai River supports approximately 40 species of resident and anadromous fish. The river runs 82 miles (132 km) westward from Kenai Lake in the Kenai Mountains through the Kenai National Wildlife Refuge and Skilak Lake to its outlet into Cook Inlet and offers opportunities for both sport fishing and personal use fishing for smelt (hooligan) and sockeye salmon. In northern Cook Inlet, sport fishing is popular in many accessible streams. Smelt and sockeye salmon are available for personal use fishing in multiple areas. The popular Kenai River Chinook sport fishery draws anglers from around the world. The UCIMA sport fish district also supports the most aggressive lake stocking program in the state. More than 120 of the area lakes are stocked with rainbow trout, arctic grayling, arctic char, landlocked coho, and Chinook salmon [3]. Northern UCIMA sport fisheries (Susitna, Little Susitna, and Matanuska drainages) focus on Chinook, coho, and rainbow trout with some additional harvest of pink and chum salmon, char, grayling, and invasive northern pike.

3.2.2. *UCIMA: commercial fish district*

The commercial fish district in the UCIMA consists of the Central and Northern Districts, both located north of Anchor Point Light. All five species of Pacific salmon as well as herring are available for commercial harvest. Over 1300 drift and set gillnet limited entry fishing permits have been issued for the UCI area, contributing about 10% of salmon permits issued statewide. Sockeye salmon are most important in terms of their economic value. Small commercial harvests of smelt and a herring bait fishery also occur [3].

3.2.3. *LCIMA: sport fish district*

South of Anchor Point Light, LCIMA recreational fishing opportunities range from bank fishing in small clearwater streams, to saltwater trolling and jigging for salmon and halibut, lingcod, and rockfish, and clam digging. Chinook and coho salmon, as well as steelhead trout and Dolly Varden are sought in the clear water streams that cross under the highway on the drive to "land's end" on the Homer Spit. Popular major drainages include the Ninilchik River, Deep Creek, and Anchor River. The Nick Dudiak Fishing Lagoon on the Homer Spit is also a popular saltwater destination and is stocked annually with chinook and coho salmon smolt by one of Alaska's two state-run Sport Fish hatcheries [4].

3.2.4. *LCIMA: commercial fish district*

The LCIMA area offers a wide variety of commercial fishing

opportunities for salmon, groundfish, and scallops. It once supported crab, shrimp, and herring fisheries, but those stocks are currently rebuilding and fisheries are closed. All five Pacific salmon species are present in LCI waters, with an abundance private non-profit hatchery enhanced sockeye salmon. Enhancement has played an important role in LCI salmon production for over three decades. Some years, up to 90% of commercial harvest is made up of hatchery produced salmon [10]. Salmon are harvested by seines, drift gill nets, and set gill nets. This area also has commercial fisheries for Pacific halibut, Pacific cod (*Gadus microcephalus*), and other groundfish in state waters with regulations that usually parallel regulations adopted for federal waters.

3.3. Southeast

The Southeast Alaska/Yakutat Region consists of Alaska waters between Cape Suckling on the north and Dixon Entrance on the south and covers an area about 500 miles in length from the U.S./Canada border. Southeast includes over 1000 islands immediately westward from the mainland. Southeast Alaska is signified by its maritime climate, fjords, glaciers, old growth spruce and hemlock forests, and diverse fisheries.

3.3.1. Sport fisheries

Marine and freshwater sport fishing opportunities include cutthroat trout, steelhead, all five species of Pacific salmon, halibut, lingcod, rockfish and a variety of other species. Opportunities for both freshwater and saltwater shoreline fishing for salmon exist near most towns and cities. There are over 330 streams documented to support pristine runs of wild steelhead. Yakutat's Situk River has the state's largest run of steelhead averaging over 7000 steelhead/year for the past four years and also supports runs of all five species of Pacific Salmon, rainbow trout, cutthroat trout, and Dolly Varden char [5].

3.3.2. Commercial fisheries

Salmon are commercially harvested in Southeast Alaska with purse seines and drift gillnets; in Yakutat with set gillnets; and in both areas with hand and power troll gear. Purse seines and gillnets are the primary gears used to catch whole herring.

Aside from salmon fisheries, Southeast Alaska supports other diverse commercial fisheries. Miscellaneous species (sea cucumber, sea urchins, and geoduck clams) are harvested in dive fisheries in the region. The region supports jigging for rockfish and longlining for Pacific cod and for sablefish. There are also several commercially important shellfish species in Southeast Alaska. They include golden and red king crab, Dungeness crab, Tanner crab, and pandalid shrimp [6].

4. Methods

This paper focuses on one form of stakeholder communication with the Board: the proposal. Proposals from Bristol Bay, Cook Inlet, and Southeast Alaska are located in two places: 1) the ADFG Board of Fish website and 2) the State Library Archives and Museum (SLAM) in Juneau, Alaska. For meetings from October 2003-present, the proposals and Supplementary materials were downloaded from the website [9]. For meetings from January 2000-October 2003, archivists at SLAM provided paper records, which were digitized into PDFs through scanning.

A spreadsheet based program was used to log and code proposals. The coding system expanded upon a 2012–2013 study completed by John Jensen, a former Chair of the Board of Fish [23]. The data includes the date of the meeting, the area (Bristol Bay, Cook Inlet, Southeast), the sector (commercial, sport, personal use, subsistence), proposal numbers, proposal summary, author(s), author group, action (Board carried, carried as amended, tabled, failed, or took no action on the proposal), and vote record (favor, against, absent, or abstained). If the proposal was summarized in the "Summary of Meeting Actions"

Table 3
Multinomial Model Results with standard errors, z and p-values for Action by Group.

	Intercept	AC	ADFG	Association
C	−2.32884191 ± 0.11567487 z = −20.1326521 p = 0	1.10392131 ± 0.202253 z = 5.4581206 p = 0.0000004812007	4.199058 ± 0.1853664 z = 22.652741 p = 0	0.5865804 ± 0.18641428 z = 3.14665 p = 0.001651528
C/A	−1.68569928 ± 0.08715957 z = −19.3403814 p = 0	0.70498691 ± 0.1746784 z = 4.0359128 p = 0.00005439042	2.31289 ± 0.1883741 z = 12.278173 p = 0	0.4249134 ± 0.14838258 z = 2.863634 p = 0.004188116
F	−0.03747734 ± 0.04920117 z = −0.7617164 p = 0.4462293	−0.09600707 ± 0.1257533 z = −0.7634558 p = 0.4451916	−1.667051 ± 0.3472194 z = −4.801145 p = 0.000001577611	−0.2354752 ± 0.09894171 z = −2.379938 p = 0.017315542

	BOF	Business	Government	Hatcheries	Tribe/Village Council
C	2.94783383 ± 0.4828743 z = 6.10476477 p = 0.000000001029522	0.7475955 ± 0.4309195 z = 1.734884 p = 0.0827613	2.4832906 ± 0.5682551 z = 4.370027 p = 0.00001242309	2.535522 ± 0.3908353 z = 6.487444 p = 0.000000000830483	0.8932462 ± 0.5109776 z = 1.748112 p = 0.0804446
C/A	2.37907321 ± 0.47103 z = 5.05078913 p = 0.000000439886	−0.7465528 ± 0.6096679 z = −1.224524 p = 0.22075476	1.8395793 ± 0.5632151 z = 3.266211 p = 0.001089971	1.517257 ± 0.418833 z = 3.622581 p = 0.000291678	0.9442697 ± 0.3939071 z = 2.397189 p = 0.0165214
F	0.03719226 ± 0.5368237 z = 0.06928207 p = 0.9447651	−0.7166642 ± 0.3071113 z = −2.333565 p = 0.01961853	0.7310564 ± 0.5024209 z = 1.455068 p = 0.1456505	−1.142317 ± 0.5739054 z = −1.990428 p = 0.04654386	0.2116918 ± 0.3000733 z = 0.705467 p = 0.4805196

document, the same sentence was entered into the coded dataset. If a proposal summary didn't exist, then a one sentence summary was created to reflect the proposal intent. The proposal authors were coded to fit into one of nine groups: Advisory Committees, ADFG, Associations, Board of Fish, Business, Hatcheries, Individuals, and Tribes/Village Councils.

The National Center for Ecological Analysis and Synthesis (NCEAS) conducted a quality assessment of our coding process. Two NCEAS staff coded a random sample of proposals duplicating our methods to check for accuracy. Prior to this coding effort, the California-based NCEAS staff was given a detailed coding manual (Appendix B). Both results were then compared, and the coding process and manual were adapted as needed.

The coding effort produced a dataset [25] which was then used to analyze 1) stakeholder participation (group) and 2) stakeholder success (action) for each region. Using R statistical software, the following packages aided with analysis: MASS, nnet, tidyverse, ggplot2, effects, and extrafont. Records with missing groups or action values were removed and baseline values were chosen. For this analysis, Individuals were chosen as our baseline for Group, all three regions for Region (proposals containing data pertinent to all three regions) and No Action (N/A) for Action.

A Chi-squared test was first run for independence to see if proposal action and the area in which a proposal originated were associated, or if the proposal action differed by area. Then another Chi-squared test was performed to see if proposal action and group were associated, or if the action differed by group.

A proportional odds model was used to predict the probability of action based on a specific group. A multinomial logistic regression model found that the multinomial model provided a much better fit to the data after a Chi-Square goodness of fit test. Therefore, all analyses were completed using the multinomial model to predict proposal success based on 1) group or region, 2) the probability of having a proposal carry or have no action based on group or region, and 3) marginal effects. To demonstrate the utility of this approach, some specific examples of model use and results will be outlined.

5. Results

3758 proposals were included in this analysis: 555 from Bristol Bay, 1544 from Cook Inlet, and 1430 from Southeast. The remaining 229 proposals were relevant statewide. A Chi Squared test investigated the null hypothesis that the proposal action was not affected by the region where the proposal originated against the alternate hypothesis that two variables, action and region, were not independent of each other (Table 1). With $p \ll 0.01$, there was very strong evidence to suggest that proposal action differs based on area.

Of the 3758 proposals, 407 were submitted by Advisory Committees (AC), 525 by the Alaska Department of Fish and Game (ADFG), 697 by Associations, 41 by the Board of Fish, 60 by Businesses, 32 by Government, 44 by Hatcheries, 1891 by Individuals, and 61 by Tribes/Village Councils. A similar Chi Squared test was run to see if proposal action and the group from which the proposal originated were associated. With a p-value of 0.01, it was determined that proposal action differs based on the group from which the proposal was submitted (Table 2)

6. Discussion

Stakeholder participation in the Board's process is distributed across a range of state, private, nongovernmental, local, and native groups as well as individuals. Individuals dominated the proposal process in terms of the number of submitted proposals (1891) within all three regions. It should be noted that these numbers include repeat proposals because there is no limit on how many times a single proposal is submitted. A single proposal can be re-submitted by an individual every three years and/or by all of the groups within a single proposal cycle. Citizens clearly participated in the open proposal submittal process, which indicates that the system is utilized. Individual participation was followed in numbers by Associations (697), ADFG (525), and Advisory Committee (407) participation. The high number of ADFG proposals is most likely due to the fact that many of ADFG's proposals are "housekeeping" proposals, which clarify existing regulations or resolve internal inconsistencies. The Board of Fish, Businesses, Government, Hatcheries and Tribes/Village Councils submitted far less proposals, each with less than 100 (Fig. 3).

Using the multinomial model to look at proposal action based on group (Table 3), the log odds of having a proposal carried versus no action taken varied by group. For example, the odds of having a proposal carry versus having no action taken will increase by 1.10 if an Advisory Committee submits a proposal versus and Individual (Table 3). If the Alaska Department of Fish and Game submits a proposal versus an individual, the log odds of having a proposal carry will increase by 4.20, the highest odds.

The model also predicts that there is a relationship between the relative probability of having a proposal carried versus having no action taken. For example, the model predicts that proposals submitted by an Advisory Committee are associated with an increase in relative probability of having a proposal carried rather than no action taken. The relative probability is 302% higher for Advisory Committees than Individuals, and 6662% higher for the Alaska Department of Fish and Game (Table 4).

The marginal effects of the multinomial model also provided some interesting results. For example, Advisory Committees were compared to other groups. The average probability of having a proposal carry for an Advisory Committee is 0.24, and 0.15 for all other groups (on average). Therefore, proposals submitted by Advisory Committees are 9% more likely to carry than those of other groups. The probability for a proposal to fail for an advisory Committee is 8% less than all other groups, and for no action is 5% less than other groups. Therefore, submitting a proposal through an Advisory Committee increases the odds of a proposal carrying (Fig. 4).

Table 4
Multinomial Model Results with Relative Risks with the coefficients exponentiated.

	Intercept	AC	ADFG	Association	BOF	Business	Government	Hatcheries	Tribe/Village Council
C	0.09740849	3.0159694	66.6235454	1.7978301	19.064612	2.1119158	11.980623	12.6230232	2.443047
C/A	0.1853148	2.0238202	10.1035788	1.529458	10.794894	0.4739977	6.29389	4.5596987	2.570935
F	0.96321625	0.9084576	0.1888031	0.7901953	1.037893	0.4883787	2.077274	0.3190788	1.235767

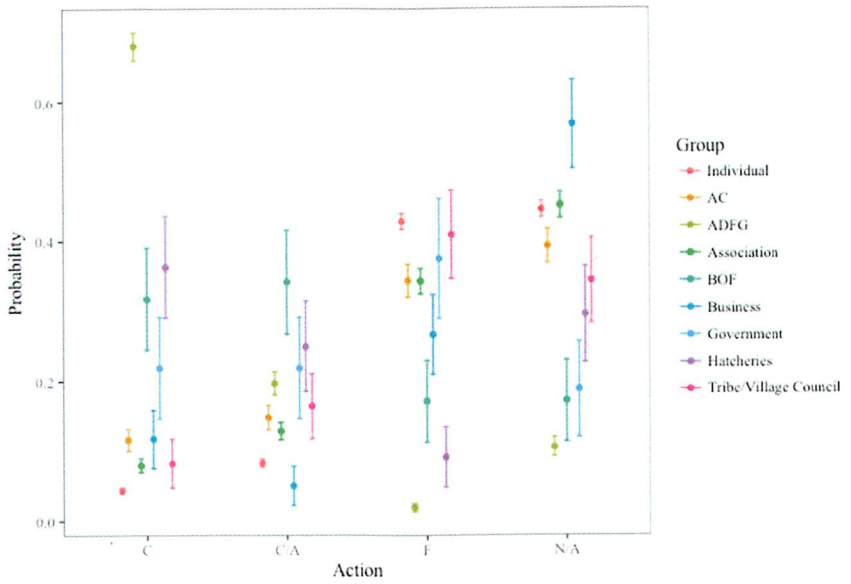

Fig. 4. Probability of proposal action based on Group.

7. Conclusion

Even though the public participation process is identical, our analysis shows that stakeholder participation and success rates varied across the groups and regions. The existence of conflict, geographic isolation, cultural and language barriers, and funding access may be limiting factors; but a more detailed and historical analysis is needed to confirm the existence and extent of those barriers.

This paper provides a few examples of the many different ways to use the Board of Fish coded proposal dataset. Assessing statewide regions as well as group success may shed light on how to more effectively "win" the Board process – perhaps by attending local Advisory Committee meetings or consulting the Department of Fish and Game prior to submitting a proposal. Regional awareness may also be key. Digging into the complexity of proposals (e.g., proposal topic) may show why certain regions, such as Cook Inlet, have far lower overall success rates than the other regions.

This pilot study is the predecessor to a geographically larger and more detailed Board of Fish coded proposal dataset that will be publically accessible online within the next year. The finished dataset will include all regions statewide as well as detailed proposal information in 19 categories that include the proposal topic, location, author, species, sector, relevant constitutional statute, and Board votes. For more information about the statewide dataset and how to access it, please contact the authors of this paper.

Acknowledgements

This research briefly began through the Biology Department and Alaska Center for Conservation Science at the University of Alaska Anchorage (UAA) with support from NSF award #OIA-1208927 and the State of Alaska. The work was largely completed through the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California Santa Barbara and Nautilus Impact Investing with support from the Gordon and Betty Moore Foundation as part of the State of Alaska's Salmon and People (SASAP and Data Task Force (DTF) Projects. The authors are extremely grateful for the willingness of Matt Jones, Dr. Ian Dutton, and Dr. Frank Davis to provide the technical and financial support needed the complete the project. The project would not have been possible without the archival assistance and work space provided by Chris Hieb, Wayne Norlund and Micah Sommers at the State Library, Archives, and Museum in Juneau, Alaska. The authors would also like to thank Dr. Paula Williams, Courtney Breest, Dr. Jim Powell, Shelby Oliver, and Naomi Louchouarn. We would also like to thank all of the citizens, managers, elected officials, and scientists who participate in public processes.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2018.07.010.

References

[1] Alaska Department of Fish and Game (ADFG), The Kenai River. Recreational Fishing Series, Division of Sport Fish, Southcentral Region, Anchorage, 2015 (AK. Retrieved from:), ⟨adfg.alaska.gov/static-sf/Region2/pdfpubs/kenairiver.pdf⟩.
[2] Alaska Department of Fish and Game (ADFG). Bristol Bay Commercial Fisheries. Retrieved from: ⟨adfg.alaska.gov/index.cfm?Adfg=commercialbyareabristolbay.main⟩.
[3] Alaska Department of Fish and Game (ADFG). Northern Cook Inlet Management Area Fisheries. Retrieved from: ⟨http://www.adfg.alaska.gov/index.cfm?Adfg=ByAreaSouthcentralNorthCookInlet.main⟩.
[4] Alaska Department of Fish and Game (ADFG). Lower Cook Inlet Management Area Fisheries. Retrieved from: ⟨adfg.alaska.gov/index.cfm?Adfg=ByAreaSouthcentralLowerCookInlet.main⟩.
[5] Alaska Department of Fish and Game (ADFG). ⟨adfg.alaska.gov/index.cfm?Adfg=SportByAreaSoutheast.main⟩ (Accessed 12 December 2016).
[6] Alaska Department of Fish and Game (ADFG). *Southeast Alaska/Yakutat Commercial Fisheries*. Retrieved from: ⟨adfg.alaska.gov/index.cfm?Adfg=commercialbyareasoutheast.main⟩.
[7] Alaska Department of Fish and Game (ADFG). *Alaska's Fisheries and Game Board Process*. ⟨adfg.alaska.gov/index.cfm?Adfg=process.main⟩ (Accessed 17 March 2017).
[8] Alaska Department of Fish and Game (ADFG). Alaska's Board of Fisheries. Retrieved from: ⟨adfg.alaska.gov/index.cfm?Adfg=fisheriesboard.main⟩.
[9] Alaska Department of Fish and Game (ADFG). Alaska's Board of Fisheries. Retrieved from: ⟨adfg.alaska.gov/index.cfm?Adfg=fisheriesboard.meetinginfo⟩.
[10] Alaska Department of Fish and Game ADFG. Lower Cook Inlet Fisheries Management Commercial Fisheries Overview. Retrieved from: ⟨http://www.adfg.alaska.gov/index.cfm?Adfg=commercialbyarealci.main⟩.
[11] L.M. Ballou, N. Albritton, L.S. Horowitz, Enforcement encourages participation in resource management: explaining a fisheries management paradox in Hawaii, Asia Pac. Viewp. 57 (3) (2016) 379–392.
[12] Bristol Bay Native Association (BBNA). *Bristol Bay*. Retrieved from: ⟨http://www.bbna.com⟩.
[13] A. Buanes, S. Jentoft, G.R. Karlsen, A. Maurstad, S. Söreng, In whose interest? An exploratory analysis of stakeholders in Norwegian coastal zone planning, Ocean Coast. Manag. 47 (2004) 207–233.
[14] J.R.A. Butler, R.M. Wise, T.D. Skewes, E.L. Bohensky, N. Peterson, W. Suadnya, Y. Yanuartati, Y. Handayani, P. Habibi, K. Puspadi, N. Bou, D. Vaghelo,

W. Rochester, Integrating top-down and bottom-up adaptation planning to build adaptive capacity: a structured learning approach, Coast. Manag. 43 (2015) 346–364, https://doi.org/10.1080/08920753.2015.1046802.
[15] L.M. Carr, W.D. Heyman, "It's about seeing What's actually out there": quantifying fishers' ecological knowledge and biases in a small-scale commercial fishery as a path toward co-management, Ocean Coast. Manag. 69 (2012) 118–132.
[16] K.L. Cochrane, Complexity in fisheries and limitations in the increasing complexity of fisheries management, ICES J. Mar. Sci. 56 (6) (1999) 917–926.
[17] S.J. Cooke, N.W.R. Lapointe, E.G. Martins, J.D. Thiem, G.D. Raby, M.K. Taylor, T.D. Beard Jr., I.G. Cowx, Failure to engage the public in issues related to inland fishes and fisheries: strategies for building public and political will to promote meaningful conservation, J. Fish. Biol. 83 (2013) 997–1018, https://doi.org/10.1111/jfb.12222.
[18] N.A. Davis, Evaluating collaborative fisheries management planning: a Canadian case study, Mar. Policy 32 (2008) 867–876.
[19] D.P. Dixon, Material expertise: an ontological approach to stakeholder participation in marine policy, Mar. Policy 72 (2016) 107–114.
[20] Environmental Protection Agency (EPA), An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska. EPA 910-R-14-001ES, Region 10, Seattle WA. Retrieved from: epa.gov/bristolbay, 2014.
[21] L. Evans, N. Cherrett, D. Pemsl, Assessing the impact of fisheries co-management interventions in developing countries: a meta-analysis, J. Environ. Manag. 92 (2011) 1938, https://doi.org/10.1016/j.jenvman.2011.03.010.
[22] S.T. Grabacki. *Sustainable Management of Alaska's Fisheries: A Primer*. Retrieved from: ⟨alaskaseafood.org/wp-content/uploads/2015/10/Sustainability-White-Paper.pdf⟩.
[23] J. Jensen. *An Overview of the Board of Fish Process*. Retrieved from: ⟨www.swamc.org/files/Jon%20Jensen.pptx⟩.
[24] S. Jentoft, Fisheries co-management—delegating government responsibility to fishermen's organizations, Mar. Policy 13 (2) (1989) 137–154.
[25] M.B. Krupa, M.M. Cunfer, Alaska board of fish Proposals 1959–2016, Knowl. Netw. Biocomplexity (2017), https://doi.org/10.5063/F1G73BVP.
[26] L. Leite, C. Pita, Review of participatory fisheries management arrangements in the European Union, Mar. Policy 74 (2016) 268–278.
[27] R.K. Mitchell, B.R. Agle, D.R. Wood, Towards a theory of stakeholder identification: defining the principle of who and what really counts, Acad. Manag. Rev. 22 (4) (1997) 853–886.
[28] C. Pita, G.J. Pierce, I. Theodossiou, Stakeholders participation in the fisheries management decision-making process: fishers' perceptions of participation, Mar. Policy 34 (2010) 1093–1102.
[29] R. Pomeroy, J. Parks, K. Courtney, N. Mattich, Improving marine fisheries management in Southeast Asia: results of a regional fisheries stakeholder analysis, Mar. Policy 65 (2016) 20–29.
[30] J.L. Santiago, M.A. Ballesterosa, R. Chapelaa, C. Silvac, K.N. Nielsend, M. Rangele, K. Erzinie, L. Wisec, A. Camposc, M.F. Borgesc, A. Salaf, M. Virgilif, J.R. Viðarssong, A. Baudronh, P.G. Fernandesh, Is Europe ready for a results-based approach to fisheries management? The voice of stakeholders, Mar. Policy 56 (2014) 86–97.
[31] K. Stange, J. van Leeuwen, J. van Tatenhove, Boundary spaces, objects and activities in mixed-actor knowledge production: making fishery management plans in collaboration, Marit. Stud. 15 (14) (2016) 1–19.
[32] K.E. Tarbox, T. Bendock, Can Alaska Balance Economic Growth with Fish Habitat Protection? A Biologist's Perspective. Alaska Fishery Research Bulletin 3(1), Summer 1996, Alaska Department of Fish and Game, Anchorage, AK, 1996.
[33] T. Von Wirth, U. Wissen Hayek, A. Kunze, N. Neuenschwander, M. Stauffacher, R.W. Scholz, Identifying urban transformation dynamics: functional use of scenario techniques to integrate knowledge from science and practice, Technol. Forecast. Social. Change 89 (2014) 115–130, https://doi.org/10.1016/j.techfore.2013.08.030.
[34] J.C. Young, A. Jordan, K.R. Searle, A. Butler, D.S. Chapman, P. Simmons, A.D. Watt, Does stakeholder involvement really benefit biodiversity conservation? Biol. Conserv. 158 (2013) 359–370.