

RESEARCH ARTICLE

Stakeholder consensus suggests strategies to promote sustainability in an artisanal fishery with high rates of poaching and marine mammal bycatch

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Abstract

1. Illegal fishing for high value species in artisanal fisheries drives incidental catch and declines of marine mammals and other large vertebrates of conservation importance around the world. Engaging with stakeholders is essential to understand which strategies will be effective in motivating the development of more sustainable practices, and disengagement from illegal fisheries.
2. Here we present the results of a Q study carried out in autumn 2018 with 50 stakeholders from the Caspian Sea coast of Dagestan (Russian Federation), including fishers illegally targeting sturgeon (*Acipenseridae*) and Caspian seals *Pusa caspica*, traders and fisheries managers. We assess viewpoints on biodiversity governance; illegal, unreported and unregulated (IUU) fishing; illegal wildlife trade (IWT) and conservation.
3. Three distinct viewpoint groups emerged from a factor analysis, which we designated as 'Nostalgists', 'Optimists' and 'Pessimists'. Nostalgists were concerned with decline in environmental quality, and emphasised a need for increased centralised involvement of authorities reminiscent of the old Soviet system. Optimists expressed support for a well-regulated legal fisheries sector, while Pessimists were very aware of the negative impact of illegal fisheries and IWT, but felt they could not be controlled.
4. Among all groups we found a strong desire for alternative livelihoods (ALs), improved sustainability and agreement on the potential effectiveness of marine protected areas (MPAs) and increased regulation, even if some stakeholders felt they were not achievable goals.
5. We used our results to inform three workshops in which Dagestani fishers and fishery experts discussed potential conservation interventions, and the barriers to their implementation. Six action types were identified including enhanced law enforcement, increased regulation, protected areas, alternative livelihoods,

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reducing demand for sturgeon and seal products and the need for further research to guide policy development.

6. This consensus suggests that communities are willing to reduce participation in illegal fishing given appropriate support. The socioeconomic factors driving illegal fisheries and bycatch for Caspian seals parallel those for other endangered marine mammals such as Vaquita *Phocoena sinus* and suggest that Q studies could be applied in other artisanal fisheries with high rates of marine mammal bycatch to help identify policy interventions supported by involved communities.

KEYWORDS

barrier analysis, fisheries policy, bycatch, Q sort, Caucasus, illegal, unreported and unregulated (IUU) fishing, pinnipeds, Russia

1 | INTRODUCTION

Achieving conservation and natural resource management goals requires changes in human behaviour, which involves understanding human perspectives and how people might adopt new values, approaches or practices (Nielsen et al., 2021; Stankey & Shindler, 2006; Stoll-Kleemann, 2019). Successful conservation outcomes may depend on identifying viewpoint areas of consensus and disagreement among different stakeholders on proposed policy interventions, and how these relate to historical and cultural contexts, and underlying values. When attempting to persuade stakeholders to change behaviours, especially in relation to illegal biological resource use, interventions may need to be socially acceptable (though see Brockington (2004) for the limitations of this argument), so that stakeholders in communities feel they share goals, and will benefit from supporting changes in governance (Brooks et al., 2013; Cooney et al., 2017; Robinson, 2011). Community supported interventions can potentially be effective in motivating the development of more sustainable practices, and disengagement from the illegal wildlife trade (IWT) (Biggs et al., 2016; Cooney et al., 2017; Fukushima et al., 2021), and from illegal, unreported and unregulated (IUU) fishing (Widjaja et al., 2019).

Biological resource management issues, such as IWT and IUU fishing, affect many species in Russia, but are under researched (Kühl et al., 2009; van Uhm & Siegel, 2016; Vilkov & Tian, 2019; World Wildlife Fund, 2020). Within the Caspian Sea, fisheries are severely depleted due to a history of overharvesting and loss of fish spawning grounds due to dam building and other infrastructure development (Harkonen et al., 2012; Lagutov & Lagutov, 2009; Strukova et al., 2016). These declines have been exacerbated by weakened environmental governance and economic collapse stemming from the breakup of the Soviet Union in the 1990s (Caspian Environment Programme, 2002; Mammadov et al., 2016; Raymakers, 2002).

Currently IUU fishing threatens all the economically important Caspian sturgeon species (*Acipenseridae*) with extinction and causes high mortality for the endemic endangered Caspian Seal *Pusa caspica* (Caspian Environment Programme, 2002; Dmitrieva et al., 2013; Strukova et al., 2016; van Uhm & Siegel, 2016). Caspian

seals experience high rates of bycatch in sturgeon fisheries and ghost nets, caught as nontarget species, and are sometimes targeted for their blubber and pelts, which are traded as valuable commodities in local markets (Dmitrieva et al., 2013; Ermolin & Svolkinas, 2016, 2018; Svolkinas, 2021; Svolkinas et al., 2020). The seal population has declined by more than 90% since the start of the 20th century, to around 168,000 individuals at present (Dmitrieva et al., 2015; Goodman & Dmitrieva, 2016; Harkonen et al., 2012). The species was listed as Endangered by IUCN in 2008, and included in the Red Data Books of all the Caspian countries by 2020 (Kazakhstan Government, 2020; Russian Government, 2020a). There is an urgent need to reduce fisheries-related seal mortality and develop lasting solutions to address the issues of illegal fishing and trade of seal products.

IUU fishing activity is particularly high in the Republic of Dagestan, Russian Federation, where a combination of weak governance, inconsistent law enforcement, corruption, the absence of alternative sources of income and extremely high prices for sturgeon caviar (Gadziev et al., 2017; Raymakers, 2002; Vaisman, 1997), provide incentives for the involvement of organised crime (Ermolin & Svolkinas, 2016; van Uhm & Siegel, 2016; Wyatt et al., 2020). Illegal fishing is associated with an artisanal, small boat fishery, based in economically disadvantaged coastal communities (Figure 1; Dmitrieva et al., 2013; Ermolin & Svolkinas, 2018; Raymakers, 2002). Participant attitudes towards biodiversity loss and conservation interventions are poorly understood, as is whether fishers can be incentivised to reduce illegal activities and bycatch. Understanding views on these topics is of critical importance, because they are precursors and predictors of stakeholder behaviour and intentions (Liu et al., 2011).

Globally, IUU fishing and IWT are key threats to marine biodiversity, driving declines of marine vertebrates (Agnew et al., 2009; Sas-Rolfes et al., 2019). There is an increasing need for fishery management and anti-IWT agencies to engage with stakeholders, including the private sector, local communities and nongovernmental organisations at global, regional and local levels, to develop policy interventions as part of effective responses to IUU and IWT (Cooney et al., 2017; Food and Agricultural Organisation of the United



FIGURE 1 A self made, 'Baida' small boat used in artisanal and illegal fishing. Sulak, Dagestan, Summer 2013. Image Dr Linas Svolkinas.

Nations, 2001; Widjaja et al., 2019). To date the emphasis in most policy debates has been on top-down solutions through strengthening regulation and law enforcement (compliance and deterrence) or militarisation (Duffy et al., 2019). The potential importance of action at the community level as routes for anti-IWT interventions and leveraging behaviour change has also recently been recognised (Biggs et al., 2016; Cooney et al., 2017). However, details of how and where community-level interventions should be implemented, and how they impact IUU remain uncertain, with examples of such actions largely lacking (Battista et al., 2018; Widjaja et al., 2019).

Here we employ Q methodology to assess viewpoints on biodiversity governance, with the aim to identify human perspectives (consensus and disagreement) for actions needed to address IUU and IWT. We also report outcomes from workshops with key stakeholders to identify potential interventions, and the barriers and solutions to reducing illegal fishing and associated IWT in the Dagestani artisanal fisheries.

This study has implications for conservation not just in the Caspian, but by showing how insights into areas of stakeholder consensus around potential interventions can be gained, it is also relevant for broader understanding of how to develop IUU and IWT mitigation measures supported by community stakeholders in other regions with weak biodiversity governance, leading to lasting solutions.

2 | METHODS

2.1 | Study area overview

The focal study area was selected based on previous work by the authors (Dmitrieva et al., 2013; Ermolin & Svolkinas, 2016). Dagestan (50,370km²; Figure 2) is a semi-autonomous republic in the south of the Russian Federation, bordering the Caspian Sea and flanked by the eastern edge of the Caucasus mountains, with a population

of 3.18 million people (Russian Government, 2020b). The coast extends from the Kuma river in the north to the Azeri border in the south. Most fishing activity is based in small coastal communities, with a mixture of people tracing their ancestry to 18th/19th Century European Russian settlers, and largely Muslim, mixed ethnic Dagestanis (Kisriev & Ware, 2005; Sokolsky et al., 2008).

State management of fisheries is implemented via the Federal Fisheries Agency through regional offices in Dagestan, including issuing of quotas and licences, monitoring of catches and enforcing species, spatial and temporal limitations on fishing activity (Caspian Environment Programme, 2002). State and Federal police, and border control services also participate in fisheries-related law enforcement. Legal fisheries (working under state management) operate offshore and in rivers, targeting native species of *Cyprinidae* (carp), *Siluridae* (catfish) and *Esocidae* (pike) and introduced *Mugilidae* (mullet) for food (Abdusamadov et al., 2016; Karpinsky, 2005), with the fish traded locally and regionally. These fisheries use small, open, aluminium and wooden boats of 4–8m, and employ gillnets with mesh size up to 90mm. Dagestan's coastline is subdivided into northern, middle and southern fishery administrative regions (Figure 2), supporting a minimum of 723, 374 and 200 fishermen respectively. Fishing is of particular economic significance in the northern arid steppe region where soil salinity and lack of water limit agriculture and horticulture. Communities in the middle and southern regions have more diversified economic activity, with some supplementing incomes with horticulture and animal husbandry.

Within regions fishing is organised into local fish producing enterprises controlled by producers, who hold fishing licences and lease boats to fishermen, or employ fishing crews to operate boats. Producers variously may reside locally, or in distant cities including Makhachkala, Kizlyar. The number of producing enterprises licensed to catch fish has declined from 63 in 2015 to 28 in 2019 (Dagestan Government, 2015, 2019). The reasons for the decline have not been documented, but are likely to be multifactorial, including reduction in the economic viability of earning a living from fishing. Enterprises are granted fishing rights for 10years through a tendering process overseen by the Federal Fisheries Agency.

Targeting sturgeons and seals and trading in their products is illegal, however, regulation in Dagestan is only partially effective due to corruption and limited resources for enforcement (World Wildlife Fund, 2020), allowing the IUU fishing sector to operate outside the state regulation system. It consists of approximately 400 open, self-made, small boats, typically up to 8m length (Figure 1), working at distances ranging from 5 to 300km from shore, in water up to 30m deep, using large mesh gillnets (greater than 90mm) and hook lines (Dmitrieva et al., 2013). Illegal fishing activity peaks during the spring (late March to early June) and the autumn (September to December) following seasonal sturgeon migrations. Legal and illegal fishing can occur simultaneously within the same community.

'Illegal traders' of seal products can operate openly due to a lack of enforcement. Such traders purchase carcasses or processed seal products (e.g. pelts or hats and other items made from seal

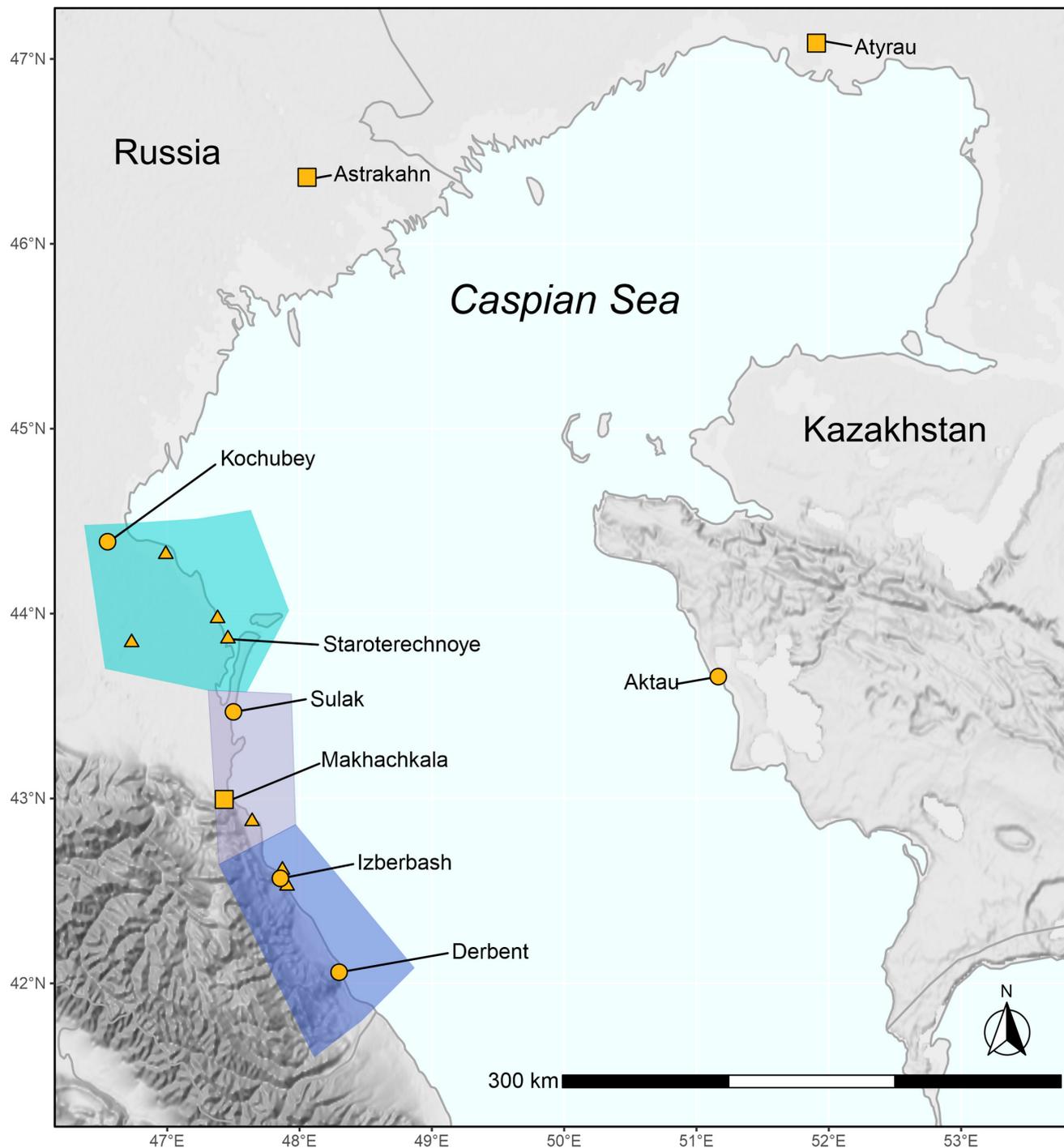


FIGURE 2 Study area map. Coloured polygons indicate survey areas within Dagestan, and the northern, middle and southern fisheries regions. Squares—regional capitals; Circles—cities or towns; Triangles—settlements.

pelts, blubber or seal oil), from fishers or middlemen and sell them in street marketplaces selling food and clothing goods (Svolkinas et al., 2020). Some market stall holders may simultaneously sell legal and illegal product (e.g. traders of seal oil often sell fish or agricultural produce). Sturgeon and seal products are traded extensively within the region, throughout Russia and internationally (Dmitrieva et al., 2013; Ermolin & Svolkinas, 2016; Svolkinas, 2021; Svolkinas et al., 2020).

2.2 | Q study design and interviews

First developed in psychology in the 1920s, Q method (Watts & Stenner, 2013) is increasingly used to study conservation issues (Cairns et al., 2014; Chamberlain et al., 2012; Zabala et al., 2018), biodiversity governance and sensitive environmental policy issues. Q assumes that while there are many potential views on a topic within a population, they will tend to cluster into certain themes. Using a

combination of statistical factor analysis and qualitative analysis of semistructured interviews, Q method identifies these clusters, alongside areas of divergence and consensus within small groups (typically 40–60) of respondents (Hamadou et al., 2016). It does not make claims about the relative distribution of these viewpoints within wider populations.

Q studies start by creating a small number of statements that each capture a key feature of different potential topics. Following standard guidelines (Brown, 1980; Watts, 2015; Watts & Stenner, 2013; Zabala et al., 2018), we extracted an initial set of 202 statements related to conservation and governance issues in the Caspian Sea from previous semistructured interviews collected with fishers (Dmitrieva et al., 2013; Ermolin & Svolkina, 2016), literature reviews, scientific articles, reports by international and nongovernmental organisations and other grey literature, conference materials, newspaper articles and social media debates. These were indexed into six question themes: (1) 'economic value of fisheries and seals'; (2) 'perception of conservation and sustainable use of resources'; (3) 'perceptions of authorities'; (4) 'perceptions of local communities'; (5) 'perceptions of regulations'; and (6) 'understanding, perceptions and knowledge of seals'. We reduced this to 51 (Table 1) by removing statements overlapping in meaning, those that lacked clarity, or those statements judged to be on lower priority issues. After translation from English to Russian by a professional translator, and pilot interviews with four university students, minor amendments were introduced to eight statements, before the Q set was finalised.

Participants in Q are chosen purposively, to capture the main viewpoints that exist, across a cross-section of stakeholders. Our participants included fishers (legal, illegal, leisure), fishing boat owners, fisheries managers and traders of fish and seal products (Table 2). We employed Food and Agriculture Organization (FAO) criteria for 'Illegal Unreported and Unregulated' fishing (Food and Agricultural Organisation of the United Nations, 2001). We assigned research participants employed by legal fishing enterprises (producers), and who claimed they complied with fishing rules, to the legal fishers category. We assigned participants who admitted targeting sturgeons, to using of gillnets with mesh size over 90mm, to fishing in no-take areas or without licences or quotas, or to inaccurately reporting fishing activities, to the IUU category. Fifty Q interviews were carried out with respondents between September and December 2018, at fisher homes (23), restaurants (10), workplaces (9), fishing wharfs (4), fishing markets (2) and other settings (2). Thirty-one interviews were carried out in rural settlements, seven in Dagestan's capital city of Makhachkala, 10 in Izberbash, three in Kizlyar and one in Kaspysk.

In line with Q methodology protocols, we recruited participants from key fishing settlements using purposive snowball sampling, aimed at capturing the principle viewpoints (Biernacki & Waldorf, 1981; Rastogi et al., 2013; Watts & Stenner, 2013). To reduce potential biases associated with snowball sampling we partitioned the Dagestani coast into three survey regions (Figure 2) corresponding to fisheries administrative areas of Dagestan northern coast (21 interviews), middle coast (20 interviews) and southern coast (9 interviews)

reflecting the relative distributions of fishing and trade intensity (Dmitrieva et al., 2013). Following multiple visits to the southern survey region, we identified two illegal fishing quays (sites from which fishers have lost their fishing quota and licences, but still chose to fish illegally). The majority of respondents in the southern region were recruited at such quays. In the other survey regions, no illegal fishing quays were identified. Some fishing villages are located in restricted border zone areas (semiclosed areas within the Russian Federation along international borders with restricted access for nonresidents, Russians and foreigners alike), requiring a permit issued by the border guard service to enter. In fishing villages outside restricted areas, we carried out transect walks and identified boat launching spots, boats and boat trailers, fishing gear and tractors or other fishing-related vehicles (or their tracks on the ground). People were approached at these spots and asked to participate in the research. Fish traders were approached at their market stalls, while seal pelt intermediaries or illegal traders of seal products were recruited using fisher recommendations. Participants from public offices (fisheries managers and fish producers) were approached and recruited at their workplaces.

Some of research participants in this study may be illiterate, so we assumed that verbal informed consent was more appropriate. Prior to interviewing, we allowed participants a minimum of 2 h to familiarise themselves with the project information, and their consent was recorded using a voice recorder. For each participant, the collected interview materials were supplemented with standard sociodemographic information. As IUU fishing and trade in sturgeons are criminal activities in Russia, informants were free to choose to report whether they had any involvement, and we did not cross-check this with other responses. Research participants were individuals from diverse ethnic background, including Kumyks, Nogays, Dargins, Russians, Avars and Laks. Russian was used as a language for interviewing since all participants were fluent in this language.

The research was approved by the Ethics Review Committee of the School of Earth and Environment, at the University of Leeds (ref: AREA 17-036). LS was working under the appropriate study visa and the work was done with support from Dagestan State University. No research permits are required for carrying a research in Russia, however, since some Dagestan coastal settlements are within restricted border zones, special permits are needed to access them. The relevant permits to access villages in border zone areas were issued to a local research assistant in October 2018 (number: 03/И No. 941, valid from 20 October 2018 to 19 October, 2021), and where appropriate, participants were brought for interview by LS at locations outside restricted zones. Most of interviews (48) were conducted by LS, a fluent Russian speaker. Two additional interviews were conducted by the research assistant, holding the necessary permit, with participants who could not travel from border areas.

2.3 | Data analysis and factor selection

With Q, participants sort statements on a grid in relative order of agreement. Statements were read out loud to illiterate research participants.

TABLE 1 Q sort statements and factor loading scorings (Q score). No.—statement number (order in which they appeared in the concourse); Statement—full list of statements used for this study; Question theme—lists themes that emerged while indexing; Factors 1,2,3—factor loading score for each statement; Con—C indicates full consensus between factors, PC partial consensus (consensus between two factors on a statement, which diverge from the third), blank—indicates statements with no consensus; C* indicates significant full consensus between factors (significance at $p < 0.05$); PCF—the factor pairs between which agreement was observed in the case of partial consensus.

No.	Statement	Question theme	Factors			Con	PCF Pairs
			1 Q_sc	2 Q_sc	3 Q_sc		
38	The Caspian environment and fisheries are as healthy and productive as they have always been	Economic value of fisheries and seals	-5	0	-2		
7	Caspian seals are a commercial species	Economic value of fisheries and seals	-3	-1	-1		2,3
3	Fishing pays well and helps people easily support their families	Economic value of fisheries and seals	-2	-2	-5	PC	1,2
48	There is no future in fisheries	Economic value of fisheries and seals	-2	-3	4	PC	1,2
35	Everybody should just take what they can from the environment because it will be gone soon	Economic value of fisheries and seals	-1	-3	-5		
10	Fishermen are happy when they trap seals because pelts and blubber are valuable	Economic value of fisheries and seals	-1	-3	-4	PC	2,3
34	Fish producers exploit ordinary fishermen	Economic value of fisheries and seals	-1	-5	0		
50	There are problems with outsiders overfishing in community territories	Economic value of fisheries and seals	0	0	1	C	
47	Bycatch of seals happens accidentally	Economic value of fisheries and seals	0	1	4	PC	1,2
37	It is much harder to get a good catch of fish than it used to be	Economic value of fisheries and seals	3	0	2	PC	1,3
51	If there were jobs that paid well many people would stop fishing	Economic value of fisheries and seals	5	3	5	C	
33	Conservation of Caspian seals poses a threat to fisher	Perception of conservation and sustainable use of resources	-3	-3	-2	C*	
15	Fishermen report seal bycatch	Perception of conservation and sustainable use of resources	-2	-2	-3	C*	
13	Creating protected areas will not stop fishermen from fishing there	Perception of conservation and sustainable use of resources	-1	-2	-2	C*	
14	Fisheries and conservation cannot coexist	Perception of conservation and sustainable use of resources	0	0	0	C	
43	Fishing communities should be involved in the management of protected areas	Perception of conservation and sustainable use of resources	1	1	2	C*	
28	Every fishermen should be interested in conserving overexploited species	Perception of conservation and sustainable use of resources	1	4	0		1,3
16	Seals should only be conserved if there is an economic benefit to fishermen	Perception of conservation and sustainable use of resources	-2	-2	-3	C*	
4	Bycatch is a threat to the seal population	Perception of conservation and sustainable use of resources	0	-1	-1	C	2,3
36	Nature has its own value and should be preserved, even at the expense of some economic development	Perception of conservation and sustainable use of resources	2	5	2		
6	Seal hunting is a threat to the seal population	Perception of conservation and sustainable use of resources	2	0	2	PC	1,3
26	Hydroelectric dams are responsible for the decline in fisheries	Perception of conservation and sustainable use of resources	2	0	-1	PC	2,3
5	Oil extraction is a threat to the seal population	Perception of conservation and sustainable use of resources	3	-1	0	PC	2,3
1	The Caspian seal is under threat of extinction and should be protected	Perception of conservation and sustainable use of resources	3	0	4		1,2
25	Restricting the times of fishing seasons could help reduce seal bycatch	Perception of conservation and sustainable use of resources	0	-1	-2		

TABLE 1 (Continued)

No.	Statement	Question theme	Factors			Con	PCF Pairs
			1 Q_sc	2 Q_sc	3 Q_sc		
31	A sustainable approach to fisheries is important and will make fishermen more prosperous	Perception of conservation and sustainable use of resources	2	1	1	C	
20	Fishing communities should be involved in the management of fisheries resources	Perception of conservation and sustainable use of resources	2	3	0	PC	1,2
18	Marine protected areas are needed to help with the conservation of species	Perception of conservation and sustainable use of resources	3	5	-2		
40	Overfishing and human greed are responsible for the decline of fisheries	Perception of conservation and sustainable use of resources	4	2	1		
44	State provides enough resources to deal with the environmental issues in the Caspian	Perceptions of authorities	-4	1	0	PC	2,3
29	State does a good job of species conservation	Perceptions of authorities	-4	2	-1		
41	State institutions act in the interests of fishing communities	Perceptions of authorities	-3	0	-1		
46	Fish producers seeks to protect seals	Perceptions of authorities	0	1	0		
22	State places too many restrictions on fishermen	Perceptions of authorities	0	0	5		
27	State should build factories that replenish depleted seal population	Perceptions of authorities	1	-1	3		
42	Since the Caspian is shared by five countries, international organisations and scientists should have role in the conservation of seals	Perceptions of authorities	5	4	3	C*	
49	Fishermen discuss the problem of seal bycatch in their families	Perceptions of local communities	-1	-2	-4		
30	Fishing communities play an active role in biodiversity conservation	Perceptions of local communities	-1	1	-1	PC	1,3
32	Fishermen are respected within their communities	Perceptions of local communities	0	2	3	PC	2,3
23	Fishing is an important tradition for the fishing communities	Perceptions of local communities	1	2	0		
45	Fish producers comply with fishery regulations	Perceptions of utility and regulations	-2	1	1		
12	Fishermen comply with fishing regulations	Perceptions of utility and regulations	-1	3	2	PC	2,3
11	Fishing is a poorly regulated activity	Perceptions of utility and regulations	0	-1	-3		
17	Violators of fishing regulations face harsh punishments	Perceptions of utility and regulations	1	3	3	PC	2,3
21	People with money can get away with anything in fisher	Perceptions of utility and regulations	1	-4	1	PC	1,3
24	People with good connections can get away with anything in fisheries	Perceptions of utility and regulations	1	-5	0		
39	Rules are important for managing resources in a sustainable way	Perceptions of utility and regulations	4	4	1	PC	1,2
19	Seals are dangerous for people	Understanding, perceptions and knowledge of seals	-5	-4	-4	C	
2	Seals are bad for fisheries	Understanding, perceptions and knowledge of seals	-4	-4	-3	C	
8	Seals are like any other fish in the sea	Understanding, perceptions and knowledge of seals	-3	-1	-1	PC	2,3
9	Caspian seals are important for the overall vitality of the Caspian Sea	Understanding, perceptions and knowledge of seals	4	2	1	PC	2,3
Explained variance (%)			23	16	10		

We began by asking participants to sort statements into three piles (agree, disagree and neutral) and, following this, rank-order statements over a quasi-normal flattened distribution of the forced choice grid using a value scale from +5 (most agree) to -5 (most disagree), which

assured that each statement was considered (Figure S1). Flattened distributions are appropriate for concourses containing 40–50 statements (Brown, 1980; Watts & Stenner, 2013). These scoring grids generated by each individual are termed 'Q sorts'.

TABLE 2 Summary of participant professions, sample sizes and estimated population size of actor class in the region.

Respondent professions	Sector	Sample size	Population size ^a	Definition
Fishers	Legal fisheries	17	Approximately 1600 boats	Legal fishers, catching fish for their livelihood within the official permitting system
Active (8) and former sturgeon fishers (1)	IUU fisheries	9	Up to 400 boats	Illegal fishers, practicing nonlicensed fishing, targeting sturgeon
Fishers/pelt middlemen	Traders/IUU fishers	2	No data	Resell seal pelts to furriers
Fish producers	Producers	8	30–60	Quota and licence holders, who employ fishers
Fish stallholders	Traders	3	No data	Sell fish and medicinal seal oil in marketplaces of Dagestan
Former sturgeon caviar reseller	Traders	1	No data	Buys up sturgeon caviar from fishermen and sells them to consumers
Leisure hunters/fishers	Leisure seekers	6	No data	Catch Caspian species of birds or fish for leisure or domestic consumption
Conservation advocate and biological resource managers	Public	4	No data	Involved in management of resource use

^aData from Dagestan Government (2015) and Dmitrieva et al. (2013) where available.

We used PQ Method software, version 2.35 for Microsoft Windows (Schmolck, 2015), to analyse and calculate intercorrelation between pairs of Q sorts. We used principal component analysis (PCA) to classify participants (independent variables) based on the intercorrelation between Q sorts (dependent variables). PCA reduces the number of factors, so that participants who sort similarly, and have loaded onto similar factor are assumed to share similar views. The initial PCA yielded eight factors with eigenvalue >1. The first three factors explained 49% of the variation within the sample, with eigenvalues of 17.4150, 4.5905 and 2.0894 respectively. Including a fourth factor added only an additional 3% of variation with eigenvalue 2.03, so we chose to retain three factors, which we designated 'Nostalgists', 'Optimists' and 'Pessimists' (see Section 3.2, for definitions). In addition, retaining three factors was supported by the significant factor loading rule, Humphrey's rule (partially), and a Scree test (Tables S1–S4; Equations S1 and S2; Figure S2). The Scree test was performed using the R package nFACTORS (Raiche & Magis, 2020). Participant Q sorts were assigned to factors using automatic flagging with varimax rotation. The initial assignments were reviewed, and three-participant Q sorts that lacked strong association with any factor were flagged manually.

2.4 | Interpretation

The 'ideal' Q sorts derived from factor arrays were used in combination with interview data to facilitate thematic interpretation of viewpoints. During postsorting interviews, participants were asked to provide comments on their Q sort ranking choices, including, why they strongly agreed, disagreed or chose neutral (Benitez-Capistros et al., 2016; Watts & Stenner, 2013). We recorded interviews using a digital recorder, and created verbatim transcripts, which were reduced to 1005 statements, coded using the NVivo software, wherein informants explained their choices (QSR International Pty

Ltd., 2018). Further information on key statements in each factor, Q scores and consensus areas is given in Table 1. We also identified statements showing full consensus (Table 1, column Con), where all factors had a similar placement of these statements, to a statistically significant degree, and based on their underpinning z-scores. For example, statement 15 had a Q score of –2 in two factors, and –3 in a third. We also show pairwise consensus (Table 1, column PCF), with statistically similar placement between two factors, which diverged from the third. For example, statement 3, with a Q score of –2 in two factors, and –5 in a third. We further assessed how viewpoints correlated with sociodemographic profiles of age, education and compared factor groups for differences in spatial distributions across survey areas using nonparametric Kruskal–Wallis tests.

2.5 | Stakeholder workshop

Following preliminary analysis of viewpoints identified in the Q analysis, to help frame themes for further exploration, we engaged stakeholders in workshops to explore potential solutions and barriers to seal conservation, particularly regarding alternative livelihoods, marine protected areas (MPAs) and bycatch. One workshop for local experts was held in Makhachkala in September 2019; and two in rural fishing communities for fishers, in Staroterechnoye in September 2019, and Sulak in October 2019. Participants for the expert workshop were drawn from key stakeholder groups in Dagestan (Table S5). For fishers' workshops, we invited Q study participants, and other fishers (illegal and legal), crew, skippers and boat owners, with a total of approximately 40 participants. In both cases, following opening statements, there were round table discussions on how stakeholders perceived bycatch threats to Caspian seals, how to reduce illegal fishing, and the role of alternative livelihoods in this process.

Written minutes were taken for each workshop, and analysed using the software NVivo for qualitative analysis. Thematic coding

was implemented to produce a synthesis of discussion points summarised as a table of potential interventions, barriers and solutions, that according to stakeholder opinion could reduce illegal fishing, associated IWT and high rates of seal bycatch.

3 | RESULTS

3.1 | Demographic profile of study participants

The average age of participants was 42 years (range 18–71 years, $SD=12.3$; Table S6). The median age of people from viewpoint groups were 45 (Nostalgists), 46 (Optimists) and 32 (Pessimists) years respectively, however, the age difference among groups was nonsignificant (Kruskal–Wallis H test, $H(2)=4.34$, $p=0.11$). The median values for the years in education for Nostalgists, Optimists and

Pessimists were 12, 11, and 11 respectively (Kruskal–Wallis test, $H(2)=1.1$, $p=0.57$), again with no significant difference. The average time spent in education across regions was 11.86 years (range 4–14 years, $SD=2.26$). The median values of years in education for the north, middle and south were 12, 11 and 11 respectively (Kruskal–Wallis rank sum test, $H(2)=5.27$, $p=0.07$).

The proportion of illegal fishers among respondents was highest in the south (78%; Figure S3). No respondents from the north stated they fished illegally. Participation in illegal fishing appeared to be less frequently reported by Optimists (8% illegal vs. 92% legal; Figure S4a). Pessimists' occupations comprised of pelt intermediary and fishers, while Nostalgists and Optimists were drawn from more diverse professions (Figure 3; Figure S4c). Nostalgists were the dominant viewpoint in all three regions, with the greatest frequency difference in the south, 78% Nostalgists versus 11% each for Optimists and Pessimist (Figure 3; Figure S3b). The relative proportion of

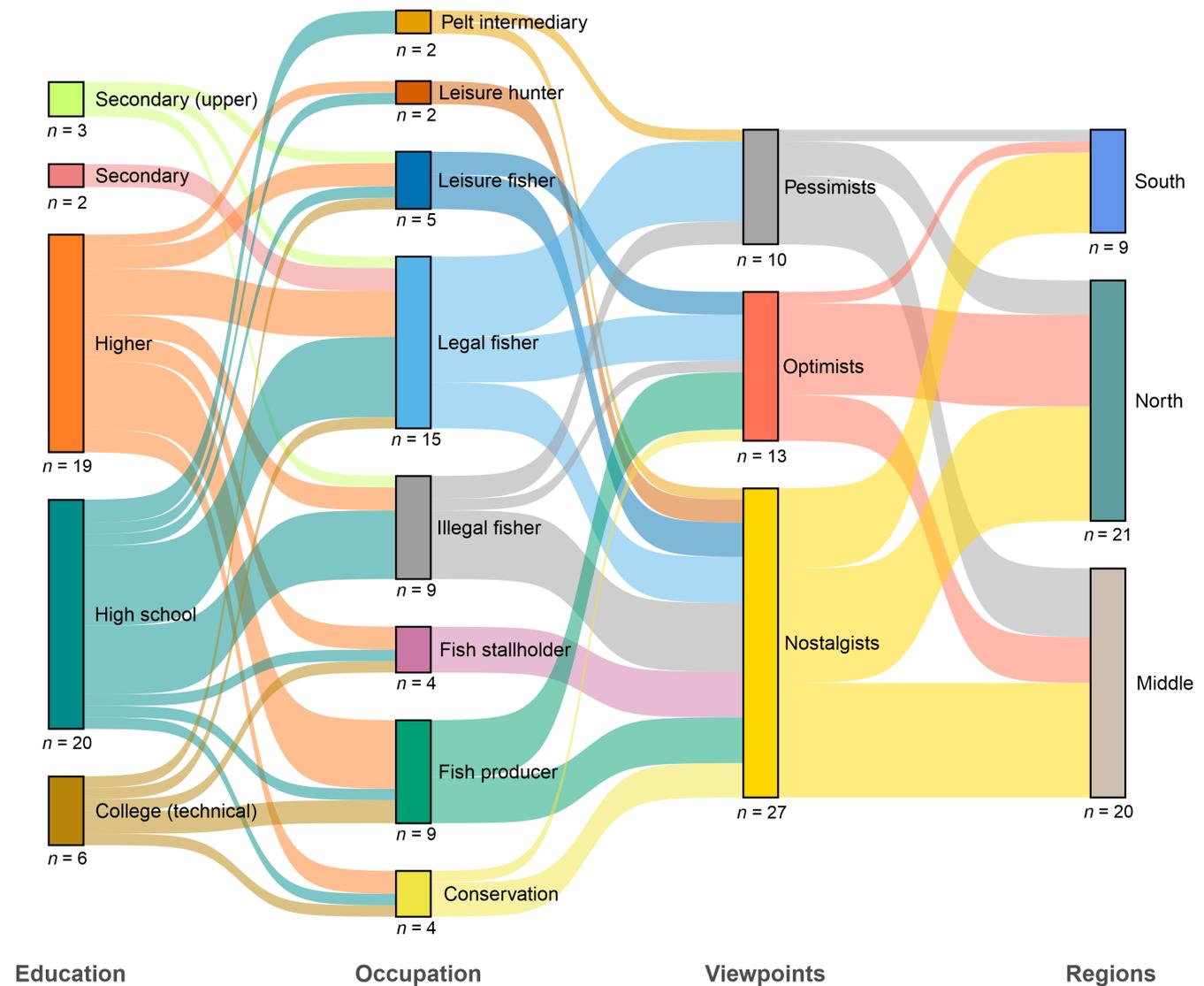


FIGURE 3 Sankey plot summarising distribution of educational attainment, professions and fishing region relative to viewpoint categories. Secondary, secondary upper, high school, college (technical) and higher correspond to a minimum of 4, 9, 11, 12 and 14 years of education respectively.

Optimists was highest in the north, while Pessimists occurred with the highest relative frequency in the middle sector.

3.2 | Viewpoint summaries

Here we describe each factor in detail. Where we use direct quotes, it is from an informant who loaded onto this factor. Numbers in parentheses refer to the relevant statement number, followed by the normalised Q score for that statement for that factor. Where three Q scores are given in the same parentheses, these refer to Nostalgists, Optimists and Pessimists respectively.

3.2.1 | Viewpoint 1: 'Nostalgists'

This viewpoint (Figure S5) is defined by a consideration that the health of the marine ecosystem has declined due to overfishing, pollution and other factors, that the state has failed to address collapsed fisheries and economic issues, and that solutions lie in return to a 'Soviet' style planned economy and regulation. Twenty-seven participants from diverse backgrounds loaded onto this factor (Figure 3; Figure S4).

Nostalgists strongly disagree that the Caspian environment and fisheries are currently healthy (ST38, -5). This viewpoint, more so than others, is concerned that oil spills from offshore oil rigs damage the health and wellbeing of seals, fish and other animal species, (ST5, +3) and disagree that seals are commercially harvested (ST7, -3) since hunting quotas are no longer issued. Likewise, the abundance of fish stocks is declining due to overfishing (ST40, 4), pollution or hydroelectric dam construction (ST26, +2). Seals are considered an important part of Caspian ecosystem (ST9, +4), being valued for cultural reasons as a flagship species, for social reasons or because they are rare (ST1, +3) and because seal blubber has perceived health benefits to humans and pelts might sell as commodities. Nostalgists are unaware about seal bycatch in fisheries (ST4, 0) or that it happens accidentally (ST47, 0).

Current state governance is perceived as ineffectual (ST29, -4), lacking sufficient resources (ST44, -4), and failing to support socioeconomic needs in fishing communities (ST41, -3). Nostalgists perceive this is due to widespread corruption, leading many fishers and fish producers to not to comply with fishing rules (ST45, -2). A 51-year-old intermediary described the situation in fisheries: '*I am sure that 90% of fishers do not follow them [fishing rules]. I would not if I were a fisher*'.

In contrast to the other viewpoints, Nostalgists agreed least that punishments were harsh enough (ST17, +1). This viewpoint strongly agreed that '*If there were jobs that paid well many people would stop fishing*' (ST51, +5), and emphasised solutions are linked to socioeconomic interventions akin to Soviet-type planning for resource use, factory building and industrial development of rural areas, and building new fish restocking facilities. In general, sustainable approaches to fisheries are welcomed (ST31, +2), as well

as MPAs (ST18, +3), and enforced through appropriate legislation (ST33, +4).

3.2.2 | Viewpoint 2: 'Optimists'

This factor (Figure S6) is defined by a view that fishing communities themselves can create sustainable fisheries, with greater involvement of local communities in decentralised governance. Participants (13) who loaded onto this viewpoint are from fishery related backgrounds (Figure 3; Figure S4).

Compared to other viewpoints, Optimists viewed the health of the Caspian Sea in a more positive light (ST38, 0). Optimists had least agreement with the statement '*the Caspian seal is under the threat of extinction*' (ST1, 0). One participant mentioned that seals in Kazakhstan were still abundant, but admitted that seals are rare where they fished. In general, the Optimist viewpoint was unaware that seals are accidentally caught in fishing gear (ST47, +1).

This viewpoint was comparatively positive about the role of the state in addressing poaching and corruption (ST29, +2), and stronger than others in supporting that allocated resources were sufficient (ST44, +1). Optimists supported protected areas (ST18, +5), and co-management approaches (ST28, +4), and involvement of scientists (ST42, +4).

Optimists consider that fishers are rule-abiding (ST12, +3), and strongly disagreed with the idea that fish producers exploit ordinary fishers (ST34, -5), since salaries are fair as they are based on catch. Some emphasised the importance of rules (ST33, +4) and claimed they would not offer fishing jobs to fishers with a record of fishing rule infringements. Optimist fish producers were aware of poachers operating in the fishing settlements, but chose not to report such cases. Optimists strongly disagreed that corruption posed an issue (ST21, -4 and ST24, -5), however, they did not feel safe to discuss corruption in depth, because of fears of harassment from law enforcement.

The Optimist viewpoint perceived fishing more positively than other factors (ST48, -3; ST40, +1). In contrast to Nostalgists, Optimists sought to achieve balanced development through small-scale businesses, a diverse rural economy, and are opposed to large-scale industrial development in rural areas and supported decentralised conservation interventions.

3.2.3 | Viewpoint 3: 'Pessimists'

This viewpoint (Figure S7) is very pessimistic about the current state of fisheries, and the potential for improvements. It considers that drastic conservation measures are needed to protect species, but is sceptical that they can be implemented effectively. It agrees with the total closure of sturgeon fisheries. Nine fishers and an intermediary loaded on this viewpoint (Figure 3; Figure S4).

This viewpoint strongly disagreed with the statement '*everybody should just take what they can from the environment because it will be*

gone soon' (ST35, -5). Some informants considered this as a normative statement, and others admitted the statement captured well the essence of IUU fisheries. The viewpoint strongly agreed that seals are rare and need protection (ST1, +4) and supported state restocking of the Caspian Sea with sturgeon as something that state *ought to do to*, to help fishers to cope with an unfavourable economic situation. Some from this viewpoint strongly supported use of seals as an economic resource, including establishment of a state supported restocking programme for seals, paralleling that for sturgeon (ST27, +3), so that a recovered seal population could be harvested as in the past.

This viewpoint strongly agrees that '*there is no future in fisheries*' (ST48, +4). Pessimists claimed that depleted fish stocks made it difficult for fishers to support their families. Some depend on loans raised through social networks, but few could repay the loans on time, causing tensions in families. One fisher noted: '*we have gained nothing from this work [fishing], only debts*'. The view that fishing was '*tradition*' loaded in the middle of the grid (ST23, 0). One respondent mentioned: '*fishing is not a tradition, but a way of survival*'. Pessimists strongly agree that if there were jobs that paid well many people would stop fishing (51, +5).

The Pessimist viewpoint strongly supported relaxing the burden of state regulations (ST22, +5) and, in general, were opposed to measures that could restrict the access to fishing grounds, such as, closed seasons (ST25, -2) or MPAs (ST18, -2). In contrast to Nostalgists, Pessimists viewed current punishments as too harsh (ST17, +3), yet legal and illegal fishers alike supported the view that total closure of sturgeon fisheries, and its enforcement was needed for there to be any impact on IUU fishing practices. Similarly, despite their opposition to MPAs due to a desire for relaxed regulation, Pessimists still thought strictly enforced MPAs would be an effective measure (ST13, -2).

3.3 | Areas of consensus

The overall pattern of consensus among viewpoints on key thematic topics is summarised in [Figure 4](#).

3.3.1 | State of the Caspian Sea environment and root causes of environmental problems

Stakeholders did not consider the Caspian Sea environment to be in good condition, although there was some disagreement about the extent of this, reflecting broader views. Nostalgists had strongly disagreed that '*the Caspian environment and fisheries are as healthy and productive as they have always been*' (ST38, -5) and strongly agreed that '*it is much harder to get a good catch of fish than it used to be*' (ST37, +3) than the fisheries optimists (ST38, 0; ST37, 0). While all factors scored positive on statement 40 that '*overfishing and human greed are responsible for the decline of fisheries*', this was stronger among the Nostalgists (+4) than the Optimists (+1). The same pattern, by which Nostalgists gave greater salience to threats than optimists, was observed in statements on oil extraction (ST5)

and hydroelectricity (ST26), and seal hunting as a specific threat to seals (ST6). Oil extraction (ST5) was rated as a greater threat among the Nostalgists (+3) than among Optimists (-1) or Pessimists (0). There was agreement between Nostalgists and Pessimists on how the statement on seal hunting was rated (ST6; 2, 2). Yet overfishing was rated a greater threat than these other causes within each of the three factors. Informants noted that IUU sturgeon fisheries was the main issue, and sturgeon stocks have collapsed, such that they are no longer found in their previous range areas. This view is particularly strong among older (>40 years) informants, who had experienced plentiful resources in the past.

3.3.2 | Attitudes to seals

Across all factors, there is general agreement that seals are at least benign, and often positively viewed. The idea that '*seals are dangerous for people*' (ST19; -5, -4, -4) was rejected. Stakeholders viewed seals as timid, but might bite if cornered. There were varying levels of positive agreement that '*Caspian seals are important for the overall vitality of the Caspian Sea*' (ST9; 4, 2, 1), important to the ecosystem, and the only endemic marine mammal, hence they were not '*like any other fish in the sea*' (ST8; -3, -1, -1), with a right to exist irrespective of any impact on fishing (ST16). The idea that '*seals are bad for fisheries*' (ST2; -4, -4, -3) was rejected. For informants in viewpoint 2, this was because seals are too rare to cause damage, but there was some sentiment that high prices for seal pelts and blubber could compensate for gear loss or damage, or increased fishing costs, and because seal blubber was beneficial to humans through its perceived medicinal properties. Yet informants disagreed to varying degrees that '*fishers are happy when they trap seals because pelts and blubber are valuable*' (ST10; -1, -3, -4), because fishers were not happy to have to kill seals, felt sorry for seals but had no other choice, or feared arrest if caught by law enforcement. Thus, there is consensus in disagreeing that fishers report bycatch (ST15; -2, -2, -3), due to fear of potential legal penalties. One fisher commented: '*why should fishers create problems for themselves? No, if fishers report, they are penalized. The fines per seal could range from 8 to 15 thousand rubbles [100-200 euro] this is a criminal liability. The boat could be confiscated*'. Pessimists strongly support that '*bycatch of seals happens accidentally*' (ST47; 0, 1, 4) on the grounds that fishers do not target seals. There is tension across viewpoints, between seeing seals as benign or positive parts of the ecosystem, and not wanting to catch them because of the legal consequences, while recognising that fishers benefit from selling seal products.

3.3.3 | Perceptions of the role of state, conservation and regulation

The three viewpoints differed on their views of the state, and its interactions with fishing and the environment. All saw the state as currently corrupt and inefficient, but disagreed over the extent to which this

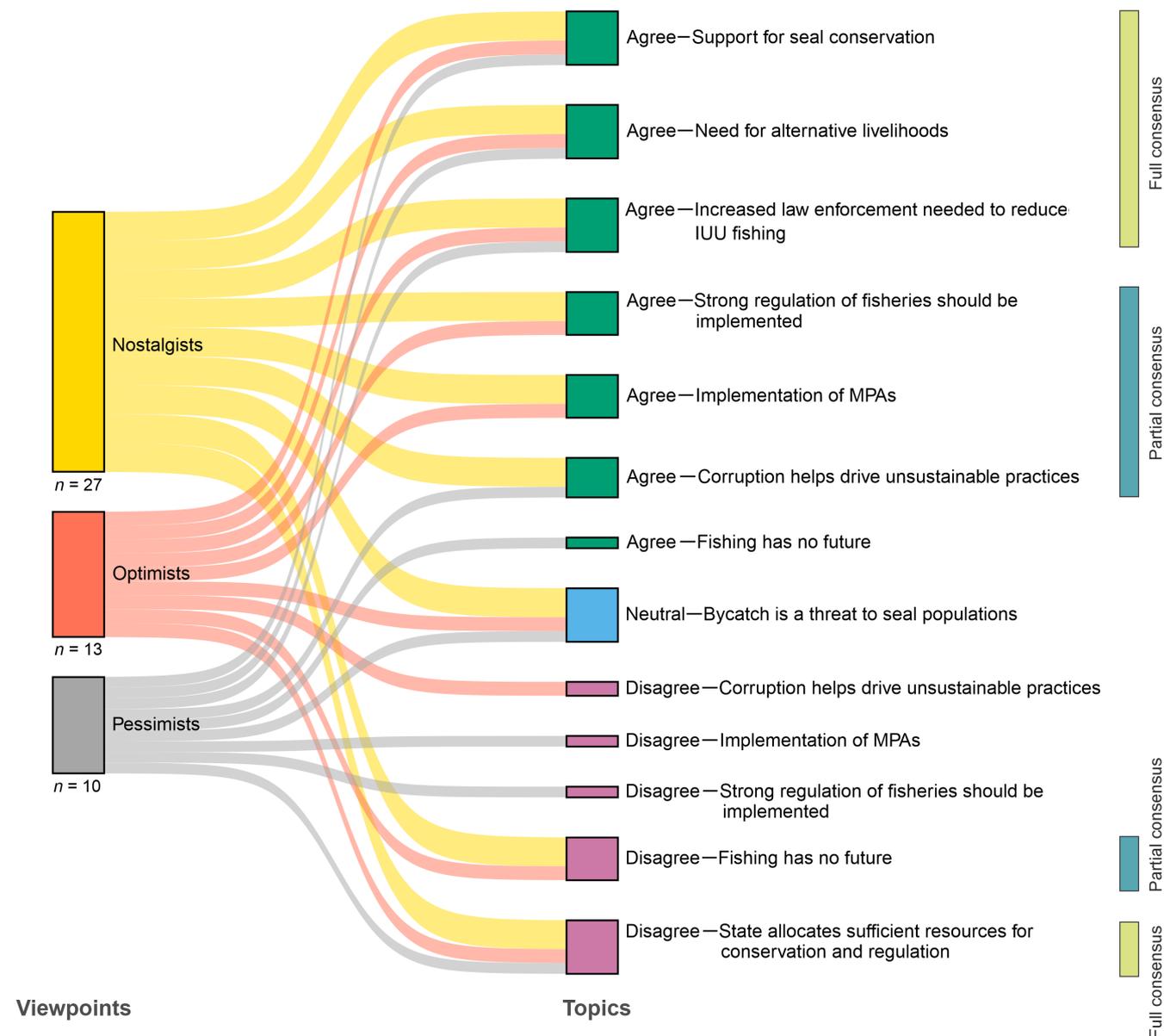


FIGURE 4 Sankey plot summarising patterns of consensus and divergence on key topic areas among the three viewpoints.

included law enforcement and fisheries, and whether this, and wider relationships between fishing communities and the state, could be improved. The Nostalgist viewpoint disagreed that the state does a good job of conservation (ST29, -4), that it had sufficient resources (ST44, -4), or that it acted in the interest of fishing communities (ST41, -3). The state was seen as inefficient, ineffective and corrupt, certainly compared to memories of the Soviet era when fisher's livelihoods were stronger, fishers complied with fishing regulations, and the state supported them. This viewpoint favoured a state that is reformed, with a return to the perceived pre-1990 past, with a planned economy, state organised factories, more resources and supportive regulation.

By contrast, Optimists viewed the state's record on conservation more positively (ST29, +2; ST44, +1), viewed the fisheries sector as less corrupt (ST24, -5), although corruption existed elsewhere, and was more enthusiastic about further state regulations such as MPAs

(ST18, 5) as well as the state's role in tackling poaching. This is part of a more positive view of the future for fishing, whereby the state would work with fishing communities to create prosperous and sustainable fishing industries.

Pessimists were most sceptical about the state's past, present and future, and wanted less direct state involvement in fishing. It felt strongly that the state placed too much regulation on fishers (ST22, +5), and was least in favour of rules for managing resources in a sustainable way (ST39; 4, 4, 1) or MPAs (ST18, -2), because such future regulations would continue current patterns of inefficiency and corruption. Instead, as part of a lack of a future in fishing (ST48; -2, -3, +4), it wanted a state that strongly supported alternative livelihoods, and restocking of commercially important species.

Stakeholders generally favoured strengthening seal conservation measures, as participants (especially those loading onto

Nostalgist and Pessimist viewpoints) are aware that seals are under the threat of extinction (ST1; 3, 0, 4). Participants tended to disagree that *seals should only be conserved if there is an economic benefit to fishers* (ST16; -2, -2, -3), for divergent reasons. Some claimed that targeting seals is pointless, as they are rare, while causing minimal damage to fisheries.

Creating MPAs was the most favoured conservation measure discussed with stakeholders. The Nostalgist and Optimist viewpoints both favoured creating MPAs (ST18; +3, +5, -2) since they might restore fishing stocks. Illegal fishers that loaded onto pessimist viewpoint chose not to support MPAs as they restrict access to fishing areas and feared punishments. Surprisingly, across factors there was an agreement that creating MPAs would be effective (ST13), even among Pessimists, since enforcement would prevent fishers from using those areas.

3.3.4 | Future of fishing in the Caspian

There were divergent views on whether there was a future in fisheries (ST48; -2, -3, +4). Only Optimists were positive about the current state of resources. Fish producers from Makhachkala perceived that 'kilka' stocks (genus *Clupeonella*), a small pelagic fish, had recovered from overfishing which occurred in 1980s. Small-scale fish producers in the north were open to new ways of fishery management (ST31, 1). Nostalgists and Pessimists stressed that fish stocks were depleted, fishing salaries were low and work arduous and risky, diverging from Optimist views (ST3; -2, -2, -5). Some fishers sought employment elsewhere, and encouraged their children to choose other occupations or to seek education. Thus, even the Optimist viewpoint agrees that fishers might change their occupation if they found alternative employment in Dagestan or Russia (ST51; +5, +3, +5). Scientific work carried out by international or local scientists was positively viewed (ST42; +5, +4, +3). Support for international scientists is more common among fishers and some producers in rural areas.

3.4 | Workshop outputs

The workshops identified six areas for targeting interventions (Table 3), reflecting the breadth of issues highlighted by participants, although not all proposals are equally acceptable to all stakeholder groups.

First, *Increased law enforcement* emphasised targeting illegal fishing activity and trade in sturgeon and seal products, and perceived barriers included state recognition of the issue, availability of resources, corruption and organised crime, and gaps in legislation.

Increased fisheries regulation and *protected areas* could include restrictions on fishing gear types, seasons and areas, changes to quotas, introduction of subsidies and financial incentives to change fishing practices, and enhanced roles for community self-regulation.

Barriers were similar to those for law enforcement with the addition of political conflicts and cultural traditions.

A range of *alternative livelihoods* were suggested, including agriculture and animal husbandry, aquaculture, ecotourism as well as skilled and unskilled jobs (e.g. labouring, factory work, driving) in nearby cities. Examples of some of these alternatives already exist in Dagestan, with cases of individuals, communities and cooperatives establishing successful enterprises to transition away from fishing being highlighted. Such businesses include farming of trout and sturgeon, market gardens supplying produce and ecotourism for birdwatching and leisure fishing. Reported barriers included lack of access to business capital and knowledge of business development in communities reliant on fishing, a need for improved adult education, a culture of expectation of state economic provision (as a legacy of the Soviet era), and poor or broken infrastructure (e.g. irrigation systems in disrepair preventing agricultural development, unsurfaced roads impeding access to cities).

Reduction of demand highlighted the role for community led action and public awareness campaigns, with several members of fishing communities wishing to pursue such activities. Participants in the expert workshop identified a priority for further *research* on socioeconomic factors to help inform design and implementation of alternative livelihood programmes, the need to establish a seal stranding monitoring and investigation programme.

Fishers also identified other economic pressures, such as the need to service debts incurred in purchasing boats and gear from previous seasons and the absence of jobs paying sufficiently well to sustain a livelihood without fishing. High rates of unemployment in rural areas meant there was a pool of cheap labour to undertake illegal fishing at a minimal cost to boat owners. Fishers participating in workshops widely supported investment to diversify economic opportunities in rural areas, and thought this would be a strong incentive to disengage from illegal fishing and pursue sustainable livelihoods.

The proposal that diversified socioeconomic incentives are needed to help fishers transition to sustainable fishing or alternative occupations did not receive support from all expert groups. Participants affiliated with the Dagestan section of the Caspian Fisheries Scientific Research Institute, and Caspian Institute of Biological Resources emphasised that kilka stocks have recovered to a sufficient degree from overfishing, and that a commercial fishery could restart. Subsidies and investment need to be directed to support the commercial fishing fleet suitable for fishing kilka stocks. Other experts expressed strong support for building new sturgeon restocking facilities and claimed that illegal fishing no longer posed a threat.

In relation to further *research*, it was recognised that designing effective and acceptable strategies for alternative livelihoods will need input from economists and development specialists, alongside consultation with governmental stakeholders and communities. This should focus on identifying locally appropriate solutions, how they can sustainably be financed, and evaluating their effectiveness through pilot projects.

TABLE 3 Summary of interventions, barriers to implementation and potential solutions to enhance fisheries sustainability and reduce seal bycatch and poaching in Dagestan coastal communities.

Intervention	Barriers to implementation	Potential solutions	Stakeholders
<p>Enhanced law enforcement</p> <ul style="list-style-type: none"> Target illegal fishing and poaching activity Target trade in sturgeon and seal products 	<ul style="list-style-type: none"> State recognition of issue and willingness to enforce law State resources and capacity Corrupt officials Organised crime Legal gaps 	<ul style="list-style-type: none"> Increase State prioritisation and allocation of resources Anti-corruption action Legislation 	Federal and State law enforcement agencies, civil society
<p>Increased fisheries regulation</p> <ul style="list-style-type: none"> Date restrictions Area restrictions Gear restrictions and alternatives Fisheries quotas Community self-regulation Subsidies and financial incentives 	<ul style="list-style-type: none"> State recognition of bycatch issue Community recognition of bycatch issue State resources and capacity Corrupt officials Nontransparent decision-making Political and community conflicts Unwillingness to engage due to cultural traditions and personal motivations 	<ul style="list-style-type: none"> Increase State prioritisation and allocation of resources Community consultations Build community awareness of sustainability and sustainable management Support community self-policing Anticorruption action 	State fisheries agencies, communities and civil society
<p>Protected areas</p> <ul style="list-style-type: none"> Fishing exclusion zones Habitat protection and restoration Net removals 	<ul style="list-style-type: none"> State recognition of issue and willingness to act State resources and capacity Corrupt officials Legal gaps 	<ul style="list-style-type: none"> Increase State prioritisation and allocation of resources Community consultations Anticorruption action Legislation 	Federal and State environment ministries, State fisheries agencies, communities, NGOs and civil society
<p>Alternative livelihoods</p> <ul style="list-style-type: none"> Agriculture Animal husbandry Aquaculture Ecotourism Other unskilled job (Factory work, driving, labouring, etc) Other skilled jobs 	<ul style="list-style-type: none"> State recognition of issue Low economic activity and opportunities Poor infrastructure—derelict irrigation systems, unsurfaced roads Lack of access to small business capital and personal credit Lack of knowledge on business development Lack of formal education Personal administration irregularities (e.g. lack of tax/financial records, misdemeanour/criminal records) Corrupt officials Political and community conflicts Expectations of State provision Unwillingness to engage due to cultural traditions and personal motivations 	<ul style="list-style-type: none"> Increase State prioritisation and allocation of resources State support for regional economic development Subsidies and financial incentives Restore broken infrastructure, improve roads Business education and development support Support access to small business development capital Support adult education and alternative skills development Anticorruption action Community consultations Build community awareness of alternative livelihoods Economic diversification 	State government, communities, NGOs, banks, private enterprise, cooperatives, civil society
<p>Reduce demand for sturgeon and seal products</p> <ul style="list-style-type: none"> Community action Public awareness campaigns 	<ul style="list-style-type: none"> Strong cultural traditions Lack of access to conventional medicine Lack of public awareness Lack of NGO capacity and resources 	<ul style="list-style-type: none"> Support NGOs for public awareness campaigns Support community action 	NGOs, civil society, communities
<p>Research</p> <ul style="list-style-type: none"> Socioeconomic factors to inform design and implementation of alternative livelihoods Stranding monitoring and investigation 	<ul style="list-style-type: none"> State recognition of issue and willingness to act State resources and capacity Local academic institutional resources and capacity 	<ul style="list-style-type: none"> Increase State prioritisation and allocation of resources Support capacity and development in academic institutions Support translation of research outputs into policy recommendation and implementation 	Federal and State research bodies, NGOs, International NGOs, and scientific collaborations

4 | DISCUSSION

4.1 | Q study findings

Using Q methodology, we assessed perspectives around biodiversity governance, regulation, and resource use in Dagestani fishing communities, to understand their implications for conservation policy and mitigation measures. We identified three different stakeholder viewpoint groups, Nostalgists, Optimists and Pessimists, representing distinct aspects of how stakeholders perceived fishing and conservation. We show areas of divergence and disagreement, but also areas of alignment in viewpoints.

The key points of consensus include positive communal attitudes for conserving seals, a desire to see development of alternative livelihoods and economic diversification in fishing communities, along with the importance and effectiveness of well-implemented regulation of fisheries, international scientific research and MPAs. The partial consensus or areas of divergence deal with the future prospects of the Caspian fisheries to provide benefits, support for illegal fishing, whether fisheries have a future, seal bycatch, state of biodiversity, the perception of law enforcement, corruption and threats from pollution.

The existence of areas of consensus indicates that communities see that change is needed, and are willing to work towards it. This suggests that an integrated strategy combining MPAs, increased regulation and support for alternative economic strategies to traditional fishing could potentially reduce incentives to fish illegally, especially if developed and implemented in consultation with communities. While all the viewpoint groups recognise that MPAs and enhanced regulation can be effective in promoting sustainability, the Pessimist viewpoint currently seeks lower regulation and reduced state intervention, and it may be challenging to engage people holding this perspective in the process.

4.2 | Alternative livelihoods

In Dagestan, some fishing communities have already transitioned to alternative livelihoods in horticulture, aquaculture and ecotourism. These enterprises were established by individuals, companies and cooperatives, because they offered better financial returns than fishing. This demonstrates the viability of economic diversification in the region, and reflect other successes achieved by the Caspian Environment Programme's small grant schemes implemented between 1998 and 2006 in rural Dagestan (Caspian Environment Programme, 2002). The presence of large cities, such as Makhachkala (population=600,000) in close proximity to fishing communities, provides further employment opportunities (e.g. manufacturing, transportation, construction or service sector). There are significant barriers to livelihood diversification as solutions to problems in fisheries in Dagestan. Fishing communities can lack access to capital and experience in business, and face problems of corruption, harassment, local political conflict and poor infrastructure. However, in

principle, many of these issues could be relatively straightforward to address with appropriate support to communities for business development, access to finance, adult education and investment in infrastructure.

Elsewhere, studies have emphasised that transitioning from fishing to alternative livelihoods might be necessary to reduce illegal or unsustainable fishing (Avila-Forcada et al., 2020). Alternative livelihoods can provide more sustainable options, and reduce incentives to fish illegally. However, when an alternative livelihood is developed, it does not always mean it will substitute for the harmful one, so whether alternative livelihoods can deliver effective conservation impact remains contested (Roe et al., 2015; Wright et al., 2016). In some cases where fishers have acquired new opportunities, they diversified their livelihood strategies but continued fishing (Avila-Forcada et al., 2020; Brugere et al., 2008). Successful transitions might depend on availability of incentives such as subsidies, for the alternatives to provide increased income relative to fishing, and that incomes reach the right people (Avila-Forcada et al., 2020; Diedrich et al., 2019; Wright et al., 2016).

Our data also identify barriers related to the stakeholder worldviews. For example, the Nostalgist view that it is the state's role to create and manage economic opportunities may be unrealistic within post-Soviet societies. A desire to see restocking of seal populations to support harvesting is biologically infeasible. In addition, some expert stakeholders participating in the workshop opposed economic diversification in coastal areas, instead favouring increasing subsidies for re-emergent kilka trawl fisheries. They also disagreed that IUU activity posed a threat to seal populations, and did not see the need for policies to address IUU impacts. This suggests more effort is needed to raise awareness of threats and viable solutions, and to improve dialogue between communities and resource managers.

Additional impetus for diversification comes from the challenge of adapting to climate change. Sea level in the Caspian is projected to decline by 9–18m by the end of the 21st century. The shallow northern Caspian basin and coastal areas will transition to dry steppe and desert (Prange et al., 2020), with catastrophic socioeconomic implications for the fishing communities. In future some of those communities surveyed may be too distant from the sea to have viable fishing livelihoods.

In anticipation of this, we strongly recommend renewed political impetus for exploring alternative livelihood strategies. Priority should be given to workshops and feasibility studies in coastal settlements, involving stakeholders from the communities, Dagestan state government, Russian and international NGOs, charities and international organisations such as the United Nations Environment Programme.

4.3 | Corruption

Corruption in Dagestan reinforces unsustainable resource use and facilitates criminal behaviour (Musing et al., 2019; van Uhm & Siegel, 2016). Study participants frequently cited instances of

bribery and corruption in the Dagestani government, law enforcement services and criminal justice system, that allow avoidance of penalties, and access to lucrative illegal sturgeon fishing and caviar trade activities. However, many were unwilling to discuss corruption due to fear of harassment. If corruption remains routine it can potentially undermine any policy seeking to build sustainable solutions. For example, in relation to Vaquita *Phocoena sinus* conservation, corruption influences how illegal fishing is organised, how catch and bycatch is regulated, and trade across different levels of the totoaba *Totoaba macdonaldi* commodity chain, substantially impeding policies to protect Vaquita and improve sustainability of fisheries (Aceves-Bueno et al., 2021). Corruption also affects implementation of evidence-based management policy by creating information gaps that prevent setting of appropriate catch limits (Sumaila et al., 2017). On paper Russia has robust anticorruption legislation and harsh sentences for those convicted of corruption or giving or taking a bribe (World Wildlife Fund, 2020). Yet, in practice, the level of enforcement is low (Newell & Henry, 2016; van Uhm & Siegel, 2016; Wyatt, 2014). Identifying effective anticorruption interventions would require an interdisciplinary approach and engagement with multiple stakeholders (Musing et al., 2019; Williams et al., 2016; Wyatt & Cao, 2015). Due to rigid state control of NGOs, civil society groups and academia in Russia, there are presently few, if any, independent organisations with capacity to influence anticorruption policies.

4.4 | Bycatch reduction

Measures can be introduced to reduce bycatch, such as bans or modification of fishing gear, date and area based bans on fishing activity, which have been used successfully to reduce bycatch rates for Saimaa seals *Pusa hispida saimensis* (Gormley et al., 2012; Jounela et al., 2019). These measures are more likely to be successful if they are seen as legitimate, and acceptance is voluntary. Uptake is more likely if measures are easy, quick and cheap, although seals and marine mammals can be subjected to retaliatory measures if fishers view them as causing damage to fish or fishing gear (Karamanlidis et al., 2020; Ratamäki & Salmi, 2015). Such measures have potential in Dagestan, where seals are viewed positively, although a key barrier is that communities do not see bycatch as a threat to seal populations (Svolkinas, 2021). Individuals mapping to the Pessimist viewpoint, fishers and seal pelt intermediaries, were strongly aware of high seal mortalities in fishing gear, yet many claimed they are unaware that bycatch had detrimental impact on seal populations. This suggests that no bycatch mitigation has been carried out in Dagestan, despite growing evidence of its impact (Dmitrieva et al., 2013; Svolkinas, 2021). Consultations and workshops with fishing communities could spread awareness and identify legitimate interventions to reduce bycatch, which will require additional resources. Supporting willing local community members to act as advocates for sustainable practices could be an effective strategy for influencing values of Fishers and promoting behaviour change.

5 | CONCLUSIONS

This study aimed to identify stakeholders and their perspectives in an artisanal small boat fishery operating from the coast of Dagestan in the Caspian Sea. The fishery supports extensive IUU fishing, which has pushed Caspian sturgeon species to the brink of extinction to supply lucrative meat and caviar markets, while simultaneously creating high mortality for Caspian seals (Dmitrieva et al., 2013). This illegal fishery for a high value product, generating high rates of incidental marine mammal mortality, has parallels to the context for Vaquita and the totoaba fishery (Aceves-Bueno et al., 2021; Taylor et al., 2017), including the involvement of organised crime. The current socioeconomic situation for fishing communities in Dagestan in part has emerged as a result of the collapse of the old Soviet system and failure to adapt to a capitalist economy (Ermolin & Svolkinas, 2018).

This study builds on others from the broader Caspian region, where unsustainable fishing and hunting is driven by a combination of illegal trade (Dmitrieva et al., 2013; Ermolin & Svolkinas, 2016; Kühl et al., 2009; Sokolsky et al., 2008); poor awareness of sustainability and conservation issues (Mammadov et al., 2016); weak and failing governance (Lagutov & Lagutov, 2009; Schmidt et al., 2017); and the historical absences of protections for key species and habitats in southern Russia (Pryde, 1997), compared to better managed regions of the Arctic regions and Siberia (Solovyev et al., 2017). Our study strengthens understanding around community motivation for involvement in a key illegal wildlife trade in Russia, and what incentives could influence disengagement, or transitions to more sustainable fishery practices. It demonstrates that such communities are open to engagement with researchers, and that there is some consensus across diverse stakeholders on key issues for successful solutions. Despite the current impacts of IWT and unsustainable practices, it provides some optimism that solutions are possible with the right support, both in the Caspian and elsewhere in Russia.

More broadly, small boat artisanal fisheries comprise a significant proportion of global fishing effort and are important economic resources for coastal communities in low- and middle-income countries (Johnson et al., 2013). However, they can be associated with high rates of undocumented, unregulated and illegal fishing, supplying products into illegal commodity chains, and may generate high rates of bycatch for marine megafauna, and have been implicated in their extinction (Read, 2008; Sumaila et al., 2020; Turvey et al., 2007). Successfully reducing bycatch in artisanal fisheries is challenging since they are embedded in complex socioeconomic/political contexts, often involving global organised crime and ineffective national governance structures. Top-down solutions which focus solely on law enforcement risk not addressing the reasons why people choose to fish illegally. Therefore, understanding local stakeholder perspectives can be important for developing more effective solutions. Our study shows the importance of understanding these in the context of regional political, cultural and economic histories.

This study is the first to assess fisher perceptions on conservation, fisheries management and illegal wildlife trade using Q

methodology. We show how Q methodology can identify potential consensus areas, points of divergence and polarising issues in this context. This suggests that Q can generate policy relevant information in other cases where illegal artisanal fisheries targeting high value product species drive bycatch of other marine megafauna, that can be used as starting point to initiate community engagement in policy development and implementation.

AUTHOR CONTRIBUTIONS

Linas Svolkinas, Simon J. Goodman and George Holmes designed the research. Lilia Dmitrieva gave input into the Q sort questionnaire statement selection and reviewed their Russian translation. Linas Svolkinas collected and analysed the data, and wrote the first draft of the manuscript. Ilya Ermolin, Pavel Suvorkov and Lilia Dmitrieva provided comments on the manuscript development. Simon J. Goodman, George Holmes and Linas Svolkinas edited the manuscript to generate the final version. All authors read and approved the final submission.

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CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

DATA AVAILABILITY STATEMENT

Data files for (i) anonymised data on research participants, viewpoint, age, gender, residence, trade status, survey region, occupation, occupation class and education; and (ii) data from individual Q sort grids; are available from the University of Leeds Data Repository (<http://doi.org/10.5518/1347>).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Figure S1: Q sort grid, used in this study.

Table S1: Eigen values for Q sort Factor analysis.

Table S2: Quantitative and qualitative criteria for Factor selection analyses.

Equation S1: Calculation of Significant factor loading (SFL) criteria.

Table S3: Factors scores that satisfy SFL criteria.

Equation S2: Calculation of SFL Standard error.

Table S4: Factor scores satisfying Humphrey's rule.

Figure S2: Results of Scree test showing reduction in factor eigenvalues with increasing factor number.

Table S5: Organizations/communities participating in workshops.

Table S6: Information on research participants.

Figure S3: Histograms showing distribution of fishing and demographic parameters with respect to region.

Figure S4: Histograms showing distribution of fishing and demographic parameters with respect to viewpoint.

Figure S5: Viewpoint 1 ('Nostalgists') Array plotted using the Q grid structure.

Figure S6: Viewpoint 2 ('Optimists') Array plotted using the Q grid structure.

Figure S7: Viewpoint 3 ('Pessimists') Array plotted using the Q grid structure.

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