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# 'It builds on trust': Exploring fishers' trust in management of fisheries in Norway

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This paper explores trust in fishery management in Norway, reporting results from a survey (n=184) of Norwegian coastal cod and herring fishers. We explore antecedents of trust identified in prior literature, including dispositional trust and perceptions of managers, as well as characteristics of management data, using factor analysis. We use the resulting factors, combined with other potential influences on trust (demographic variables, self-reported understanding of management, and stakes) to predict a) trust in Norwegian fisheries management in general and b) trust in management of a relatively novel, controversial fishery for *Calanus finmarchicus*. We supplement the statistical approach with analysis of open-ended survey responses asking respondents to explain their trust judgements. We find that the antecedents of trust derived from prior work load onto three distinct factors, representing data quality, perceived manager benevolence, and salient value similarity. Respondents also mentioned each of these antecedents of trust in their open-ended responses; a significant minority also mentioned perceived management bias. Respondents who reported higher trust in management generally referenced different concepts in their justifications (e.g., research) than those who reported lower trust (e.g., the management agency). Our model results show that these three antecedents of trust are positively and significantly predictive of probable trust in general fisheries management. However, the antecedents of trust are much less predictive for trust in *Calanus* management. Resource users' trust in management is commonly forwarded as a key component in successful, sustainable management of natural resources. Norway is generally perceived to be a high trust society, but our results indicate that low trust in *Calanus* management is a function of more than simply known trust antecedents.

## KEYWORDS

trust, fisheries management, fisheries governance, stakeholder trust, stakeholder perceptions

# 1 Introduction

Trust is deeply involved in risk assessment and decision-making in the face of uncertainty. In environmental policy and natural resource management, trust can improve outcomes, facilitate collaboration, increase compliance, and enable conflict resolution (Stern and Coleman, 2015; Lacey et al., 2018), and low trust in natural resource management agencies and their management is associated with negative perceptions of management actions (Schroeder et al., 2021). In the specific realm of fisheries, despite the documented importance of trust for successful marine resource management (De Vos and Van Tatenhove, 2011; Ordoñez-Gauger et al., 2018), fishers' low trust in management institutions is well-documented across diverse contexts (Ordoñez-Gauger et al., 2018; Ford and Stewart, 2021; Silva et al., 2021). Fostering trust, especially by deliberately engaging in proactive, participatory management, may be a key component in reducing fishery conflict in the face of environmental or economic changes (Hanna and Smith, 1993; Gordon et al., 2022; Szymkowiak et al., 2024).

## 1.1 Study context

This study examines fishers' trust in fisheries management, and the predictors of that trust, in Norway. Norway is commonly understood as a highly trust-based society, with Norwegians reporting very high levels of trust in public institutions (OECD, 2022), scientists (European Commission, 2021), and each other (Delhey and Newton, 2005) when compared to other nationalities. Furthermore, Norwegian fisheries management institutionalizes stakeholder participation in management through an annual Advisory Meeting in which fisheries industry groups, as well as other stakeholders, provide input on proposed quotas, allocation, and regulation.

Yet despite societal context and participatory management strategies, fisheries conflict, and a lack of trust in management, have been much in the Norwegian news in recent years (Eggen, 2017; Lindbæk, 2020; Danielsen, 2021; Norges Fiskarlag National Board, 2021; Lindbæk, 2022; Lysvold, 2022). It remains unclear whether these reports indicate low fisher trust in management generally or if trust issues only apply to particular fisheries. Current efforts to expand the Norwegian commercial fishery for the planktonic copepod *Calanus finmarchicus* (Calanus), which is super-abundant in the North Atlantic, have, for instance, been greatly controversial, despite very limited Calanus landings at present [only 194 of a total 254,000 ton quota landed in 2024 (Norwegian Directorate of Fisheries, 2024)]. Calanus is a rich source of omega-3 fatty acids and micronutrients; Calanus oil is currently marketed as a human nutritional supplement, but the copepod is also of interest as an ingredient in marine and terrestrial feeds. Cod and herring fishers, however, express concern about ecosystem effects of fishing the bottom of the food web as well as

concerns about bycatch of planktonic early-life stages of cod and herring in Calanus trawls (Crosman et al., under review)<sup>1</sup>.

## 1.2 Trust and its antecedents

Trust is a complex and multidimensional concept that has been widely explored in the academic literature, although consensus on the most salient dimensions and related constructs remains elusive (McEvily and Tortoriello, 2011; Stern and Coleman, 2015; PytlikZillig et al., 2016). Trust (low to high) is generally understood to be distinct from distrust (Cook and Gronke, 2005; McEvily and Tortoriello, 2011; Stern and Coleman, 2015; PytlikZillig et al., 2016; Emborg et al., 2020).

Because trust is contextual, it can be challenging to import measures of trust from one context into another, even within the same general area of study [e.g., organizational studies (McEvily and Tortoriello, 2011)]. However, commonly cited definitions of trust include several shared characteristics. At its core, trust is relational, occurring in interaction between an individual 'trustor' and an individual or organizational/institutional 'trustee' (McEvily and Tortoriello, 2011), in which the trustor is asymmetrically dependent on the trustee. Trust is the trustor's willingness to be vulnerable to the trustee, in the expectation of certain positive behaviors or actions and despite uncertainty (McKnight and Chervany, 2001; Earle and Siegrist, 2006; McEvily and Tortoriello, 2011; Stern and Coleman, 2015; PytlikZillig et al., 2016; Lacey et al., 2018; Toman et al., 2021).

In common parlance, however, the word 'trust' elides several distinct concepts which are worth unpacking here. Understandings of the antecedents of trust and their inter-relationships are diverse. There is general agreement, however, that trust is influenced by the trustor's individual characteristics such as outlook and general attitudes (i.e., 'dispositional' or 'general' trust) (McKnight and Chervany, 2001; Stern and Coleman, 2015; PytlikZillig et al., 2016; Emborg et al., 2020; Siegrist, 2021). In short, some people simply tend to trust more easily or more often than others. The degree to which individuals are predisposed to trust is also influenced by social and cultural memberships (Siegrist, 2021) such as nationality.

As previously noted, however, trust is relational, comprising the trustor's perceptions or assessments of the trustee. The list of possibly relevant perceptions and assessments is long, and constructs are highly intercorrelated (PytlikZillig et al., 2016); furthermore, there is significant inconsistency in what is measured between studies and domains. In organizational research and other fields, for example, commonly measured antecedents of trust include benevolence, competence, and

<sup>1</sup> Crosman, K. M., Hayes, A. L., Davies, E. J., and Majaneva, S. K. (under review). Conflict, Cod and Calanus: Can Technology Increase Trust in Management of a Contested Fishery?

integrity (McEvily and Tortoriello, 2011). Benevolence is the trustor's assessment of how well-disposed and caring the trustee is towards them or people like them (McKnight and Chervany, 2001; Earle and Siegrist, 2006; McEvily and Tortoriello, 2011; Stern and Coleman, 2015; PytlikZillig et al., 2016; Siegrist, 2021; Bostrom et al., 2024). Competence is the trustor's perception that the trustor has the knowledge, expertise, and ability to take necessary action (McKnight and Chervany, 2001; McEvily and Tortoriello, 2011; Stern and Coleman, 2015; Bostrom et al., 2024). This factor is treated as separate from trust by some authors [e.g., 'confidence' (Earle and Siegrist, 2006)] but the applied distinction remains unclear (Bostrom et al., 2024). Integrity is defined somewhat differently across studies, with some authors emphasizing the trustor's perception that the trustee is fair and honest and others focusing on whether the trustee is perceived to be acting from values that are acceptable to or shared by the trustor (PytlikZillig et al., 2016). The second of these definitions aligns with a construct common in the risk and natural resource management literatures, that of salient value similarity (Siegrist et al., 2000), often termed "shared values" when the trustor is an organization/institution (Smith et al., 2013; PytlikZillig et al., 2016; Schroeder et al., 2021). This refers to the trustor's perceptions of whether and to what extent the trustee shares their values and goals (McKnight and Chervany, 2001; Earle and Siegrist, 2006; Stern and Coleman, 2015; Siegrist, 2021). Different authors take different approaches to grouping and splitting constructs [e.g., 'affective' vs. 'rational or cognitive' trust, variously treated as umbrella concepts referring to the interior emotional vs. cognitive processes underlying trust judgements (Stern and Coleman, 2015; PytlikZillig et al., 2016) or distinct trust judgements in and of themselves (McEvily and Tortoriello, 2011)].

In the context of fisheries management, simple trust measures are further complicated by the complex processes and multiplicity of actors that may be the objects of fishers' trust. When respondents express their trust judgements, who or what are they expressing more or less trust in (Siegrist, 2021)? In natural resource management, potential trustors may also include multiple relevant agencies as well as their individual representatives (Stern and Coleman, 2015; Toman et al., 2021). In the context of Norwegian fisheries, relevant institutions include the Institute of Marine Research (IMR), responsible for fisheries science, and the Fisheries Directorate, which applies the information provided by IMR to decision-making and implementation of decisions. Trust in management institutions is definitionally distinct from trust in individuals (McKnight and Chervany, 2001; Schroeder et al., 2021). Trust in institutions or organizations may also be influenced or affected by the perceived legitimacy, fairness, and/or effectiveness of the rules and systems that constrain or shape their actions – some authors treat this trust in procedures as a component of institutional trust (McKnight and Chervany, 2001), some as a separate construct (Schroeder et al., 2021), and still others as a distinct type of motivator for lower-level trust judgements [on a par with 'affective' and 'rational' trust (Stern and Coleman, 2015)].

Beyond the antecedents discussed above, other variables are likely to influence trust. Perceptions of management information,

although little studied to date, seem especially interesting in this context. Fisheries management is an information-intensive undertaking in which data are input into complex analyses such as stock assessments that are, at least from the fishers' perspectives, a black box. Information outputs are used to make decisions that structure and in some cases challenge livelihoods. Meanwhile, fishers spend their days on the water, developing their own understandings of fish behavior, abundance, and distribution. Inconsistencies between the data-driven knowledge held by fisheries scientists and the lived knowledge of fishers themselves may result in mistrust in management (Dobbs, 2000; Gray et al., 2012). Indeed, mistrust in stock estimates has previously been cited as motivation for non-compliance with fisheries management in Norway (Hønneland, 2000).

The perceived complexity of management processes may also in and of themselves influence trust in fisheries management. On one hand, the more complex the environment in which a potentially risky interaction takes place, the greater the need for trust (Siegrist, 2021). On the other, the extent to which trustors understand the complexities of management processes may influence their ability to judge the competence, intentions and goals of management actors (Gray et al., 2012). Lastly, we might expect the stakes – the degree of risk to which the trustor is subject – to influence trust judgements (Siegrist, 2021). These stakes could be economic (risks to income or livelihoods) or socio-cultural (risk to identity or cultural values).

### 1.3 Research questions

Here we address the following research questions: To what extent do Norwegian fishers trust a) general fisheries management and b) management of the Calanus fishery? And c) What predicts those trust judgements?

## 2 Methods

### 2.1 Survey sample

In order to investigate trust in the context of Norwegian fisheries' management, we surveyed 184 vessel owners active in the coastal Norwegian Atlantic cod (*Gadus morhua*) and spring-spawning herring (*Clupea harengus* L.) fisheries. We focused our sample on these fisheries because our survey instrument also included a scenario-based experiment exploring perceptions of the *Calanus finmarchicus* fishery, introduced above, which has been linked to conflict and controversy with cod and herring fishers. Further discussion of that conflict can be found in Crosman et al. (under review)<sup>1</sup>.

We identified our sample from the Fishery Directorate's vessel registry (Norwegian Directorate of Fisheries, 2023), filtering for coastal vessels (<27.99m) with cod or herring quota in the waters where Calanus are also fished (north of 63° N). The 1598 vessels thus identified were cross-referenced with vessel ownership data to

identify 1450 individuals vessel owners. Norfakta, a Norwegian polling firm, obtained contact information for 915 individuals and successfully contacted and surveyed 184 respondents, representing 13% of the universe of eligible respondents and a 20% response rate. Meaningfully disaggregating non-responses into failure to answer *vs.* declines is difficult as Norfakta is a known survey administrator and there is anecdotal evidence that respondents who do not answer may be declining to participate by default by blocking calls. Respondents for whom contact information was available were called a minimum of eight times. The survey was translated into Norwegian and administered via phone in June 2023.

## 2.2 Survey instrument

We developed our survey items from the theoretical grounding and common antecedents of trust discussed above. Our antecedent items measure dispositional trust, benevolence, competence/expertise, and salient value similarity; given practical considerations and the somewhat unclear distinction between integrity and salient value similarity we found in the literature, we omitted a separate measure of integrity. Consistent with the literature, we avoided engaging with active distrust. In light of the contextual nature of trust, and the length constraints imposed by the inclusion of a scenario-based experiment in our survey [reported in Crosman et al. (under review)]<sup>1</sup>, which necessitated the use of a single measure for each antecedent, we developed new survey items. Although novel, our survey items are generally consistent with those used elsewhere [e.g., (Smith et al., 2013; PytlikZillig et al., 2016)]. Trust in Norwegian fisheries management was measured by a final item in this question set. The foregoing items were all presented with closed-ended 5-point ordered response scales ('strongly agree' to 'strongly disagree'; centered at 'neither agree nor disagree'), plus a 'don't know' response option. Don't knows were recoded to NA prior to analysis. Survey items targeting trust are shown, with their respective target constructs, in Table 1.

Consistent with the above discussion, we measured also other potential influences on trust. Additional measures included items targeting perceptions of different aspects of management data (accuracy, sufficiency, and validity) that were selected based on theoretical constructions of data quality [e.g., as presented in (Gerring, 2012)], concerns reflected in press reports of Norwegian fisheries conflict (Lindbæk, 2020; Lindbæk, 2022), and 14 informational/key informant interviews that were also used to inform the qualitative coding scheme. Other potential influences on trust measured included perceived complexity (self-reported understanding of management processes), and economic and socio-cultural stakes in the fishery (percentage of household income derived from fishing, years fishing, number of familial generations working as fishers).

The items targeting trust (and its antecedents) in Norwegian fisheries management were followed by items specifically targeting the Calanus fishery, as discussed above. We explore only one variable

from the Calanus-focused section of the survey here: specifically, an item asking respondents how much they trust management of the Calanus fishery (4-point response scale from 'not at all' to 'a great deal') that was asked before the scenario treatment but after items targeting awareness of and support for that fishery. Additional findings from the Calanus-focused portion of the survey are reported in Crosman et al. (under review)<sup>1</sup>.

The survey also included demographic items, including sample inclusion verification (age, education, professional role, vessel ownership, and target species fished). We secured information on the region of respondents' primary residence, the number of vessels owned, vessel(s) length, total associated cod and herring quota and ownership corporate structure from Fisheries Directorate data in combination with publicly available ownership data.

Immediately after the closed-ended item targeting trust in general fisheries management, respondents were asked an open-ended follow-up requesting that they elaborate on their closed-ended response. Open-ended responses were coded using a multi-level qualitative coding scheme deductively developed from the theories of trust, diversity of actors/potential targets of trust, and the other potential influences on trust presented above. Development of the coding scheme was supplemented with information drawn from 14 key informant interviews with experts in digital ocean technologies, Calanus finmarchicus, and Norwegian fisheries management; key informants were selected in the context of the section of the survey that focused on management of Calanus, discussed further in Crosman et al. (under review)<sup>1</sup>. The initial coding scheme was extended inductively when multiple respondents mentioned a novel topic that fell into an existing parent category (e.g., a code for international cooperation was added under parent code 090 – Management processes – in response to multiple answers that referenced either the International Council for the Exploration of the Sea or historical cooperation with Russia on cod management). One parent code (050 - Bias) was added to capture responses that discussed discrimination or expressed a sense of unfairness.

Norfakta staff administered the survey and transcribed open-ended responses during administration. Anonymized data were shared with the research team, who conducted all coding and analysis. A primary coder coded all open-ended responses. As an intercoder reliability check, 20% of open-ended responses were independently coded by a second coder trained in the coding scheme. Average percent agreement between the two coders was 94%, with a Cohen's kappa (corrected for the possibility of agreement by chance) of 0.66. Codes were applied to each proposition in a respondent's reply; commonly, multiple codes were applied to a single response. For the full coding scheme see Appendix A.

We first generated descriptive statistics for all variables and tested for collinearity in the closed-ended items. We then ran exploratory factor analyses to examine the structure of the antecedents of trust. The first factor analysis omitted the item measuring perceived complexity of fisheries management for a three-factor solution; the second and third analyses add that item for a three- and four-factor solution, respectively. We specified five



TABLE 1 Survey items measuring trust and its antecedents.

Closed-ended items						
Response scale	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Don't know
Dispositional trust	People are generally trustworthy					
Shared values	The people managing Norwegian fisheries share my goals and values					
Manager expertise	The people managing Norwegian fisheries are experts at what they do					
Manager benevolence	The people managing Norwegian fisheries are supportive of fishers like me					
Perceived complexity	I understand how Norwegian fisheries management decisions are made					
Data accuracy	The data and information used to make fisheries management decisions are accurate					
Data sufficiency	Managers have enough data and information to make management decisions					
Data validity	Managers have the right data to make management decisions					
Trust in management	I trust Norwegian fisheries management					
Open-ended item						
Trust in management	What contributes to your trust or lack of trust in Norwegian fisheries management?					

For all closed-ended items, respondents were presented with an ordered scale of responses running from 'strongly agree' (2) to 'strongly disagree' (-2), centered at 0 ('neither agree nor disagree'), plus a 'don't know' response item.

ordered probit models predicting respondent trust in Norwegian fisheries management from respondent characteristics and respondents' perspectives on management data and fisheries managers (i.e., demographics, stakes, and items measuring antecedents of trust). Model 1 includes respondent characteristics and perceived understanding of management; model 2 adds characteristics of management data (accuracy, sufficiency, and appropriateness); model 3 omits data characteristics but include perceived characteristics of managers; model 4 includes both data and manager characteristics; and model 5 substitutes the 3-factor solution from the factor analysis described above for individual variables measuring perceived data and manager characteristics. We then replicated these models to predict trust in Calanus management, using the relevant closed-ended response as our dependent variable.

All data were analyzed in R version 2023.06.1 + 524 (base package). Factor analyses were conducted using the 'psych' package (Revelle, 2017), and ordered probit models were fit using the 'mass' package (Ripley et al., 2024).

## 3 Results

### 3.1 Demographics and stakes

All 184 respondents met sample inclusion criteria. Overall, the sample was fairly homogenous: 146 (79%) cod fishers, 8 herring fishers (4%), and 30 fishing both (16%). The majority of the sample (n=174) also fished for species other than cod and herring, with only two fishing for Calanus. 172 respondents identified as owner-operators, with the remainder fairly evenly split between other

onboard roles (n=4), business-side-only involvement (n=3), and silent partners (n=3), plus two non-responses.

The majority of respondents (155) reported leaving formal education early, approximately between ages 13 and 16 (after *grunnskole* or *videregående skole*); at the time of the survey, respondents had an average age of 51. Average years working in fishing was 29.1, and average generations employed in fishing was 4.2. Economic dependence on fishing was high, with the majority of respondents (n=115) relying on fishing for more than three-quarters of their household income and an additional 44 relying on fishing for between half and three-quarters. Most individuals owned all or part of a single vessel (n=122), with a significant minority owning two or more vessels (n=62). No respondent owned more than six vessels. Cod fishers held an average of 82.4 tons of cod quota and herring fishers held an average of 326 tons of herring quota. Respondents were concentrated in the north of Norway, in the counties of Nordland, Troms, and Finnmark (n=114). 36 respondents had primary residences in mid-Norway (Møre og Romsdal and Trøndelag) and the remainder (n=34) in the Western fjords (Agder, Rogaland, and Vestland).

At a high level, our sample appears to be a fairly good match with the potential universe of respondents. Disaggregated demographic statistics for Norwegian fishers are not publicly available by target species or vessel size. However, in 2023, of a total of 10,833 registered commercial fishers in Norway, 90% listed fishing as their main occupation (Norwegian Directorate of Fisheries, 2025); in our sample, 86% reported that fishing constituted at least half of their household income. According to national statistics, in the counties represented in our sample, registered fishers had an average age of between 40–49 years (Norwegian Directorate of Fisheries, 2025); the average age in our sample was 51.

When comparing demographics of eligible quota holders with our sample, we find that single vessel owners made up 69.5% of the 1450 potential respondents and 66% of our sample. Of the 1450 potential respondents, 3% fish only herring, 87% fish only cod, and 10% fish both; in our sample, the respective percentages are 4, 79, and 16. Eleven (<1%) of the potential respondents reported primary residence in a county other than those represented by our sample (e.g., Oslo and environs, inland counties), and 5 (<1%) had no residency information publicly available. Northern Norwegian fishers were under-represented in our sample and Western fjord fishers over-represented. 72% of potential respondents reported a primary residence in Nordland, Troms or Finnmark, versus 62% in our sample; 19% in Trøndelag and Møre og Romsdal, versus 20% in our sample; and 12% resided in Vestland and Adger, versus 18% in our sample.

### 3.2 Closed-ended items

Our respondents expressed low trust in both Norwegian fisheries management in general, and in Calanus management in particular. Respondents' mean level of agreement with the statement 'I trust Norwegian fisheries management' was 0.27 on a 5-point scale centered at zero, or slightly over 'neither agree nor disagree.' In response to an item asking if they trusted Calanus management 'not at all,' 'not very much,' 'somewhat,' or 'a great deal,' arranged on a scale of zero to 3 the mean response was 0.63, between 'not at all' and 'not very much'.

Figure 1 shows mean responses to closed-ended items targeting the antecedents of trust, across the full sample. To report means, each of the five-point response scales are numerically scaled  $-2$  (strongly disagree) to  $+2$  (strongly agree). Social or dispositional trust is relatively high among this group (mean 1.10, or just over 'slightly agree,' in response to the statement 'People are generally trustworthy'). Respondents were less confident of their understanding of Norwegian fisheries management (mean = 0.68,

or slightly under 'slightly agree,' in response to the statement 'I understand how Norwegian fisheries management decisions are made'). Respondents were only slightly positive in their assessments of management data (means of 0.26, 0.28, and 0.46 in response to the accuracy, sufficiency, and validity of data, respectively, falling between 'neither agree nor disagree' and 'slightly agree'). Perceptions of managers were lower still. On average, respondents doubted manager expertise (mean  $-0.36$ , slightly under 'neither agree or disagree,' in response to 'The people managing Norwegian fisheries are experts at what they do'), were noncommittal on manager benevolence (mean  $-0.02$ , very close to 'neither agree nor disagree', in response to 'The people managing Norwegian fisheries are supportive of people like me'), and mildly positive about shared values with managers (mean 0.34, slightly over 'neither agree nor disagree' in response to 'The people who manage Norwegian fisheries share my goals and values').

In agreement with previous literature, the measure of antecedents of trust were all positively correlated, including some correlations that were quite high. Correlations ranged from 0.14 (shared values and data sufficiency) to 0.64 (data sufficiency and accuracy) with most correlations above 0.4.

Based on observed collinearity, we ran a series of exploratory factor analyses on the relational antecedents of trust and characteristics of management data. For a three-factor solution, applying a varimax rotation, the three items related to data quality (accuracy, sufficiency, and appropriateness) loaded strongly onto the first factor (Table 2). Perceived manager benevolence and perceived value similarity with managers each loaded heavily onto their own separate factors. Perceived manager expertise loaded weakly across the three factors at 0.47, 0.42, and 0.30 on the data quality, manager benevolence, and value similarity factors, respectively.

We reran the factor analysis, adding an item measuring perceived understanding of the management process in case perceptions of fisheries managers were strongly related to understanding the management process. Perceived management understanding loaded weakly onto the factors, with a loading of 0.41 on the data quality factor and below 0.2 on all others. On a four-factor solution, the management understanding item loaded at 0.58 onto its own factor, but the factor had a very low sum square of loadings, indicating weak factor coherence. Patterns of factor loadings for the other survey items – data quality and relational antecedents of trust – remained the same across all factor analysis solutions. For this reason, we prefer the three-factor solution that does not include the item related to understanding the management process. For the full set of factor analyses see Appendix B.

### 3.3 Predicting trust in Norwegian fisheries management

Model results are summarized in Table 3; we present results for all model specifications here but prefer Model 5 due to the high collinearity in the items comprising the factors introduced above. In our preferred model, trust in Norwegian fisheries management is predicted by region of primary residence, amount of cod and herring

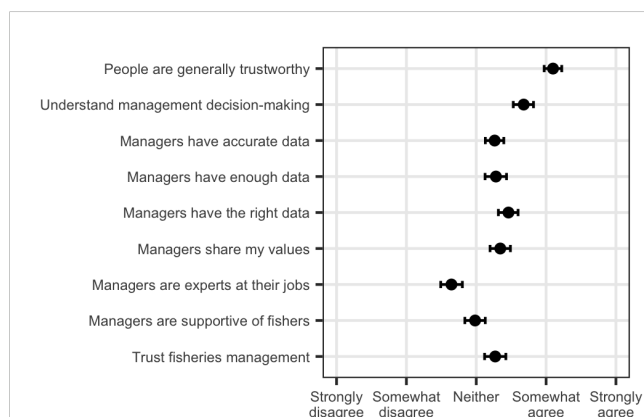


FIGURE 1

Mean responses (with bars representing standard errors) to closed-ended survey items targeting antecedents of trust as well as trust in Norwegian fisheries management. Responses centered at 0 ('neither agree nor disagree') and running from 'strongly agree' (2) to 'strongly disagree' (-2).

TABLE 2 Exploratory factor analysis of trust antecedents.

	Data factor loading	Benevolence factor loading	Values factor loading	Communality	Uniqueness	Complexity
Data accuracy	<b>0.64</b>	0.17	0.32	0.55	0.45	1.6
Data sufficiency	<b>0.76</b>	0.21	0	0.63	0.37	1.2
Data correctness	<b>0.77</b>	0.24	0.14	0.67	0.33	1.3
Manager values	0.14	0.17	0.97	1	0	1.1
Manager expertise	0.42	0.47	0.3	0.49	0.51	2.7
Manager benevolence	0.25	<b>0.91</b>	0.13	0.9	0.1	1.2
	Data factor loading	Benevolence factor loading	Values factor loading	Communality	Uniqueness	Complexity
SS loadings	1.85	1.21	1.17			
Proportion Var	0.31	0.2	0.2			
Cumulative Var	0.31	0.51	0.71			
Proportion Explained	0.44	.29	0.28			
Cumulative Proportion	0.44	0.72	1			

Shown here is the three-factor solution (omitting perceived complexity), showing factor loadings on characteristics of the data (Factor 1), perceived manager benevolence (Factor 2), and perceptions of shared values with managers (Factor 3). Values in bold indicate primary factor loadings.

quota, perceived complexity, perceived quality of management data, salient value similarity, and perceived manager benevolence.

Region of primary residence significantly predicts trust in fisheries management, with respondents in north ( $n = 114$ ; marginal significance in model 3 and no significance in model 4) or mid-Norway ( $n = 36$ ) showing higher predicted probabilities of trust in management than their counterparts in the western fjords ( $n = 34$ ). Age was not found to be a significant predictor of trust in any model; level of education was marginally significant in models 3 and 4, with an increase in education decreasing the predicted probability of trust in fisheries management.

Stakes, as measured by proportion of income, years fishing, and generations fishing, are not significant predictors in any model. However, stakes measured by the amount of herring and cod quota held (logged) are consistently significantly predictive across model specifications. An increase in herring quota increases the probability that a respondent trusts fisheries management. In contrast, an increase in the amount of cod quota held decreases the predicted probability of trust. Holding no cod quota at all ( $n = 8$ ) does not significantly change the predicted probability of trust; however, holding no herring quota ( $n = 146$ ) does, with respondents who hold no herring quota showing higher predicted probabilities of trust (Figure 2).

Dispositional trust ('People are generally trustworthy', strongly agree to strongly disagree, 5-point scale centered at 0) is a marginally significant predictor only in model 4, with an increase in dispositional trust increasing the predicted probability of trust in fisheries management. A decrease in perceived complexity ('I understand how Norwegian fisheries management decisions are made', strongly agree to strongly disagree, 5-point scale

centered at 0) significantly increases the predicted probability of trust across model specifications (marginal significance in model 5).

We find a generally positive relationship between perceived data quality and trust in management, though these results are not consistent across items or models. In model 2, an increase in the perceived accuracy and appropriateness of data significantly increases the predicted probability of trust, although the effect of data sufficiency is not significant. In model 4, when perceived characteristics of managers are included in the model, no data characteristic variables are significant. However, in model 5, our preferred model, Factor 1, on which all data characteristics most strongly load, is significant, with an increase in the perception that data are appropriate, accurate, and sufficient associated with an increasing the predicted probability of respondent trust.

Results for perceived characteristics of managers are more consistent, with the perception of shared values with managers, and managers' perceived benevolence and expertise, significantly predicting respondent trust. In models 3, 4 and 5, both Factor 2 (manager benevolence) and Factor 3 (shared values) are positively related to a statistically significant increase in the predicted probability of respondent trust.

### 3.4 Predicting trust in Calanus management

We used a similar approach to model trust in Calanus management ('How much do you trust current management of the Calanus fishery?'; 4-point scale, 0=not at all, 3= a great deal). The antecedents of trust that predict trust in general management

**TABLE 3** Results of probit models testing demographic variables, stakes, and antecedents of trust as predictors of trust in Norwegian fisheries management.

	DV: Trust fishery management (-2 = Strong disagree, 2 = Strong agree)				
	Model 1	Model 2	Model 3	Model 4	Model 5
<b>Demographic variables</b>					
<i>Region = Trondheim</i>	1.127*** (0.309)	1.266*** (0.321)	0.893*** (0.325)	0.951*** (0.339)	1.055*** (0.334)
<i>Region = Tromsø</i>	0.752*** (0.291)	0.803*** (0.297)	0.579* (0.313)	0.478 (0.321)	0.703** (0.313)
<i>Age (in log yrs)</i>	0.688 (0.498)	0.469 (0.520)	0.411 (0.530)	0.29 (0.551)	0.361 (0.535)
<i>Education</i> (1=some HS, 5=grad degree)	-0.137 (0.103)	-0.16 (0.104)	-0.185* (0.107)	-0.198* (0.108)	-0.168 (0.106)
<b>Stakes</b>					
<i>Herring quota (log MT)</i>	0.606** (0.267)	0.663** (0.277)	0.759*** (0.278)	0.734** (0.288)	0.736*** (0.277)
<i>Cod quota (log MT)</i>	-0.13 (0.107)	-0.162 (0.111)	-0.258** (0.115)	-0.259** (0.119)	-0.226* (0.117)
<i>Has Cod quota</i>	0.497 (0.596)	0.372 (0.624)	0.875 (0.633)	0.740 (0.663)	0.726 (0.651)
<i>Has Herring quota</i>	-3.004 (1.476)	-3.465** (1.531)	-4.124*** (1.536)	-4.079** (1.591)	-3.949*** (1.529)
<i>Years in fishery (log)</i>	-0.056 (0.221)	-0.048 (0.227)	-0.035 (0.238)	-0.091 (0.243)	-0.091 (0.238)
<i>Generations in fishery</i>	-0.011 (0.043)	0.001 (0.044)	-0.004 (0.044)	0.012 (0.045)	-0.001 (0.044)
<i>Percent income fishing</i> (1=less than 1/4, 5=more than 3/4)	-0.03 (0.092)	-0.041 (0.095)	-0.02 (0.097)	-0.023 (0.099)	-0.062 (0.097)
<b>Antecedents of trust</b>					
<i>People are trustworthy</i> (-2=Strong disagree, 2=Strong agree)	0.073 (0.086)	0.099 (0.090)	0.125 (0.091)	0.177* (0.096)	0.115 (0.093)
<i>Understand fishery management</i> (-2=Strong disagree, 2=Strong agree)	0.325*** (0.075)	0.200** (0.081)	0.203** (0.081)	0.173** (0.085)	0.150* (0.084)
<i>Management data are sufficient</i> (-2=Strong disagree, 2=Strong agree)		-0.018 (0.090)		-0.102 (0.100)	
<i>Management data are accurate</i> (-2=Strong disagree, 2=Strong agree)		0.225** (0.100)		0.013 (0.111)	
<i>Management has correct data</i> (-2=Strong disagree, 2=Strong agree)		0.222** (0.110)		0.156 (0.116)	
<i>Managers share my values</i> (-2=Strong disagree, 2=Strong agree)			0.232*** (0.081)	0.192** (0.088)	
<i>Managers are supportive of fishers</i> (-2=Strong disagree, 2=Strong agree)			0.178** (0.090)	0.206** (0.093)	
<i>Managers are experts</i> (-2=Strong disagree, 2=Strong agree)			0.422*** (0.090)	0.440*** (0.097)	
<b>Factors</b>					
<i>Factor 1</i> (correct, accurate, sufficient data)					0.391*** (0.097)
<i>Factor 2</i> (managers are supportive)					0.440*** (0.091)

(Continued)



TABLE 3 Continued

	DV: Trust fishery management (-2 = Strong disagree, 2 = Strong agree)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Factors					
Factor 3 (managers share my values)					0.516*** (0.095)
-----	----	----	----	----	----
Strongly disagree Disagree	2.99	2.91	3.46	2.96	0.46
Disagree Neither	3.77	3.72	4.43	3.91	1.39
Neither Agree	4.16	4.15	4.93	4.44	1.89
Agree Strongly agree	5.46	5.56	6.59	6.18	3.47
Observations	182	178	178	174	174
-----	----	----	----	----	----
AIC	513	497	445	449	461
Note:			*p<0.1;	**p<0.05;	***p<0.01

Model coefficients are presented first with standard errors in parentheses. Cutpoint estimates defining the division between ordered categories are reported beneath the model coefficients. Standard errors for cutpoints are not reported. Reported AIC is based on alternative model runs limited to a set of observations (N=174) that is consistent across all models.

are poor predictors of trust in Calanus management. Across our models of trust in Calanus management, increased trust is consistently predicted only by region of primary residence.

We report the trust in Calanus models in Table 4. In this case, model 1 includes only the demographic and stakes variables found to be significant predictors of trust in management more generally (i.e., region and quotas), perceived understanding of the

management process, plus general trust in fisheries management. Model 2 includes the same demographic covariates as model 1 and the three factors identified in our preferred factor analysis in place of perceived understanding of fisheries management and general trust in fisheries management. Model 3 adds perceived understanding of management and trust in general fisheries management to the Model 2 specification. Model 4 uses all

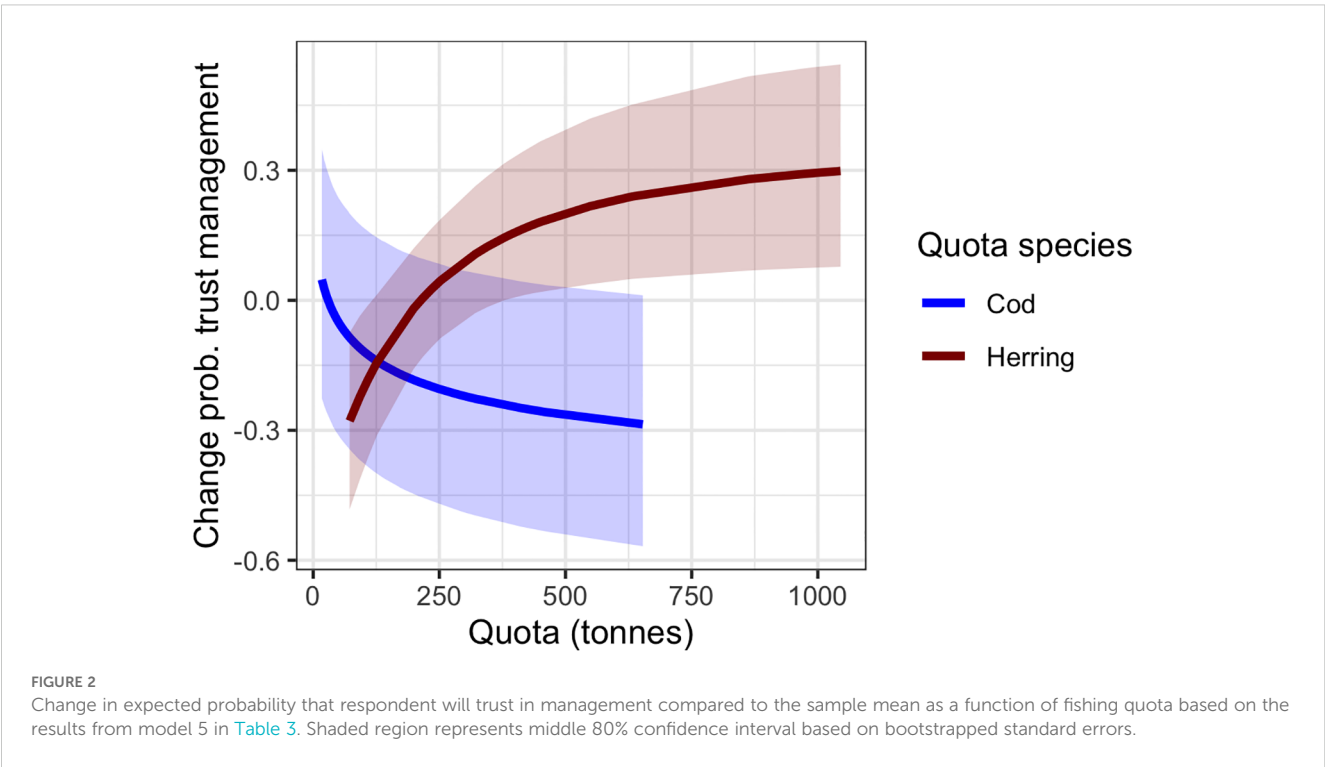


TABLE 4 Result of probit models testing demographic variables, stakes, antecedents of trust, and trust in general management on trust in management of the Calanus fishery.

	DV: How much do you trust current management of the Norwegian Calanus fishery? (0=Not at all, 3=A great deal)				
	Model 1	Model 2	Model 3	Model 4	Model 5
<b>Demographic variables</b>					
<i>Region = Trondheim</i>	-0.650** (0.367)	-0.635** (0.366)	-0.650* (0.373)	-0.595 (0.369)	-0.625* (0.375)
<i>Region = Tromsø</i>	-0.356 (0.329)	-0.295 (0.336)	-0.308 (0.342)	-0.263 (0.346)	-0.287 (0.351)
<i>Age (in log yrs)</i>				0.353 (0.607)	0.344 (0.607)
<i>Education (1=some HS, 5=grad degree)</i>				0.124 (0.113)	0.127 (0.114)
<b>Stakes</b>					
<i>Herring quota (log MT)</i>	0.416 (0.272)	0.492* (0.269)	0.479* (0.276)	0.470* (0.278)	0.442 (0.285)
<i>Cod quota (log MT)</i>	0.179 (0.123)	0.149 (0.123)	0.153 (0.124)	0.167 (0.127)	0.176 (0.128)
<i>Has Cod quota</i>	0.124 (0.666)	0.267 (0.669)	0.251 (0.673)	0.233 (0.695)	0.199 (0.699)
<i>Has Herring quota</i>	-1.595 (1.503)	-2.005 (1.489)	-1.937 (1.526)	-1.873 (1.549)	-1.727 (1.585)
<i>Years in fishery (log)</i>				-0.188 (0.269)	-0.191 (0.269)
<i>Generations in fishery</i>				0.031 (0.047)	0.032 (0.047)
<i>Percent income fishing (1=less than 1/4, 5=more than 3/4)</i>				0.033 (0.11)	0.036 (0.11)
<b>Antecedents of trust</b>					
<i>People are trustworthy (-2=Strong disagree, 2=Strong agree)</i>				-0.076 (0.097)	-0.08 (0.098)
<i>Understand fishery management (-2=Strong disagree, 2=Strong agree)</i>	0.091 (0.086)		0.056 (0.09)	0.052 (0.093)	0.048 (0.094)
<i>Factor 1 (correct, accurate, sufficient data)</i>		0.083 (0.101)	0.076 (0.106)	0.081 (0.103)	0.068 (0.108)
<i>Factor 2 (managers are supportive)</i>		0.173* (0.096)	0.166 (0.102)	0.183* (0.097)	0.168 (0.103)
<i>Factor 3 (managers share my values)</i>		0.164* (0.098)	0.155 (0.107)	0.176* (0.1)	0.158 (0.109)
<i>Trust fishery management (-2 = Strong disagree, 2 = Strong agree)</i>	0.119 (0.080)		0.02 (0.095)		0.042 (0.096)
-----	----	----	----	-----	----
0 1	1.357	0.911	0.955	1.914	1.971
1 2	2.328	1.895	1.94	2.909	2.968
2 3	3.497	3.101	3.144	4.145	4.201
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(Continued)

TABLE 4 Continued

	DV: How much do you trust current management of the Norwegian Calanus fishery? (0=Not at all, 3=A great deal)				
	Model 1	Model 2	Model 3	Model 4	Model 5
<b>Antecedents of trust</b>					
<i>Observations</i>	169	169	169	169	169
<i>AIC</i>	355	355	357	363	365
<i>Note:</i>			* $p<0.1$ ;	** $p<0.05$ ;	*** $p<0.01$

Model coefficients are presented first with standard errors in parentheses. Cutpoint estimates defining the division between ordered categories are reported beneath the model coefficients. Standard errors for cutpoints are not reported.

demographics and stakes variables, plus all individual variables other than general trust in management. Model 5 adds general trust in fisheries management to the model 4 specification.

Region of primary residence remains significant for predicted probability of trust in Calanus management, although only for mid-Norway, where trust is consistently lower than in the Western fjords. Similar to the general trust model, neither age nor level of education are significant predictors. Non-quota measures of stakes also remain insignificant for the Calanus model. In contrast to the general trust model, the (log) quantity of cod quota does not significantly predict probable trust in Calanus management; however, although the (log) herring quota is only marginally significant in models 2, 3, and 4, the effect remains generally positive.

Dispositional trust and perceived understanding of management are not significant in any model predicting probable trust in Calanus management. Although all three factors (characteristics of the data, manager benevolence, and shared values) have the expected positive sign across models, Factor 1 is not significant in any model, and Factors 2 and 3 are both only marginally significant in models 2 and 4, the models that omit general trust in management as a separate predictor. General trust in Norwegian fisheries management is not a significant predictor of probable trust in Calanus management in any model, and is very small in magnitude in all but model 1.

### 3.5 Open-ended items

All antecedents of trust and related constructs that we targeted with closed-ended items were also reflected in open-ended responses. Although we did not include integrity as a separate antecedent in our closed-ended items, open-ended responses indicating a sense of unfairness or undue influence by certain groups were common enough that we added a code for mentions of bias to our coding scheme. Table 5 shows parent and sub-codes for antecedents of trust, including bias, with example texts; it also includes the relevant constructs of complexity, data and information, and stakes (livelihood/income). Not all antecedents of trust were mentioned equally frequently. Dispositional/social trust was mentioned by 19 respondents; competence/expertise by 52; perceived benevolence by 36; salient value similarity by 5; and bias by 38. Complexity was mentioned by 13 respondents, data and information by 24, and livelihood/income by two.

The top codes mentioned varied by whether or not the respondent reported more or less trust in fisheries management. Respondents who reported trusting Norwegian fisheries management (responding “somewhat agree” or “strongly agree” to the statement “I trust Norwegian fisheries management”, strongly agree to strongly disagree, 5-point scale centered at 0;  $n=102$ ) provided a variety of justifications for their trust in response to the open-ended cue ‘What contributes to your trust or lack of trust in Norwegian fisheries management?’. Topping the list of higher-level categories mentioned were positive management outcomes ( $n=26$ ), research ( $n=24$ ), perceived competence ( $n=24$ ), and management implementation ( $n=19$ ); the most frequently mentioned sub-category was the distribution of quotas. The most commonly mentioned individual category overall was dispositional/social trust (e.g., ‘In general I have trust in politicians, that they have familiarized themselves with what they are working with’, ‘It builds on trust’) ( $n=16$ ).

Respondents who reported less trust (responding “neither agree nor disagree”, “somewhat disagree”, or “strongly disagree” to the open-ended trust prompt;  $n=82$ ) most commonly cited perceived competence/expertise of managers in their open-ended responses ( $n=28$ ), particularly manager knowledge or experience ( $n=11$ ). The other high-level categories that were mentioned most include references to bias ( $n=23$ , e.g., the role of money and economic interests), management implementation ( $n=21$ ), and perceived management benevolence ( $n=21$ , e.g., attitudes toward fishers). The most commonly mentioned individual category was management agencies/bureaucracy ( $n=12$ ). The Calanus fishery was independently mentioned as reason for low trust in general management by two respondents (note that the section of the survey asking about Calanus occurred after the open-ended results reported here). The most mentioned individual codes for both groups are shown in Figure 3.

Most respondents did not specify the actors to whom they referred (e.g., “They have good people for that, and boats”), although in some cases, actor identity was strongly implied (e.g., “It is because they have sufficient knowledge but still make wrong decisions” seems likely to refer to the Fisheries Directorate). However, responses were only coded for specific actor groups when the organization or type of actor was explicitly named. 34 respondents called out specific actors, with 6 responses referring to researchers, 19 referring to management agencies/bureaucracy, 9

**TABLE 5** Example texts assigned to parent codes and sub-codes for antecedents of trust and related variables, mentioned in response to the prompt: What contributes to your trust or lack of trust in Norwegian fisheries management?

Code (subcodes)	Example text
<i>Dispositional/social trust</i>	<p>“I choose to trust the authorities, that is to say they do their best”</p> <p>“After all, we have to trust the authorities”</p>
<i>Competence/expertise (including sub-codes manager knowledge and experience; fisher-manager knowledge match mismatch)</i>	<p>“Those who are out at sea doing research are very good at that”</p> <p>“Trust that they are in control and know what’s going on”</p> <p>“They have people who don’t understand our everyday life, a lack of understanding about performing the profession”</p> <p>“A hell of a lot of mess and committees and commissions that mostly haven’t been at sea”</p> <p>“Those who sit and manage do not have a fisheries background, they are often lawyers, or they have background from research or something similar, and they make decisions that are not in line with what fishermen see out at sea.”</p>
<i>Perceived benevolence (including sub-codes listening to fishermen; attitudes towards fishermen; trust in fishermen)</i>	<p>“The Directorate of Fisheries is not on the fishermen’s side”</p> <p>“They want what is best for the industry”</p> <p>“I think they listen a little too little on the man in the boat”</p> <p>“That they listen to those who stay at sea and take advice”</p> <p>“Feels a little criminal all the time, should follow with a warning for fishermen that now you are becoming a criminal”</p> <p>“If we make a mistake they believe we were cheating intentionally”</p> <p>“It is their lack of trust in us fishermen that is the reason”</p>
<i>Salient value similarity (including sub-code shared values)</i>	<p>“Make decisions that are best for the group”</p> <p>“I believe that they are managing it in a good way that tries to balance preservation of fish stock and that fishermen should get good earnings”</p> <p>“There is a responsible management and proper handling of the resources”</p>
<i>Bias (including sub-codes malfeasance; fairness; role of economic interests; role of political interests/lobbying; vessel/company size; geography/residency/nationality)</i>	<p>“How they treat people varies, it feels like there is some kind of different treatment/discrimination”</p> <p>“The distribution of quotas is unfair”</p> <p>“Corrupt system”</p> <p>“In too a high degree governed by capital interests of the large ship owners and investors - they are to a large extent controlling the decisions made by the ministry”</p> <p>“The heavy capital forces that influence and the lobbying of decision makers”</p> <p>“They listen more to the large organizations, the smaller fishing fleet is disregarded”</p> <p>“That the different groups between ocean, fjord and coast are not treated equally with regards to the resources and the administration’s implementation”</p>
<i>Complexity (including sub-codes environmental systems; management processes; regulations; competing needs)</i>	<p>“The ornithologists say food shortage, the ocean researchers say climate change. Nobody speaks about the ocean management. There are more species than herring and cod. The ocean consists of a large diversity of species which is food for the world’s population and wildlife”</p> <p>“It is complicated to understand and it is a long coastline, and many different needs”</p> <p>“There is never anything firm to relate to, you learn something new just in time to have to get used to something completely different”</p> <p>“They are juggling quotas, quota sets, laws and regulations. There is a lot of nonsense”</p>
<i>Data and information</i>	<p>“It feels like it corresponds to what they are researching, numbers and such”</p> <p>“The ocean research is two years behind the cycle”</p> <p>“For instance with capelin fishing they set the wrong basis for the stock estimate. This makes me not have much trust in them”</p>
<i>Livelihood /income</i>	<p>“We fishermen must have our salary”</p> <p>“We feel that we have a stable future”</p>

referring to politicians and 3 to industry organizations (two responses referred to multiple actors). Furthermore, not all respondents who mentioned a specific actor also mentioned a specific antecedent of trust. Cross-code analysis of mentions of actors with antecedents of trust, disaggregated by high/low trust in fisheries management, reported in [Table 6](#), reflects a very limited sub-sample and is purely exploratory.

## 4 Discussion

This study seeks to answer three research questions: to what extent do Norwegian fishers trust a) general fisheries management and b) management of the Calanus fishery? And c) What predicts those trust attitudes? The fishers in our sample expressed relative ambivalence in the degree to which they trust in Norwegian

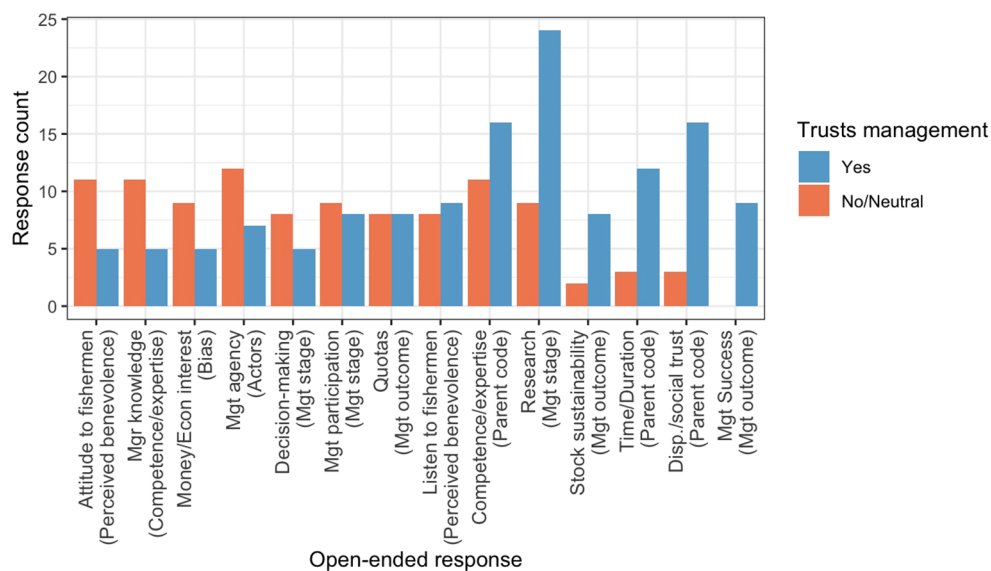


FIGURE 3

Counts of respondents mentioning the most common individual codes in open-ended responses to the prompt 'What contributes to your trust or lack of trust in Norwegian fisheries management?' Responses are disaggregated by those who reported trusting management (selecting 'strongly' or 'slightly agree' in response to the statement 'I trust Norwegian fisheries management') and those who reported less trust in management (responding 'neither agree nor disagree', 'slightly disagree', or 'strongly disagree').

**TABLE 6** Analysis of code co-occurrence for open-ended responses that mentioned both a specific actor/actor type and a specific antecedent of trust.

Actors	Trust antecedent, disaggregated by high/low trust in mgmt			
	Bias	Benevolence	Values	Competence
Researchers	1/0	0/0	0/0	4/1
Management agency	2/0	1/1	0/0	1/3
Politicians	2/2	0/1	0/0	2/2
Industry organizations	0/0	0/0	0/0	0/0
Companies	0/0	0/0	0/0	0/0

Numbers on the left count respondents who reported high trust in fisheries management ('strongly agree' or 'slightly agree' in response to the statement 'I trust Norwegian fisheries management'); those on the right count respondents who reported lower trust ('neither agree nor disagree', 'slightly disagree', or 'strongly disagree').

fisheries management (mean 0.27, or just over "neither agree nor disagree" on a 5-point scale centered at zero). Trust in management of the Calanus fishery, which has been a source of controversy among cod and herring fishers like the ones in our sample, was also very low: 0.63 on a 4-point scale from 0 ('not at all') to 4 ('high trust').

We find mixed support for the validity and predictive power of the antecedents of trust we derived from the literature: dispositional/social trust, perceived benevolence, salient value similarity, and competence/expertise. Dispositional/social trust is not predictive of trust in fisheries management, although it does appear in our open-ended responses justifying respondents' trust judgements. Dispositional trust may be foundational to trust in natural resource management where people lack experience with/

knowledge of the management agency (Leahy and Anderson, 2008); however, the fishers in our sample had worked in fisheries for an average of almost 30 years at the time of our survey. It seems likely that they no longer rely on general trust assessments and instead base their trust judgements on their extensive direct experience.

Our factor analysis shows that manager benevolence and shared values with managers are both distinctly perceived constructs among our respondents and that they are both significantly predictive of trust in general fisheries management. However, how individuals think about manager expertise, which loads onto the latter two factors as well as the factor for data quality, is less clear. This finding is especially interesting given that 'perceived competence/expertise' and its subcodes were commonly mentioned in open-ended responses. Under the umbrella higher-level code of



perceived competence/expertise, respondents commonly pointed out mismatches between managers' perceptions and fishers' knowledge (for example, "It is not always so that what the fishers see corresponds to what the researchers see"), fishers' experience, (for example, "They have people who don't understand our everyday life, [a] lack of understanding about performing the profession"), or a complete disconnect with reality (for example, "They are sitting in an office and think they know everything, but don't really have a clue"). These unprompted references to the differences in how managers and fishers think about and experience fisheries are consistent with work that has extensively documented similar perceived disconnects elsewhere (Dobbs, 2000). It seems likely both that manager expertise is entangled with other management-related antecedents of trust, and that how fishers' think about manager expertise is more complex than we were able to capture in a single survey item.

We also assessed the validity and predictive power of related relevant constructs: perceived complexity, data quality, and stakes. Perceived complexity significantly predicts trust in management (marginal significance in Model 5), and respondents referred to complexity of the environmental, management, and regulatory systems in their open-ended responses. The inclusion of measures of data/information quality in our survey is relatively novel [but see (Gray et al., 2012)]; based on results, perceptions of management information seem worth further study. Our factor analysis suggests, however, that although respondents do critically assess management data they do not necessarily disaggregate their perceptions into complex components [validity, reliability, etc (Gerring, 2012)] but rather consider the quality of the data as a whole.

Although stakes as measured by percent income from fisheries, years fishing, and generations fishing were not significant predictors of trust in general fisheries management, this is likely due at least in part to the homogeneous and socially-situated nature of our sample (i.e., limited variation in responses to these items). The salience of economic stakes, in particular, for the trust judgements explored here should be understood in the context of Norwegian social realities. Norwegian fishers are relatively economically privileged: historically, Norwegian fishers' income has exceeded, and increased more quickly than, the national average, regardless of vessel type, gear type or fishery, and for both full and part-time fishers (Nielsen et al., 2018). In 2021, according to Fiskeridirektorat statistics<sup>2</sup>, over 1.7 billion NOK worth of cod and over 300 million NOK worth of spring spawning herring was caught in Norwegian coastal waters. Regardless of their opinions of (or trust in) fisheries management, the fishers in our sample are thus likely to be relatively well-off, with a general sense of economic stability. The possibility of economic risks being less salient is supported by the fact that only two respondents mentioned livelihoods in their open-ended justifications of their trust judgements.

In contrast, however, quota size was strongly predictive of probable trust in management, with higher cod quota associated

with an increase in probable trust and higher herring quota associated with a decrease in probable trust. Given sample homogeneity, quota size (logged) may be a better proxy for economic stakes than our percent of income measure. If this is the case, economic stakes are indeed salient and predictive for trust judgements, but in different ways for cod and herring fishers. This finding is somewhat puzzling.

Our findings for general trust in fisheries management do not carry over to management of the (relatively novel, controversial) Calanus fishery. The only significant predictor of trust in management was region of primary residence; the finding that trust in the Calanus fishery is significantly lower in mid-Norway is consistent with anecdotal evidence, including from key informant interviews used in study design, that opposition to Calanus fishing is concentrated in Trøndelag.

Neither general trust in management nor its predictors significantly predicted trust in Calanus fishery management. Although the underlying antecedents of trust are comparatively more predictive of trust in Calanus management than is trust in management in general, the significance of those antecedents is inconsistent and effects are weak. The fact that Factors 2 and 3 (manager benevolence and shared values) are significantly predictive only where general trust in management is omitted from the model may suggest that the effect of these covariates is primarily through their effect on general trust in management rather than on attitudes to Calanus specifically. Weak predictive power of our models may be because perceptions of Calanus fishery management are more uniform and negative than trust in general fisheries management. Over 80% of responses included in the model report trusting in Calanus management "not very much" or "not at all". Future research could address this by extending the trust scales to include active distrust in addition to simple lack of trust (Cook and Gronke, 2005).

Whatever the explanation, the second set of models very clearly presents a messier story about trust and its antecedents than does the first. This is not entirely surprising, given both the context of the Calanus fishery and what previous work suggests about the nature of trust. Uncertainty generated by opening a new fishery can generate skepticism or even hostility. Some of this may be an innate resistance to change. Fishers are often highly risk averse, and strive to maintain consistency in their fishing operations even at the expense of additional economic opportunity (Smith, 2005; Holland, 2008; Szymkowiak, 2020; Schwoerer et al., 2023; Le Bras et al., 2024). Calanus was not top of mind for our respondents in the first portion of the survey, prior to the topic being introduced. Only two respondents mentioned Calanus in response to the open-ended follow-up on trust in general fisheries management, both framing Calanus management negatively: "Contempt related to advice about Calanus, they don't want to hear [other] points of view" and "The management they do with Calanus. That they are going to fish and increase the quota on the base of the food chain. That I have zero trust in." However, when asked directly about Calanus management, respondents reported very low levels of trust and, as discussed further in Crosman et al. (under review)<sup>1</sup>, provided different rationales for that low trust, in particular management

<sup>2</sup> <https://www.fiskeridir.no/Yrkesfiske/Tall-og-analyse/Loennsomhet/aarstabeller>

outcomes, specifically fears of the ecosystem effects (echoed in the second open-ended response above) of removing low-trophic level species from the food web and the potential for bycatch in Calanus nets.

Researchers have long argued that trust also has an affective/emotional component (Lee and Selart, 2011; Engdahl and Lidskog, 2014; Stern and Coleman, 2015; PytlikZillig et al., 2016). For example, research on the COVID-19 pandemic shows that trust in government decreases as anxiety, fear, sadness and anger increase (Ahn et al., 2021). For some researchers [e.g. (Stern and Coleman, 2015)], this emotional component is captured by trustors' sense of affinity to the trustee, as reflected in our closed-ended item measuring shared values. For others, however, the emotional component of trust also includes the ways in which a topic or context affect an individual's overall affect (Lee and Selart, 2011). While our study does not capture the emotions that our respondents experience in relation to either general fisheries management or Calanus management, we infer from both the larger context and from the different relative frequencies of topics mentioned in open-ended responses that the two topics elicit different emotional responses. This difference in emotional response may in fact be eminently rational in the context of our respondents' fears of potential ecosystem collapse, and little to no perceived gain, from Calanus fishing.

Understanding the connections and interactions between rational and affective/emotional components or drivers of trust in the context of an established conflict, like the one between cod fishers and the Calanus fishery, would be a fruitful topic for future research. Indeed, anxiety around the novel risks associated with the Calanus fishery, in combination with little potential gain, high uncertainty, and an external locus of control, may create an ideal recipe for trust challenges (Stern and Coleman, 2015). Recognizing that rational fear and anxiety associated with fishing for Calanus may be driving our respondents' low trust implies that management rules and other governance should be re-examined in the light of sustained, two-way communications that take fishers' concerns, and the potential risks and benefits they face, seriously.

## 4.1 Limitations and future directions

This study is subject to a number of limitations. Our sample is limited to Norwegian coastal cod and herring fishers, challenging generalizability. Trust antecedents known to be complex are measured by single items. Because of mis-matched scales, trust in general fisheries management and Calanus management are not directly comparable. Lastly, although fisheries management is a process – one that in Norway includes participation by fishers, expected to increase trust (Gray et al., 2012) – we did not examine procedural trust judgements in this study.

For both theoretical and practical reasons, we targeted only a limited number of possible antecedents of trust in this study. Although the antecedents we explored are among those most commonly addressed in relevant literatures (McEvily and Tortoriello, 2011), we did omit many potentially interesting constructs. In particular, our choice to subsume integrity into shared values in our closed-ended items seems likely to

have impacted the thoroughness of our analysis. Other authors have noted an overlap between integrity and other antecedents of trust, both in terms of shared values (Stern and Coleman, 2015; Toman et al., 2021) and in terms of benevolence (McKnight and Chervany, 2001). However, given the frequency of open-ended responses coded with the inductively added code for Bias (and sub-codes), it seems likely that inclusion of assessments of integrity/fairness in closed-ended responses would have added value. Note, however, that although integrity refers at least in part to expectations of fair action for some authors (PytlikZillig et al., 2016), others treat fairness and integrity as separate constructs (McEvily and Tortoriello, 2011). The distinction between bias, fairness, integrity and shared values remains unclear and would benefit from further investigation.

Furthermore, our approach makes it difficult to disaggregate judgements of different types of trustors, or trust in individuals vs. institutions. We have only very limited evidence from our open-ended responses about the specific actors or organizations that respondents were thinking of when they responded to items phrased around 'managers,' making it difficult to determine differences in perceptions of the many possible targets of trust (researchers/IMR, agency staff/the Fisheries Directorate, politicians, etc.). Still, our exploratory code co-occurrence analysis points towards some intriguing possibilities, including different assessments of the competence/expertise of researchers and the management agency. If the tendency to associate researchers and competence with higher trust in management and the management agency and competence with lower trust in management extends into the full sample, it could explain some of our analytical findings, specifically the failure of perceived competence/expertise to load consistently on to its own factor. Deeper exploration of the antecedents of trust by type of trustor should be addressed in future work.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by Norwegian Agency for Shared Services in Education and Research. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because no personal information, recordings, or images were collected.

## Author contributions

KC: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. AH: Formal Analysis, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing.

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## Conflict of interest

The authors declare the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

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