Do you trust me? – Go Fish! A Study on Trust and Fisheries Management

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ABSTRACT

This paper investigates trust among stakeholders in fisheries management. We asked the general public, environmental bureaucrats, and recreational and commercial fishers whether they believed various stakeholders have sufficient knowledge to take a stance regarding fisheries management issues in a choice experiment they themselves had just been exposed to. We found that the general public and recreational fishers tend to trust bureaucrats to have sufficient knowledge, while bureaucrats distrust the general public. The commercial fishers in our sample deviate from the other respondents with high self-trust and low trust in both the general public and bureaucrats. In addition, bureaucrats tend to think that their colleagues are more knowledgeable than them. When looking at observable characteristics, we find that, regardless of comparison group, males show higher trust in their own knowledge than do females, and those with higher education believe they are more knowledgeable than people in general.

*Go Fish is a classic simple card game that is popular among children.

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1. Introduction

Environmental problems are typically complex, uncertain, and affect various members of a society. One way to allow public influence on environmental policy and decision making (i.e., public participation) is to incorporate values held by those who are affected by the policy using cost-benefit analysis. There is, however, a considerable debate about whose preferences should be considered when measuring environmental benefits (Kontoleon et al., 2001). Some argue that everyone in society is entitled to influence policy, or at least that values for everyone affected by a policy should be taken into account (e.g., Kling et al., 2012), whereas others contend that experts alone should guide decision makers (e.g., Hausman, 2012).

When it comes to fisheries, stakeholders who may or may not share views on how to manage a resource include recreational anglers, commercial fishers, bureaucrats working with environmental management, and the general public. Moreover, each of these groups may hold beliefs regarding whether members of the other groups have sufficient knowledge that entitles them to influence fisheries management. Our point of departure is to consider beliefs about others' knowledge as attitudes that can be identified as trust. Thus, trust in one's own and other stakeholders' knowledge level is the focus of this study. More specifically, we analyze whether stakeholders in fisheries trust each other to have sufficient knowledge to choose between different options in a choice experiment (CE)[2] study regarding fisheries management. We address this question by using data from a survey sent to the general public, recreational and commercial fishers, and bureaucrats at three government agencies responsible for environmental, water, and fisheries management, respectively. We are especially interested in analyzing whether the government agency representatives trust the general public to have sufficient knowledge and whether recreational and commercial fishers trust the authorities in the same respect.

Trust between authorities and the members of a society is crucial in many aspects. Marien and Hooghe (2011) show that people with low levels of political trust are significantly more likely than people with high levels of political trust to accept illegal behavior such as tax fraud. Folke et al. (2005) claim that building trust is a major requisite for successful adaptive governance of social-ecological systems. Moreover, establishing the link between trust and knowledge, Metlay (1999) holds that institutional trust depends on beliefs about institutional behavior and on how competent an institution appears to be. Jentoft (1989) and Jonker and

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[2] While there are several methods for estimating environmental benefits in a cost-benefit analysis, stated preference methods such as the contingent valuation method and the choice experiment (CE) method are among the more popular.

Treur (1999) discuss that trust develops over time and is based on previous experiences: Negative experiences will lower the level of trust while more positive experiences will increase the trust in an agent. According to Rova (2004), fishers tend to respect and follow their own self-imposed operational rules to a much greater extent than rules coming from authorities. Grafton (2005) points out that if fishers and regulators trust each other they are more likely to share knowledge and information with each other leading to lower regulation costs. Young (1979) contends that even if illegal fishing may be highly profitable, rule violations can be kept low if there is a norm of mutual trust among the individuals involved. De Vos and van Tatenhove (2011) point out that effective co-management by the fishing industry and authorities hinges on not only well-working institutions but also trust between the two camps. Nielsen (2003) claims that uncertainty and thereby management costs can be reduced by establishing mutual trust among the participants in the fisheries management decision-making process. Thus, increasing trust among fishers and between fishers and authorities implies economic advantages to society. While trust is necessary, it is of course not alone sufficient to make fishers comply with government regulations. Social norms and social capital are other important factors.[3] (For a deeper discussion on how social capital influences fisheries governance, see Grafton, 2005). Clearly, the insight that institutional trust can increase compliance with government regulations and engagement in moral civic behavior is important in fisheries management.

While the question of whether fishers trust bureaucrats to be knowledgeable enough to make decisions about fisheries management is inspired by the compliance literature that holds trust to be important for compliance, the question of whether bureaucrats trust the general public is more a question of bureaucrats' perception of whose preferences should matter for environmental policies. Faber et al. (2002) found that German environmental bureaucrats do not solely obey the directives of their minister, i.e., the public interest as expressed by the representative democracy, but rather act as "political bureaucrats" who "develop their own political orientations and conceptions of justice and the common good, and act according to them." A recent study asked the EPA administrators in Sweden whether, and if so who, should have more to say when deciding Swedish environmental policy. They were asked to choose from different interest and professional groups and from people who are especially affected by the environmental problem in question. The results show that about 60% of the

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[3] In most countries, the fishery industry is heavily represented in the decision making, e.g., through advisory committees (McCay and Jentoft, 1996). This kind of co-operation in management between fishers and authorities could lead to a higher degree of converging norms and mutual understanding (Rova, 2004).

EPA administrators think that people with environmental education (such as biologist/ecologists or environmental economists) should have a greater influence on the setting of priorities in environmental management. Only 12% of the respondents think that people who are especially affected by a certain environmental problem should have an increased influence on the related environmental policy making (Carlsson et al., 2011). However, it is not clear from this result whether bureaucrats distrust that people in general have sufficient knowledge to qualify them for participation in this kind of decision making. Glenn et al. (2012) investigated fishers', fishers' organizations'/representatives', policy makers', and scientists' trust in the fisheries science community in five countries[4]. They found that trust in scientists differs across both countries and stakeholder groups, and that commercial fishers distrust scientists the most. The latter result is strongest in countries where the fishers and scientists have limited contact.

The main contribution of this paper is that we attempt to quantify relative trust between different stakeholders, i.e., trust in own ability vs. the ability of others to take a stance on fisheries management issues. To the best of our knowledge, this has not been done before. We then proceed to investigate how gender, education, and age may influence perception of own and others' ability to take a stance on complex decisions. By using multiple-choice test of sports trivia Beyer and Bowden (1997) found significant gender differences in overconfidence in male-coded domains such as knowledge in football, baseball, and basketball, but not in female-coded or gender-neutral areas.[5] Barber and Odean (2001) found males to be overconfident in another male-coded domain, i.e., stock trading. Bengtson et al. (2005) studied overconfidence among students and found males, especially young males, to be more overconfident than their female counterparts about their exam results. Previous literature on the relationship between age and overconfidence shows mixed results. Hansson et al. (2008) found evidence that age increases overconfidence in various judgment and decision-making tasks. Pliske and Mutter (1996) found the opposite, i.e., that age decreases overconfidence, while Bruine de Bruin et al. (2012) did not find any significant age effect at all.

To summarize the main findings, we find that bureaucrats actually do not trust that the general public has sufficient knowledge to manage the fisheries, while the general public and recreational anglers generally trust that authorities have sufficient knowledge to do so. The

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[4] Iceland, Greece, Spain, United Kingdom, and Faroe Islands. They particularly asked about trust in the science community regarding competence, common language, common vision, benevolence, receptivity, strong ties, integrity, predictability, and credibility.

[5] The feminine task in the study by Beyer and Bowden (1997) was trivia about movies and TV-series targeted to women, and the gender neutral task was a test of common knowledge. Each task had 40 multiple choice questions.

commercial fishers, on the other hand, strongly distrust both the authorities and the general public. We also find that all respondents, regardless of which stakeholder group they belong to, are more likely to believe that they themselves are more knowledgeable than the general public. When looking at socio-economic variables, we find that, regardless of the comparison group, males have significantly higher self-trust than females, i.e., males to a larger extent than women tend to think they have more knowledge than others. Also, regardless of the comparison group, those with three years or more of university education believe they have more knowledge about fisheries management than the general public.

The remainder of this paper is organized as follows. In the next section we describe the sampling framework and how the data was collected. Section 3 presents the main research hypothesis, Section 4 is the result section, and Section 5 concludes the paper with a thorough discussion.

2. Data collection methodology

The data for this paper was collected using an additional module that followed a choice experiment survey concerning people's willingness to pay for an increase in the abundance of coastal cod along the Swedish west coast. Samples were collected from four different populations: 1) the general public, 2) bureaucrats at three different agencies, i.e., the Swedish Environmental Protection Agency (SEPA), the County Administrative Board of Västra Götaland, the Water Protection Department (WPD), and the Swedish Agency for Marine and Water Management (SwAM), 3) recreational anglers, and 4) commercial fishers.

Inshore coastal cod stocks along the Swedish west coast have been severely depleted since the 1970s and tests by research trawl vessels indicate that in 2008 the stock levels were only 2–3% of the levels in the 1970s. Marine researchers unanimously state overfishing by commercial and recreational fishers as the main reason for this development (Svedäng et al., 2010; ICES, 2010) and that reaching a permanent increase in the coastal cod stock in Western Sweden would require a reduction of the current fishing pressure. However, fishers often stress small perturbations as important factors on future consequences and likely emphasize the importance of environment rather than realizing that a declining fish stock is the result of overfishing in previous years (Wilson and Pascoe, 2006). The decrease in the cod population has been intensively debated in the media for several years. In 2002, the Green Party made Baltic Sea cod stock recovery a major election issue in Sweden (Eggert and Olsson, 2009), and in 2014, WWF Sweden launched a campaign for a consumer boycott of Swedish shrimp

that received a lot of media attention. In addition, fishing in marine waters is open to all and more than 10 percent of the Swedes have engaged in recreational fishing (The Swedish Agency for Marine and Water Management, 2015). Hence, parts of the general public are fairly well informed about the state of the coastal cod stocks. However, overall the knowledge level about the coastal cod stock most likely varies across the four samples: Commercial fishers and bureaucrats working with fisheries probably have the most knowledge, while the general public likely has the least. The CE was designed to be completed by laypersons without a need for pre-existing knowledge about fisheries or fisheries management. All four respondent groups received the same baseline information about the situation for coastal cod along with a description of the attributes included in the CE. The trade-offs should therefore be a matter of preferences and taste.

In the first section of the survey, respondents were shown a map with the coastline of interest in our study, followed by questions about the respondents' location. In the second section, the respondents were provided information about the coastal cod stock and policy measures that could increase the cod stock. The second part also contained information about the attributes in the choice experiment (CE),[6] an example of a choice set, the choice experiment itself, and finally the focus of this study: the trust questions. The third section contained questions to identify the respondents' socioeconomic status.

The choice experiment consisted of four attributes. The first attribute describes the size of the coastal cod stock, and the second describes the various fishing restrictions regarding when and where fishing is allowed: If the trawl boundary is moved further out from the coast, mostly commercial fishers are affected, while a complete fishing stop inside the existing trawl boundary would affect both commercial and non-commercial fishers, including recreational anglers. The third attribute describes two different cost principles to finance a cod stock enhancement.[7] Finally, the last attribute is a cost that was framed as a monthly tax to finance measures to increase the coastal cod stock. Each choice set consisted of three alternatives: two improvement alternatives where the attribute levels were varied and one opt-out alternative where the attributes where kept constant at the current real world level (Appendix 1 provides an example of a choice set). In the CE, each respondent was asked to choose the alternative

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[6] In a choice experiment, individuals are given a hypothetical setting and asked to choose their preferred alternative among several alternatives in a choice set. The participants are usually asked to answer a sequence of such choice sets. Each alternative is described by a number of attributes. For overviews of the choice experiment method, see Louviere, Hensher, and Swait (2000) and Alpizar, Carlsson, and Martinsson (2003).
[7] The cost distribution attribute had two levels: i) everybody pays the same amount irrespective of income level and ii) everybody pays the same percentage of their income, so the amount increases with income.

they considered to be the best for fishery management in western Sweden. For the results of the CE part, see Eggert et al. (2016).

In this paper we will focus on the part of the survey where respondents were asked whether they believed that they themselves, people in the general public, and bureaucrats working for environmental authorities have sufficient knowledge to answer the CE questions they had just answered. We consider beliefs about other people's knowledge to be attitudes that can be identified as trust. Each respondent was asked the three ordinal scale questions as described in Table 1.

Table 1: Main dependent variables: a) *self-trust*, b) *general public trust* and c) *authority trust*.

a) Do you have sufficient knowledge to take a stance on the choices you were asked to make?

b) Do people in general have sufficient knowledge to take a stance on the choices you were asked to make?

c) Do officials at the Swedish Environmental Protection Agency, the County Administrative Board of Västra Götaland Unit of Water Management, and the Swedish Agency for Marine and Water Management have sufficient knowledge to take a stance on the choices you were asked to make?

A 1–5 scale was used where 1 was "strongly disagree" and 5 "strongly agree." For simplicity, we will define an average value of 2 and below as low trust and a value of 4 and above as high trust. A value between 2 and 4 will be defined as moderate trust.

As mentioned above, the samples were collected from four different populations: the general public, bureaucrats at three different environmental agencies, recreational anglers, and commercial fishers. The general public and recreational anglers were recruited from the two adjacent Swedish counties Västra Götaland and Halland, to whom the Skagerrak and Kattegat straits are the natural references for issues relating to the sea. The subjects were reached using a random regional sample from the Citizen Panel at the University of Gothenburg, which consists of about 16,000 active participants who regularly contribute to Swedish and international survey research by answering web questionnaires that they receive through e-

mail invitations. The panel members do not get paid for their participation. The population of recreational fishers included all registered members of the Swedish Anglers' Association within the region of concern. Commercial fishers included all fishers with a homeport along the Swedish west coast. Finally, the bureaucrats were approached following approval by the respective agency management. The general public and the bureaucrats completed the survey online, while the recreational anglers and commercial fishers received their surveys by regular mail. The surveys were sent out from April to June 2014. For the general public, invitations were sent by email to 4,199 men and women 18–80 years old. Two reminders were also sent out, one and three weeks later. In total, 2,259 responses were received (54%). As some of the responses could not be used due to missing items, 2,248 responses were used in the final analysis. The mail survey to the Swedish Anglers' Association was sent to 2,466 members, of whom 816 responded (33%). For the environmental bureaucrats, an e-mail with a link to the web questionnaire was sent out to 72 officials at the Swedish Agency for Marine and Water Management (SwAM), 49 at the County Administrative Board of Västra Götaland's Water Protection Department (WPD), and 262 at the Swedish Environmental Protection Agency (SEPA). All in all, 164 useable responses were received from this group (43%). As for the commercial fishers, 649 individuals received the survey by mail and 74 (11%) of them provided useable answers. Obviously, the commercial fishers were very skeptical of our survey as about 30 of them personally called us and questioned the survey.

3. Hypotheses

Many psychological studies find that people generally overestimate their own relative ability and are overly optimistic about the future. When respondents estimate their own position in a distribution of peers regarding traits such as driving ability, future income, and longevity, far more than 50% think they belong to the upper half. Connected to this, economic experiments indicate that overconfidence leads to excessive business entry (see Camerer and Lovallo, 1999, and references therein). Our main hypothesis is that people have a tendency to trust their own judgment more than the judgment of others. We test this hypothesis by comparing the subjects' assessment of own judgment relative to others. In the over-confidence literature, a person´s belief about own judgment to be better than others' judgment is known as overplacement or illusionary superiority (Moore and Healy, 2008; Benoît and Dubra, 2011; Benoît, 2015).[8] For example, if more than half of the population believes that

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[8] That people think they are better than others is in the psychology literature called optimistic bias (van der Pligt, 1996) and unrealistic optimism (Weinstein, 1980).

their judgment is better than half of the population, a bias is identified in the population. In our context, however, it is important to remember that the choices the subjects were asked to make were designed to be answered without any need for knowledge about fisheries or fisheries management. All respondents received the same information about current fishing restrictions and the current situation for the coastal cod stock. Hence, from the perspective of how the CE study was designed, the subjects should ideally strongly agree that they had sufficient knowledge to make the choices they were asked to make.

4. Results

4.1 Descriptive statistics

Table 2 shows the descriptive statistics based on the three different trust questions. Note that the three groups of bureaucrats are lumped into one group. Later on, we will look at possible differences between the three groups of bureaucrats.

Table 2: Mean trust* (standard deviation in parentheses)

	Stakeholders			
	General public (GP)	**Bureaucrats (B)**	**Recreational anglers (RA)**	**Commercial fishers (CF)**
Self-trust	2.52 (1.09) *moderate*	2.86 (1.24) *moderate*	3.51 (1.14) *moderate*	4.55 (0.72) *high*
General Trust	2.00 (0.86) *low*	1.98 (0.88) *low*	2.08 (0.91) *moderate*	1.65 (1.03) *low*
Authority Trust	3.81 (0.93) *moderate*	3.56 (0.97) *moderate*	3.75 (1.05) *moderate*	1.92 (0.96) *low*
Share of males	0.55	0.46	0.97	0.99
Age	53.96 (13.99)	46.19 (9.60)	55.55 (14.05)	54.92 (13.88)
University education, 3 years or more	0.49	0.96	0.27	0.03
#Observations	2,248	164	816	74

* Trust is measured on a scale from 1 to 5.

There are some interesting patterns in Table 2. For all stakeholder groups, we observe that *self-trust* is considerably higher than *general trust*, i.e., respondents believe that they are more knowledgeable than the general public when it comes to making choices regarding fisheries management. For all stakeholders except commercial fishers, we also observe a considerably high score for *authority trust*, i.e., stakeholders on average trust that bureaucrats working at environmental agencies have sufficient knowledge and the trust in bureaucrats is even higher than *self-trust*. On average, commercial fishers exhibit extremely high self-trust, while their trust in bureaucrats and in the general public is very low. The mean values also show that bureaucrats have low trust regarding the general public´s likelihood of having sufficient knowledge to make the choices about fisheries management that they were asked to make in the CE. On the other hand, for *general trust*, the bureaucrats' mean value is in line with the mean values for the general public and recreational anglers. Another interesting result in Table 2 is that bureaucrats have more trust in their fellow bureaucrats than in themselves. We will explore these findings in more detail and also test for statistical significance in the next subsection.

Our sample of the general public does have some overrepresentation in mean age, share of males, and education level (respondents with at least three years of university education).[9] We therefore estimated an OLS regression including these three overrepresented variables as independent variables to see whether they significantly affect the stated trust levels and subsequently we corrected for overrepresentation by predicting trust based on the regression model using the population means of the independent variables (OLS results are shown in Table A2 in the Appendix). We find that being a male significantly increases *self-trust* and *general trust* but decreases *authority trust*. University education significantly increases *self-trust* and *authority trust*, while the level of *general trust* decreases with education. Finally, age has significant and negative effect on *authority trust* only. Importantly, the corrected mean values turn out to be basically the same for all trust variables compared with the results in Table 2 (see Table A2 for details).

4.2 Inferential statistics

Do people tend to trust their own judgment more than the judgments of others? We study this by statistically testing for differences between *self-trust* and *general trust*. Hence, *relative*

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[9] The share of males is 55% in our sample but 50.5% in the whole population (Statistics Sweden, 2015a). The share of university educated is 49% while the population value is 20% (Statistics Sweden, 2015b). The mean age in our sample is 54 years while the population mean is 47 years (Statistics Sweden, 2015c).

trust = self-trust – general trust, and the interpretation is that superior trust is observed if *relative trust > 0.* Similarly, a negative difference will be labeled inferior (relative) trust. The top four panels in Figure 1 show the distribution of the relative trust variable. The very left panel is for the general public (GP), followed by bureaucrats (B), recreational anglers (RA), and commercial fishers (CF). To contrast these findings, the bottom four panels show distribution of a variable that is generated by taking the difference between *self-trust* and *authority trust*, which also forms a version of relative trust. Again, superior trust is observed if *self-trust – authority trust > 0* and inferior trust is observed if *self-trust – authority trust < 0.*

Figure 1: Distribution of relative trust
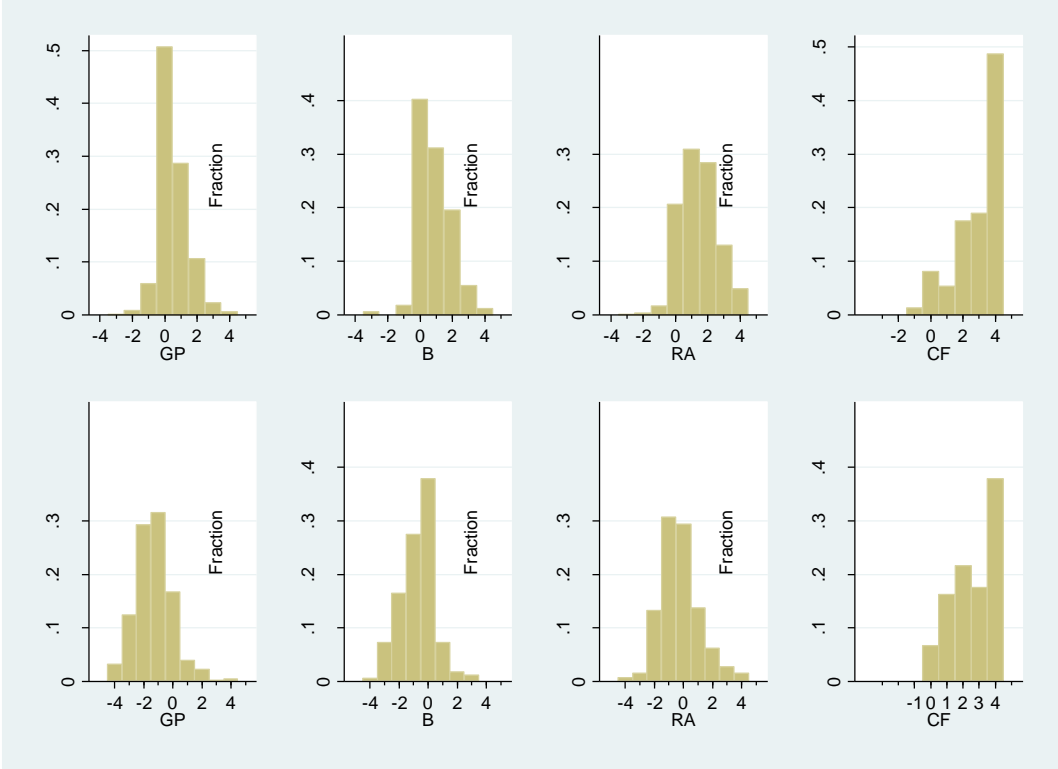
Top four panels: General public: superior trust 42%, inferior trust 7%. Bureaucrats: superior trust 57%, inferior trust 2%. Recreational anglers: superior trust 77%, inferior trust 2%. Commercial fishers: superior trust 91%, inferior trust 1%.

Bottom four panels: General public: superior trust 7%, inferior trust 57%. Bureaucrats: superior trust 10%, inferior trust 52%. Recreational anglers: superior trust 24%, inferior trust 46%. Commercial fishers: superior trust 93%, inferior trust 0%.

In Figure 1 we see that all of the top four panels show right-skewed distributions in line with superior trust, i.e., all four groups believe that they have more knowledge to answer the CE than people in general. The bottom four panels give a more mixed impression: The left skewness of the general public indicates that people in the general public have inferior relative trust compared with bureaucrats, and interestingly we find that bureaucrats also have inferior relative trust and believe other bureaucrats to be more knowledgeable. We will look at this phenomenon in more detail when analyzing heterogeneity among bureaucrats. The commercial fishers clearly deviate; none of them believe that bureaucrats have better knowledge to answer the CE than any of them. To formally test the relative trust hypothesis, we test whether H0: *relative trust = 0* can be rejected, which if so would support the superior or inferior trust hypotheses. The results are presented in Table 3.

Table 3: Testing for relative trust (Wilcoxon signed-rank test, two sided)

	Stakeholders			
Confidence	**General public**	**Bureaucrats**	**Recreational anglers**	**Commercial fishers**
	(GP)	**(B)**	**(RA)**	**(CF)**
Self-Trust - General Trust	0.52***	0.88***	1.44***	2.91***
Self-Trust – Authority Trust	-1.29***	-0.70***	-0.24***	2.64***
#Obs.	2,248	164	816	74

Table 3 reveals that the respondents do show superior relative trust and there is a tendency to believe that one's own judgment is better than the general public's judgment. In relation to the authorities, we find that the general public and recreational anglers, but also the environmental bureaucrats, display inferior trust. Again the commercial fishers clearly diverge from the other respondents. They show very high self-trust but low trust in both the authorities and the general public. This may be a typical result for countries with traditionally regulated fisheries, like Sweden, where the authority base decisions on biological advice while almost all fishers lack property rights and thereby long-term investment incentives in stocks. Fishers tend to distrust biologists, who in their view do not understand fluctuations and spatial movements of fish stocks (see, e.g., Raakjaer, 2003; Pálsson, 1995), and they are likely not to heed scientific advice until they gain control over the means of production (Scott, 1989; Christy, 1996). Also note that although we observe superior trust in the general public sample, we cannot confirm that superiority in trust is illusionary (biased) since less than 50% of the subjects exhibit it (see Figure 1). This means that we cannot ignore the possibility that the 40% who believe that they are more knowledgeable than others also belong to those who in fact are more knowledgeable.

Finally, as discussed earlier, our general public sample does have some overrepresentation in mean age, share of males, and education level (respondents with at least three years of university education). We therefore estimated an OLS regression with relative trust as dependent variable and the three overrepresented variables as independent variables. We then used the population means of the independent variables to correct the

overrepresentations. (OLS results are shown in Table A3 in the Appendix). Overall, this exercise confirms the conclusion from Table 3.[10]

4.2.1 Regression analysis

In this subsection we analyze relative trust using regressions that allow us to control for socio-economic characteristics. A seemingly unrelated regression (SUR) is estimated with the two dependent variables $y_1 = Self\_Trust - General\_Trust$, and $y_2 = Self\_Trust - Authority\_Trust$, where the regression equations are linked by the fact that their error terms could be correlated (Wooldridge, 2010). In model 1 we include observations from all samples. In model 2 we only include the two samples general public and bureaucrats. The reason for this is that we want to control for gender and the samples for recreational anglers and commercial fishers consist of almost only males. Finally, in model 3 we focus on only bureaucrats and control for observed heterogeneity based on which agency the bureaucrats work at.

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[10] For the general public and recreational anglers samples, the respondents were asked to answer the CE in one of the two different roles (as a private person or a bureaucrat) using a between-subject design. The results in Table 3 remain basically the same whether we analyze the data separately for the two roles or jointly using the entire sample.

Table 4: Seemingly unrelated regression analysis for the dependent variables:
$y_1 = Self\_Trust - General\_Trust$ and
$y_2 = Self\_Trust - Authority\_Trust$

	Model 1 Coeff.	Model 2 Coeff.	Model 3 Coeff.
y_1			
Male	-	0.254*** (0.0380)	0.417*** (0.157)
Age	-0.002* (0.001)	0.0004 (0.001)	-0.011 (0.008)
University education	0.177*** (0.038)	0.238*** (0.0398)	-
General public	Ref.	Ref.	-
Bureaucrats	0.266*** (0.084)	0.275*** (0.078)-	-
SEPA			Ref.
WPD	-	-	0.317 (0.211)
SwAM	-	-	0.517*** (0.191)
Recreational anglers	0.961*** (0.042)	-	-
Commercial fishers	2.473*** (0.121)	-	-
Constant	0.559*** (0.078)	0.237*** (0.087)	1.000**
R2	0.21	0.04	0.11
y_2			
Male	-	0.485*** (0.052)	0.856*** (0.178)
Age	0.002 (0.002)	0.006*** (0.002)	-0.002 (0.009)
University education	0.0001 (0.050)	0.020 (0.054)	-
General Public	Ref.	-	
Bureaucrats	0.616*** (0.109)	0.666*** (0.106)-	-
SEPA			Ref.
WPD	-	-	0.262 (0.239)
SWAM	-	-	0.286 (0.217)
Recreational anglers	1.046*** (0.055)	-	-
Commercial fishers	3.921*** (0.157)	-	-
Constant	-1.419*** (0.102)	-1.882*** (0.119)	-1.145** (0.465)
Rho	0.51***	0.52***	0.51***
R2	0.22	0.05	0.15
#Obs	3,303	2,412	164
Sample	GP,B,RA,CF	GP,B	B

Swedish Environmental Protection Agency (SEPA), Swedish Agency for Marine and Water Management (SwAM), County Administrative Board of Västra Götaland's Unit of Water Management (WDP)

Starting with model 1, we see that the intercept for the first equation is positive and significant. This confirms the superior relative trust we discussed earlier. We also see that a

respondent with at least three years of university education has higher trust in their own knowledge than in others' knowledge, i.e., superior relative trust increases with education. The negative and significant coefficient for age implies that superior relative trust goes down with age. Finally, we observe that superior relative trust is greater for bureaucrats, recreational anglers, and commercial fishers than for the general public.

Continuing with the second regression equation in the model 1, we see that the intercept is negative, which is in line with our earlier findings that the general public displays inferior relative trust relative to authorities. Moreover, we see that the inferior relative trust is of lower strength for bureaucrats and recreational anglers than for commercial fishers, who instead show superior relative trust in relation to the authorities.

Continuing with model 2, we see a positive and significant coefficient for males in both regressions, implying that males have both a higher level of superior relative trust and a lower level of inferior relative trust than females. Since males are clearly overrepresented in fishing, our results could be in line with other studies that found that males are overconfident in tasks that are traditionally seen as more masculine (Beyer and Bowden, 1997; Barber and Odean, 2001).

In model 3 we control for observed heterogeneity among bureaucrats based on which agency they work for. The significant value 0.517 indicates that bureaucrats at SwAM, which is the government agency that deals inter alia with fisheries management in Sweden, show more superior relative trust than do bureaucrats at SEPA, who are more specialized in terrestrial challenges. WPD deals with water management but to a very limited degree with fisheries management, and we did not find that they differ significantly from SEPA. In the second equation of model 3, the negative intercept implies that bureaucrats believe that other bureaucrats are more knowledgeable than them. Interestingly, this inferior relative trust among individual bureaucrats is not found to differ across the agencies. In some sense, this result shares some common features with the well-known Dunning-Kruger effect and what they refer to as "the burden of expertise" (Kruger and Dunning, 1999; Dunning et al., 2003), i.e., that people who are very able tend to underestimate their rank relative to others with whom they compare themselves. Hence, they overestimate other people's abilities while they actually have a good awareness of their own abilities. Finally, the previous result that males have superior relative trust is confirmed in both regressions. Moreover, compared to model 2, the male coefficients are larger in model 3 where we only include bureaucrats. Thus, male

bureaucrats have clearly a higher level of superior relative trust as well as a lower level of inferior relative trust than female bureaucrats.[11]

5. Concluding discussion

Politicians and public authorities have the challenging task of balancing the different interests in a society, which involves difficult trade-offs on a daily basis. In for example fisheries, the interests of recreational anglers can clash with those of commercial fishers, which in turn can be in conflict with the interests of the general public. Trust in public authorities, or institutional trust, is important as it can increase compliance by for example making more fishers accept regulations. With no or poor trust in authorities, there is a risk that fishers only believe in their own experiences concerning fishing. But institutional trust is not one-sided. It requires reciprocal efforts from the authorities and must be established together with both fishers and other citizens. Institutional trust can fall short due to uncertainty about whether bureaucrats act in their own self-interest or in the interest of the public they represent. To build the two-sided trust, the authorities have to allow some level of public influence in environmental policy and decision making and incorporate values held by the community. But this requires that the bureaucrats trust that the citizens they represent are sufficiently knowledgeable to participate.

In this study we study trust among relevant authorities and other stakeholder groups regarding decisions about coastal cod stocks. On the one hand, we find that the general public as well as recreational anglers do trust the authorities to have sufficient knowledge to make decisions about fisheries management. On the other hand commercial fishers show no trust in the general public or in authorities. Hence, one of the main lessons learned from this study is that there is a need to improve the trust between authorities involved in fisheries management and commercial fishers. Moreover, environmental bureaucrats show little trust in the general public. This indicates a potential risk that Swedish authorities are less willing to involve the general public in environmental decision making. We also found that people in the general public tend to believe they are more knowledgeable than other non-experts. However, we could not confirm whether this superiority in relative trust is illusionary. Interestingly, while bureaucrats distrust the general public, individual bureaucrats tend to believe they are significantly *less* knowledgeable than other bureaucrats. In a sense, this result shares some

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[11] The university education variable is not included in model 3 since almost all (96%) of the bureaucrats have at least three years of university education.

common features with the Dunning-Kruger effect (e.g., Dunning et al., 2003), which holds that highly able people tend to have a good self-awareness while they overestimate other people's abilities.

When looking at observable characteristics, we find that males have higher trust in their own knowledge than in the knowledge of people in general. In addition, males display a lower level of inferior trust in relation to authorities than women do. Both these results are strongest among male bureaucrats. Those with at least three years of university education (the typical time required to obtain a Bachelor's degree in Sweden) to a larger extent than others believe they have more knowledge than the general public, i.e., superior relative trust increases with a university degree.

In this paper we study beliefs about own and other people's knowledge. Our results show that recreational and commercial fishers agree or even strongly agree that they have sufficient knowledge to take a stance regarding choices for fisheries management. Since the mean trust values of the environmental bureaucrats and the general public were below 3 (in the scale of 5), we conclude that bureaucrats and the general public to a lesser extent agree that they have sufficient knowledge. This is not in line with our prior beliefs. In this sense, our prior beliefs about how respondents would experience our CE were clearly also biased: The CE seems to be perceived as more difficult than stated in the feedback we received when preparing the survey design using focus groups and pilot studies. It would be interesting to see whether or not this finding is representative for other CE surveys. Moreover, the response rate of commercial fishers is low in our study. It is possible that those who answered our survey had lower trust and were more negative regarding how the fisheries management is handled in Sweden compared with those in this group who did not answer. If so, our results for commercial fishers might exaggerate the distrust among commercial fishers. On the other hand, our results are well in line with the results by Rova (2004), who found that fishers to a greater extent tend to respect and follow their own self-imposed rules than rules handed down by authorities. Glenn et al. (2012) also found that, among all stakeholder groups included in their study, commercial fishers had the highest level of distrust in the fisheries science community. Regardless, as always with empirical studies, replication is the way forward to gain more and precise knowledge.

How can the vicious circle of potentially biased beliefs and distrust among authorities and other stakeholders be broken? Although our research does not address this question, we believe that open communication, citizen juries, and other participatory tools could be one way forward. It remains, however, a venue for future research.

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Appendix 1

Table A1. Example of a choice set

	Alternative 1 (Situation today)	**Alternative 2**	**Alternative 3**
Size of the coastal cod stock: amount of at least 5 year old cod caught per trawl hour	About 2 kg	About 50 kg	About 25 kg
Restrictions regarding when and where fishing is allowed	Like today	No fishing at all for cod inside the existing trawl boundary	The trawl boundary is moved 3.7 km further out from the coast. Inside the boundary, trawl fishing is prohibited.
Your tax increase per month (year) the next 10 years	SEK 0	SEK 200 (SEK 2,400)	SEK 100 (SEK 1,200)
Cost sharing principle to finance cod stock enhancement		Everybody pays the same amount, irrespective of income level.	Everybody pays the same percentage of their income; amount increases with income
Mark the alternative you prefer (X)			

Exchange rate euro 1 = SEK 9.20 (April–June, 2014)

Table A2. OLS regressions for the general public and prediction of adjusted trust

Variable	Self-trust	General trust	Authority trust
Male	0.358*** (0.046)	0.119*** (0.037)	-0.099** (0.039)
University education > 3 years	0.148*** (0.047)	-0.094** (0.037)	0.127*** (0.040)
Age	0.002 (0.002)	0.001 (0.001)	-0.004** (0.001)
Constant	2.153*** (0.104)	1.938*** (0.083)	4.035*** (0.089)
No. of observations	2,248	2,248	2,248
	Adjusted Predicted Self Trust = 2.45	Adjusted Predicted General Trust = 2.02	Adjusted Predicted Authority Trust = 3.81

Table A3. OLS regressions for the general public and prediction of adjusted relative trust

Variable	Self-Trust – General Trust	General Trust – Authority Trust
Male	0.239 *** (0.039)	0.456*** (0.054)
University education > 3 years	0.242*** (0.040)	0.006*** (0.002)
Age	0.002 (0.002)	0.021 (0.055)
Constant	0.215** (0.104)	-1.883*** (0.123)
No. of observations	2,248	2,248
	Adjusted Predicted Relative Trust = 0.43***	Adjusted Predicted Relative Trust = -1.36***