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Impulsivity, Voluntary Cooperation, and Denunciation among Fishermen

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Abstract:

Abundant laboratory evidence shows that many people incur costs to punish free-riders. In this paper, we investigate punishment in the context of fishermen who decide whether to denounce other fishermen who catch illegally small fish. Our laboratory and survey evidence suggests that the level of impulsivity plays an important role for costly punishment. Fishermen who behave more impulsive during a laboratory inter-temporal choice task report to have a higher propensity to denounce misbehavior from other fishermen. This finding suggests that impulsivity may help to explain why many people incur costs to punish free-riders. Moreover, we find that fishermen, who contribute more in a laboratory public goods experiment, report to be more likely to denounce free-riding in the field, suggesting that voluntary cooperativeness is also important to account for denunciation in the field.

Keywords: Altruistic Punishment, Impulsivity, Strong Reciprocity, Experiments.
JEL codes: C93, O33, Q

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1. Introduction

Humans are remarkable for their propensity to incur costs to punish unfair behavior. This individual propensity can deter people from free-riding, thus implicates important group benefits, and facilitates cooperation for human activities such as big game hunting and fishing which played a crucial role in ancestral societies (Acheson, 1988; Richerson and Boyd, 1998; Sober and Wilson, 1998). Laboratory studies (Yamagishi, 1986; Ostrom et al, 1992; Fehr and Gächter, 2002) show that many individuals even spend money for punishment in environments where it is implausible that the costs are repaid in the future, a phenomenon commonly denoted as "altruistic punishment" (Fehr and Gächter, 2002; Herrmann et al, 2008). These studies suggest that many people are "strong reciprocators" (Gintis et al., 2003), i.e. have predispositions to cooperate voluntarily and punish uncooperative behavior at a personal cost even if no individual benefits are expected.[1]

While most researchers are concerned about clarifying the role of strong reciprocity for altruistic punishment, we propose an additional possible explanation for altruistic punishment: *Impulsivity*. Impulsivity specifies the extent to which an individual acts in a spontaneous, unplanned fashion without careful deliberation of the resulting costs (Loewenstein et al., 2001).[2] It has been shown that the individual degree of impulsivity – or, more generally, impatience – has a strong effect on important decisions including investment choices (Warner and Pleeter, 2001), vaccination behavior (Chapman and Coups, 1999), and occupational choices (Munasinghe and Sicherman, 2000).

[1] There are also studies that challenge the existence of strong reciprocity and its relevance for altruistic punishment. Haley and Fessler (2005) and Barclay (2006), for example, argue that reputational benefits cannot be completely removed even in anonymous one-shot laboratory experiments. In addition, other researchers argue that the laboratory context is too abstract to explain complex naturally-occurring behavior and that there is less cooperation outside the laboratory because in the "real world" individuals are subject to markets and market experience (List, 2006; Levitt and List, 2007).

[2] Numerous animal and human studies show that high degrees of impulsivity are common (e.g. Fairbanks et al., 1999; Manuck et al., 2000; Seroczynski et al., 1999) rendering it possible that they are transmitted by genes and the product of frequency-dependent selection (Krebs and Davis, 1993; Budaev, 1999; Dingemanse and Reale, 2005) or the result of an evolved mechanism responding to adverse environmental circumstances (Belsky et al, 1991).

There is also a literature on the relationship between impulsivity and aggression. "Impulsive aggression" or "reactive aggression" is considered as one distinct form of aggression that often occurs in response to provocation or frustration (Dollard et al., 1939; Berkowitz, 1993). And there is suggestive evidence that the level of impulsivity is positively correlated to aggression. For example, Crockett et al (2010) manipulated the neurotransmitter serotonin and find that it affected both impulsivity and altruistic punishment in ultimatum games. The study by Batton et al. (1995) shows that people who are more impulsive are also more likely to exhibit impulsive aggression. Therefore, it seems plausible, that more impulsive individuals are more likely to incur costs to satisfy a sudden urge such as the one to punish uncooperative behavior.

In this study, we present laboratory and survey field data from fishermen to explore the role of impulsivity and voluntary cooperativeness for the denunciation of the catching of illegally small fish. Our study takes place in Brazil with fishermen from a lake where fishing is the main profession. Most fishermen catch fish alone, sell their catch on fish markets and in this way provide their family with nutrition and income. Our subject pool faces a common pool resource dilemma in their daily lives: While it is optimal for the individual fishermen to catch small and big fish, for the group of fishermen it is optimal to refrain from fishing small fish.

There is one legal regulation which prohibits the catching of small fish (below 20–30 centimeters depending on fish type). This regulation is, however, not enforced by the legal authority. One possibility to reduce the catching of small fish seems to be that fishermen denounce other fishermen who catch or sell small fish to the legal authorities. Denouncing other fishermen for over-exploiting the fish resources may be regarded as a behavior similar to adaptive altruistic punishment. It is adaptive in the sense that the behavior has the function to mitigate a social dilemma problem. It is likely altruistic because the fishermen in this setting believe that it potentially involves high costs (a denounced fisherman may find out

who was denouncing him and take revenge) but leads only to uncertain, small benefits (even if one fishermen stops the catching of small fish, it will not significantly change the overall level of over-exploitation at the lake).

During fishermen's meetings we asked the participants individually about their willingness to denounce the catching of small fish. In addition, in different meetings, the participants took part in two laboratory experiments, an inter-temporal choice experiment to measure impulsivity and a public goods experiment to measure voluntary cooperativeness. We find that fishermen who are more impulsive in the laboratory inter-temporal choice task and those who contribute more in a public goods experiment report to have a stronger propensity for adaptive altruistic punishment. For example, more than two-thirds of the fishermen who are impulsive in the laboratory report to denounce the catching of very few small fish in comparison to less than half of the fishermen who are patient in the laboratory.

At the same time we provide some evidence that more impulsive participants do not have a higher propensity for non-adaptive altruistic punishment – i.e. punishment that fails to serve a clear purpose. Interestingly, and in contrast to Curry et al (2008), we observe that more impulsive participants in the inter-temporal choice experiment are not less cooperative in the public goods experiment. Therefore, our study suggests that impulsivity is in addition to voluntary cooperativeness a potential source for adaptive altruistic punishment in the field. Finally, we also find that many fishermen appear to be conditionally cooperative; i.e., they are more willing to denounce other fishermen if they believe that more other fishermen denounce (Fischbacher et al, 2001; Frey and Meier, 2004).

2. Methods

Our experiments and surveys took place with fishermen in the northeast of Brazil. We report data from 112 fishermen who all participated in two different meetings. In the first meeting, the fishermen participated in an inter-temporal choice and a public goods experiment.

In the second meeting fishermen were individually interviewed about the fishing situation and their willingness to denounce the catching of small fish. The meeting took place approximately two weeks after the laboratory experiments.

2.1 Field Measure for Adaptive Altruistic Punishment: Denouncing catching of small fish

One possible way to deter the exploitation of the fishing grounds and thus increase the chance that fishermen can survive is by punishing the catching of illegally small fish. In our field setting, a legal authority is in charge to control that fishermen comply with the legal fishing rule to not catch small fish. This rule is, however, hardly enforced, probably also because monitoring is difficult in this remote field setting and it involves high costs for the legal authority. Most fishermen do not fear controls and small fish are frequently caught.

In contrast, monitoring for the fishermen is logistically easier and because they have a better knowledge when and where small fish are caught, they could then denounce this illegal behavior to the legal authority. However, according to the fishermen such peer monitoring involves significant costs and at the same time insecure benefits. Most importantly, fishermen fear revenge by the fishermen they denounce – even if the denouncing to the legal authority was anonymous, the denounced fishermen may still have a good idea who denounced them. From the perspective of an individual fisherman, this risk may outweigh the potential benefits. Even if the denounced fisherman stops catching small fish it seems unlikely that the denouncing fisherman will be able to significantly catch more fish – there are too many other fishermen at the lake. Thus, monitoring and denouncing other fishermen shares characteristics with altruistic punishment.

During fishermen's meeting we informed the participants of the possibility to denounce someone to the legal authority for catching small fish – which was not common knowledge among the fishermen. Later at this meeting during individual interviews, we asked under which circumstances they were willing to denounce the illegal catching of small fish. There were five

response categories: (0) never, (1) if they observe another fisherman catching a lot, (2) some, (3) few, or (4) very few small fish. Fishermen could only respond to one of these categories.

In addition, we wanted to know more about their expectations about the other fishermen's willingness to denounce. We measured expectations by asking participants about their belief how many out of ten fishermen are generally willing to denounce the catching of small fish.

2.2 Laboratory Measure for Impulsivity

We chose a very simple inter-temporal choice experiment to proxy impulsivity. There is suggestive evidence that inter-temporal choice experiments are well suited to capture impulsiveness, also in comparison to psychometric tests (Alessi and Petri, 2003). In our inter-temporal choice experiment, all fishermen decided whether they prefer 1.5 Reais immediately or 3 Reais the next day (the Brazilian currency is called Real (singular) or Reais (plural). 1 Real = US $ 0.47, 3 Reais = US $ 1.41). Note that these are comparatively high stakes for the participants which generate on average a daily income of 12 Reais. If they preferred the single amount immediately, fishermen received it shortly after their decision. If they preferred the double amount the next day, we distributed vouchers with which they could collect their good the next day in the house of a village leader. The village leader was elected by the residents and is considered as an extraordinarily trustworthy person.

2.3 Laboratory Measure for Voluntary Cooperativeness

We used a public goods experiment as a proxy for voluntary cooperativeness. In this experiment, fishermen were anonymously separated in groups of four and played five periods within the same group. Each period, they could decide to contribute between zero and seven monetary units (MUs) to a public good. One MU equaled one Real. For each unit they decided to contribute, they received additionally 0.5 MUs to their endowment of 10 MUs. For each unit

they decided not to contribute, they received additionally 1 MU but also reduced the balance of each of their group members by 0.5 MUs. For each unit their group members decided not to contribute, their balance is reduced by 0.5 MUs. Thus, the fishermen's return from contributing one unit was 0.5 MUs, whereas the group return was 2 MUs. Because the return from not contributing was higher, it was always in the material interest to never contribute. The experiment was played with comparatively high stakes (fishermen earned on average 1.4 times of their daily income).

3. Results

From our 112 participants, 99 are male and they aged 18-75 years (mean = 37.45, S.D. = 12.14). The average fishermen spent 3.59 years in school (S.D. = 2.72), reported to fish for 25.05 hours per week (S.D. 13.81) and has approximately three children (mean = 3.16, S.D. 3.33).

3.1 Denouncing of Catching Small Fish: Adaptive Altruistic Punishment

The large majority of fishermen report to be willing to denounce the catching of small fish (90.17 percent, 101 out of 112). Yet, there are differences under which circumstances fishermen report to be willing to denounce: 57.14 percent report to denounce someone catching very few small fish, whereas 25.89 percent only want to denounce someone who is catching large amounts of small fish. 7.14 percent want to denounce someone who is catching few or some small fish.

3.2 Impulsivity and Voluntary Cooperativeness

In the inter-temporal choice experiment we observe that 46.64 percent of the fishermen were impulsive and preferred the single amount of money immediately (50 out of 112). The remaining 62 fishermen were less impulsive and decided to wait one day for the double amount

of money. In the public goods experiment we find that only 8.92 percent of the fishermen do not contribute to the public good in the first period. 18.75 percent contributed the maximum amount of seven MUs, 51.78 percent contributed between three and five MUs in the first period. Average contributions declined constantly over the five periods (period 1: 4.27, period 2: 4.18; period 3: 4.05, period 4: 3.76, period 5: 3.67). In the last period, 29.46 percent did not contribute and 17.86 percent contributed between three and five MUs.

3.3 Relation between Laboratory Measures for Impulsivity and Voluntary Cooperativeness

Impulsivity and voluntary cooperativeness may be both important to understand the willingness to denounce the catching of illegally small fish. The two laboratory experiments provide the possibility to derive distinct measures for both factors. We use the inter-temporal choice experiment to obtain an individual measure for impulsivity and the public goods experiment to obtain an individual measure for voluntary cooperativeness. If the participants understood that there are no inter-temporal spillovers in the public goods experiment we should observe no significant relationship between our measures for impulsivity and voluntary cooperativeness. This is confirmed by our data. There is no significant relationship between impulsivity in the inter-temporal choice experiment and cooperation in the public goods experiment. Impulsive fishermen are not less or more likely to contribute more in the first period or across all periods (Spearman Correlation, $p > .784$, two-sided). Thus, the two laboratory experiments provide us with statistically independent measures for impulsivity and voluntary cooperativeness in this setting to predict altruistic punishment in the field.

3.4 Impulsivity and Adaptive Altruistic Punishment

We now compare the behavior in the laboratory inter-temporal choice experiment to our measure of adaptive altruistic punishment, the self-reported willingness to denounce the catching of small fish. Figure 1 distinguishes between impulsive fishermen who preferred the

single amount of money immediately and those who were more patient and preferred the double amount the next day. We can see that impulsive fishermen report to be more willing to denounce the catching of small fish. For instance, 34 out of 50 impulsive compared to only 30 out of 62 patient fishermen are willing to denounce someone who catches very few small fish. In contrast, only 8 of 50 impulsive fishermen will denounce someone for catching a lot of small fish compared 21 of 62 patient fishermen. The difference in the reported willingness to denounce on the five-point scale is highly significant between the impulsive and patient fishermen (Mann-Whitney, $n_1 = 50$, $n_2 = 62$, $p = .034$, two-sided).

{INSERT FIGURE 1 ABOUT HERE}

This relationship is even more pronounced in a regression model where we control for several covariates such as the cooperativeness in the public goods experiment and the beliefs about other fishermen's denunciation behavior. In Table 1 we can see that the dummy for impulsivity (which is one if the fishermen preferred the single amount of money immediately) is significant at the 1-percent level ($p = 0.003$) and has a large impact. The coefficients are represented in marginal values to reach the highest category in the denunciation variable. This means that an impulsive fisherman is 28.2 percent more likely than a patient fisherman to report to denounce someone who catches very few small fish.

3.5 Voluntary Cooperativeness in the Laboratory and Adaptive Altruistic Punishment in the Field

In this section we investigate whether voluntary cooperativeness from fishermen in a laboratory public goods experiment predicts their reported willingness to denounce the catching of small fish. Figure 2 distinguishes between four categories of fishermen according to their contribution behavior in the first period of the public goods experiment. We observe

that fishermen who contribute more are more likely to report to denounce the catching of very few small fish. 38.46 percent of the fishermen who contribute between 0-1 points in the first period of the public goods experiment report to denounce the catching of very few small fish compared to 70.59 percent of the fishermen who contributed at least six points. The positive correlation between voluntary cooperativeness and the willingness to denounce is almost significant at the 1-percent level ($r = .24$, $p = .011$, two-sided). There is also a highly significant positive relationship between the mean cooperation behavior during all five periods and the willingness to denounce ($r = .24$, $p = .010$, two-sided) and the cooperation in the last period of the public goods experiment and the willingness to denounce ($r=.22$, $p=.019$, two-sided).

In Table 1 we observe that voluntary cooperativeness in the laboratory is also positively related to altruistic punishment tendencies in the field if we control for several covariates, including impulsivity ($z = 2.04$, $p = .042$). For each MU a fishermen contributes more in the first period of the public goods experiment, he is 5.1 percent more likely to denounce the catching of very few small fish, i.e. a fisherman who contributed seven instead of zero MUs is 35.7 percent more likely to denounce another fishermen for catching very few small fish.

{INSERT FIGURE 2 ABOUT HERE}

{INSERT TABLE 1 ABOUT HERE}

3.6 Further Determinants of Adaptive Altruistic Punishment

In the previous sections we have concentrated on the relationship between our two laboratory measures and the willingness to denounce the catching of small fish. In this section, we turn to the investigation of other variables we find to have a meaningful impact on altruistic punishment in the field. In Table 1 all significant covariates are mentioned explicitly (all covariates are mentioned in the "notes" of this table). The

results show that the expectation of the denunciation behavior of the other fishermen is significantly predicting denunciation. Fishermen who believe that more other fishermen denounce the catching of small fish are also more likely to denounce ($z = 1.92$, $p = 0.055$), an observation that is in line with conditional cooperation, i.e. the willingness to cooperate if others cooperate (Fischbacher et al, 2001; Frey and Meier, 2004).

In addition, age, marital status and fishing behavior seem to play an important role. Older fishermen ($z = 2.75$, $p = 0.006$) and married fishermen ($z = 2.10$, $p = 0.036$), report to be more willing to denounce. It is possible that older fishermen have been more exposed to the overexploitation of the fishing resources and therefore favor more denunciation. One may also speculate that married fishermen are more concerned about over-fishing because they want to secure that their offspring can live in this setting as fishermen.

Alternatively, if older and married fishermen enjoy a higher status in the fishing villages it could be that they are more likely to denounce because they can more easily afford to punish free-riders (as they may be less subject to revenge due to their status). Moreover, we observe that fishermen who report to catch a higher fraction of big fish ($z = 1.95$, $p = 0.051$) report to be more willing to denounce the catching of small fish. This finding can be explained by assuming that fishermen who catch a higher fraction of big fish are more vulnerable to being exploited and are thus more likely to denounce (Price et al, 2002).

Finally, we report that environmental education can increase the willingness to denounce the catching of small fish. Some of our fishermen took part in an environmental program with the goal to find solutions to mitigate the exploitation of the fishing grounds (Cavalcanti et al, 2010; Cavalcanti et al, 2013). We find that these participants are more likely to denounce ($z = 2.86$, $p = 0.004$). All other covariates that

we use in Table 1 (like sex, education and religiosity) are not significant on the 10-percent level.

3.7 Determinants of Non-adaptive Altruistic Punishment

So far we have shown that impulsivity and voluntary cooperativeness are significantly related to adaptive altruistic punishment. In this section we investigate whether impulsivity is also related to *non*-adaptive punishment, i.e., punishment that is dysfunctional and fails to serve a clear purpose such as the mitigation of a social dilemma. Our measure for non-adaptive punishment is the disapproval of catching "Piaba", a fish species which does not grow and is typically not sold or consumed (but often used as bait). We asked participants how they react seeing someone catching Piaba. The participants had to indicate their disapproval on a five-point scale illustrated by angry/smilie faces. Catching Piabas does not exploit fish resources per se (catching huge amounts of Piaba may endanger the Piaba stock, however; but, we are not aware of fishermen catching huge amounts of Piabas) and is not prohibited. Yet, 33.9% report to disapprove (21.4% even to strongly disapprove) the catching of Piabas (33% neither disapprove nor approve, 21.4% approve, 11.6% strongly approve).

If impulsivity has any ultimate functionality for altruistic punishment we should find no significant relationship between the laboratory impulsivity measure and the disapproval of catching Piabas. However, it seems also possible that impulsive individuals have a higher propensity to punish regardless whether the punishment serves a clear purpose. The findings suggest that the latter is not the case. We find no significant relationship between our impulsivity measure and measure for non-adaptive altruistic punishment, neither for their raw correlation ($r = -.08$, $p = .397$), and nor in a Probit model where we control for the variables used in regression table 1 ($z = -0.75$, p

= 0.455). This provides suggestive evidence that impulsivity is linked to adaptive altruistic punishment but not to non-adaptive altruistic punishment.

4. Discussion

In this study, we investigate the relationship between impulsivity, voluntary cooperativeness, and altruistic punishment in the context of fishermen who face the problem of over-fishing. We find that fishermen who are more impulsive in a laboratory inter-temporal choice task report to be more likely to denounce the catching of small fish. In addition, we observe that fishermen who are more voluntary cooperative in a laboratory public goods experiment have a higher tendency to denounce. These relationships are robust to the inclusion of covariates.

Studying altruistic punishment outside the laboratory is extremely difficult. First, it is hard to get access to individual field data on altruistic punishment. Often, like in our field setting, such data is not available or highly sensitive and we are not aware of any field study providing individual data on altruistic punishment. Second, unlike the decision environment in the laboratory, costs and benefits of punishment are not clearly determined in the field. This has to do with the fact that punishment in the field is usually embedded in an environment where repeated interactions between actors are possible. Thus, punishment can in principle serve as a costly signal and may have substantial future benefits for the punisher in which case it is unclear whether punishment is motivated by pure altruism and whether it can overcome the second order free-rider problem (Smith et al, 2005; Barclay, 2006).

To get around these problems, we asked fishermen in a survey about their willingness to denounce the catching of small fish. We believe that there is a high probability that the denunciation of catching small fish potentially entails such high costs (because of the danger of revenge) that it is unlikely to be motivated by pure self-

interest. Our belief is supported through informal discussions with local fishermen and their unwillingness to talk about actual punishment in the field. Nevertheless, it might be still possible that some fishermen gain reputational benefits for denouncing the catching of small fish. It seems in particular possible that fishermen with high status are less at the danger of revenge and thus their reputational benefits may outweigh their potential costs (and we provide some speculative evidence in this regard as the variables age and marital status which might be proxies for status are positively related to denunciation). If this was true, it could explain how the denunciation of catching small fish can evolve and therefore provide ideas about the functionality of impulsivity in this field setting.

It is important to note that the observed self-reported willingness to denounce is different from actual denunciation behavior in at least two ways. First, there are no monetary incentives for the survey participants to truthfully report their actual willingness to denounce. While we cannot exclude the possibility that the participants misrepresent their willingness, we have evidence from the same subject pool showing that the self-reported mesh size of the fishnets (a measure for voluntary cooperativeness) is very much in line with the actual mesh size of the fishnets (Fehr and Leibbrandt, 2011), thus suggesting that self-reported measures need not be biased. Second, it is possible that fishermen respond to the survey question on denunciation fast and in an unplanned manner whereas the actual denunciation may involve a goal-directed planning process. If this was true, the self-reported willingness to denounce may be more of an impulsive act than the actual denunciation. While this is a valid concern, we did not get the impression that participants took the survey question on denunciation easily and we also observed that many took considerable time to respond. Moreover, it seems equally possible, that the role of impulsiveness is even stronger in the heat of the moment when observing the actual catch of small fish.

To the extent that our results can be generalized to actual denunciation and other settings, this study provides first empirical evidence that impulsivity is an additional reason for adaptive altruistic punishment in the field. Existing research seems to have neglected to investigate the link between impulsivity and the tendency to punish altruistically. We hope that our study is a starting point to look further into the relationship between impulsivity and altruistic punishment, for example, also in light of cultural differences in punishment (Price, 2005; Henrich et al, 2006; Herrmann et al, 2008) which may also result from cultural differences in impulsivity.

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Figures

Figure 1: Impulsivity and willingness to denounce catching of small fish

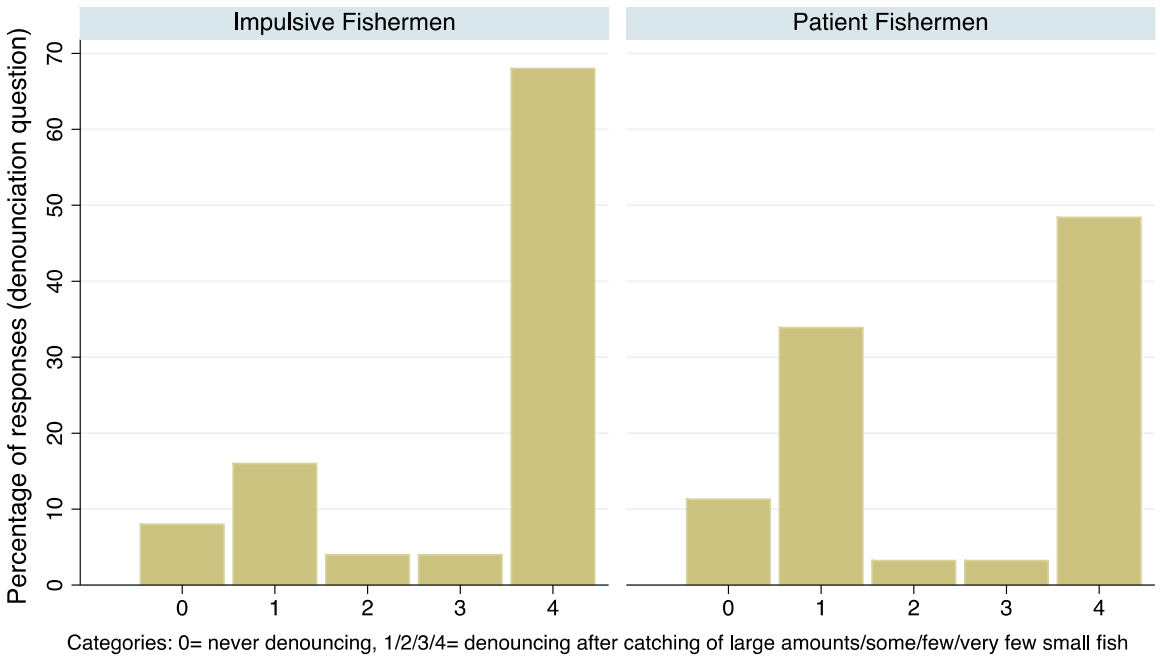
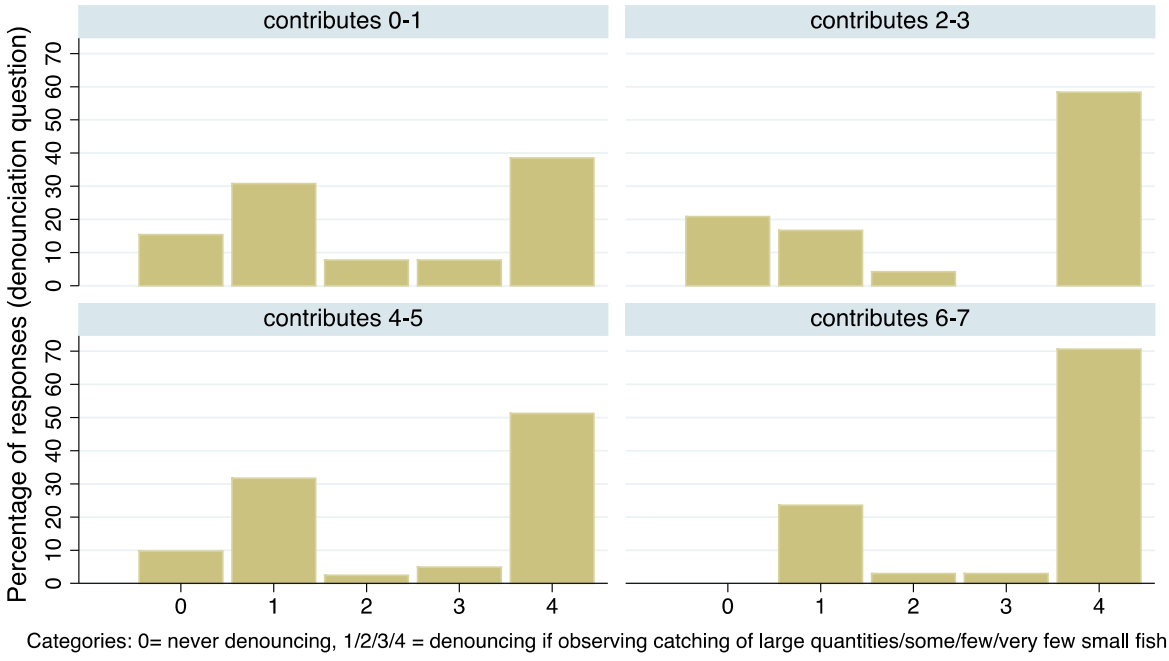


Figure 2: Voluntary cooperativeness and willingness to denounce catching of small fish



Table

TABLE 1—DETERMINANTS OF ADAPTIVE ALTRUISTIC PUNISHMENT (*OProbit)*

Dependent Variable: *Denunciation of catching of small fish*		
Controls	Yes	
	Marginal Effect	P - Value
Impulsivity Dummy	28.2%	0.003
Cooperativeness	5.1%	0.042
Expectations of Altruistic Punishment	3.2%	0.055
Age	1.3%	0.006
Marital Status (Dummy)	21.5%	0.036
Catch Composition	7.2%	0.051
Participant in Environmental Program (Dummy)	29.8%	0.004

Notes: Observations: 112. Notes: Ordered probit regression for non-parametric analysis. Marginal values indicate increase in probability to reach the highest category (denounce always catching of small fish). The coding of the dependent variable is as follows: 0 = never denouncing, 1 = denouncing after observing a fisherman catching large amounts of small fish, 2 = denouncing after observing a fisherman catching some small fish, 3 = denouncing after observing a fisherman catching few small fish, 4 = denouncing after observing a fisherman catching very few small fish. Control Variables include beliefs in the first period of the public goods game, sex, education, religiosity, weekly hours fishing, perception which mesh size of fishnet is harmful. Additional control: leader opinion about altruistic punishment. All independent variables that are not shown are insignificant (p>0.10).