

## The Perception of the Population that Captures Mussels and Barnacles at Easter on Measures of Ecosystem Conservation

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**Abstract.** The perception of the population that captures mussels (*Mytilus galloprovincialis*) and barnacles (*Pollicipes pollicipes*) on Holy Friday on the campaign launched by the Cascais city council (“At Easter the one who pays is the mussel”) to prevent the depletion of the stocks and their opinion on the need of preservation of these two species and biodiversity in intertidal area.

To evaluate it we went to the area where the campaign was launched and made a questionnaire to each family, in a total of 62 surveys.

This activity is mainly carried out by men between the ages of 30 and 60 years old. 62% of the pickers came from different areas of the council, 30% come from neighbouring councils and the other 8 % from distant places.

The results confirm that the capture is mainly done at Easter (82%). 41% of the people inquired collect mussels, 16% collect barnacles and 43% collect both species.

The majority of the pickers knows the maximum weight allowed to capture mussels but doesn't know it about barnacles and less than half of the people answer correctly about the minimum length of the mussel shell. 94% state that the capture is done to private consumption. The perception of the people about the need of conservation of both species and biodiversity in intertidal is above 70%.

As far as the campaign is concerned, people, in general, agree with it but their answers are not consensual: some said it is very good (40%) while others said that it is very bad (47%). About the reinforced surveillance done during this day by the Maritime and the City Council Police almost everybody said that it may end up with this tradition.

**Keywords.** *Mytilus galloprovincialis*, *Pollicipes*

*pollicipes*, mussel, barnacle, Holy Friday capture, conservation, biodiversity.

### 1. Introduction

#### 1.1. Species

This work is about the harvest, on Holy Friday, of two species:

- *Mytilus galloprovincialis* Lamarck, 1819, called the Mediterranean mussel,
- *Pollicipes pollicipes* (Gmelin, 1789) called pedunculated barnacle or stalked barnacle

The Mediterranean mussel *Mytilus galloprovincialis* is a bivalve which lives in Portugal in low mid-shore zone of exposed shores [1]. This specie is commonly captured in intertidal zone and is a popular dish to be cooked to family and / or friends.

In Cascais, a study on mussels found a negative correlation between the accessibility to sites and the abundance of mussels [2] and another study on the grading of human disturbance showed that the effects depend on the distance from the access point [3].

The stalked barnacle *Pollicipes pollicipes* is a crustacean that lives exposed on rocky shores. This specie is a very important economical resource on intertidal rocky shores of continental Portugal. The pressure over this resource is enormous and is aggravated with the actual financial crisis. A study done in Portugal by Sousa *et al.* (2013) [4] concluded that the higher proportion of adult barnacles was found in low shore while juveniles were relatively more abundant at mid shore.

The present maximum weight allowed to capture is (Portaria n. ° 14/2014) [5]:

- Mussels – 3 kg per person
- Barnacles – 0.5 kg per person

In the past, when the campaign was launched, it was: mussels - 2 kg and barnacles - 0,5 kg.

The rise in the quantity of capture allowed does not take into consideration the pressure that non-professional people do in intertidal area.

The minimum length of mussel shell allowed to capture is 5 cm.

There is no minimum length for barnacles. In fact, except for the marine protection areas of the Southwest coast and the Berlenga islands there is no specific legislation on barnacles. This subject has been discussed in the media in the last months.

## 1.2. Study Area

This work was developed on the Atlantic coast in Cascais, Portugal.

This is a carsic area, with very eroded platforms where the beaches are formed by dunes, sand and sedimentary rocks which allow a special environment with a very rich biodiversity including the one of the intertidal area.

The chosen local is Arriba Beach, a beach without supervision, with two areas of sand separated by a cliff. The rocky part that is exposed at low tide is populated with mussels and barnacles (Fig. 1 and 2).

The hydrodynamism is high and wave direction is mainly along N-W direction.

The surveys are done at Holy Friday 03-April-2015, between 07:30 am till 12:30 am.

The sun rise occurred at 6:46 am [6].

The low tide occurs at 08:55am height 1 m and the high tide have been at 15:15 am height 3.4 m. [6]

## 1.3. Campaign

According Christian Calendar, Easter is celebrated on the first Sunday after the first full moon of the spring's Equinox. Every Holy Friday the lunar cycle synchronism with high and low tide originates a very low tide, ideal for the capture of mussels and barnacles [7]. Happening on the day the Christians do not eat meat soon this capture became a family tradition in Cascais. During the morning many family capture lots of mussels and barnacles in a few hours. The results are a deep derangement in the intertidal ecosystem provoking a serious depletion of those two species. Since 2011 the environmental department of the Cascais city council launched a campaign named "Na Páscoa quem paga é o

Mexilhão" (At Easter the one who pays is the Mussel) [8], trying to touch everyone to the preservation of those resources, which are fundamental in the biodiversity of intertidal area.



**Figure 1. Map of Study Area signaling the local of surveys with arrow yellow. Source: Google maps (38.719367, -9.480802)**

So on the Holy Friday, from 7:00 am and during all morning, some people responsible for this campaign and some police officers go to the capture places to sensitize the pickers and subject their capture to surveillance and control. They explain the situation and given people a flyer (Fig. 3). Technical teams were also equipped with scales to weigh bags collected when in doubt.

This year, 2015, the campaign was done only in the capture places and through the local media.

With this work, we aim at understanding how

people react to this campaign and what they think about it. We want also to check if the pickers know the legislation that regulates this practice.



Figure 2. Pictures in the Holy Friday: Mussel's and barnacle's capture. Arrow yellow is the first author doing the surveys

## 2. Methodology

### 2.1. Surveys

The survey was designed and pre-tested, in a small group.

The survey targeting people capture mussels and barnacles in intertidal during the low tide (Fig. 2).

The survey had five parts:

- A. *Personal data*
- B. *Knowledge of capture habits*

C. *Knowledge of the activity (legal aspects)*

D. *Perception about the preservation of resources*

E. *Evaluation of the campaign "At Easter who pays is the mussel"*



Figure 3. Campaign flyer "At Easter who pays is the mussel"

The personal data included gender, age and address.

The knowledge of capture included four different aspects: habits of capture, i.e. which specie or species they capture, if capture was done by hand or with the help of an instrument, the frequency of captures and the final destination of captures.

The knowledge of the activity (legal aspects) included the maximum weight allowed to capture:

- Mussels – 3 kg per person
- Barnacles – 0.5kg per person,

and the minimum length of mussel shell allowed which is 5 cm.

In past when campaign was established the level of mussels were 2 kg and barnacles 0,5 kg.

To know their perception about the preservation of resources we asked them to scale between 1 and 5, according to the Likert scale (psychometric scale) the need of preservation of mussels, barnacles and intertidal area.

To evaluate the campaign “At Easter the one who pays is the mussel” we also used the Likert scale and asked them if the inspection methods were adequate, if they agreed with the campaign and if the information provided by the people responsible for the campaign was good.

The results of the survey were introduced in the LimeSurvey programme to facilitate their understanding.

**2.2. Statistical treatment**

SPSS software (IBM SPSS Statistics V21) was used for the statistics methodology, with a 0.05 value of significance.

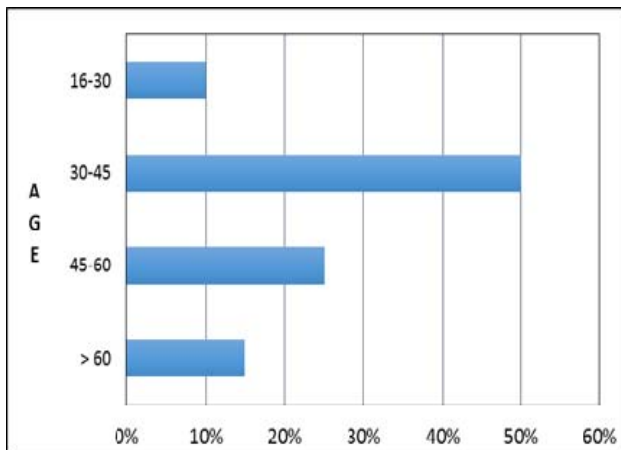
**3. Results**

We did 62 surveys on the Holy Friday in the study area during the low tide in the morning. The low tide was at 08:55 a.m.

**3.1. Personal Data**

The treatment of the surveys gives us a universe of 78% males and 22% females.

The age of pickers can be seen in Fig.4.



**Figure 4. Age of people inquired**

62% of the pickers come from different areas of the council (Cascais), 30% come from neighbouring councils (Oeiras and Sintra) and the other 8 % from distant places.

**3.2. Knowledge capture habits**

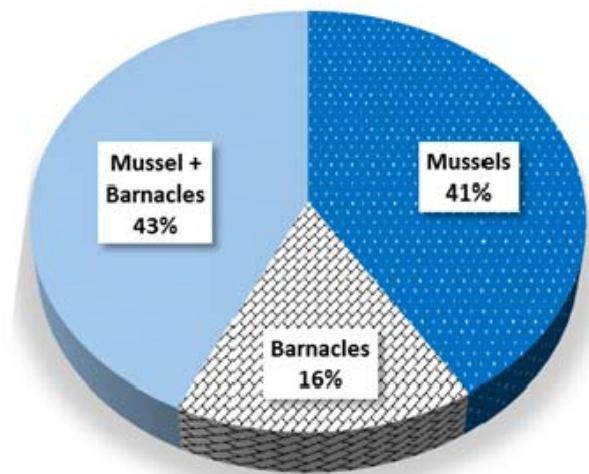
41% of the people inquired collect mussels, 16% collect barnacles and 43% collect both species (Fig. 5).

The answers demonstrated that 57% only use the hands and 43% use some instrument

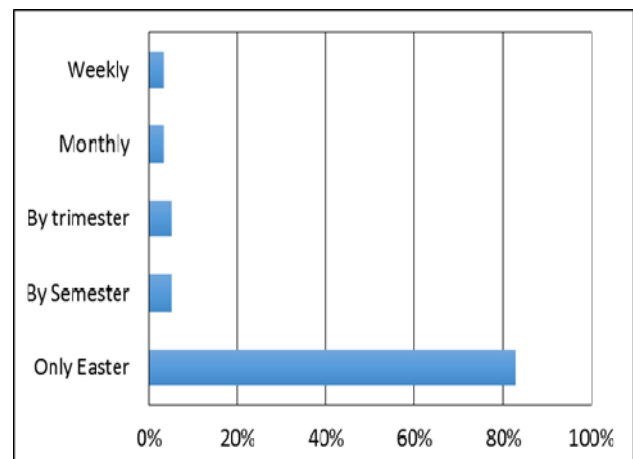
to collect the bivalves. Most of the instruments used are knives (56%), spatulas (28%) and other different instruments (16%).

Most of the people inquired say that they only pick up mussels and barnacles on the Holy Friday (Fig. 6).

The destination of the capture is said to be mainly eaten at home with family and friends (96.6%), while only 3.45% reveals that sell it.



**Figure 5. Captures ‘type**



**Figure 6. Captures frequency**

**3.3. Knowledge of the activity (legal aspects)**

To understand the pickers’ knowledge of legal aspects of the activity several questions were asked.

The percentage of people who know the maximum weight allowed to capture was:

- Mussels – 67%

- Barnacles – 48%

As far as the existence of a minimum length of mussel shell is concerned, only 47% know that there is one and of these only 27% know the correct length.

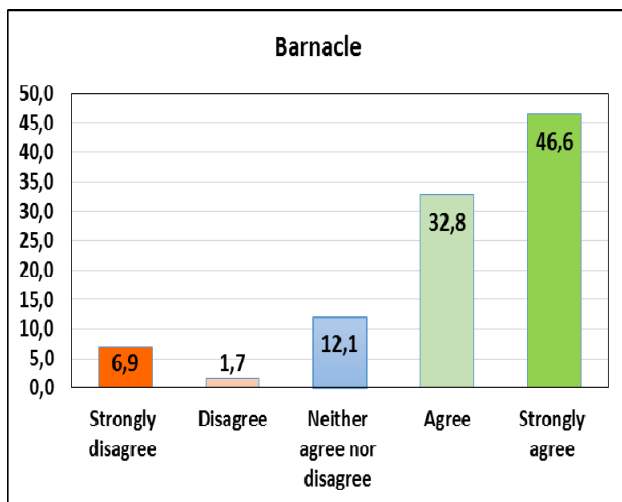
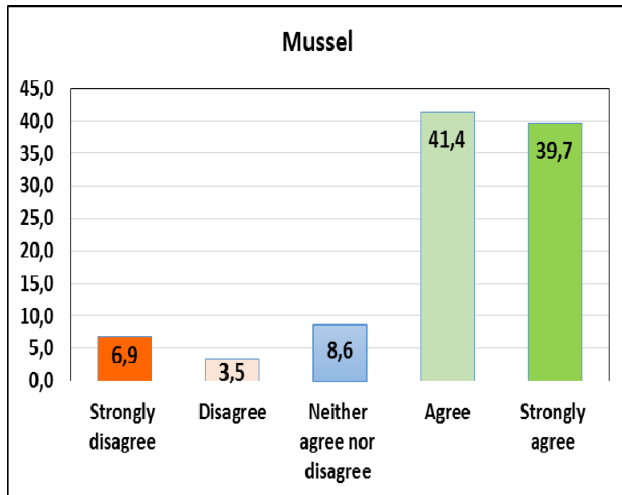


Figure 7. Preservation of species' population

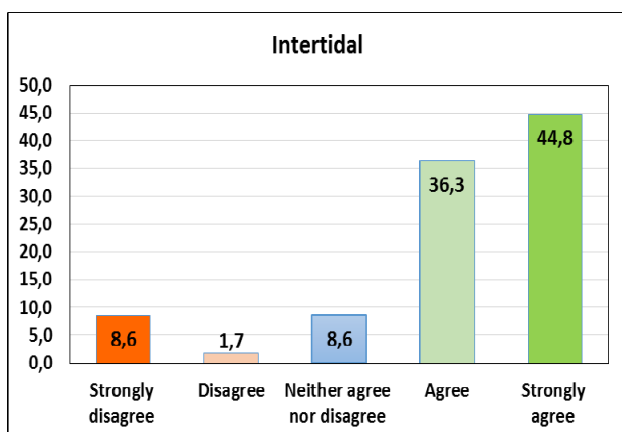


Figure 8. Preservation of intertidal area

### 3.4. Perception about preservation of the resources

The results of inquiry about the need of preservation of mussels and barnacles can be seen in Fig. 7.

Results about the need of preservation of intertidal area can be seen in Fig. 8.

### 3.5. Evaluation of campaign "At Easter the one who pays is the mussel"

It was inquired if they agree with this campaign "At Easter the one who pays is the mussel". The results can be seen in Fig. 9.

Was also asked them how would classify the information provided by the people responsible for the campaign in the captures places. The answer can be seen in Fig 10.

When we asked this question most of the people answered that the information provided by the technicians was very bad but we realized that these people were afraid of legal aspects, namely being fined, and avoided those technicians.

When we asked if they agreed with the surveillance done during this day by the Maritime and the City Council Police the answers were not consensual (Fig.11).

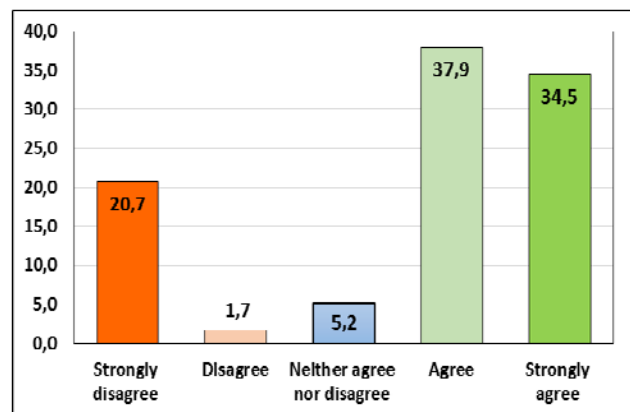
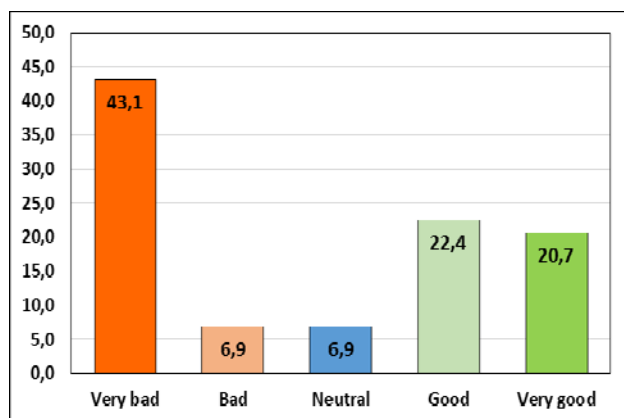


Figure 9. Agreement with campaign

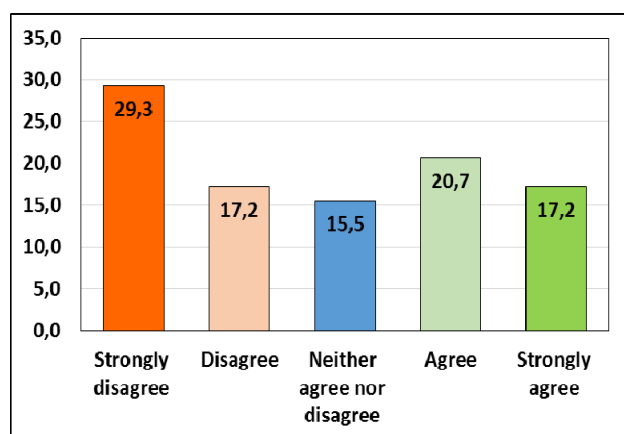
Most of the people inquired strongly disagree with the actions taken by the Maritime police and the agents of campaign in the capture places.

When they were asked to give their personal opinion on the subject, most of them said that they agree with police actions but not on the Holy Friday because it is a tradition and must

be preserved. A lot of them even said that they agree with police actions and they must be increased on the rest of the time to preserve the animals in the area.



**Figure 10. Opinion about personal information**



**Figure 11. Opinion about control campaign**

#### 4. Discussion

According to another study done in the same council, it was verified that the long-term effects of the awareness campaign seem to have a positive trend on the average length of individuals (Ferreira *et al.*, 2013) [7]. This study did not evaluate this aspect but the authors realized that people capture primarily in the areas where mussels are bigger.

We also observed that some people chose areas with bigger mussels but ended up by removing all the mussels in the area, including the smaller ones, which then throw away. The same was observed by Rius and Cabral (2004) [2], in a study in an adjacent area.

We believe that to increase the general public environmental awareness in order to change their behaviour towards this specific tradition on Holy Friday, more campaigns

should be launched and the way the information is provided should be more diversified. One way of doing this could be through the students of the area by doing some activities with them.

The perception of the population that captures mussels (*Mytilus galloprovincialis*) and barnacles (*Pollicipes pollicipes*) on Holy Friday about the damage of this activity is ambiguous. On the one hand, they agree that both species and the intertidal area must be preserved but on the other hand, they think that this tradition must continue and the reinforced surveillance on this day is wrong.

A study done by Lorena *et al.* (2014) [9], in NW Atlantic coast supports the notion that intertidal mussels are important ecosystem engineers that sustain a rich diversity of invertebrates. Mussels provide food, space, and shelter for their associated community and so their loss due to anthropogenic impacts is problematic and may provide insight into cascading effects on associated species (Smith *et al.*, 2008)[10].

Borthagaray and Carranza (2007) [11], have already stated that the richness of all macro-faunal groups was positively correlated with mussel abundance. O'Connor and Crowe (2007) [12], referred that differences in mussel size structure may affect the diversity of assemblages associated with mussel beds. This may happen because their capture occurs mainly in areas with large mussels. So the preservation of mussel beds is very important.

#### 5. Conclusion

We believe that to increase the general public environmental awareness in order to change their behaviour towards this specific tradition on Holy Friday, more campaigns should be launched and the way the information is provided should be more diversified.

It is common knowledge that to modify attitudes a change in mind is required and that it is not easy especially in cases like this one. The ancient tradition somehow justifies the maintenance of the old habit and it becomes more difficult for people in general to assume the necessity of setting a limit to the capture as the legal regulation demands. So we believe that to increase the desirable change, the

involvement of young people such as students as a new target in this matter is required and it may be possible by doing some activities with them on this issue. The maintenance of the campaign and the involvement of students may settle the change on general public.

## 6. Acknowledgements

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