LIMPET (Patella spp.) (MOLLUSCA: GASTROPODA) EXPLOITATION IN THE AZORES, DURING THE PERIOD 1993-1998

ROGÉRIO R. FERRAZ, GUI M. MENEZES & RICARDO S. SANTOS


In 1993 the Regional Government of the Azores published a new law in order to regulate limpet harvest in the Azores. Six years after the implementation of this law, the effect on the population was analysed, using the limpet capture diaries filed by the harvesters. In this study we analyse the catch per unit of effort (CPUE) in g/min and give the variability and evolution of the captures in each island. The main conclusions of this study are that the populations appear to have recovered and are stable with regard to their biomass. These results suggest that their exploitation in Central (Faial, São Jorge, Pico, Terceira, and Graciosa) and Western groups (Flores and Corvo) should be allowed as long as the implemented measures are followed. On the other hand, the limpet populations in the Eastern group (Santa Maria and São Miguel Islands) seem to be dangerously low. The implemented rules are believed to have helped the recovery of the limpet population in the Central group. For this reason, we believe that it is necessary to improve the efficiency of the legislation by an active reinforcement by the local authorities as well as by giving relevant information to the general public.

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INTRODUCTION

The exploitation of limpets in the Azores has probably been taken place since human colonisation of the islands in the 15th century. Until the 1980’s the limpet harvest in the Azores was moderate. The limpets were mainly gathered for self-consumption or for door to door bartering. The two co-occurring species (Patella ulyssiponensis aspera Röding, 1792 – “Lapa brava”, Patella candei d’Orbigny, 1840 – “Lapa mansa”) were both harvested, and much appreciated by the local population as an important source protein in some villages (see CORTE-REAL et al. 1992 & 1996 for details on taxonomy). Since no records exist for the few transactions that were made, it is impossible to obtain statistical data prior to 1980 (MARTINS et al. 1987).

With access to snorkelling and scuba diving activities in the 1980’s the exploitation of limpets increased drastically. This fact, together with an improvement in refrigeration methods, increased the commercial value and lead to a decline of the stocks, mainly in the Central group (Faial, Pico, Terceira, São Jorge, and Graciosa) during 1983-84. In these islands, the decline was at the time associated with a hypothetical “limpet disease” with unknown causes. In 1985, harvesting of limpets was banned in the central group (SANTOS et al. 1990; MENEZES 1994). This measure, however, increased the exploitation in the other islands, mainly in São Miguel and Santa Maria (Eastern group), which lead to a disruption of the stock. In an effort to save the stocks, a law was approved in 1989, which prohibited all limpet harvest in the Azores. However, in September 1990, non-commercial catch quotas were established for the Western group (Flores and Corvo) (MENEZES et al. 1991).
In 1993, it became evident that the adopted measures were not sufficient to control illegal captures. The limpet price on the "black-market" rose and the number of harvesters increased. For this reason, the Regional Directorate of Fisheries (DRP) in collaboration with the Department of Oceanography and Fisheries (DOP) made contacts with harvesters in order to draft a law that would allow a sustainable harvest and management of the limpet resource. The resulting legislation was published in July 1993.

The following measures were taken:
1. Harvesters have to obtain a license, and declare all the catches by maintaining a capture logbook - limpet capture diaries;
2. A closed season was implemented from October 1 to May 31;
3. A minimum landing size was imposed for both species: 55 mm for *Patella ulissiponensis aspera* and 30 mm for the *P. candei*;
4. Several reserves and zones with regulated harvesting were created on each island;
5. Since 1996 the DRP has only issued licences to harvesters who declared catches in the previous year.

The aim of this paper is to analyse the results obtained by the implementation of the 1993 law, to suggest modifications that should lead to a sustainable management of this resource in the Azores.

**METHODS**

The analysis is based on data from the individual "limpet capture diaries", which are filled in by each harvester every time they sell catches at the official auction (*LOTACOR* - Azorean market services). In each diary entrance, besides the total weight of each species, the identification of the harvester, date, locality and method of capture, effort (time), and the environmental conditions are registered. These diaries are sent to DOP every month where the data are introduced into a Microsoft Excel computer database.

In this study we analyse the catches per unit effort (CPUE) variations and the evolution of the captures in each island. The percentage of captures of each species is calculated based on the total landings of this period. The CPUE (in g/min) were calculated for each individual catch (dividing the capture weight - g, by the effort - minutes).

**RESULTS**

The number of limpet capture diaries received each month at DOP is presented in Table 1. After 1996 the number of diaries submitted increased substantially.

**LANDINGS**

Ninety three percent of the total weight of catches belong to the species *P. u. aspera* the remaining 7% belong to the species *P. candei*.

The total landings declared during 1993 was very low (37 kg) with only 3 landings recorded for that year (Fig. 1). In the following year the total landings increased to 1,734 kg. In 1995 there was a decline, but from 1996 to 1998 the landings increased every year. The highest volume of landings since the implementation of the 1993 law, was recorded in 1998 (6.187 kg).

**Table 1**

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<td>37</td>
<td>25</td>
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<td>27</td>
<td>59</td>
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<td>23</td>
<td>30</td>
<td>75</td>
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<tr>
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<td>28</td>
<td>3</td>
<td>12</td>
<td>71</td>
<td>47</td>
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<td>Total</td>
<td>3</td>
<td>147</td>
<td>90</td>
<td>126</td>
<td>352</td>
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Fig. 1. Total landings (in kg) recorded for all islands of the Azores from 1993 to 1998.

For all years the landings are highest at the beginning of the open season, in June and July, after which they start to decrease (Fig. 2).

Terceira is the only island with landings declared for the whole 6 year period (Fig. 3). In Pico the landings increased every year from 1994 to 1998 and this island presents the highest total landing weights in the archipelago. In Faial and São Jorge the landings have increased almost every year and in 1998 they reached 394 and 914 kg, respectively. The others 3 islands showed very low landings. In 1998, Pico landings (4,229 kg) represent about 70% of the total landings in the archipelago in this year.

Only 32 out of 54 possible zones of exploitation have been effectively exploited (Fig. 4). The results show that only in Pico and São Jorge all possible zones of exploitation were effectively exploited. Zones 24 and 25 in Terceira, and 10, 14, 15 and 16 in Pico correspond to the regions were the harvesters declared the highest limpet catch. In the remaining zones the declared catches were less than 200 kg/year. In the archipelago the most exploited zone during this period, is zone number 16 (in Pico) with a total catch of 2,225 kg.

Catches per unit effort (CPUE in g/min)

The mean capture per unit effort (CPUE in g/min) increased from 1993 to 1994, and decreased in 1995 (Fig. 5). After 1995, the mean CPUE increased annually and in 1998 the highest effort was recorded (144.94 g/min).

The CPUE differs from island to island (Fig. 6). Santa Maria and Faial islands have the lowest CPUE, 42.4 and 81.5 g/min., respectively. Graciosa (153.6 g/min.), Pico (155.9 g/min.) and São Jorge (150.1 g/min.) presents the highest CPUE values.
DISCUSSION

The majority of limpets were harvested in the Central group mainly on Pico and Terceira islands. On São Jorge and Faial the harvests were lower but showed an increasing trend. The catches declared from Santa Maria, Graciosa and Flores islands were sporadic. This is probably due to the fact that these three islands are less populated and the few registered harvesters probably sell their catches to their neighbours. From Corvo and São Miguel islands no catches were recorded in this period. These variations seem to be related to different factors (e.g. low stock levels in Santa Maria and São Miguel).

The preliminary results from a biomass survey in progress at DOP show that on islands most affected by the stock decline in the mid 1980s (Pico and Faial) the limpet populations have recovered (FERRAZ et al. 1999). On the other hand, on Santa Maria where the stock was over-exploited, the population has been depleted. In general, the Central group populations have recovered from the mortality that affected them in the 1980's and commercial exploitation is now possible. The Eastern group has not recovered from over-exploitation and as a preventive measure the exploitation should be stopped or at least reduced.

The substantial increase of landings in 1997 and 1998 appear to be connected with the licence issuing policy implemented by the DRP after 1996. Several harvesters who had licences since the beginning of the present legislation (1993)
Fig. 4 (continued). The total limpets catches declared for each exploited zone in central group of islands, from 1993 to 1998. Inside each circle are the total landings (in kg) declared for that zone.
Fig. 5. Mean captures per unit of effort (CPUE in g/min) during the period 1993-1998. SD - Standard deviation; SE - Standard error.

Fig. 6. Mean captures per unit of effort (CPUE in g/min) for each island from 1993 to 1998. SD - Standard deviation; SE - Standard error.

only started to declare their catches after 1996. We believe that this measure has helped to prevent some of the illegal catches recorded by FERRAZ (1998).

The implemented rules (1993 law) are believed to have helped the growth of the limpet population in the Central group. However, they have not been so successful in the Eastern group. For this reason it is necessary to improve current legislation and promote active enforcement by the local authorities as well as increase public awareness and information on this issue.

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