

SHRIMPS OF THE FAMILIES PANDALIDAE AND HIPPOLYTIDAE (CRUSTACEA: DECAPODA) CAUGHT IN BENTHIC TRAPS OFF THE AZORES

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ARQUIPÉLAGO



MARTINS, H.R. & P.M. HARGREAVES 1991. Shrimps of the families Pandalidae and Hippolytidae (Crustacea: Decapoda) caught in benthic traps off the Azores. - *Arquipélago*. Life and Earth Sciences 9:47-61. Angra do Heroísmo. ISSN 0870-6581.

A trial fishery with benthic traps set around 6 islands in the Azores archipelago at depths from 18 to 864 m, caught 4 species of pandalid shrimps: *Plesionika narval* (Fabricius, 1787), *P. edwardsii* (Brandt, 1851), *P. martia* (A. Milne Edwards, 1883) and *P. gigliolii* (Senna, 1903). Of these, the latter three had not been recorded previously from the Azores. Two hippolytid species were also captured, *Ligur ensiferus* (Risso, 1816) a new record, and a new species of *Lysmata*, described by FRANSEN (1991). The most abundant species was *P. narval* followed by *P. edwardsii*. Length frequency distributions for *P. narval*, *P. edwardsii* and *Ligur ensiferus* are given, as well as length/weight relationships.

MARTINS, H.R. & P.M. HARGREAVES 1991. Camarões das Famílias Pandalidae e Hippolytidae capturadas, com covos, nos Açores. - *Arquipélago*. Ciências da Natureza 9:47-61. Angra do Heroísmo. ISSN 0870-6581.

No decurso de uma pesca experimental, com covos, realizada em 6 ilhas dos Açores, a profundidades de 18 a 864 m, foram capturadas 4 espécies de camarões pandalídeos: *Plesionika narval* (Fabricius, 1787), *P. edwardsii* (Brandt, 1851), *P. martia* (A. Milne Edwards, 1883) and *P. gigliolii* (Senna, 1903).

As últimas três destas espécies não tinham sido referidas para os Açores. Foram também capturadas 2 espécies de hippolytídeos: *Ligur ensiferus* (Risso, 1816) um novo registo para a Região, e uma nova espécie de *Lysmata*, descrita por FRANSEN (1991). As espécies mais abundantes foram *P. narval* seguida de *P. edwardsii*. Distribuições de frequências de comprimentos de *P. narval*, *P. edwardsii* e *Ligur ensiferus* são fornecidas, bem como as relações comprimento-peso.

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INTRODUCTION

Previous investigations of the decapod population close to the Azores (FOXTON 1972, FASHAM & FOXTON 1979, HARGREAVES 1985) have been concerned with the pelagic population of decapods. However, relatively little is known about the benthic-pelagic and benthic decapod populations of the steeply sloping shelves of the islands.

In 1988 and 1989 the Secretariat of Agriculture and Fisheries of the Regional Government of the Azores carried out a trial fishery programme using bottom traps to investigate the occurrence of shrimps over steep slopes off the various islands of the Azores Archipelago.

A part of this material was made available to us for a more detailed analysis.

The aim of this paper is to give a preliminary account of the species found in the traps and to present data on their geographical and vertical distribution, as well as giving information on size and weight of the different species.

For more detailed geographical distribution of the species outside the Macaronesian islands see ZARIQUIEY ALVAREZ (1968), CROSNIER & FOREST (1973) and HOLTHUIS (1980).

MATERIAL AND METHODS

The type of trap deployed is shown in Fig. 1,

salted mackerel having been used for bait. The fishing trials were carried out from the tuna fishings vessels, M/V "Patrão Pedro" (1988) and M/V "Pérola do Faial" (1989), (overall lengths 31 and 19m respectively). "Patrão Pedro" placed traps on the sea-floor at 20 locations (denoted as stations in this paper) close to the islands of Faial, Pico, Terceira, S. Jorge and S. Miguel. At each location up to 14 strings of traps were set, each string contained 3 traps. (Fig.2). The positions and depths of the stations are given in Tables 1 and 2. The locations fished by the "Patrão Pedro" are marked with circles and by "Pérola do Faial" with squares (Figs. 3 and 4). Because of the steep slopes of the islands, the depths vary considerably within the same location. However, the depth of each string has been recorded. Overall, these depths varied from 18 to 864 m. The traps remained in the water during night for 7 - 10 hours and samples were labelled with the date of the haul.

Of the 20 "Patrão Pedro" stations, shrimps were caught at 17 and subsamples for more detailed study were obtained from 13 of these. "Pérola do Faial" samples were obtained from 4

stations (nos. 21-24), close to Graciosa and Pico. From Folga, Graciosa we obtained three complete samples from 3 strings of traps (3x3 traps) from depths of 72, 90 and 108 m (40, 50 and 60 fathoms) and from Ribeiras, Pico, two complete samples (2x3 traps) from 126 and 335 m (70 and 186 fathoms). The samples were deep frozen initially and later, after thawing, measured and weighed.

Measurements taken with vernier calipers to the nearest mm were as follows: Carapace length (CL), measured from the base of the eyestalk to the posterior mid-dorsal margin of the carapace; Body length (Lb), measured from the base of the eye stalk to the posterior tip of the telson; Rostrum length (Lr) measured from the tip of the rostrum to the base of the eye stalk. The total weight of each shrimp as recorded using a Mettler PM 4600 scale with an accuracy of 0.01g.

Length distribution data is based on combined sexes. However, non-ovigerous and ovigerous individuals were separated to establish length/weight relationships.

Length/weight relationships were calculated

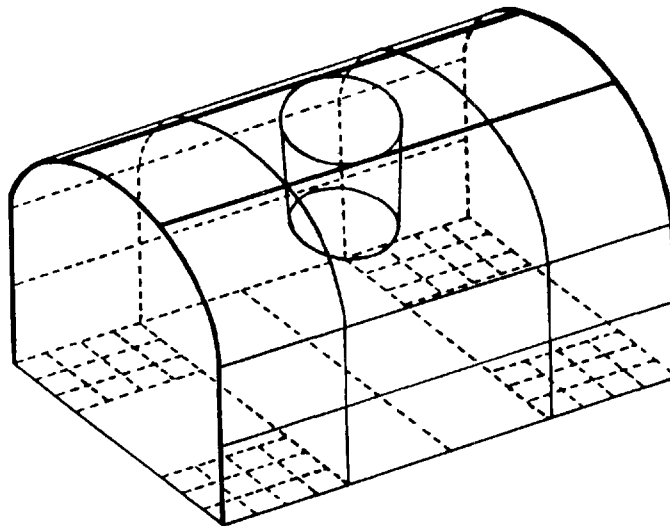


Fig. 1. Iron framework of trap used in trial fishery. Length: 90 cm; width: 50 cm; height: 49.5 cm.

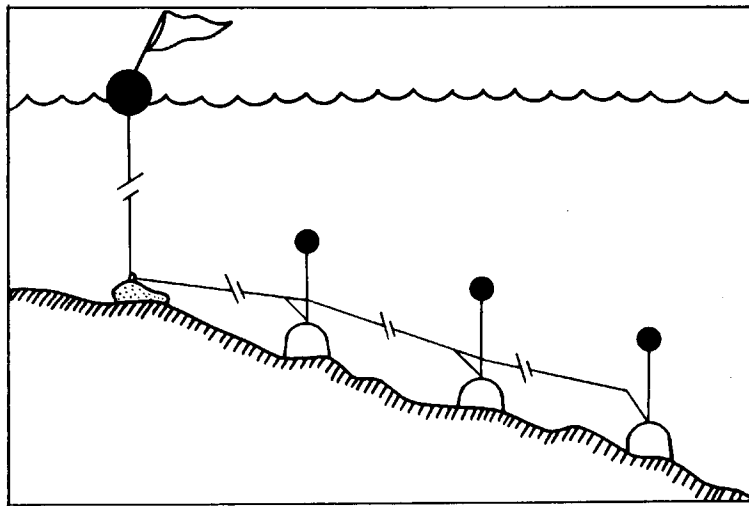


Fig. 2. Arrangement of traps in a string. Not in scale.

Table 1. Positions and depths of M/V "Patrão Pedro" trap stations 1988

Station no.	Locality	Date	Latitude (N) mean	Longitude (W) mean	Depth (m)
1	Castelo Branco, Faial	27.01	38° 30' 30"	28° 41' 11"	110-200
2	Ribeirinha, Faial	28.01	38° 35' 10"	28° 30' 23"	110-145
3	Salão, Faial	28.01	38° 37' 30"	28° 39' 10"	-----
4	Ribeiras, Pico	2.02	38° 24' 20"	28° 08' 00"	100-180
5	Ribeiras, Pico	4.02	38° 22' 30"	28° 10' 00"	120-180
6	Ribeiras, Pico	5.02	38° 24' 20"	28° 08' 00"	120-365
7	Vila Franca, S.Miguel	6.02	37° 41' 50"	25° 25' 30"	90-165
8	Ponta da Ilha, Pico	7.02	38° 25' 00"	27° 59' 10"	120-180
9	Caís do Pico, Pico	9.02	38° 30' 20"	28° 15' 05"	110-180
10	Ribeiras, Pico	10.02	38° 22' 45"	28° 12' 00"	110-180
11	Baía de Canas, Pico	11.02	38° 27' 30"	28° 07' 00"	90-455
12	Baía da Raia, S.Jorge	18.02	38° 41' 30"	28° 15' 30"	145-455
13	Velas, S.Jorge	18.02	38° 40' 10"	28° 12' 40"	90-365
14	Feteira, Faial	19.02	38° 30' 40"	28° 41' 00"	130-255
15	Varadouro, Faial	19.02	38° 32' 50"	28° 45' 55"	145-220
16	Barreira Branca, S.Miguel	25.02	37° 41' 20"	25° 30' 55"	155-230
17	Furnas de Fora, S.Miguel	26.02	37° 43' 25"	25° 48' 30"	75-550
18	Off Angra, Terceira	4.03	38° 37' 30"	27° 13' 50"	220-550
19	Ponta de S.Mateus, Terceira	5.03	38° 39' 00"	27° 17' 30"	275-400
20	Fajã Grande, S.Jorge	7.03	38° 41' 50"	28° 11' 10"	65-365

Table 2. Positions and depth of M/V "Pérola do Faial" trap stations 1989

Station no.	Locality	Date	Latitude (N)	Longitude (W)	Depth (m)
21	Folga, Graciosa	7.11	39° 00' 25"	27° 59' 62"	79-198
22	Folga, Graciosa	10.11	39° 00' 18"	27° 59' 92"	54-108
23	Ribeiras, Pico	23.11	38° 24' 30"	28° 08' 15"	18-335
24	Ribeiras, Pico	24.11	38° 24' 18"	28° 07' 50"	144-864

from frozen material. There has been no correction for weightloss.

For calculating regressions and for graphics the Statgraphics program (version 2.6) was used (Statistical Graphics System by Statistical Graphics Corporation; STSC, Inc. 2115 East Jefferson Street, Rockville, Maryland 20852 U.S.A.).

RESULTS

The material contained six species of decapod shrimps. Of these, four belonged to the family Pandalidae and two to the family Hippolytidae. The stations at which the different species were captured are shown in Figs. 3 and 4.

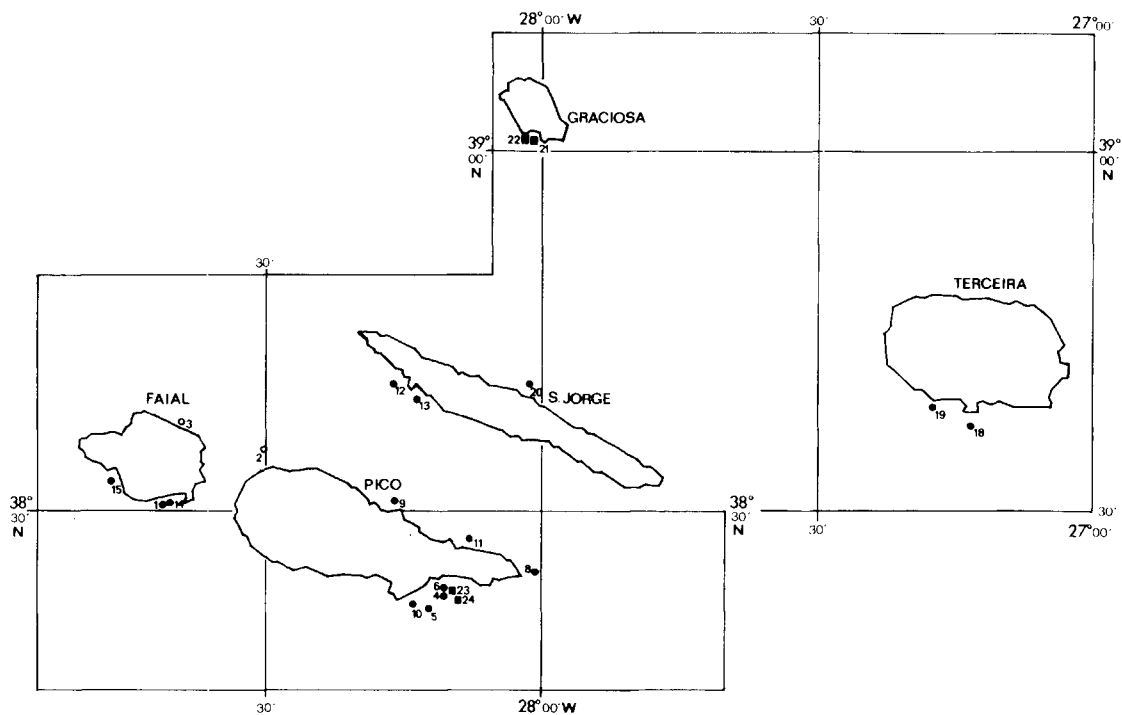


Fig. 3. Map of the Central Group of islands. Circles: "Patrão Pedro" stations; quadrats: "Pérola do Faial" stations.

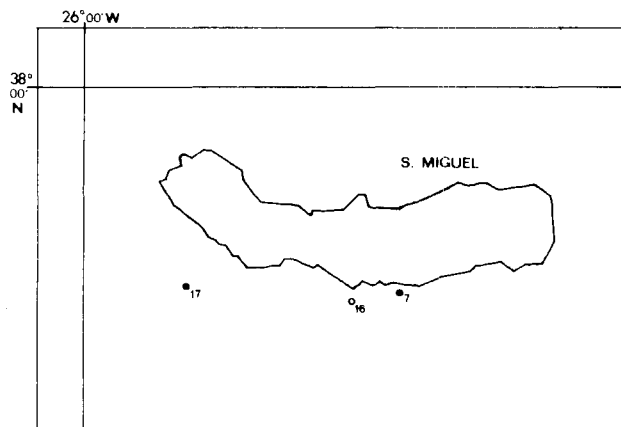


Fig. 4. Stations at S. Miguel island; legend as for Fig. 3.

Pandalidae

Plesionika narval (Fabricius, 1787)

P. narval has commonly been referred to the genus *Parapandalus* Borradaile, 1899. However, CHACE (1985), showed this genus to be a synonym of *Plesionika* Bate, 1888.

This species occurred at all the stations yielding decapod shrimps (Table 3) and was the most abundant Pandalid sampled. Even so, it has been reported from the Azores only once, as *Parapandalus narval* by Figueira (1960) whose material consisted of 4 specimens from the island of Pico.

P. narval has also been observed in thousands by divers in a cave at a depth of 37 m at Monte da Guia, Faial, (Peter Wirtz, personal communication).

Table 3. Occurrence of the species at different stations (*P.n.* = *Plesionika narval*; *P.e.* = *P. edwardsii*; *P.m.* = *P. martia*; *P.g.* = *P. gigliolii*; *L.e.* = *Ligur ensiferus*)

Station no.	Total (kg)	<i>P.n.</i>	<i>P.e.</i>	<i>P.m.</i>	<i>P.g.</i>	<i>L.e.</i>
1	3.4	x	x			
2	0		-		-	-
3	0	-	-	-	-	-
4	11	x	x			x
5	13	x	x			
6	12	x	x	x	x	x
7	5	x	x			
8	1.5	x	x			
9	1	x	x			x
10	1	x	x			x
11	0.3	x	x			x
12	0.5	x	x			
13	0.5	x				
14	0.6	x	x			
15	0.4	x				
16	0	-	-	-	-	-
17	0.3	x				
18	0.3	x				
19	0.8	x	x			x
20	1.5	x	x			x
21	20	x	x			
22	18	x				
23	5	x	x			x
24	6	x	x	x	x	x

Length frequencies of pooled data from Jan.-Feb. 1988 are shown in Fig. 5 and the length/weight relationships in Fig.10. Of 437 specimens measured from the pooled samples only 6 (0.7%) were ovigerous. The latter had carapace lengths from 16-19 mm. Length frequency distributions of complete samples from three strings off Graciosa at 72, 90 and 108 m respectively, are shown in Figs. 6 a, b, c and from off Ribeiras, Pico of complete samples from two strings at 126 and 335 m respectively in Figs. 7 and 8. Length frequency distribution of ovigerous females in the Graciosa samples are pooled in Fig. 6d, and the two samples from Ribeiras, Pico in Fig. 9. Length/weight relationships of non-ovigerous specimens in the Graciosa samples at 72, 90 and 108 m respectively are shown in Figs.11 a, b, c, and of ovigerous specimens in Fig. 12 a, b, c. With regard to the samples from Ribeiras, Pico, weight/length relationships for non-ovigerous and ovigerous specimens at 126 m are given in Figs. 13a and 14a respectively, and at 335 m in Figs 13b and 14b. The length/weight relationship equations for all samples are given in Table 4.

Although our material is from depths between 18 and 450 m, ovigerous females were only found at depths from 72 -180 m with exception of one sample from Ribeiras, Pico where they occurred at 335 m. The size at which females are ovigerous is between 12 and 19 mm (CL).

Distribution. *P. narval* is an Eastern Atlantic species (Mediterranean to Angola) and occurs in all Macaronesian Islands. Earliest records from the Canary islands were by BALSS (1925) and HOLTHUIS (1949) and from Madeira by FIGUEIRA (1957). In Madeira and the Canaries it supports small local fisheries. It was caught in Cape Verde Islands by the CANCAP expeditions (C.H.J.M. Fransen, pers. commn.).

Plesionika edwardsii (Brandt, 1851)

This species is the second most abundant after *P. narval*. It occurred at 16 of the 24 stations.

Length frequency distributions derived from pooled totals, non-ovigerous and ovigerous specimens from January and February 1988

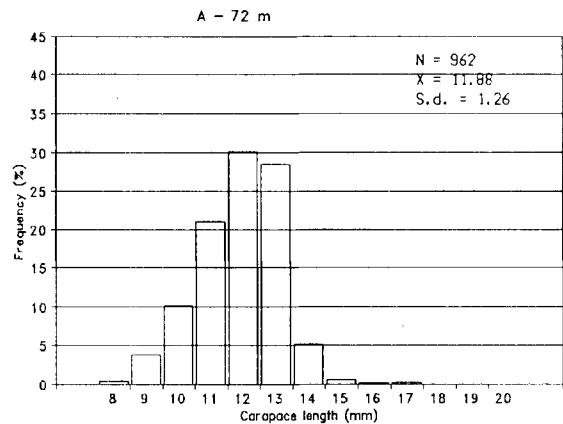
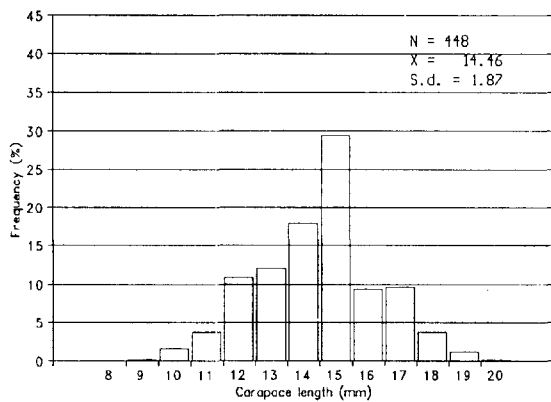


Fig. 5. *P. narval*. Length frequency distribution of pooled specimens from January and February 1988. All specimens.

samples are shown in Figs. 15 a, b, and c respectively.

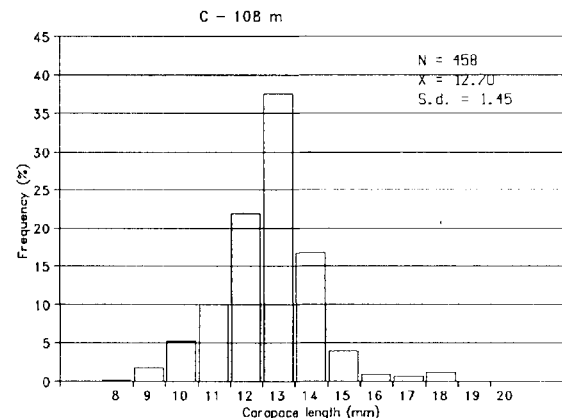
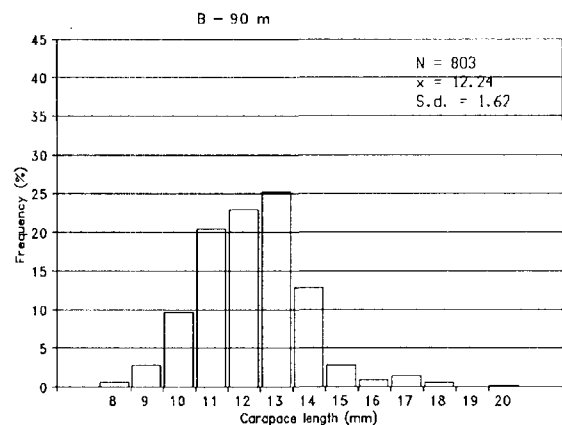
Length/weight relationships of pooled data from non-ovigerous and ovigerous individuals are shown in Figs. 16 a and b respectively, and the equations are given in Table 4.

P. edwardsii was collected at depths from 54 to 360 m, with ovigerous females from 90 to 360m. Sizes of the latter ranged from 20 to 29mm (CL), (see Fig. 15c). This is the first record of *P. edwardsii* from the Azores.

Distribution. This species occurs both in the Western and Eastern Atlantic (Mediterranean to Sierra Leone) It is also reported from the Pacific, from the Philippines and in Indonesian waters (CHACE 1985). It was first recorded from the Canary islands by GARCIA CABRERA (1970) and SANTAELLA (1973). Only recently has it been found at Madeira (BISCOITO, in press). The CANCAP expeditions caught *P. edwardsii* off Cape Verde islands (C.H.J.M. Franssen, pers. comm.).

Plesionika martia (Milne Edwards, 1883)

Only 10 specimens were captured, all in the same area (off Ribeiras, Pico), on two different occasions (Table 3), from 360-864 m depth. They varied in size from 12 to 19 mm carapace



Figs. 6a, b, c. *P. narval*. Length frequency distributions of specimens from 72, 90 and 108 m respectively, off Graciosa. All specimens.

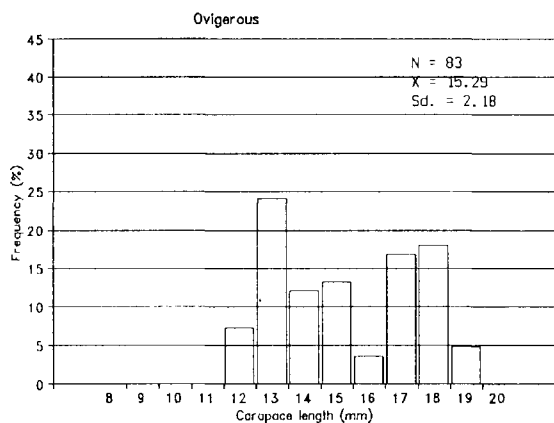


Fig. 6d. *P. narval*. Length frequency distributions of pooled ovigerous specimens from 72, 90 and 108 m, off Graciosa.

length, and are the first recorded from the Azores.

Distribution. *P. martia* (the golden shrimp), is a circumtropical species. It is common in the Eastern Atlantic off the European and African coasts (Mediterranean; Ireland to South Africa). Recently it has been reported also from the Canary Islands (GONZALEZ & al. 1990);

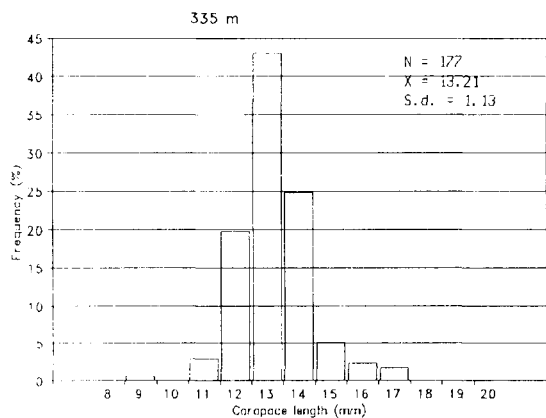


Fig. 8. *P. narval*. Length frequency distribution of specimens from 335 m. All specimens.

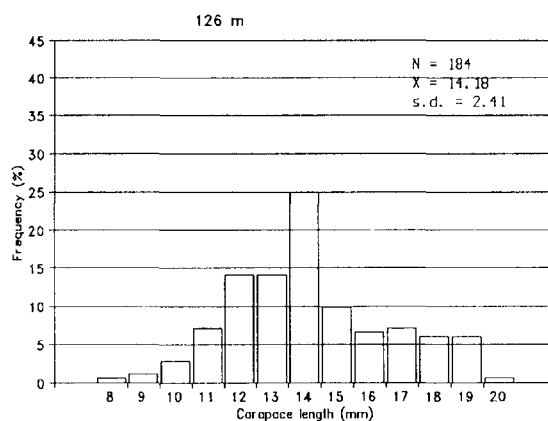


Fig. 7. *P. narval*. Length frequency distribution of specimens from off Ribeiras, Pico at 126 m. All specimens.

(recorded erroneously as *P. ensis* in GONZALEZ & al. 1988) and Madeira (BISCOITO, in press).

Plesionika gigliolii (Senna, 1903)

Only two specimens were caught, carapace lengths 10 and 13 mm respectively, both off Ribeiras, Pico at depths of 270 and 360 m. The

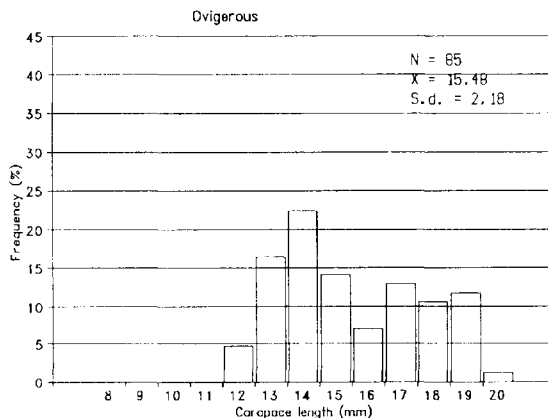


Fig. 9. *P. narval*. Length frequency distribution of pooled ovigerous specimens from 126 and 335 m, off Ribeiras, Pico.

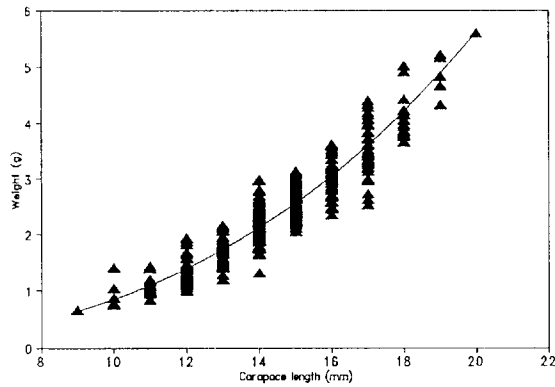


Fig. 10. *P. narval*. Length/weight relationships of pooled non-ovigerous specimens from January and February 1988.

specimen from "Patrão Pedro" was identified by C.H.J.M. Fransen, Leiden. These are the first recorded from the Azores.

Distribution. First recorded from the Mediterranean, it was captured off the West coast of Africa (LONGHURST 1958, BURUKOVSKY 1980, 1988) and recently also at Madeira (BISCOITO, in press) and at Cape Verde Islands by the CANCAP expeditions (C.H.J.M. Fransen, pers. comm.).

Hippolytidae

Ligur ensiferus (Risso, 1816)

L. ensiferus is the third most abundant species caught in this trial fishery. Occurrence at the various stations sampled is given in Table 3. Length frequency distribution of pooled data from January-March 1988 and November 1989 is shown in Fig. 17, length/weight relationships are given in Fig. 18, and equations in Table 4. No ovigerous females were captured.

There is some variation in the shape of the rostrum of this species. It has 3-6 ventral teeth and 3-5 dorsal teeth. The normal arrangement, however, is 5 ventral and 4 dorsal teeth which occurred in 42% of our material. The ventral margin had either one more tooth than the dor-

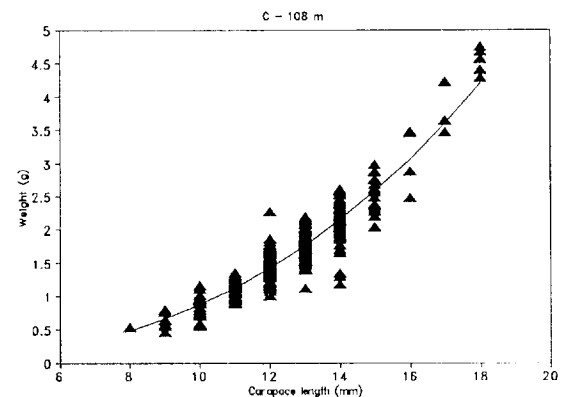
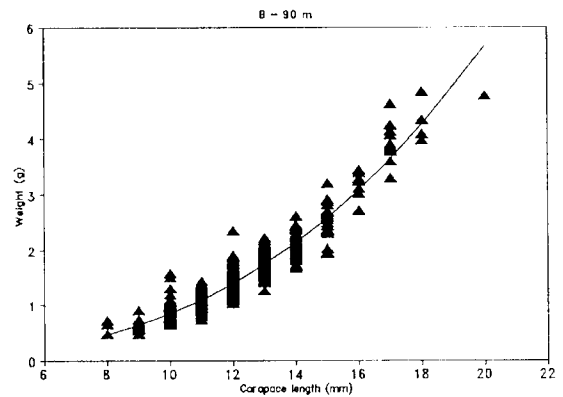
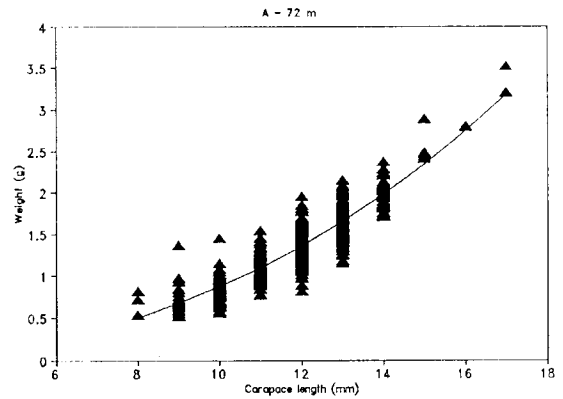


Fig. 11a, b, c. *P. narval*. Length/weight relationships of non-ovigerous specimens from 72, 90 and 108 m respectively, off Graciosa.

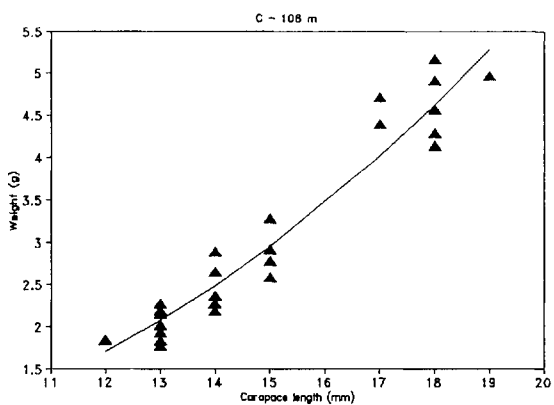
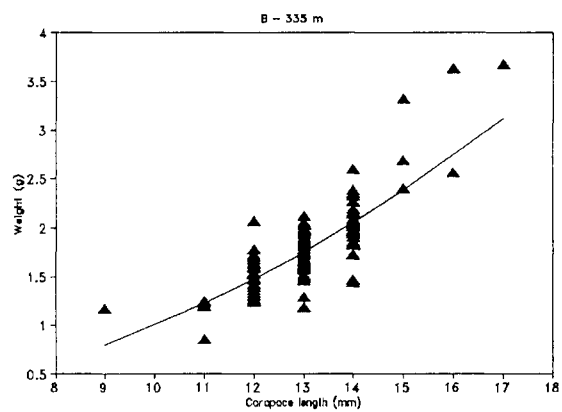
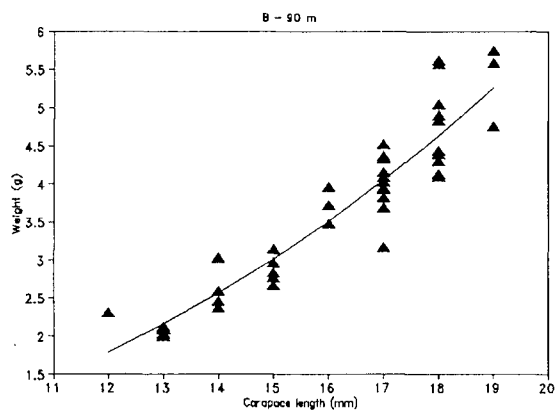
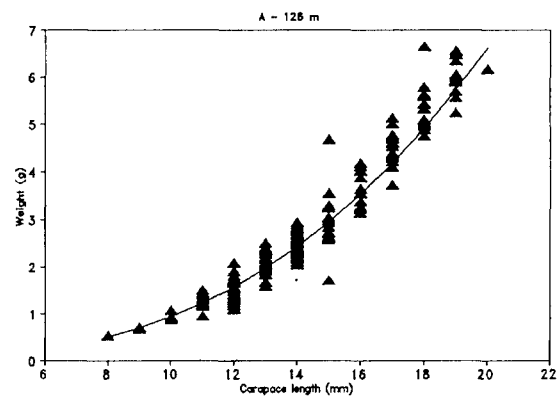
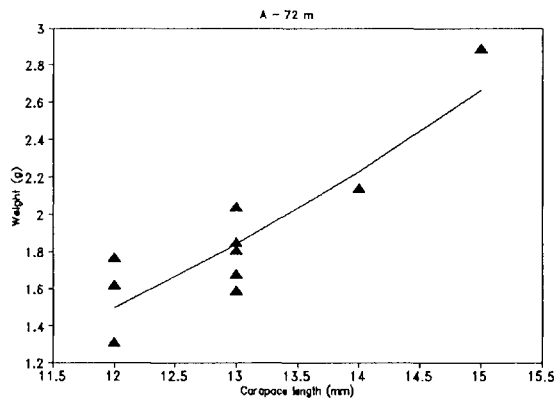


Fig. 12 a, b, c. *P. narval*. Length/weight relationship of ovigerous specimens from 72, 90 and 108 respectively, off Graciosa. Weight in g.

Fig. 13 a, b. *P. narval*. Length/weight relationships of non-ovigerous specimens from 126 and 335 m, off Ribeiras, Pico.

sal or the numbers were equal. Only in one case did the ventral margin have two more than the dorsal. There was no obvious sex-related or maturity-related relationship to the number of teeth.

These are the first records from the Azores. It was found in depths from 90 to 450 m.

Distribution. *L. ensiferus* was thought to be confined to the Mediterranean until it was reported from the Cape Verde Islands and off Senegal by CROSNIER & FOREST (1973) and from the Canary islands by SANTAELLA (1973, 1975a, 1975b). It has also been caught during the

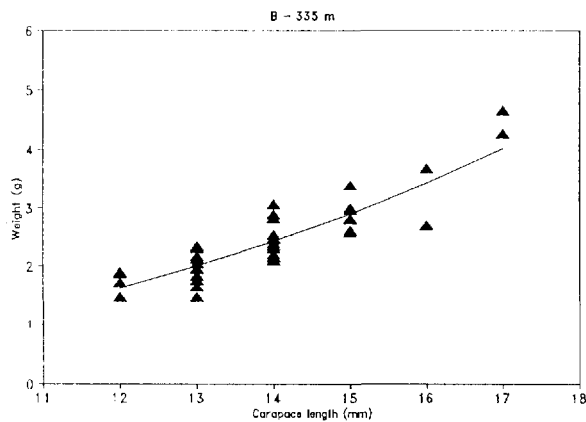
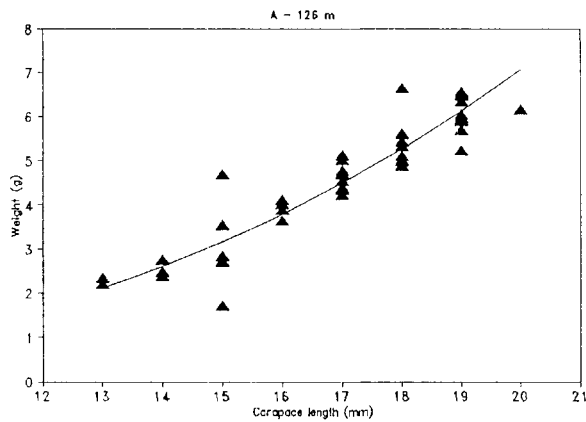


Fig. 14 a, b. *P. narval*. Length/weight relationships of ovigerous specimens from 126 and 335 m, off Ribeiras, Pico.

recent years at Madeira (Lídia Gouveia, pers. commn.).

Lysmata n. sp.

A new species of *Lysmata* was found at stations 4, 6, 8, 23 and 24. All from the south coast of Pico. It is described by FRANSEN (1991) in this volume.

DISCUSSION

Trials with benthic traps in recent years have shed new light on the benthic shrimp populations off the Azores, as well as off Madeira

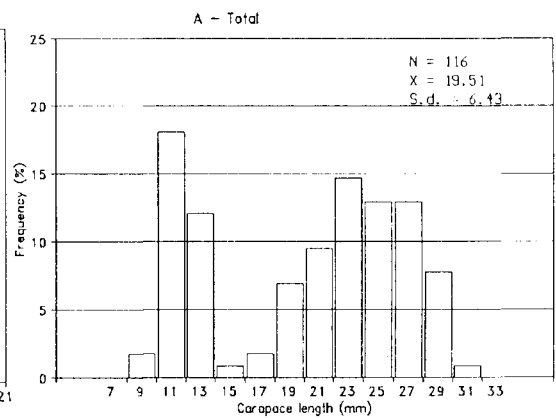


Fig. 15 a. *P. edwardsii*. Length frequency distribution of pooled specimens from January-March 1988. All specimens.

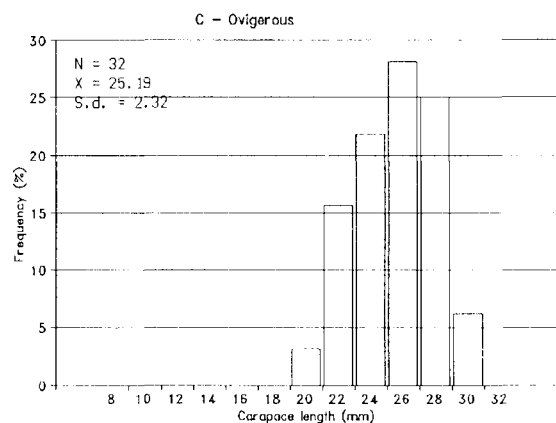
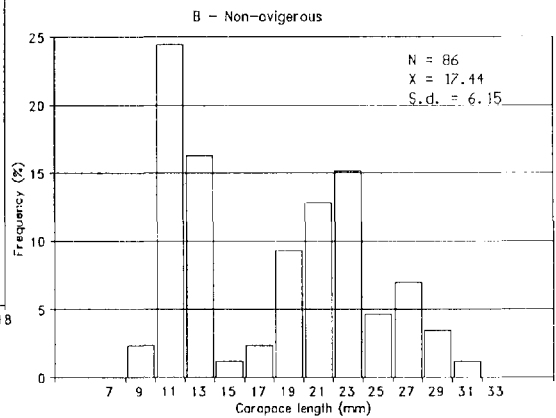


Fig. 15 b, c. *P. edwardsii*. Length frequency distributions of pooled non-ovigerous and ovigerous specimens respectively, from January-March 1988.

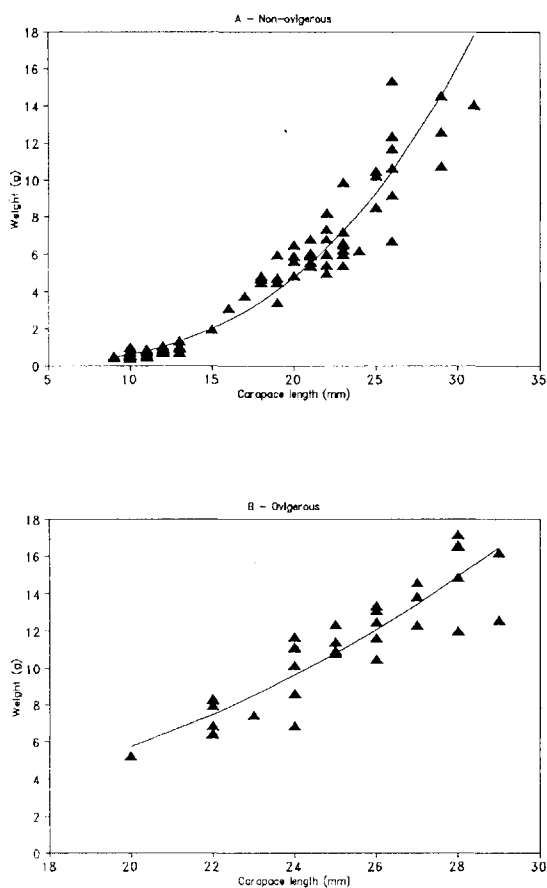


Fig. 16 a, b. *P. edwardsii*. Length/weight relationships of pooled non-ovigerous and ovigerous specimens from January-March 1988.

(Lidia Gouveia, pers. comm.; BISCOITO, in press), Salvage islands (C.H.J.M. Fransen, pers. comm.), Canary island (GONZALEZ & al. 1988 and others) and Cape Verde islands (C.H.J.M. Fransen pers. comm.).

Of the 6 species of shrimp caught by trials with benthic traps in the Azores, four species are recorded here for the first time from this region and one species is new to science.

Of special interest is the area off Ribeiras, Pico where traps were set on 6 occasions. Two of these catches yielded all 6 species captured in the trial fishery, including the new species (Table 3).

Pandalidae

There are only 6 pandalid species recorded from the Azores compared with Madeira where 11 species are known (BISCOITO, in press) and the Canary islands where 10 species occur (GONZALEZ & al. 1990). The two other species known from Azorean waters (besides the four which are mentioned in this paper) are *Heterocarpus grimaldii* described by A. MILNE EDWARDS & BOUVIER (1900), the type locality being from deep water (1300 m) between Pico and S. Jorge (38° 33' 21" N; 28° 08' 30" W) and *Bitias stocki* FRANSEN, 1990, from 1100-1300 m, S. of Pico (FRANSEN 1990). The present trial fishery did not operate deep enough to catch these species. However, in the collection of the Department of Oceanography and Fisheries (DOF) there is one specimen of *H. grimaldii* caught by R/V "Gerald" in 1980 in a bottom trap off Cedros, Faial at 1144 m.

Of other pandalids, one would have expected to find in the Azores, *Heterocarpus ensifer*, a very common species both at the Canary islands (GONZALES & al. 1988) and also at Madeira (BISCOITO, in press) where it is found between 280-500 m, and therefore within the depth range of the present trial fishery.

Plesionika narval

In the complete samples from Graciosa collected in November, we found 1% of ovigerous females at 72 m, 5% at 90 m and 6% at 108 m. By comparison, off Ribeiras, Pico during the same month the percentages were 24% at 126 m and 23% at 335 m. The pooled sample from January-February, however, revealed only 0.7% ovigerous individuals. In the Canary islands GONZALEZ & al. (1988) reported a significant 57% of ovigerous females in samples collected in June and July.

The length frequency histograms of ovigerous specimens from Graciosa (Fig.6d) and Ribeiras, Pico (Fig. 9) show similar distribution patterns and suggest that two year classes are present in these populations.

The carapace length of ovigerous females in the material as a whole varied from 12 to 19

Table 4. The length/weight relationships expressed by the equation $W = a L^b$ where W = total weight and L = carapace length. For all regressions: P < 0.001.

	N	a	b	r ²
<i>Plesionika narval</i>				
non-ovig.pooled	431	1.54x10 ⁻³	2.738	0.8824
ovig.pooled	6			
Folga, Graciosa				
72 m non-ovig.	951	3.03x10 ⁻³	2.456	0.8302
72 m ovig.	10	2.50x10 ⁻³	2.574	0.7474
90 m non-ovig.	802	1.60x10 ⁻³	2.728	0.8937
90 m ovig.	43	5.20x10 ⁻³	2.350	0.9064
108 m non-ovig.	457	1.88x10 ⁻³	2.668	0.8602
108 m ovig.	28	3.67x10 ⁻³	2.470	0.9330
Ribciras,Pico				
126 m non-ovig.	140	1.49x10 ⁻³	2.803	0.9282
126 m ovig.	44	1.61x10 ⁻³	2.800	0.8456
335 m non-ovig.	135	7.08x10 ⁻³	2.149	0.6552
335 m ovig.	40	2.55x10 ⁻³	2.598	0.7721
<i>Plesionika edwardsii</i>				
non-ovig.pooled	85	5.94x10 ⁻³	3.001	0.9526
ovig. pooled	31	1.12x10 ⁻³	2.850	0.8130
<i>Ligur ensiferus</i>				
non-ovig. pooled	88	1.89x10 ⁻³	2.630	0.8873
ovigerous	0			

mm. Exceptionally, one female carrying eggs had a carapace length of 27 mm. (St. 7). In the Canaries, however, ovigerous females ranged from 15 to 25.5 mm (CL) in a sample of 279 individuals (LOZANO & al. 1990a). Thus, the

population studied from the Canary islands (pooled samples from October, February and April) consist of larger individuals than those the Azores.

Individuals with abnormal short rostrum

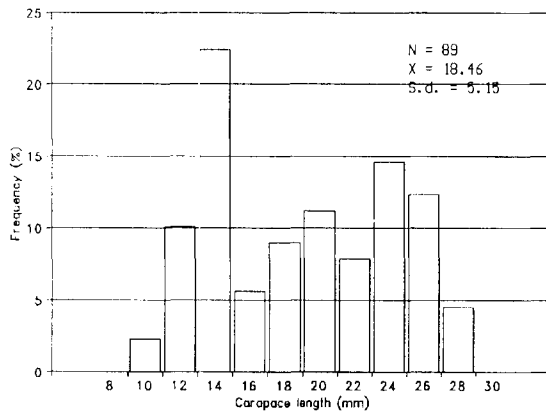


Fig. 17. *Ligur ensiferus*. Length frequency distribution of pooled samples from 1988-89. All specimens, no ovigerous specimens present.

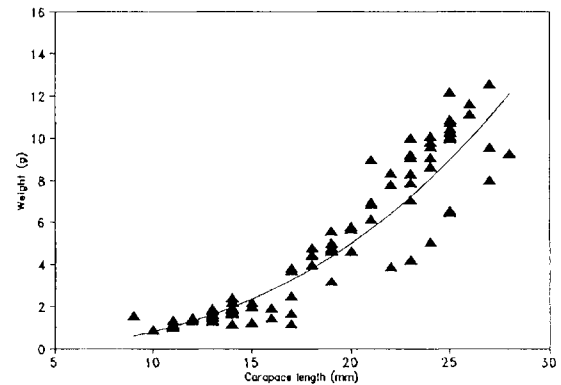


Fig. 18. *Ligur ensiferus*. Length/weight relationships of pooled specimens from 1988-89. All specimens, no ovigerous specimens present.

reported by SANTANA & al. (1990) were also present in our material.

Plesionika edwardsii

The length frequency histograms in Figs. 15a and b show a distribution pattern that could be interpreted as including 2 or perhaps 3 year classes. However, these numbers are too low to allow confirmation of this opinion.

Twenty-seven percent of pooled specimens collected from January to March 1988 were ovigerous compared with the 45.5 % in samples collected from February to May in the Canary Islands (CALDEN-TEY & al. 1990). Also, the sizes of ovigerous females in our samples measured 20-29 mm (CL) compared with the Canary Islands population of 25.5 to 35.5 mm (CALDEN-TEY & al. 1990). This same size difference was also apparent in *P. narval* from the two archipelagos.

Two specimens of *P. edwardsii* were also caught in a trap by M/V "Manuel Arriaga" at the Princess Alice bank 45 nautical miles SW of Faial (DOF collection) at a depth of 270 m in August 1990.

Plesionika martia

The 6 occurrences of this species were all from below 360 m. The maximum depth in this trial fishery was 550 m except for Station 24 where one string was set at 576 m and another at 864 m. The former contained 3 specimens of *P. martia* and 3 of *Geryon affinis*, the latter 1 *P. martia* and 3 *Geryon affinis*. (*G. affinis* was identified by Dr. L.B. Holthuis). One ovigerous female of 19 mm carapace length, was caught by R/V "Manuel Arriaga" at the Princess Alice bank, 45 nautical miles SW of Faial in August 1990 (DOF collection).

Hippolytidae

Ligur ensiferus

There is no published comparable material available from the other Macaronesian islands. The only literature records relate to material

from Mediterranean and West-African localities. *L. ensiferus* occurs in shallower water in the Azores than elsewhere (Table 5). Four specimens (DOF collection) were caught by M/K "Manuel Arriaga" at Princess Alice bank, 45 nautical miles SW of Faial, in August 1990 at a depth of 360 m. One of these was ovigerous (25 mm CL), which is the only we have observed.

August to November 1990 the fishing vessel M/V "Manuel Arriaga" made relatively large commercial catches of decapod shrimps. The maximum amount of *P. narval* caught in one setting (42 traps) was 35 kg at Folga, Graciosa (our station 21-22) in August. During the same month 27 kg of *P. edwardsii* were also caught at Varadouro, Faial (our station 15) using the same number of traps. Off Candelaria, Pico (west of Ribeiras) was also a good locality for *P. edwardsii*, but distribution was seasonal. Here, several catches of up to 18 kg were taken at the end of August. However, from September to November *P. edwardsii* was absent from areas where it had been caught previously, in August. Thus, at Candelaria in November, one setting (42 traps) yielded only one specimen (António Garrido, pers. comm.). This pattern has been shown also to occur in the Canary Islands populations of *P. edwardsii* where this species was absent above 200 m in winter and at the same time increased in abundance below 200 m (LOZANO & al. 1990 b, Figs. 4 and 5).

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Table 5. Bathymetric ranges. Depth in meters.

	Azores	Madeira BISCOITO (in press)(m)	Canary islands GONZÁLEZ & al. (1988)(m)
<i>Plesionika narval</i>	18-450	4-280	27-409
<i>Plesionika edwardsii</i>	54-360	30-360	95-409
<i>P. martia</i>	360-864	440-600	357-700
<i>P. gigliolii</i>	270-360	200-360	-
<i>Ligur ensiferus</i>	90-450	-	-(Mediterranean) 772-860 m CROSNIER & FOREST (1973) (W. Africa) 330-494 m CROSNIER & FOREST (1973)

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REFERENCES

- BALSS, H. 1925. Macrura der Deutschen Tiefsee-Expedition. 2. Natantia, Teil A. - *Wissenschaftlichen Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia," 1898-1899* 205:217-315.
- BISCOITO, M. J. (in press). An account of the shrimps of the family Pandalidae (Crustacea, Decapoda, Caridea) in Madeiran waters. - *Courier Forschungsinstitut Senckenberg*.
- BURUKOVSKY, R.N. 1980. Peculiarities of the distribution by depth of shrimps along the Atlantic coasts of Morocco. - *Okeanologia* 20:1098-1102.
- BURUKOVSKY, R.N. 1988. New finds of shrimp in the waters of the tropical east Atlantic. - *Biologičeskie Nauky* 1:37-41.
- CALDENIEY, M.A., I. J. LOZANO, F. J. HER-
NANDEZ, J.A. GONZALEZ & I. SANTANA 1990. Introducción al estudio de la fecundidad de *Plesionika edwardsii* (Brandt, 1851) (Crustacea, Caridea, Pandalidae). - *BENTOS VI*. Actas VIº Simposio Ibérico de Estudio del Bentos Marino, Palma de Mallorca, 1988: 203-211.
- CALDENIEY, M.A., J.I. SANTANA, J.A. GONZALEZ & I.J. LOZANO (in press). Observaciones biológico-pesqueras sobre los Pandalidos (Crustacea, Decapoda, Caridea) de Canarias. - *Actas Vº Simposio Ibérico de Estudios del Bentos Marino*, Tenerife 1986.
- CHACE, F.A. 1985. The Caridean Shrimps (Crustacea:Decapoda) of the *Albatross Philippine Expedition, 1907-1910*, Part 3:Families Thalassocarididae and Pandalidae. - *Smithsonian Contribution to Zoology* 411: 1-143.
- CROSNIER A. & J. FOREST 1973. Les Crevettes profondes de l'Atlantique oriental tropical. - *Faune Tropicale, Office de la Recherche Scientifique et Technique Outre Mer (ORSTOM)* 9: 1-409.
- FASHAM, M.J.R. & P. FOXTON 1979. Zonal distribution of pelagic Decapoda (Crustacea) in the eastern north Atlantic and its relation to the physical oceanography. - *Journal of Experimental Marine Biology and Ecology* 37:225-253.
- FOXTON, P. 1972. Observations on the vertical distribution of the genus *Acanthephyra* (Crustacea:Decapoda) in the eastern north Atlantic, with particular reference to species of the "purpurea" group. - *Proceedings of the*

- Royal Society of Edinburgh B.* 73:301-313.
- FIGUEIRA, A.J.G. 1960. On a small collection of Decapod Crustaceans from the Azores. - *Bocagiana* 6:1-13.
- FRANSEN, C.H.J.M. 1990. *Bitias stocki*, a new genus and new species of pandalid shrimp (Crustacea, Decapoda, Caridea) in the Eastern Atlantic Ocean. - *Beaufortia* 41(10):67-73.
- FRANSEN, C.H.J.M. 1991. *Lysmata olavoi*, a new shrimp of the family Hippolytidae (Decapoda, Caridea) from the eastern Atlantic Ocean. - *Arquipélago. Life and Earth Sciences* 9: 63-73.
- GARCIA CABRERA, C. 1970. La pesca en Canarias y Banco Sahariano. - Publ. Consejo Económico Sindical Interprovincial de Canarias (Ed.). Santa Cruz de Tenerife. 174 pp.
- GONZÁLEZ, J.A., I. J. LOZANO, M.A. CALDENTY, J. I. SANTANA, J.A. GÓMEZ & R. CASTILLO 1988. Resultados de la campaña de prospección pesquera "Canarias 85". - *Informes Tecnicos Instituto Español de Oceanografía* 57:1-93.
- GONZALEZ, J.A., M.A. CALDENTY & J.I. SANTANA 1990. Catalogo de las especies de la familia Pandalidae (Crustacea, Decapoda, Caridea) en Canarias - *Vieraea* 19:141-151.
- HARGREAVES, P.M. 1985 The vertical distribution of Decapoda, Euphausiacea and Mysidacea at 42° N 17° W. - *Biological Oceanography* 3:431-464.
- HOLTHUIS, L.B. 1949. The Caridean Crustacea of the Canary Islands. - *Zoologische Mededelingen* 30(15):227-255.
- HOLTHUIS, L.B. 1980. FAO species catalogue. Vol. 1. Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. - *FAO Fisheries Synopsis* (125) Vol. 1:261 p.
- LONGHURST, A.R. 1958. An ecological survey of the West African marine benthos. - *Colonial Office Fishery Publications* 11: 1-102.
- LOZANO, I.J., M.A. CALDENTY, F. LOZANO SOLDEVILLA, F.J. HERNANDEZ, M.C. de LORENZO & P. HERNANDEZ 1990a. Introducción al estudio de la fecundidad de *Parapandalus narval* (Fabricius, 1787) (Crustacea, Decapoda, Caridea) en las Islas Canarias. - *BENTOS VI. Actas VIº Simposio Ibérico de Estudio del Bentos Marino, Palma de Mallorca* 1988: 191-201.
- LOZANO, G., J. CARRILLO, M.A. CALDENTY, J.I. SANTANA, I.J. LOZANO, J.A. GONZALEZ, S. JIMENEZ, F. LOZANO, A. BRITO, M. FANLO & C.M. HERNANDEZ 1990b. Distribucion estacional y batimetrica de Pandalidos en el talud de Gran Canaria. - *BENTOS VI. Actas VIº Simposio Ibérico de Estudio del Bentos Marino, Palma de Mallorca* 1988: 213-221.
- SANTAELLA, E. 1973. Estudio de los Crustáceos Decápodos (excepto Peneidea) del archipiélago canario, com especial referencia a las especies de la sección Brachyura. - *Doctoral Thesis Faculty of Science, University of La Laguna*. 654 pp.
- SANTAELLA, E., J. BRAVO DE LAGUNA & A. SANTOS 1975a. Resultados de una campaña de prospección pesquera en la isla de La Palma (islas Canarias). Crustáceos Decápodos y Peces. - *Boletín del Instituto Español de Oceanografía* 193:1-36.
- SANTAELLA, E. & J. BRAVO DE LAGUNA 1975b. The Family Pandalidae (Crustacea, Decapoda, Caridea) in the Canary Islands. Species and distribution. - *International Council for the Exploration of the Sea* CM 1975/K:41, 8pp.
- SANTANA J.I., M.A. CALDENTY, J.A. GONZALEZ, I.J. LOZANO & J. CARILLO 1990. Anaomalías morfológicas rostrales en pandalidos (Crustacea, Caridea) de las islas Canarias. - *BENTOS VI. Actas VIº Simposio Ibérico de Estudio del Bentos Marino, Palma de Mallorca* 1988:223-228.
- ZARIQUIEY ALVAREZ, R. 1968. Crustáceos Decápodos Ibéricos. - *Investigación Pesquera* 32:1-510.

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