ANNEX III

SEAMOUNT ASSOCIATED SPECIES
(FISHES, CRUSTACEANS AND CEPHALOPODS)

SEAMOUNT ASSOCIATED SPECIES
(Fishes, crustaceans and cephalopods)
NAMIBIA-0802

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1.- Seamount Species

A total of 138 species of fish, 24 crustacean and 15 cephalopods were collected (Annex A). Some decapod species such as hermit crabs have been included in the benthos report. The total weight and length of each fish species was recorded. In addition, biological sampling of all crustaceans, cartilaginous fishes and all other specimens of commercial importance were recorded.

The most representative fish species in the catches (by weight) of the survey (Annex B) were: *Pseudopentaceros richardsoni* (40%), *Allocyttus verrucosus* (14%), *Alepocephalus productus* (13%), *Rouleina attrita* (9%), *Cetonurus globiceps* (8%), *Helicolenus mouchezi* (5%), *Notopogon xenosoma* (3%), other species (n=133; 8%) (Figure 1-A). Considering the abundance (number of individuals) in the catches, the most representative species were: *Notopogon xenosoma* (31%), *Cetonurus globiceps* (17%), other fishes (15%), *Pseudopentaceros richardsoni* (10%), *Allocyttus verrucosus* (9%), *Alepocephalus productus* (8%), *Rouleina attrita* (6%) and *Helicolenus mouchezi* (4%) (Figure 1-B).

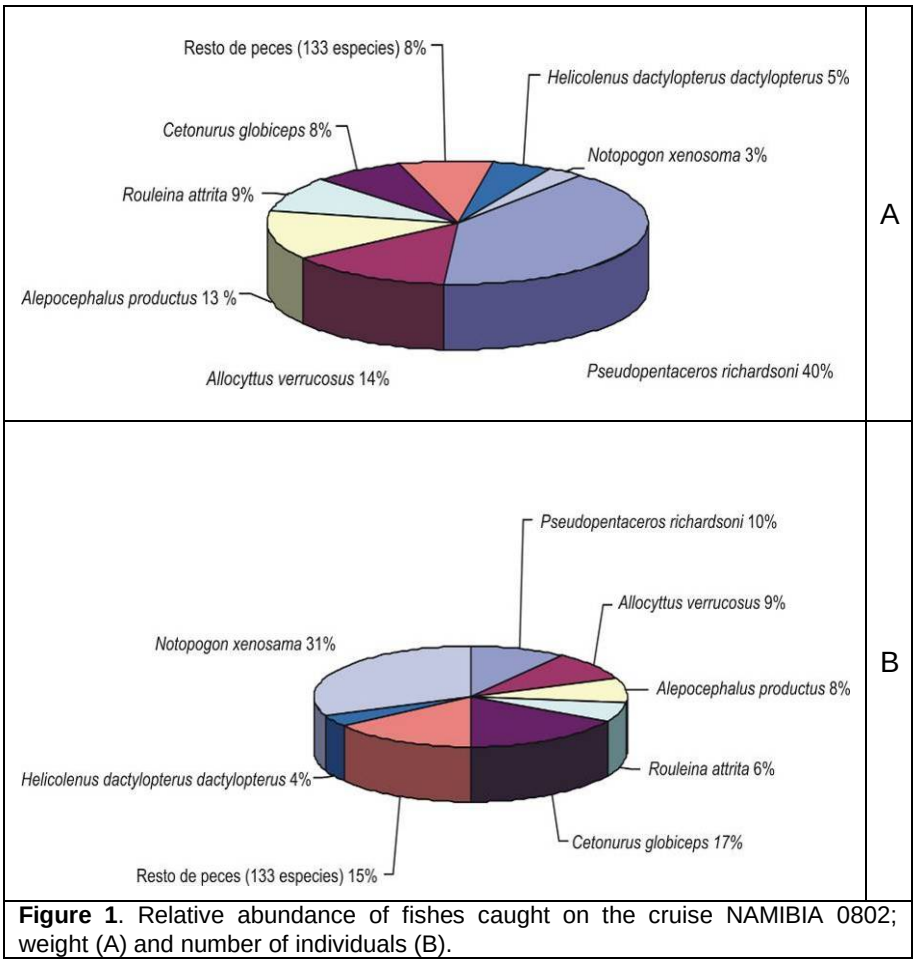


Figure 1. Relative abundance of fishes caught on the cruise NAMIBIA 0802; weight (A) and number of individuals (B).

The most representative crustacean species in the catches (by weight) of the survey were: *Chaceon* spp. (84%), *Acanthephyra eximia* (6%), *Austropenaeus nitidus* (4%), *Nematocarcinus longirostris* (3%) and other species (n=23; 3%) (Figure 2-A). Considering the abundance (number of individuals) in the catches, the most

representative species were: *Austropenaeus nitidus* (22%), *Chaceon* spp. (21%), *Nematocarcinus longirostris* (18%), *Acanthephyra eximia* (17%) and other species (22%) (Figure 2-B).

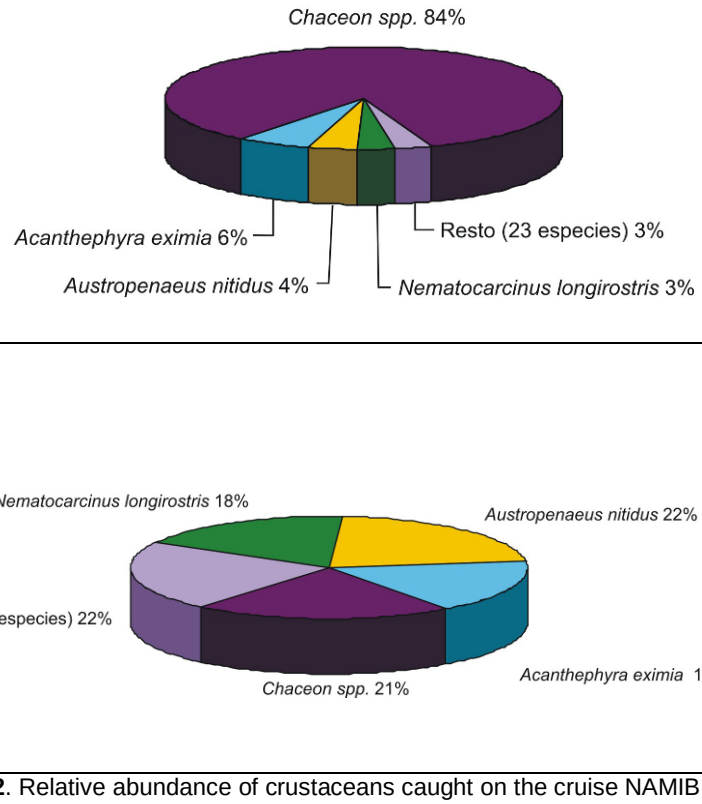


Figure 2. Relative abundance of crustaceans caught on the cruise NAMIBIA 0802; weight (A) and number of individuals (B).

2.- Biology of the most representative species in the catches

2.1.- Bony fish

For the more abundant bony fish species or those of commercial interest the size composition was calculated, as were the descriptive statistics, length-weight relationship[1], sex-ratio, gonadosomatic index[2], condition factor[3] and maturity ogives[4]: *Pseudopentaceros richardsoni, Helicolenus mouchezi*, *Hoplostethus atlanticus*, *Allocyttus verrucosus*, *Alepocephalus productus*, *Rouleina attrita*, *Cetonurus globiceps* and *Notopogon xenosoma.*

[1] $TW=a * TL^{b}$
[2] $GSI=(GW*100)/TW$
[3] $K=TW/(TL^{3}*10^{5})$
[4] $P_i= 1/(1+e^{a+b*TL_i})$

2.1.1.- *Pseudopentaceros richardsoni* – Pelagic Armorhead / Southern Boarfish

Pseudopentaceros richardsoni

Length composition of catches

The total length of this species ranged between 32 and 60 cm and it was caught at between 232 and 478 m depth (Table 1). The mean values of length and depth were 44.2 cm and 260.3 m respectively.

Table 1. Descriptive statistics of specimen sizes (cm) and depth (m) of catches of *Pseudopentaceros richardsoni*.

Variable	n	Min.	Max.	Mean	SD
TL	1961	32	60	44.2	4.3
Depth	1961	232	479	260.3	77.0

In Figure 3, the length frequency distribution of all individuals caught is presented.

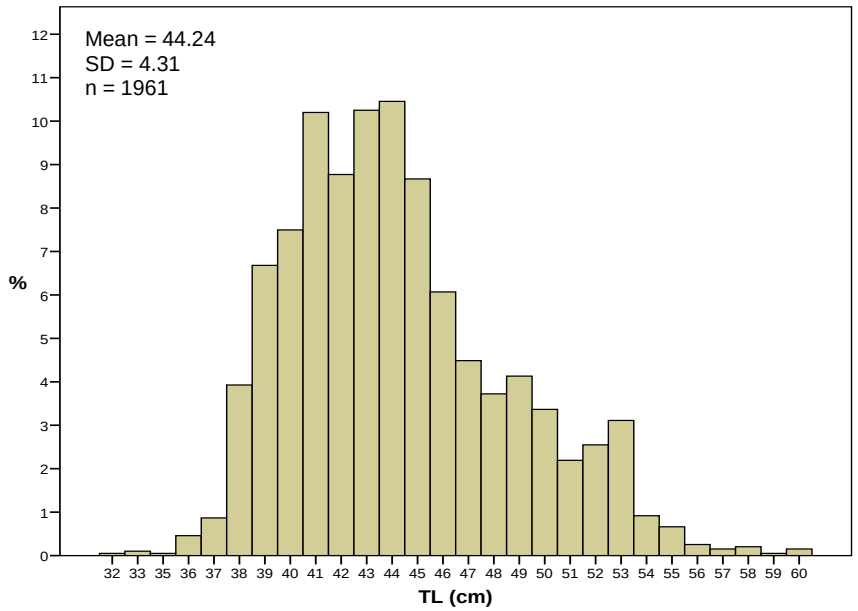


Figure 3. Length frequency distribution of catches of *Pseudopentaceros richardsoni*.

Descriptive statistics of measurement and biological data by sex

The observed length range (TL) in males ranged between 32.8 - 43.5 cm and for females 37.6 - 59.3 cm (Table 2). The total weight (TW) for males ranged between 680 and 2190 g, less than those of the females (1004 - 4525 g). Values of eviscerated weight (EW) for males ranged between 632 and 1912 g and between 902 and 3818 g for females. The maximum gonadal weight (GW) of males (96 g) was much lower than that of the females (272 g), but the minimum was the same for both sexes (3 g). The gonadosomatic index (GSI) for males and females were similar with a minimum value of 0.3 and a maximum of 5.5 for males and 6.6 for females. The average condition factor (K) for males and females was 1.9 and 2 respectively.

Table 2. Descriptive statistics of length (cm), weight (g), gonadosomatic index (GSI) and condition factor (K) by sex of *Pseudopentaceros richardsoni*.

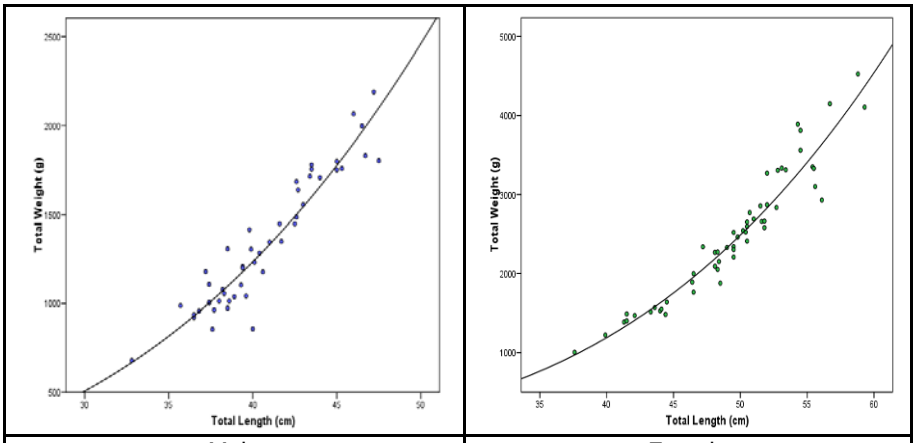
Sex	Variable	n	Min.	Max.	Mean	SD
Male	TL	48	32.8	43.5	40.7	3.4
	TW	48	680	2190	1334	369.4
	EW	48	632	1912	1193.8	323
	GW	48	3	96	30.6	19.4
	GSI	48	0.3	5.5	2.2	1.0
	K	48	1.3	2.3	1.9	0.2
Female	TL	55	37.6	59.3	49.4	4.8
	TW	55	1004	4525	2486.3	811
	EW	55	902	3818	2129.8	644.5
	GW	55	3	272	95.6	66.1
	GSI	55	0.3	6.6	3.5	1.5
	K	55	1.7	2.4	2.0	0.2

Length – weight relationship

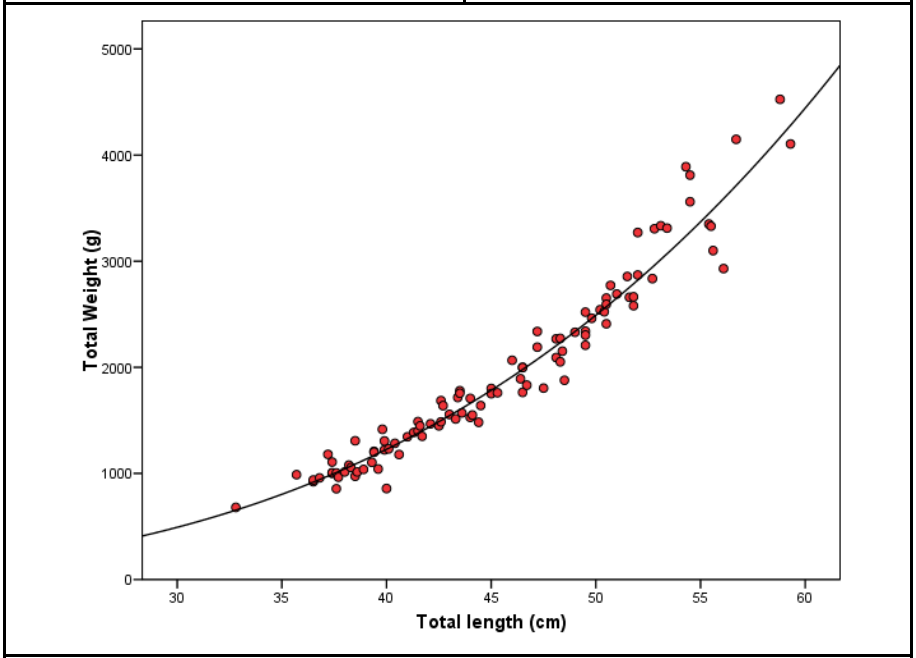
The results of the length – weight relationship analysis for males, females and all individuals are presented in Table 3. In all cases, the allometry coefficients (*b*) show close or lightly greater values than 3, which indicate an isometry or a small positive allometry between both variables. The determination coefficient (R^2) shows high values in all cases, which indicate the high correlation between the total length and the green weight of specimens. Figure 4 shows their graphic representation with real values.

Table 3. Parameters of the total length (cm) - total weight (g) relationship ($TW=aTL^b$) for males, females and all individuals of *Pseudopentaceros richardsoni*.

	a	b	R^2	n	TL range	TW range
Male	0.014	3.091	0.946	48	32.8-47.5	680-2190
Female	0.006	3.305	0.877	55	37.6-59.3	1004-4525
All individuals	0.010	3.172	0.959	103	32.8-59.3	680-4525



Male | Female



All individuals

Figure 4. Length – weight relationship for males, females and all individuals of *Pseudopentaceros richardsoni.*

Sex-ratio

The sex-ratio by length class shows all fish smaller than than 37 cm TL are males. After 37 cm, the female proportion increases gradually with all fish greater than 50 cm being female (Figure 5).

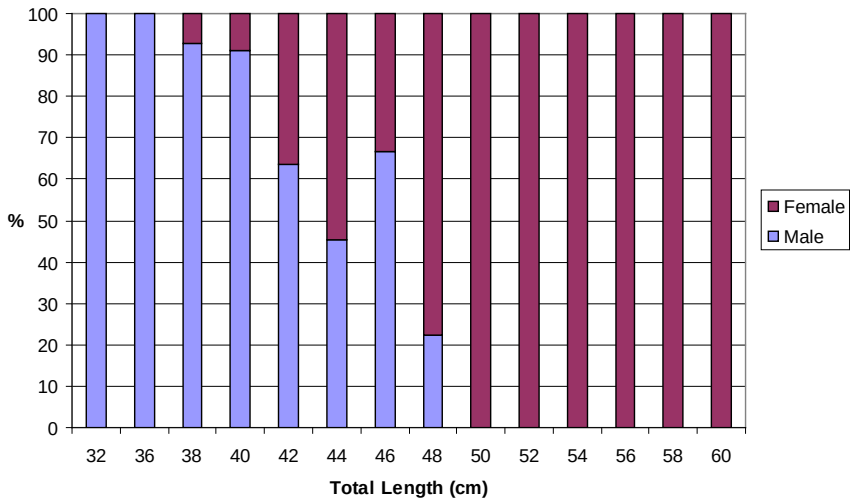


Figure 5. Sex-ratio by length class of *Pseudopentaceros richardsoni*.

Maturity

Male mean length goes from 37.4 cm TL for stage I of maturity to 39.2 cm for stage II and reaches the size of 41.1 cm at stage III of maturity. For females at maturity stage II the mean length value is 37.6 cm TL, 49.5 cm at stage III and one specimen of 58.8 cm was at IV maturity stage (Table 4).

Table 4. Descriptive statistics of total length by sex and maturity stage of *Pseudopentaceros richardsoni*.

Sex	Maturity stage	n	Min.	Max.	Mean	SD
Male	I	1	37.4	37.4	37.4	
	II	10	32.8	43.5	39.2	3.4
	III	37	35.7	47.5	41.1	3.3
Female	II	1	37.6	37.6	37.6	
	III	53	39.9	59.3	49.5	4.5
	IV	1	58.8	58.8	58.8	

2.1.2.- *Helicolenus mouchezi* - None

Helicolenus mouchezi

Length composition of catches

The total length of this species ranged between 11 and 46 cm and it was caught at between 232 and 479 m depth (Table 5). The mean values of length and depth were 32.7 cm and 281.6 m, respectively.

Table 5. Descriptive statistics of specimen sizes (cm) and depth (m) of catches of *Helicolenus mouchezi.*

Variable	n	Min.	Max.	Mean	SD
TL	935	11	46	32.7	7.4
Depth	935	232	479	281.6	96.5

In Figure 6, the length frequency distribution in 2 cm intervals for all individuals caught is presented. The wide range of sizes and the small number of individuals sampled in some length classes complicates interpretation of its natural length frequency distribution.

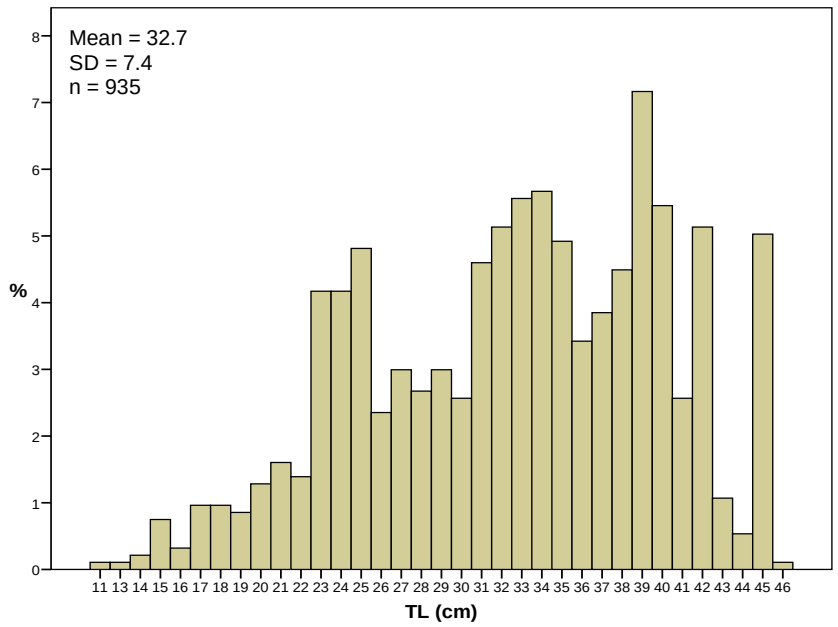


Figure 6. Length frequency distribution of catches of *Helicolenus mouchezi*.

Descriptive statistics of measurement and biological data by sex

The observed length range (TL) in males ranged between 13.1 - 45 cm and for females between 11.6 and 43.7 cm (Table 6). The total weight (TW) for males ranged between 30 and 1696 g, greater than that for the females (18 - 1590 g). Values of eviscerated weight (EW) of males ranged between 26 and 1547 g and between 14 and 1428 g for females. The maximum gonadal weight (GW) of males (14 g) was similar to that of the females (20 g), but the minimum was the same for both sexes (1 g). The gonadosomatic index (GSI) for males and females were similar with a minimum value of 0.17 and a maximum of 3.3 for males and between 2.2 and 6.6 for females. The average condition factor (K) for males and females was the same (1.6).

Table 6. Descriptive statistics of length (cm), weight (g), gonadosomatic index (GSI) and condition factor (K) by sex of *Helicolenus mouchezi*.

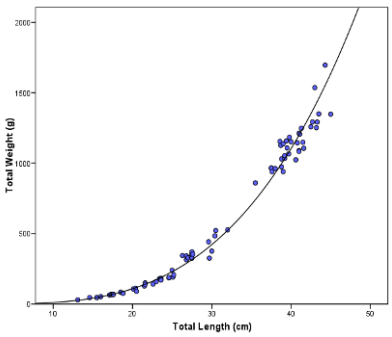
Sex	Variable	n	Min.	Max.	Mean	SD
Male	TL	78	13.1	45.0	31.0	9.4
	TW	78	30	1696	633.4	490.1
	EW	78	26	1547	566.8	449.7
	GW	78	1	14	4.5	3.8
	GSI	78	0.17	3.3	1.0	0,8
	K	78	1.0	2.0	1.6	0.2
Female	TL	74	11.6	43.7	28.8	6.8
	TW	74	18	1590	482.0	340.3
	EW	74	14	1428	429.4	297.0
	GW	74	1	20	4.7	3.8
	GSI	74	0.2	5.6	1.3	1.1
	K	74	0.8	2.1	1.6	0.3

Length – weight relationship

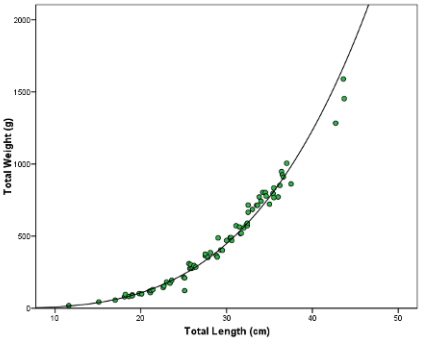
The results of the length – weight relationship analysis for males, females and all individuals are presented in Table 7 and their graphic representation with the real values in Figure 7. In all cases, the allometry coefficients (b) show greater values than 3, which indicate an isometry or a small positive allometry between both variables. The determination coefficient (R^2) shows high values in all cases, which indicate the high correlation between the total length and the green weight of specimens.

Table 7. Parameters of the Total Length (cm) - Total Weight (g) relationship ($TW=aTL^b$) for males, females and all individuals of *Helicolenus mouchezi*.

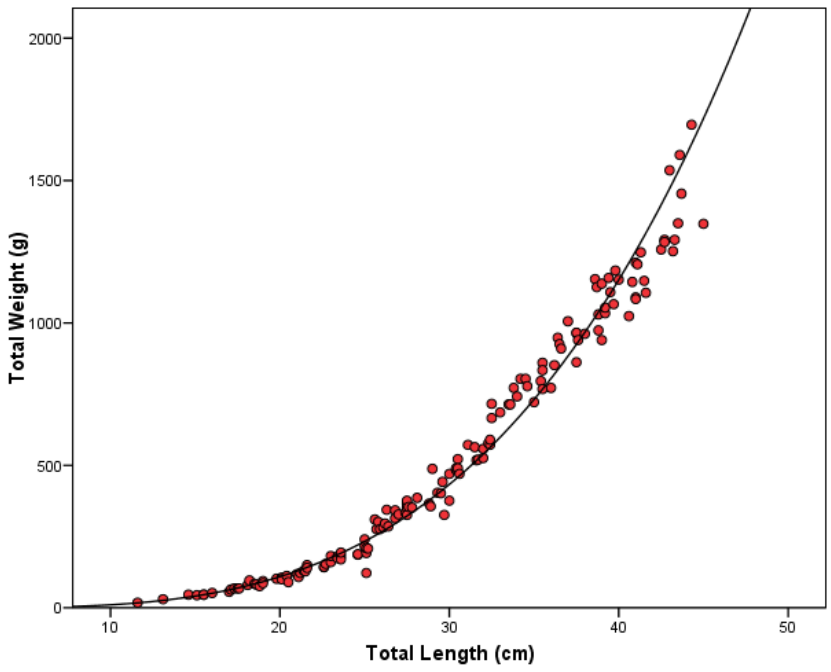
	a	b	R^2	n	TL range	TW range
Male	0,005	3.343	0,991	78	13.1-45.0	30-1696
Female	0,003	3.516	0,983	74	11.6-43.7	18-1590
All individuals	0,004	3,398	0,987	152	11.6-45.0	18-1696



Male



Female



All individuals

Figure 7. Length – weight relationship for males, females and all individuals of *Helicolenus mouchezi*.

Sex-ratio

The sex-ratio by length class does not show any well defined pattern. The proportion of females increase up to 36 cm TL while males are predominant in sizes greater than 36 cm (Figure 8).

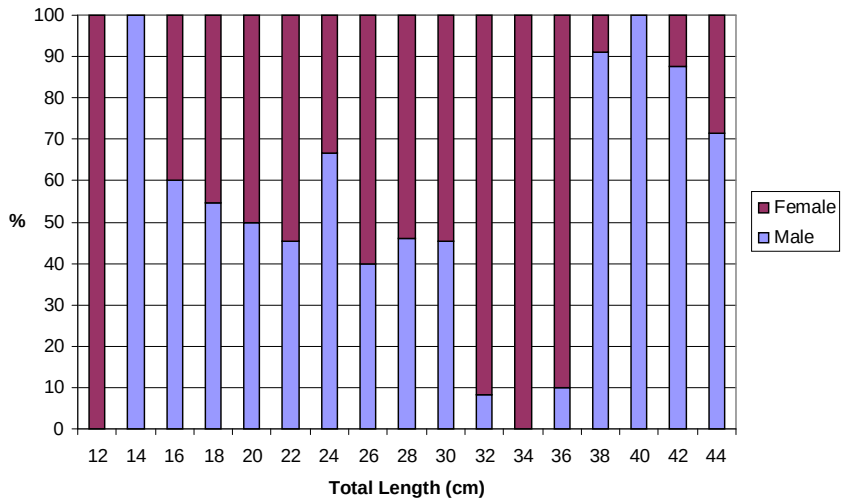


Figure 8. Sex-ratio by length class of *Helicolenus mouchezi*.

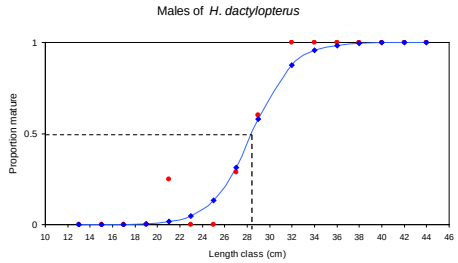
Maturity

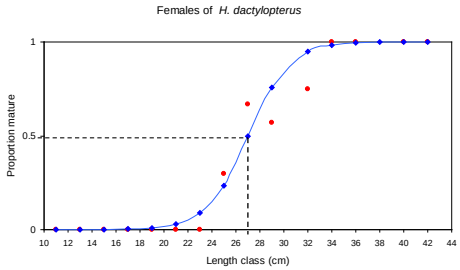
Male mean length goes from 22.3 cm TL for stage I of maturity to 37.5 cm for stage II and reaches 40.6 cm at stage III of maturity. For females at maturity stage II the mean length value is 22.9 cm and 33.3 cm at stage III (Table 8).

Table 8. Descriptive statistics of total length by sex and maturity stage of *Helicolenus mouchezi*.

Sex	Maturity stage	n	Min.	Max.	Mean	SD
Male	I	36	13.1	30.0	22.3	4.7
	II	30	21.6	45.0	37.5	5.7
	III	12	38.0	43.3	40.6	1.9
Female	II	32	11.6	31.7	22.9	4.6
	III	42	26.1	43.7	33.3	4.2

From the current data, size at first maturity seems to be different for males and females. Thus, size at first maturity for males is reached at 28.41 cm and for females at 27.02 cm (Table 9 and Figure 9).





Males maturity ogive $p_i = \frac{1}{1+e^{a+b\times TL_i}}$

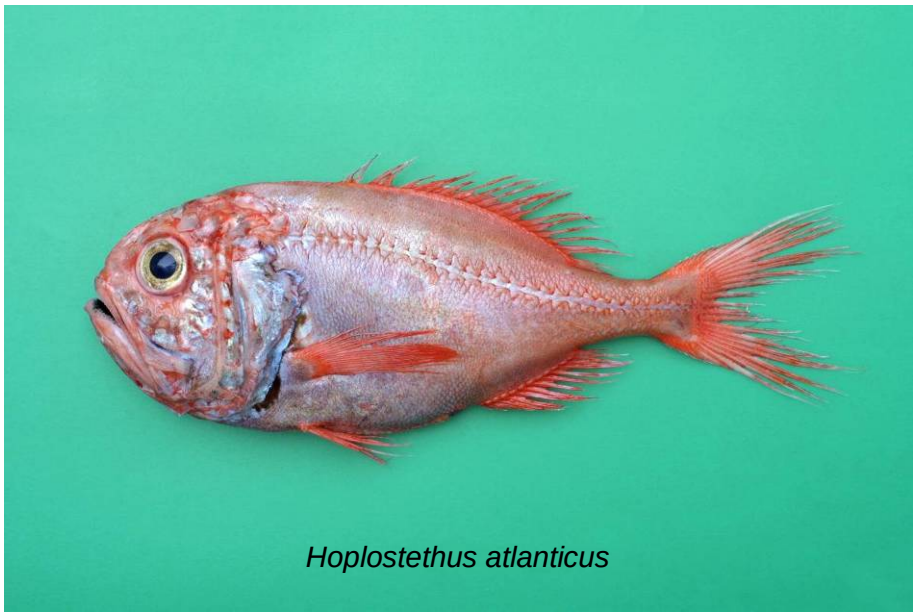
Females maturity ogive $p_i = \frac{1}{1+e^{a+b\times TL_i}}$

Figure 9. Sex maturity ogives for males and females of *Helicolenus mouchezi* .

Table 9. Maturity ogive parameters of *Helicolenus mouchezi.*

Sex	a	b	n	TL_{50} (cm)
Males	15.599	0.549	78	28.41
Females	15.727	0.582	41	27.02
All individuals	15.978	0.579	119	27.59

2.1.3.- *Hoplostethus atlanticus* - Orange roughy



Hoplostethus atlanticus

Length composition of catches

The total length of this species ranged between 8.8 and 48 cm caught between 867 and 988 m depth (Table 10). The mean values of length and depth were 27.7 cm and 920.8 m respectively.

Table 10. Descriptive statistics of specimen sizes (cm) and depth (m) of catches of *Hoplostethus atlanticus.*

Variable	n	Min.	Max.	Mean	SD
TL	80	8.8	48.0	27.7	9.3
Depth	80	867	988	920.8	42.5

In Figure 10, the length frequency distribution in 2 cm length classes of all individuals caught is presented. The wide range of sizes and the small number of individuals sampled in some length classes complicates interpretation of its natural length frequency distribution.

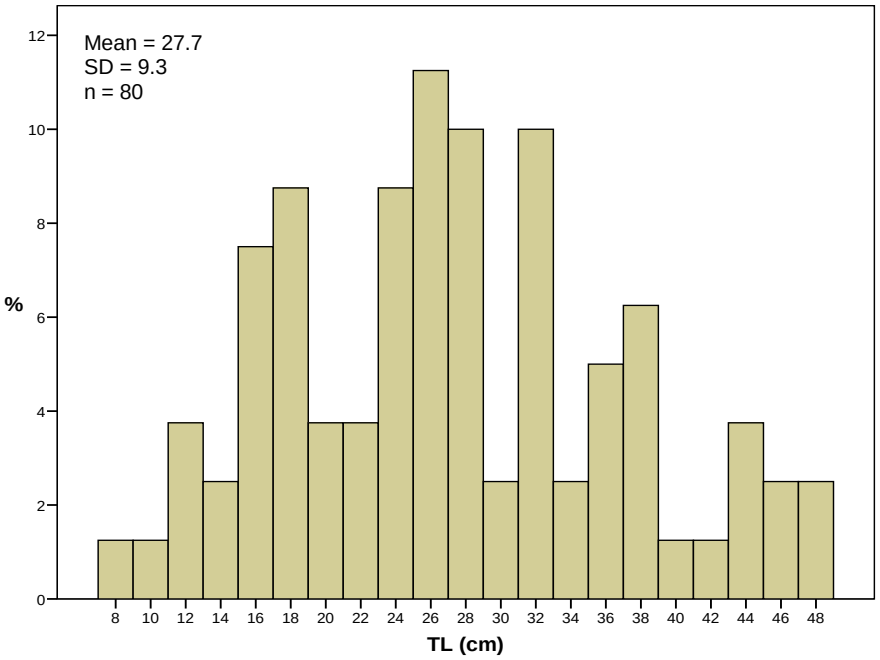


Figure 10. Length frequency distribution of catches of *Hoplostethus atlanticus.*

Table 11. Descriptive statistics of length (cm), weight (g), gonadosomatic index (GSI) and condition factor (K) by sex of *Hoplostethus atlanticus*.

Sex	Variable	n	Min.	Max.	Mean	SD
Male	TL	13	18.5	41.2	30.1	6.3
	TW	13	128	1184	489.4	301.8
	EW	13	108	1044	434.6	264.7
	GW	11	2	68	14.9	21.6
	GSI	11	0.6	7.7	2.1	2.1
	K	13	0.3	2.0	1.4	0.5
Female	TL	48	10.6	48.0	30.1	9.2
	TW	48	23	1910	595.1	518.0
	EW	48	18	1724	511.7	431.6
	GW	45	1	152	25.0	36.2
	GSI	45	0.5	8.0	2.9	1.9
	K	48	1.5	2.8	1.7	0.2
Immature	TL	15	8.8	29.5	18.0	4.6
	TW	15	11	428	120.5	95.6
	EW	15	9	382	109.9	87.4
	K	15	1.5	2.4	1.8	0.2

Descriptive statistics of measurement and biological data by sex

The observed length range (TL) for males ranged between 18.5 – 41.2 cm, between 10.6 - 48 cm for females and 8.8 - 29.5 cm for immatures (Table 11). The total weight (TW) for males ranged between 128 and 1184 g and for females between 23 and 1910 g and between 11 and 428 g for immatures. Values of eviscerated weight (EW) for males ranged between 108 and 1044 g and between 23 and 1910 g for females and

between 9 and 382 for immatures. The minimum gonadal weight (GW) of males (2 g) was similar to that of the females (1 g), and the maximum was greater for females (152 g) than for males (68 g). The gonadosomatic index (GSI) for males and females was similar with minimum values of 0.6 (males) and 0.5 (females); and a maximum of 7.7 for males and 8 for females. The average condition factor (K) for males (1.4) is smaller than for females (1.7).

Length – weight relationship

The results of the length – weight relationship analysis for males, females and all individuals are presented in Table 12 and their graphic representation with the real values in Figure 11. In all the cases, the allometry coefficients (b) show lower values than 3, which indicate an isometry or a small negative allometry between both variables. The determination coefficient (R^2) shows high values in all cases, which indicates the high correlation between the total length and the green weight of specimens.

Table 12. Parameters of the Total Length (cm) - Total Weight (g) relationship ($TW=aTL^b$) for males, females and all individuals of *Hoplostethus atlanticus.*

	a	b	R^2	n	Range TL	Range TW
Male	0.032	2.796	0.980	13	18.5-41.2	128-1184
Female	0.021	2.936	0.988	48	10.6-48.0	23-1910
Immature	0.021	2.943	0.979	15	8.8-29.5	11-428
All individuals	0.023	2.914	0,989	74	8.8-48.0	11-1910

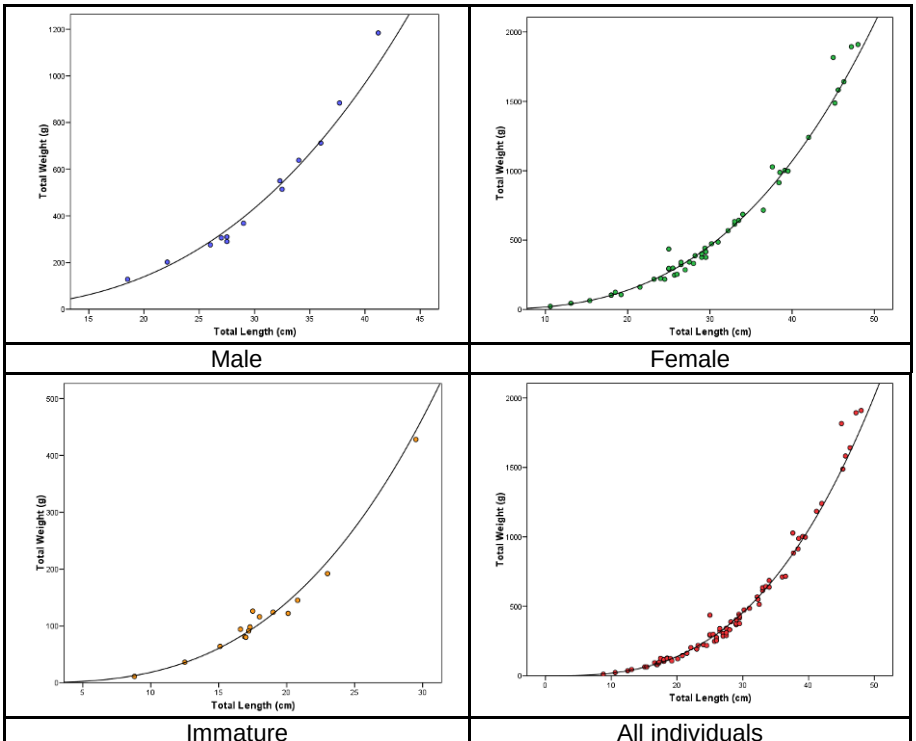


Figure 11. Length – weight relationship for males, females, immature and all individuals of *Hoplostethus atlanticus*.

Sex-ratio

The sex-ratio by length class shows a predominance of females in almost all size class while males do not exceed 50% in the intermediate sizes. In the smallest and largest sizes females dominate completely (Figure 12).

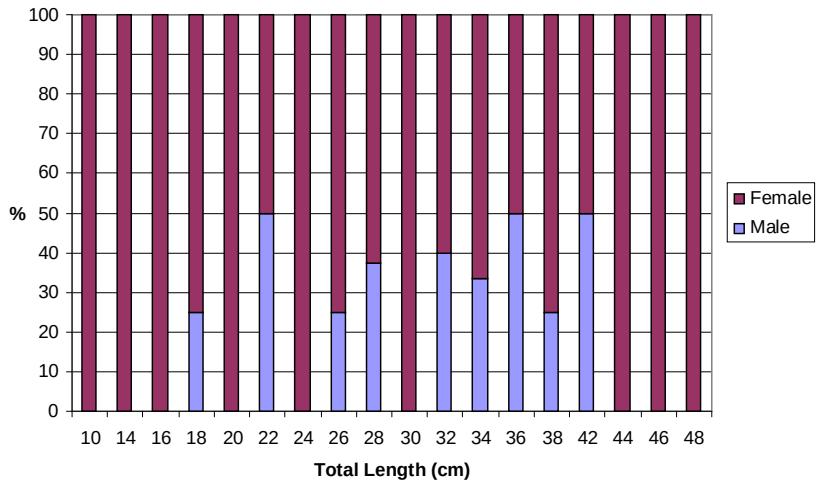


Figure 12. Sex-ratio by length class of *Hoplostethus atlanticus*.

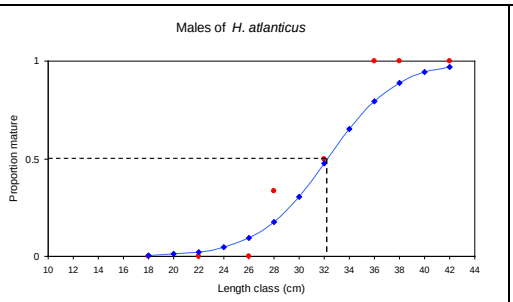
Maturity

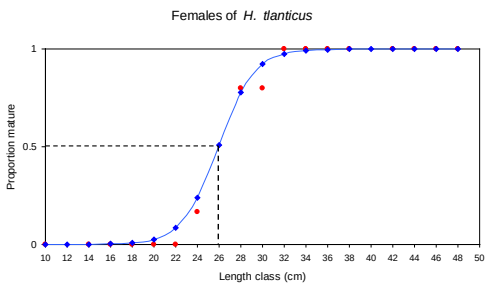
Males reach stage I of maturity at a mean length of 26.9 cm TL, stage II at 30.7 cm and stage III at 38.6 cm (Table 13). For females at maturity stage I the mean length value is 21.7 cm of TL , 28.2 cm at stage II and 38.6 cm at stage III. Only three individuals at stage IV were found, one male and two females.

Table 13. Descriptive statistics of total length by sex and maturity stage of *Hoplostethus atlanticus*.

Sex	Maturity stage	n	Min.	Max.	Mean	SD
Male	I	8	18.5	34.0	26.9	5.0
	II	2	29.0	32.3	30.7	2.3
	III	2	36.0	41.2	38.6	3.7
	IV	1	37.7	37.7	37.7	
Female	I	17	10.6	29.4	21.7	5.5
	II	12	24.5	34.0	28.2	2.7
	III	17	27.5	48.0	38.8	6.7
	IV	2	38.4	39.1	38.8	0.5

From the current data, size at first maturity seems to be different for males and females. Thus, size at first maturity for males is reached at a mean length of 32.26 cm and for females at 25.93 cm (Table 14 and Figure 13).





Male maturity ogive $p_i = \frac{1}{1+e^{a+b\times TL_i}}$

Female maturity ogive $p_i = \frac{1}{1+e^{a+b\times TL_i}}$

Figure 13. Sex maturity ogives for males and females of *Hoplostethus atlanticus*.

Table 14. Maturity ogives parameters of *Hoplostethus atlanticus*

Sex	a	b	n	TL_{50} (cm)
Males	11.713	0.363	13	32.26
Females	15.688	0.605	46	25.93
All individuals	10.607	0.383	74	27.69

2.1.4.- *Allocyttus verrucosus* - Warty oreo

Length composition of catches

The total length of this species ranged between 10 and 40 cm and it was caught at between 479 and 1660 m depth (Table 15). The mean values of length and depth were 30.6 cm and 1042.4 m respectively.

Table 15. Descriptive statistics of specimen sizes (cm) and depth (m) of catches of *Allocyttus verrucosus*.

Variable	n	Min.	Max.	Mean	SD
TL	1451	10	40	30.6	3.6
Depth	1451	479	1660	1042.4	83.8

In Figure 14, the length frequency distribution by length class of all individuals caught is presented. One predominant mode is present at 30 cm TL and of interest is the relatively low presence of small fish between 10 and 25 cm of total length.

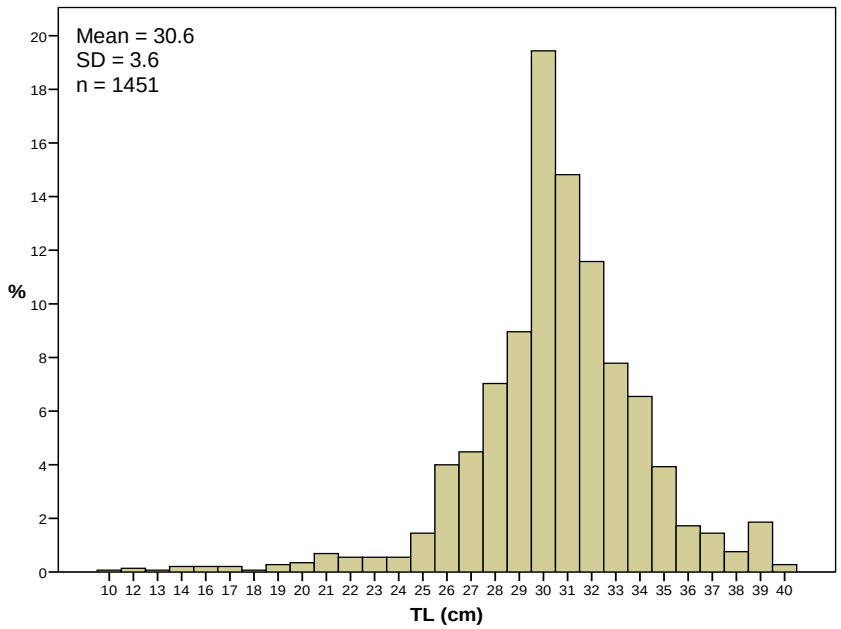
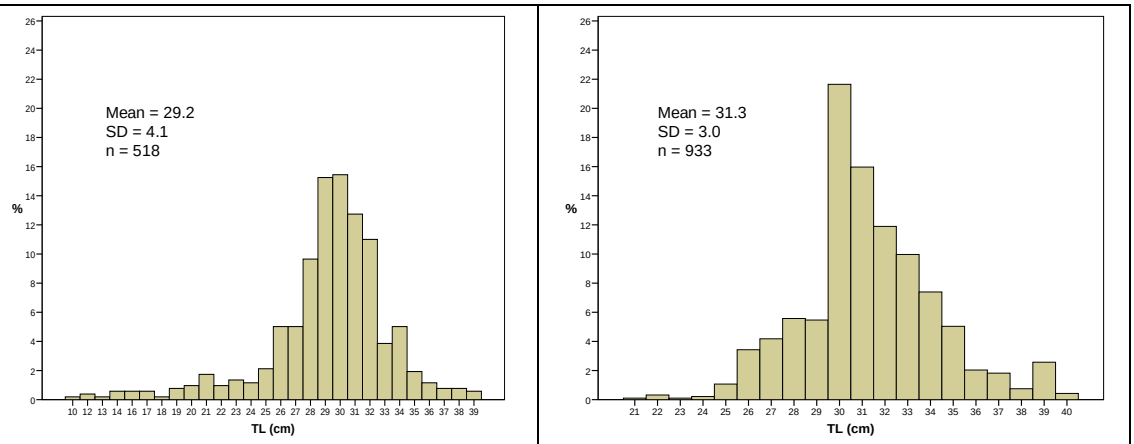


Figure 14. Length frequency distribution of catches of *Allocyttus verrucosus.*

Length frequency distributions below and above 1000 m depth have been tested for normality and mean differentiation (Kolmogorov-Smirnov and Mann-Whitney tests) and significant differences have been found. In Table 16 and Figure 15 the descriptive statistics for length and new length frequency distribution for these two strata are presented. The mode occurs at 30 cm in both cases but in shallower stratum fish smaller than 21 cm are present.

Table16. Descriptive statistics of specimen sizes (cm) of *Allocyttus verrucosus,* at depth <>1000 m.

Depth stratum	n	Min.	Max.	Mean	SD
< 1000 m	518	10	39	29.2	4.1
> 1000 m	933	21	40	31.3	3.0



< 1000 m | > 1000 m

Figure 15. Length frequency distribution of catches of *Allocyttus verrucosus* by depth stratum.

2.1.5.- *Alepocephalus productus* - Smalleye smooth-head

Alepocephalus productus

Length composition of catches

The total length of this species ranged between 12 and 68 cm and it was caught at between 867 and 1660 m depth (Table 17). The mean values of length and depth were 40.8 cm and 1011.1 m respectively.

Table 17. Descriptive statistics of specimen sizes (cm) and depth (m) of catches of *Alepocephalus productus.*

Variable	n	Min.	Max.	Mean	SD
TL	1226	12	68	40.8	13.4
Depth	1226	867	1660	1011.1	138.4

In Figure 16, the length frequency distribution in 2 cm length classes of all individuals caught is presented.

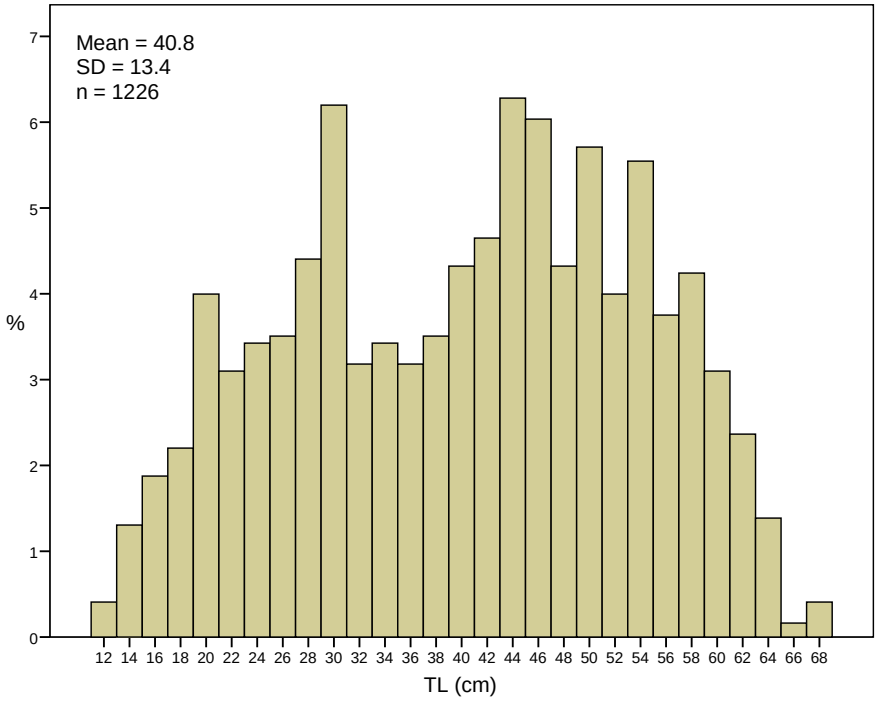
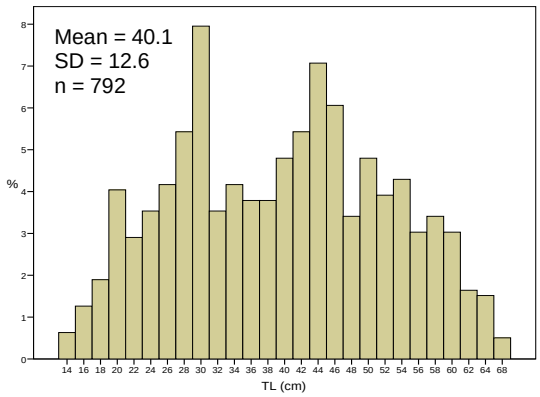


Figure 16. Length frequency distribution of catches of *Alepocephalus productus.*

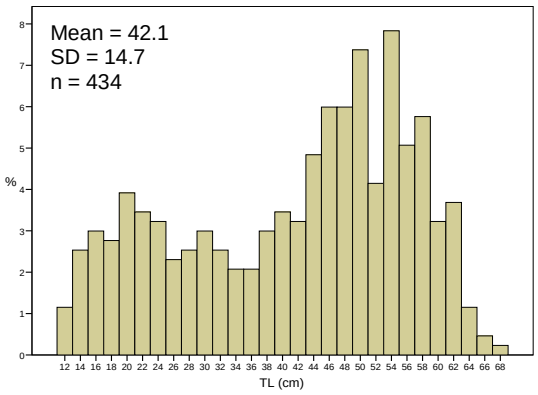
Length frequency distributions below and above 1000 m depth have been tested for normality and mean differentiation (Kolmogorov-Smirnov and Mann-Whitney tests) and significant differences have been found. In Table 18 and Figure 17 the descriptive statistics for length and new length frequency distribution for these two strata are presented.

Table 18. Descriptive statistics of specimen sizes (cm) of *Alepocephalus productus,* at depth <>1000 m.

Batimetric range	n	Min.	Max.	Mean	SD
< 1000 m	792	14	68	40.1	12.6
> 1000 m	434	12	68	42.1	14.7



< 1000 m



> 1000 m

Figure 17. Length frequency distribution of catches of *Alepocephalus productus*, by depth stratum.

2.1.6.- *Roulenia attrita* - Softskin smooth-head

Roulenia attrita

Length composition of catches

The total length of this species ranged between 20 and 57 cm and it was caught at between 973 and 1660 m depth (Table 19). The mean values of length and depth were 44.3 cm and 1093.1 m respectively. It was observed that 92% of individuals were caught at between 973 and 1155 m depth (Table 20).

Table 19. Descriptive statistics of specimen sizes (cm) and depth (m) of catches of *Roulenia attrita.*

Variable	n	Min.	Max.	Mean	SD
TL	1045	20	57	44.3	5.0
Depth	1045	973	1660	1093.2	144.5

Table 20. Frequency distribution of *Roulenia attrita* in relation to depth			
Depth	Frequency	Percentage	Percentage accumulation
973	2	0.2	0.2
981	135	12.9	13.1
1024	548	52.4	65.6
1095	4	0.4	65.9
1155	273	26.1	92.1
1270	3	0.3	92.3
1487	19	1.8	94.2
1542	52	5.0	99.1
1660	9	0.9	100.0

In Figure 18, the length frequency distribution by length class of all individuals caught is presented. One predominant mode is observed at 44 cm TL.

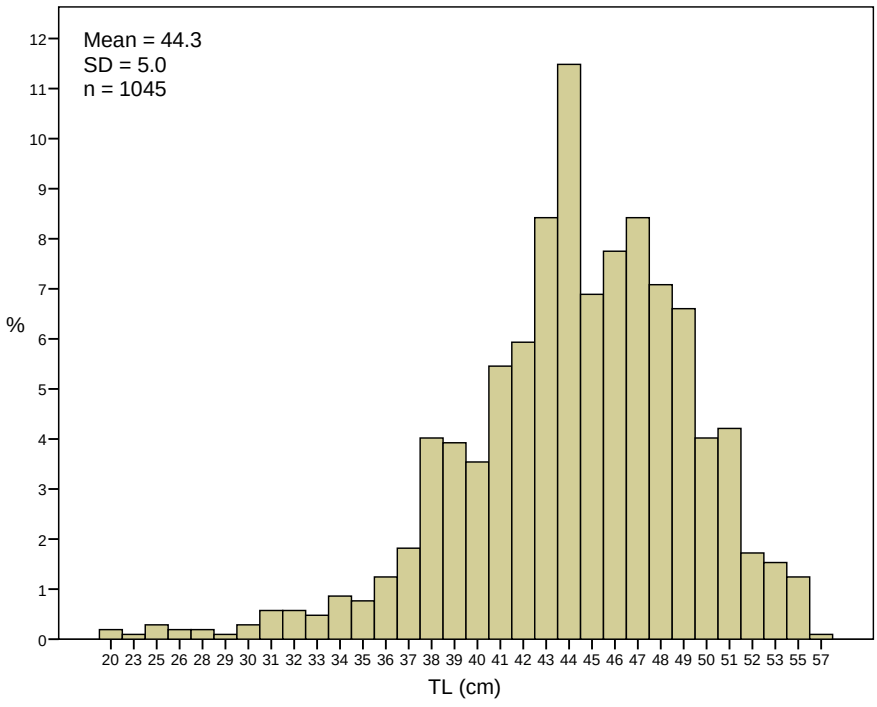


Figure 18. Length frequency distribution of catches of *Roulenia attrita.*

2.1.8.- *Notopogon xenosoma* - Longspine bellowfish

Notopogon xenosoma

Length composition of catches

The total length of this species ranged between 8 and 19 cm and it was caught at between 232 and 237 m depth (Table 21). The mean values of length and depth were 14.3 cm and 233.3 m respectively.

Table 21. Descriptive statistics of specimen sizes (cm) and depth (m) of catches of *Notopogon xenosoma*.

Variable	n	Min.	Max.	Mean	SD
TL	846	8.0	19.0	14.3	1.7
Depth	846	232	237	233.3	1.6

In Figure 20, the length frequency distribution by length class of all individuals caught is presented. One predominant mode is observed at 15 cm TL.

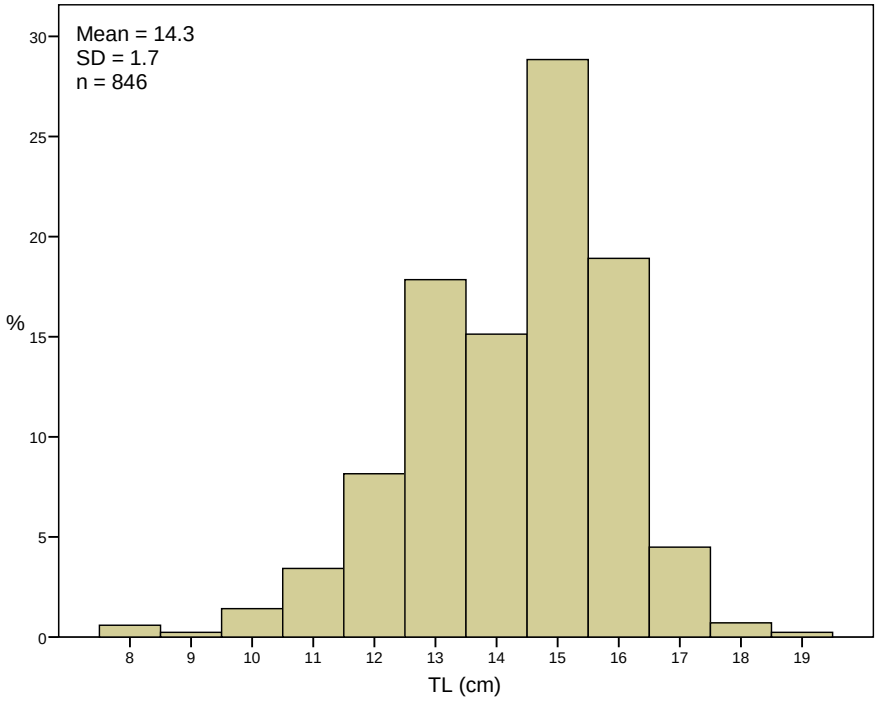


Figure 20. Length frequency distribution of catches of *Notopogon xenosoma.*

2.2.- Cartilaginous fishes

The diversity of chondrichthians in the catches was very low with only eight species at low abundance caught. One of the most remarkable findings in the survey was the total absence of skates. Taking into consideration that not all the depths were sampled because of the seamount cliffs (300 – 800 m) that are inaccessible to bottom trawling, the reasons for the poor results are unknown, but food availability, water conditions and other necessities determine the carrying capacity of the environment for those species, conditioning their abundance at specific trophic levels.

Species have been grouped by taxonomic families but analyzed individualy. Length composition of catches, descriptive statistics, length-weight relationship and reproduction are presented.

Scyliorhinidae Family: small sharks of less than 1.5 m TL, demersal and sedentary. Distributed worldwide in tropical, warm and cold waters, and inhabiting the seafloor from shallow waters to 2000 m depth. They are, for the most part, ovoviviparous.

2.2.1.- *Apristurus* sp. – Catshark

Apristurus sp.

This is a small demersal shark species that forms small assemblages. It is of no commercial interest. The genus *Apristurus* is in continuous review and individuals collected must be revised to determine their exact taxonomic position.

A total of 28 individuals were caught in eight hauls carried out at between 968 and 1270 m depth. Descriptive statistics of total length and weight by sex are shown in Table 22.

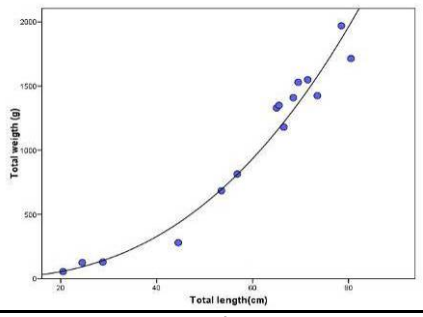
Table 22. Descriptive statistics of length (cm) and weight (g) by sex of *Apristurus* sp.

Sex	Variable	n	Min.	Max.	Mean	SD
Males	TL	15	20.5	80.5	57.8	19.6
	TW	15	55	1970	1036.7	637.8
Females	TL	13	30.5	74.0	55.8	14.1
	TW	13	155	1530	824.6	513.1

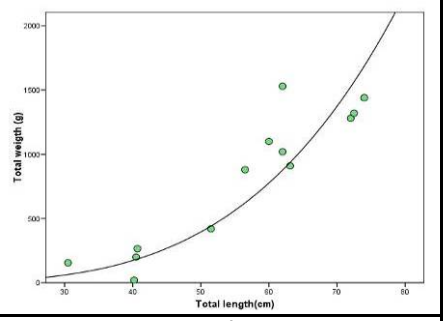
In Table 23, results of the length – weight relationship analysis for males, females and all individuals are shown. Their graphic representation with the real values is presented in Figure 21. The allometry coefficients (b) show a small negative allometry between both variables. The determination coefficient (R^2) shows high values in all cases, which indicates the high correlation between the total length and the green weight of specimens.

Table 23. Parameters of the Total Length (cm) - Total Weight (g) relationship ($TW=aTL^b$) for males, females and all individuals.

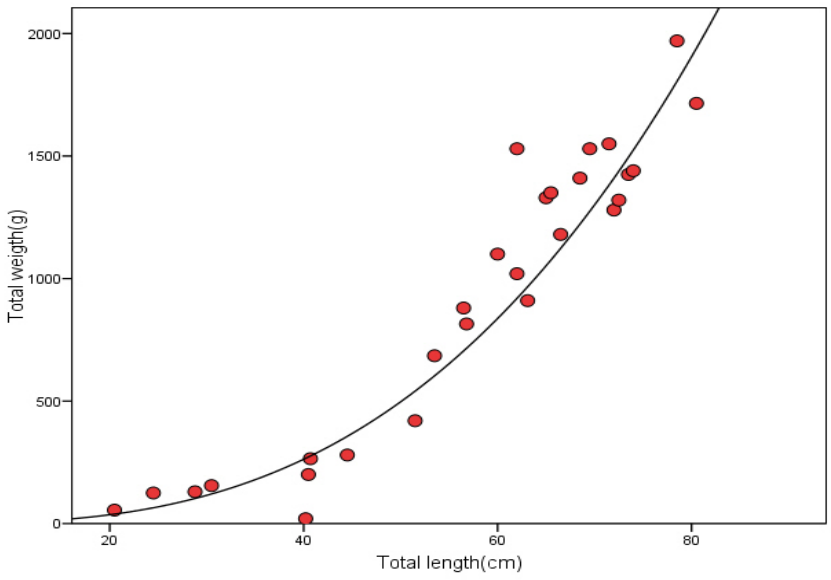
	a	b	R^2	n	Range TL	Range TW
Male	0.024	2.578	0.979	15	20.5-80.5	55-1970
Female	0.005	2.965	0.920	13	30.5-74	155-1530
All individuals	0.016	2.675	0.952	28	20.5-80.5	55-1970



Males



Females



All individuals

Figure 21. Length – weight relationship for males, females and all individuals of *Apristurus* sp.

Reproduction

32.1% of individuals analyzed were immature and 67.8% were mature adults. None showed any spawning activity.

2.2.2.- *Apristurus manis* - Ghost catshark

A species of North Atlantic distribution, and whose presence in the South Atlantic is not clear. Therefore, taxonomic determination must still be confirmed. A species of no commercial value.

Only two individuals were caught at about 981 m depth and their measurements are shown in Table 24. Both specimens were preserved for collection.

Table 24. Descriptive statistics of length (cm) and weight (g) by sex of *Apristurus manis*.

Variable	n	Min.	Max.	Mean	SD
TL	2	69	78	73.5	6.4
TW	2	1230	1920	1575.0	487.9

Reproduction

The male specimen was in the activity stage and the female inactive.

Etmopteridae Family: It includes five genus and 41 species. They are demersal sharks smaller than 90 cm TL that are present in all the oceans, inhabiting depths between 500 and 6000 m. Some species are solitary and others form great assemblages at depth. The most remarkable feature of this family is the presence of a spine in both dorsal fins.

2.2.3.- *Etmopterus princeps* - Great lanternshark.

Etmopterus princeps

This is a deep-sea shark that inhabits the slope at depths of between 500 and 2500 m. It is of little commercial value but its meat is used for human consumption.

A total of 132 individuals were caught at between 981 and 1155 m depth, 103 males and 29 females. Descriptive statistics of total length and weight by sex are shown in Table 25.

Table 25. Descriptive statistics of length (cm) and weight (g) by sex of *Etmopterus princeps*.

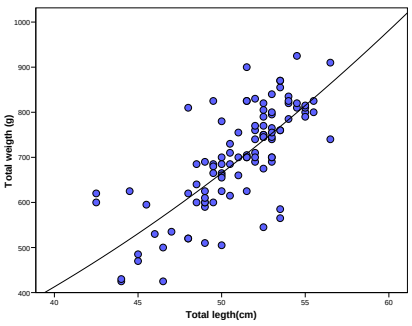
Sex	Variable	n	Min.	Max.	Mean	SD
Males	TL	15	103	42.5	56.5	51.0
	TW	15	102	425.0	925.0	700.3
Females	TL	29	42.0	64.5	54.3	5.8
	TW	28	350.0	1430.0	840.5	261.3

In Table 26, results of the length – weight relationship analysis for males, females and all individuals are shown. Their graphic representation with the real values is shown in Figure 22. The allometry coefficients (b) show a marked negative allometry between

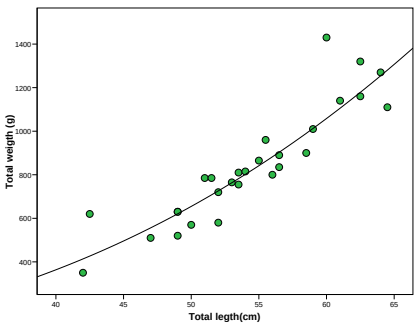
both variables. The correlation between the total length and the green weight of specimens is not very high.

Table 26. Parameters of the Total Length (cm) - Total Weight (g) relationship ($TW=aTL^b$) for males, females and all individuals.

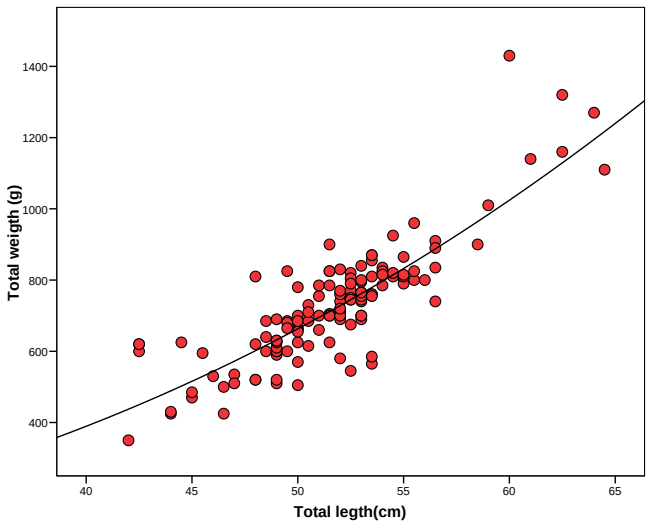
	a	b	R^2	n	Range TL	Range TW
Male	0.152	2.136	0.555	102	42.5-56.5	425-925
Female	0.022	2.635	0.831	28	42-64.5	350-1430
All individuals	0.059	2.385	0.703	132	42-64.5	350-1430



Males



Females



All individuals

Figure 22. Length – weight relationship for males, females and all individuals of *Etmopterus princeps* .

Reproduction

Although differences in bathymetric distribution by sex and maturity stage are known for this species, it has not been found in the current analysis, probably due to too few samples. 30% of males were immature and 70% adults but only one was active. For females, 76% were immature and 30% of the adults were inactive.

2.2.4.- *Etmopterus brachyurus - Shorttail lanternshark*

Etmopterus brachyurus

This is a small deep-sea shark that inhabits the slope at depths of between 450 and 2500 m, is quite rare and not well known.

A total of 41 individuals were caught at between 867 and 1270 m depth, 20 males and 21 females. Descriptive statistics of total length and weight by sex are shown in Table 27.

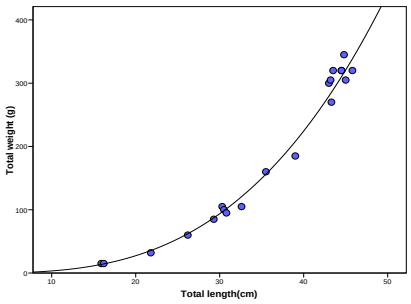
Table 27. Descriptive statistics of length (cm) and weight (g) by sex of *Etmopterus brachyurus*.

Sex	Variable	n	Min.	Max.	Mean	SD
Males	TL	20	15	345	188.1	122.1
	TW	20	15.9	45.8	35.3	9.9
Females	TL	21	10	550	146.7	141.3
	TW	21	15.5	50.0	31.8	9.7

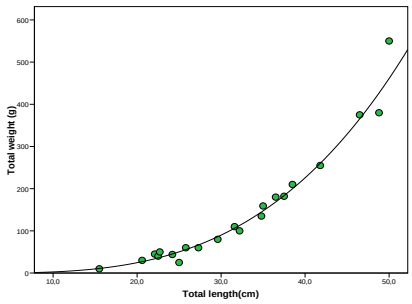
In Table 28, results of the length – weight relationship analysis for males, females and all individuals are shown. Their graphic representation with the real values is shown in Figure 23. The allometry coefficients (b) show a small positive allometry between both variables. The correlation between the total length and the green weight of specimens is quite high.

Table 28. Parameters of the Total Length (cm) - Total Weight (g) relationship ($TW=aTL^b$) for males, females and all individuals.

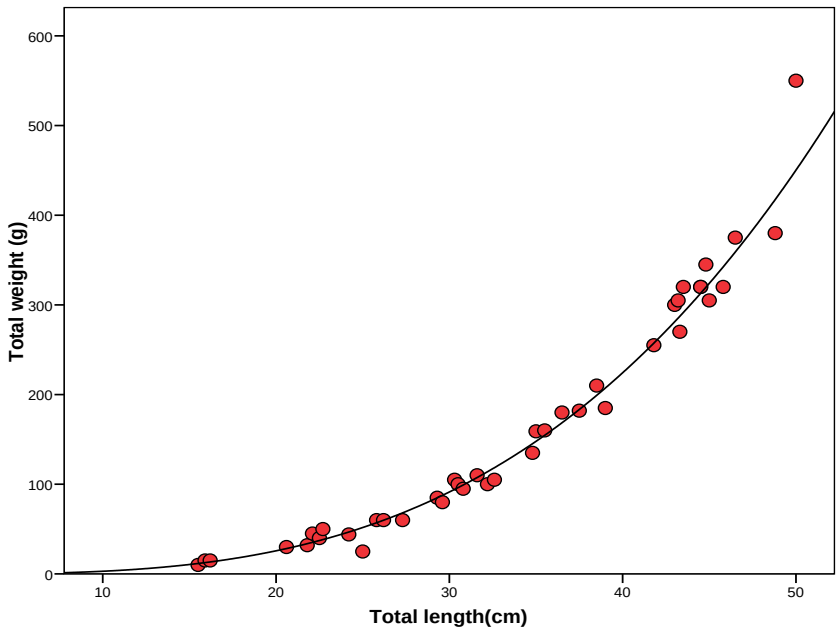
	a	b	R^2	n	Range TL	Range TW
Male	0.003	3.036	0.994	20	15-345	15.9-45.8
Female	0.002	3.200	0.962	21	10-550	15.5-50.0
All individuals	0.002	3.123	0.977	41	10-550	15.5-50.0



Males



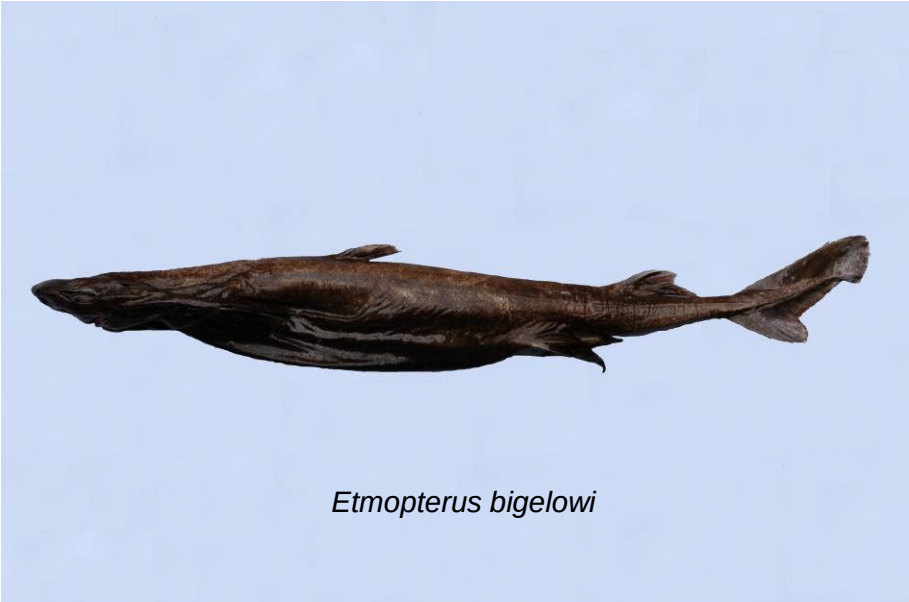
Females



All individuals

Figura 23. Length – weight relationship for males, females and all individuals of *Etmopterus brachyurus* .

2.2.5.- *Etmopterus bigelowi* - Blurred smooth lantern shark



Etmopterus bigelowi

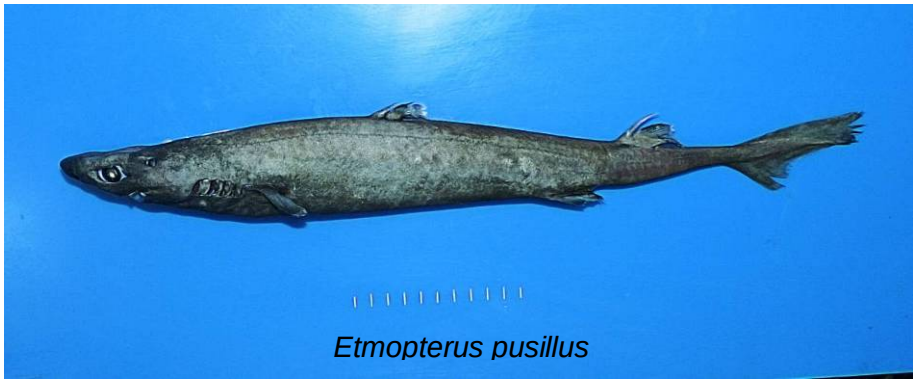
This is a small demersal shark which is distributed worldwide at between 150 and 1000m depth.

Only two males were caught at about 900 m depth. Descriptive statistics of total length and weight by sex is shown in Table 29.

Table 29. Descriptive statistics of length (cm) and weight (g) by sex of *Etmopterus bigelowi.*

Variable	n	Min.	Max.	Mean	SD
TL	2	400	880.0	640	339.4
TW	2	47.1	59.5	53.3	8.8

2.2.6.- *Etmopterus pusillus* - Smooth lanternshark



Etmopterus pusillus

This is a small demersal shark, common in the Atlantic and Pacific oceans. Its distribution ranges between 300 and 100º m depth.

Only one individual (male) was caught at about 980 m depth.

2.2.7.- *Zameus squamulosus* - Velvet dogfish

This is a demersal and/or mesopelagic shark of medium size that forms large assemblages in specific areas at depths of between 300 and 2200 m.

Three individuals were caught at between 972 and 1270 m depth, 1 male adult and 2 immature females. Descriptive statistics of total length and weight by sex is shown in Table 30.

Table 30. Descriptive statistics of length (cm) and weight (g) by sex of *Zameus squamulosus*.

Sex	Variable	n	Min.	Max.	Mean	SD
Males	TL	1	52	52	52	
	TW	1	785	785	785	
Females	TL	2	48,1	52.2	50.2	2.9
	TW	2	620.0	685.0	652.5	46.0

Chimaeridae Family: Included in the order of chimaeras that is present in all the oceans at between 200 and 3000 m depth. Its morphology is quite extraordinary and unmistakable. The family includes 2 genera and 20 species.

2.2.8.- *Hydrolagus affinis* - Smalleyed rabbitfish


Hydrolagus affinis

Three individuals were caught in one haul at about 1660 m depth, 1 male adult of 125 cm TL and 2 immature females of 38 and 99 cm TL. Descriptive statistics of total length and weight by sex are shown in Table 31.

Table 31. Descriptive statistics of length (cm) and weight (g) by sex of *Hydrolagus affinis.*

Sex	Variable	N	Min.	Max.	Mean	SD
Males	TL	1	125	125	125	
	TW	1	11520	11520	11520	
Females	TL	2	39.0	99.0	69.0	42.4
	TW	2	100.0	4940.0	2520.0	3422.4

2.3.- Crustacean

From samples obtained by trawls the size composition of catches was calculated, as were descriptive statistics, length-weight relationship and sex-ratio, for the more abundant crustacean species or those of commercial interest: *Austropenaeus nitidus*, *Chaceon* spp. and *Acanthephyra eximia*.

2.3.1.- *Austropenaeus nitidus*.

Austropenaeus nitidus

Length composition of catches

The cephalothorax length (CL) was used as a measure of size in this species. The size of specimens ranged between 16.6 and 47.7 mm and it was caught at depths ranging between 933 to 1155 m (Table 32).

Table 32. Descriptive statistics of specimen sizes (mm) and depth (m) of catches of *Austropenaeus nitidus*.

Variable	n	Min.	Max.	Mean	SD
CL	343	16.6	47.7	28.1	6.9
Depth	345	867	1660	1066.0	174.5

In Figure 24, the length frequency distribution of all individuals caught is presented. Males and females show morphometric differences (Table 32) and males represent the main component in the smaller sizes ranges of between 18 and 30 mm CL.

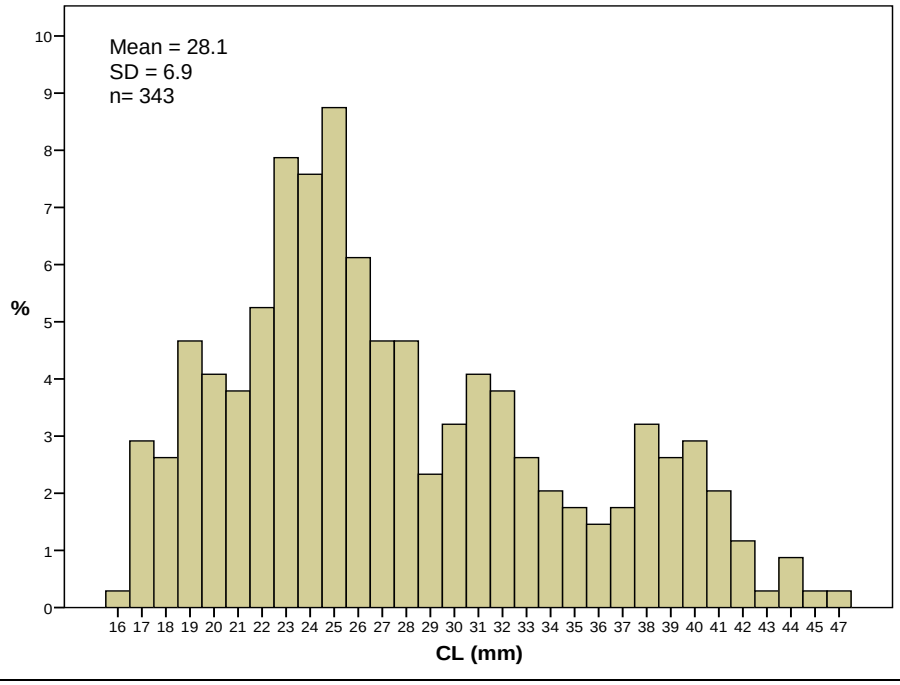


Figure 24. Length frequency distribution of catches of *Austropenaeus nitidus*.

Descriptive statistics of measurement data by sex

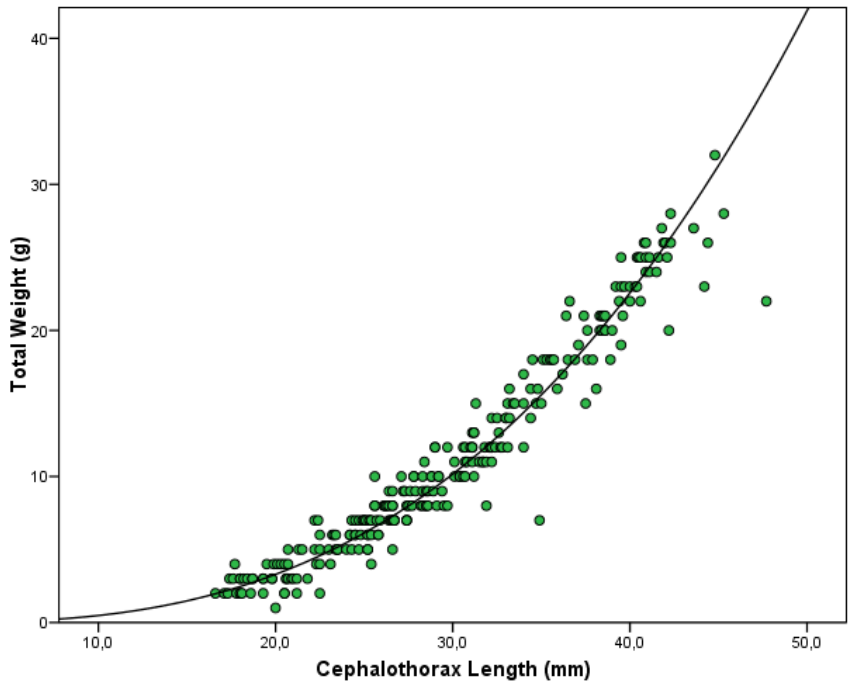
The cephalothorax length range of females is greater than that of males, as is common in species of the Aristeidae family, at between 16.6 – 47.7 mm. However, the length of males ranged between 18.6 and 29.6 mm. The weight of males ranged between 2 and 9 g with a mean value of 5 g. Female weight ranges are greater, between 1 and 32 g with a mean value of 11.3 g (Table 33).

Table 33. Descriptive statistics of cephalothorax length (mm) and weight (g) by sex of *Austropenaeus nitidus.*

Sex	Variable	n	Min.	Max.	Mean	SD
Male	CL	85	18.6	29.6	23.5	2.4
	TW	86	2	9	5.0	2.0
Female	CL	258	16.6	47.7	29.7	7.2
	TW	259	1	32	11.3	7.2
All individuals	CL	343	16.6	47.7	28.1	6.9
	TW	345	1	32	9.8	6.9

Length-weight relationship

The parameters defining the length-weight relationship of females were: a=0.001, b=2.773 y R^2=0.927. The relationship for males seems to be unrealistic possibly due to incorrect data recording. The graphic representation of the fitted curve and the values are shown in Figure 25.



Female

Figure 25. Length – weight relationship for females of *Austropenaeus nitidus*.

Sex-ratio

All the individuals greater than 30 mm CL were females and males are only present in length classes between 18 and 29 mm (Figure 26).

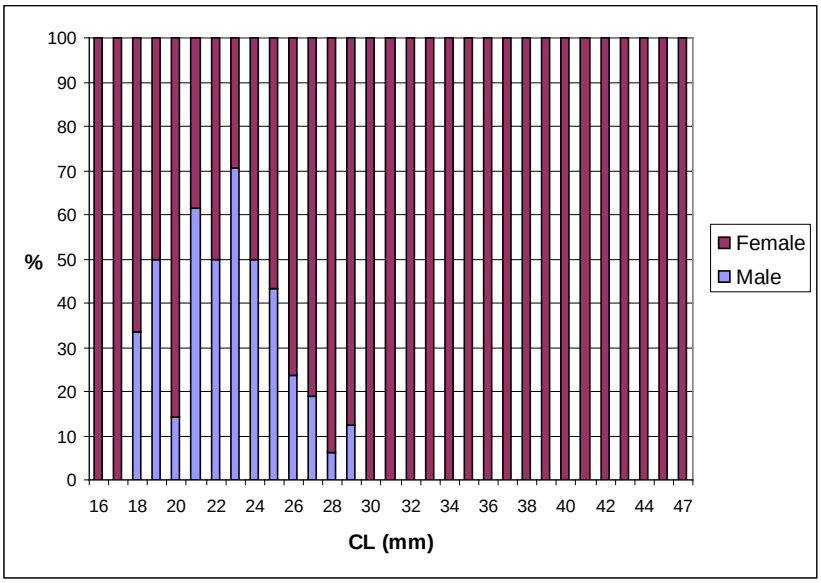


Figure 26. Sex ratio per 1 mm size class for *Austropenaeus nitidus*.

2.3.2.- *Chaceon* spp.

Two species of geryonids were present in the catches, *Chaceon erytheiae* and *Chaceon chuni* . With the exception of one haul both species were caught in the same trawls. In spite of the initial identification some doubt persists and the initial results are under review. Because of that and considering that the lengths of both species were similar we decided to process all the data together as a group of species (*Chaceon* spp.).

Chaceon erytheiae

Chaceon chuni

Size composition of catches

The carapace width (CW) and carapace length (CL) were both considered as a measure of size of *Chaceon* spp. The size of individuals ranged between 41.6 and 116.5 mm CW and between 27.8 - 96.9 mm CL. The samples were caught at depths ranging between 867 and 1660 m (Table 34).

Table 34. Descriptive statistics of specimen sizes (mm) and depth (m) of catches of *Chaceon* spp.

Variable	n	Min.	Max.	Mean	SD
CL	497	27.8	96.9	74.5	11.2
CW	496	41.6	116.5	82.7	12.7
Depth	497	867	1660	890.0	114.2

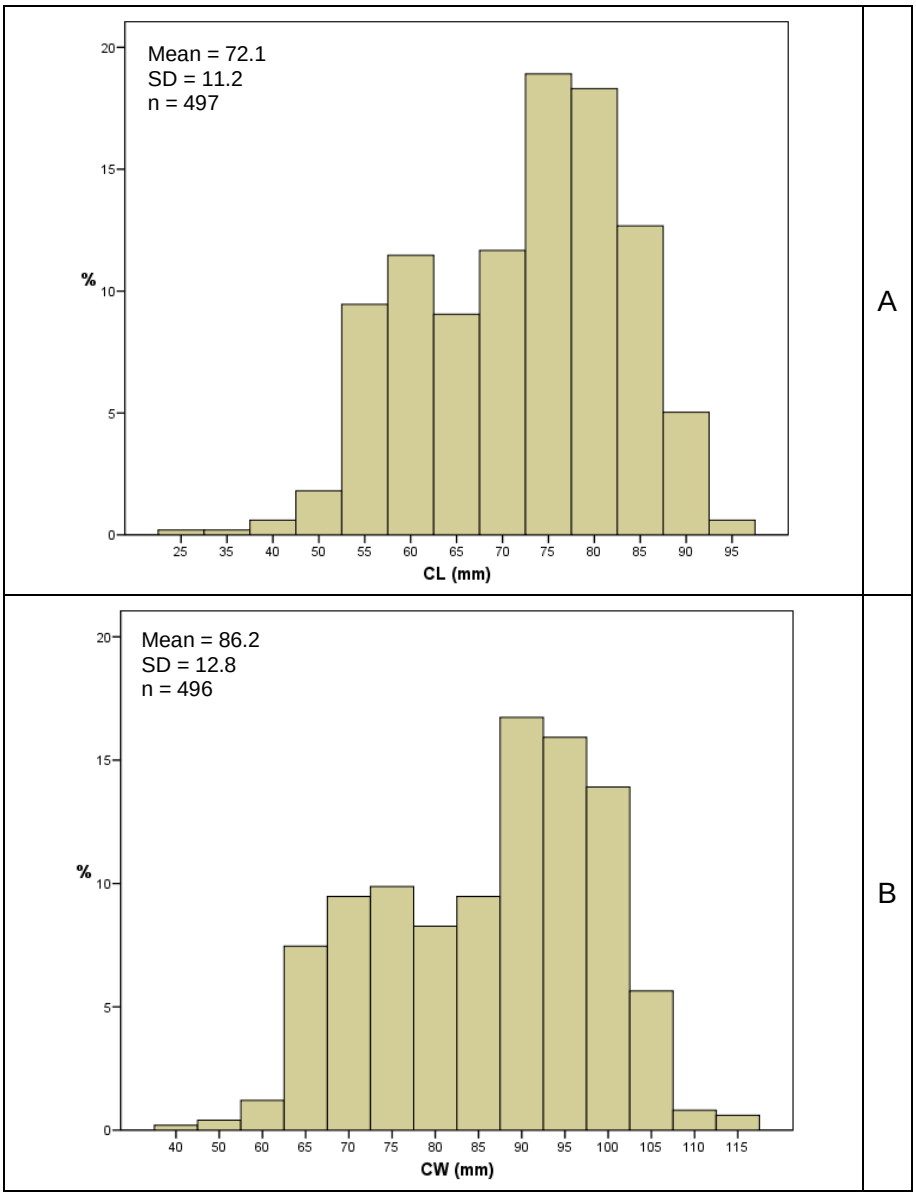


Figure 27. Size frequency distribution: A. Carapace length; B. Carapace width of *Chaceon* spp.

In Figures 27 a and b, size frequency distribution (CL and CW) in 5 mm intervals are presented. Two clear modes are present in the size distribution, which is a common pattern in geryonids.

Descriptive statistics of measurement data by sex

Males reach larger sizes than females and ranged between 35.1 and 96.9 mm CL with a mean value of 80.8 mm, which correspond to 41.6 and 116.5 mm CW and the mean value of 95.9 mm. The female CL range was between 27.8 - 86.5 mm (mean=64.2 mm), corresponding to 51.7 y 99.1 mm CW (mean= 76.7 mm). The total weight of males fluctuated between 19 and 488 g with a mean value of 269.8 g, greater than that for females 26 - 266 g (mean=120.8 g) (Table 35).

Table 35. Descriptive statistics of size (mm) and weight (g) by sex of *Chaceon* spp.

Sex	Variable	n	Min.	Max.	Mean	SD
Male	CL	310	35.1	96.9	80.8	7.4
	CW	310	41.6	116.5	95.9	8.7
	TW	310	19.0	488.0	269.8	65.9
Female	CL	187	27.8	86.5	64.2	8.3
	CW	186	51.7	99.1	76.7	8.6
	TW	187	26.0	266.0	120.8	38.7
All individuals	CL	497	27.8	96.9	74.5	11.2
	CW	496	41.6	116.5	88.7	12.7
	TW	497	19.0	488.0	213.7	92.1

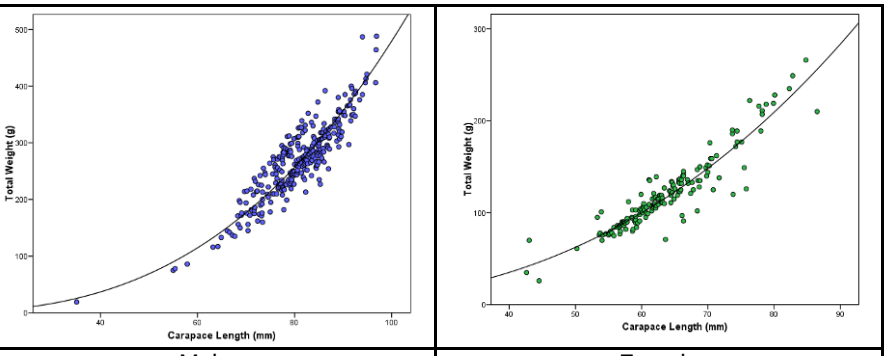
Size frequency distributions below and above 1000 m depth have been tested for normality and mean differentiation (Kolmogorov-Smirnov and Mann-Whitney tests) and no significant differences have been found. However, it was observed that smaller crabs seem to be distributed at deeper depths.

Length-weight relationship

The results of the carapace length – weight relationship analysis for males, females and all individuals are presented in Table 36 and their graphic representation with the real values is shown Figure 28. In all cases, the allometry coefficients (b) show lower values than 3 for males and females, which indicate a small negative allometry between both variables. The determination coefficient (R^2) shows high values in all cases, which indicate then the high correlation between the carapace length and the green weight of specimens.

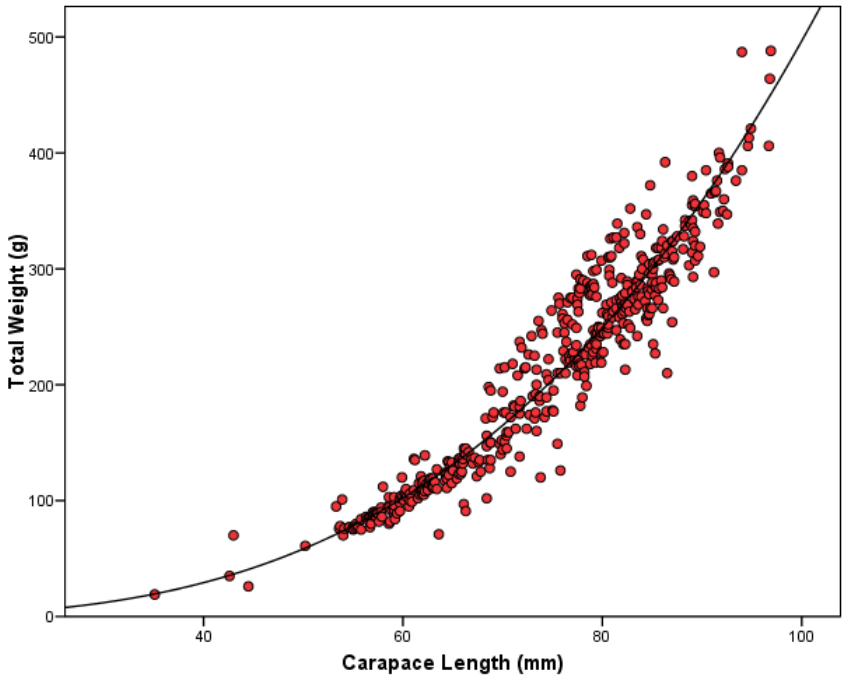
Table 36. Parameters of the carapace length (mm) - total weight (g) relationship ($TW=aTL^b$) for males, females and all individuals.

	a	b	R^2	N	CL range	TW range
Male	0.001	2.800	0.859	310	35.1-96.9	19-488
Female	0.003	2.572	0.858	169	42.6-86.5	26-266
All individuals	0.001	3.090	0.933	479	35.1-96.9	19-488



Male

Female



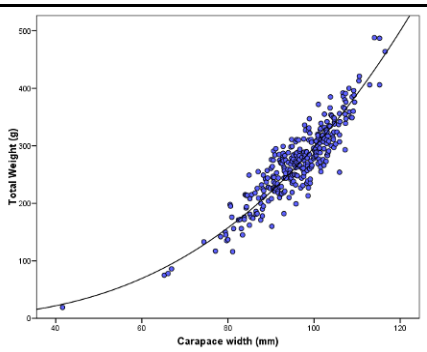
All individuals

Figure 28. Carapace length – weight relationship for males, females and all individuals of *Chaceon* spp.

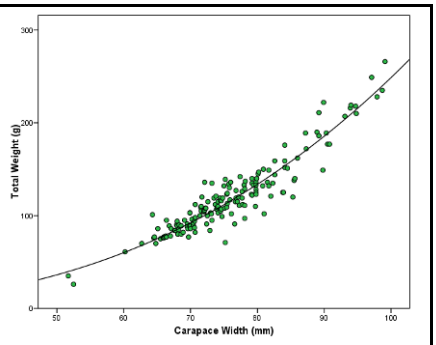
The results of the carapace width – weight relationship analysis for males, females and all individuals are presented in Table 37 and their graphic representation with the real values is shown in Figure 29. In all cases, the allometry coefficients (b) show lower values than 3 for males and females, which indicate a small negative allometry between both variables. For all individuals the allometry is positive. The determination coefficient (R^2) shows high values in all cases, which indicate the high correlation between the carapace length and the green weight of specimens.

Table 37. Parameters of the carapace width (mm) - total weight (g) relationship ($TW=aTL^b$) for males, females and all individuals.

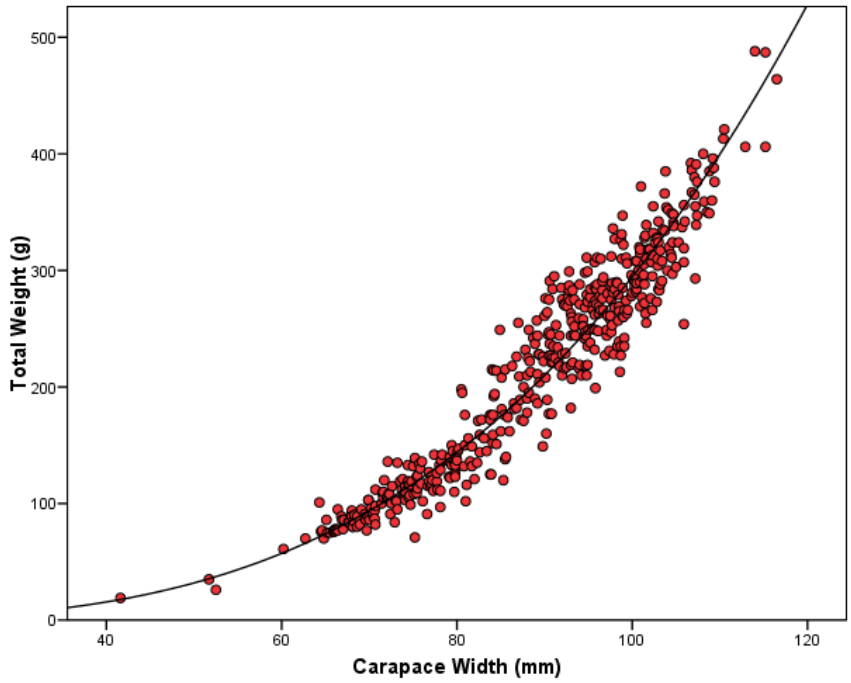
	a	b	R^2	n	CW range	TW range
Male	0.001	2.849	0.867	308	41.6-116.5	19-488
Female	0.001	2.781	0.876	166	51.7-99.1	26-266
All individuals	0.001	3.205	0.939	479	41.6-116.5	19-488



Male



Female



All individuals

Figure 29. Carapace width – weight relationship for males, females and all individuals of *Chaceon* spp.

Sex-ratio

The sex-ratio (Figure 30) in 5 mm size classes (CL) shows a confusing pattern for the smaller size class due to the scarcity of individuals in this range. Females are more abundant until 65 mm CL, the size from which males gradually begin to be dominant.

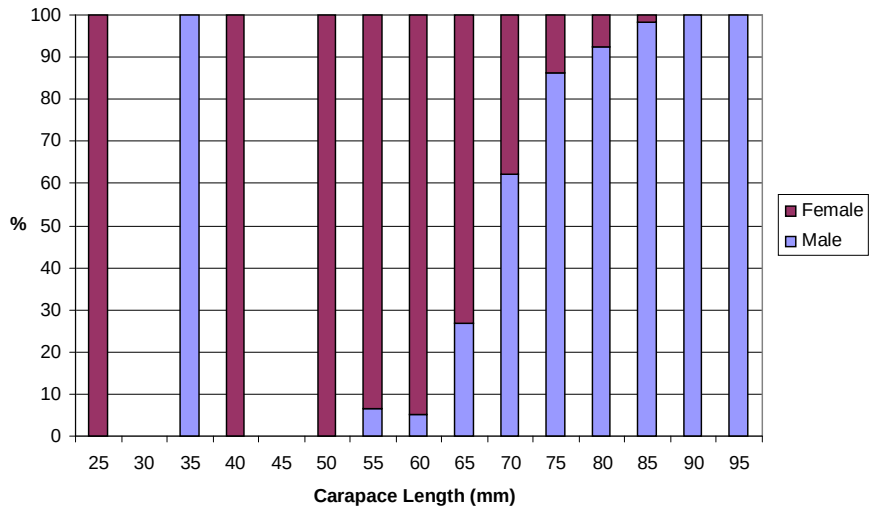


Figure 30. Sex ratio by size class for *Chaceon* spp.

2.3.3.- *Acanthephyra eximia*

Length composition of catches

The cephalothorax length (CL) was used as a measure of size in this species. Size of specimens ranged between 24.2 y 49.1 mm and it was caught at depths ranging from 986 to 1095 m (Table 38).

Table 38. Descriptive statistics of specimen sizes (mm) and depth (m) of catches of *Acanthephyra eximia*.

Variable	n	Min.	Max.	Mean	SD
CL	88	24.2	49.1	37.3	5.4
Depth	88	986	1095	1060.1	47.7

In Figure 31, the length frequency distribution by 2 mm length class of all individuals caught is presented. A main mode is present at 38 mm CL.

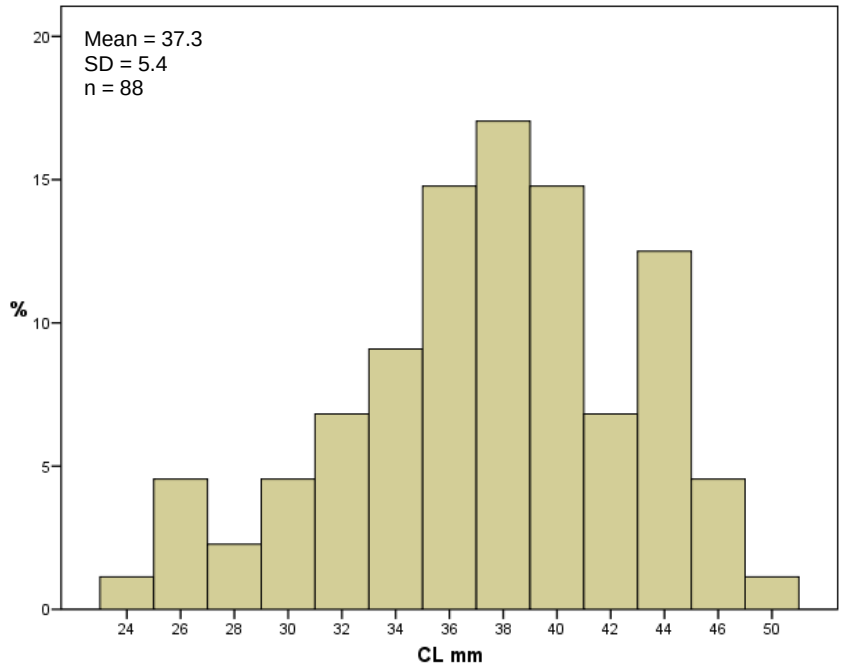


Figure 31. Length frequency distribution of catches of *Acanthephyra eximia.*

Descriptive statistics of measurement data

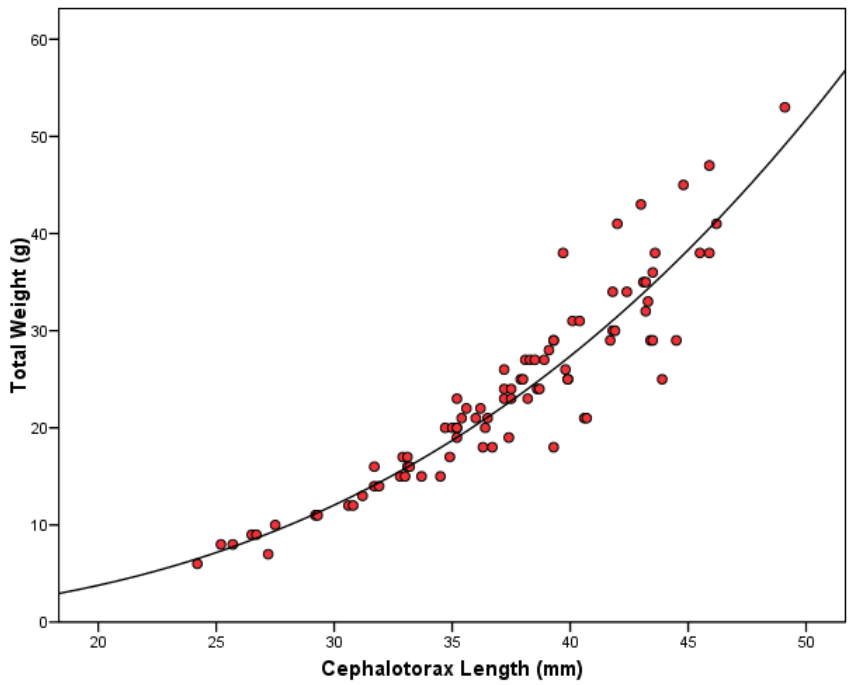
The cephalothorax length range for ovigerous females was between 35.2 - 49.1 mm CL. Unsexed individuals ranged between 24.2 and 46.2 mm. The weight of ovigorous females was between 6 and 43 g with a mean value of 20.1 g. The weight of non-sexed individuals ranged between 21 and 53 g, with a mean value of 31.2 g (Table 39).

Table 39. Descriptive statistics of cephalothorax length (mm) and weight (g) by groups of *Acanthephyra eximea.*

Sex	Variable	N	Min.	Max.	Mean	SD
Without eggs	CL	58	24.2	46.2	35.7	5.5
	TW	58	6	43	20.1	8.5
Ovigerous Female	CL	30	35.2	49.1	40.4	3.2
	TW	30	21	53	31.2	7.9
All individuals	CL	88	24.2	49.1	37.3	5.4
	TW	88	6	53	23.9	9.8

Length-weight relationship

The parameters defining the length-weight relationship of females were: a=0.001, b=2..852 y R^2=0.920. The graphic representation of the fitted curve and the values are shown in Figure 32.



All individuals

Figure 32. Length – weight relationship for females of *Acanthephyra eximia*.

Proportion between ovigerous females versus non-ovigerous individuals

Ovigerous females appear at 36 mm CL and between 40 and 46 mm CL the proportion is around 50% (Figure 33).

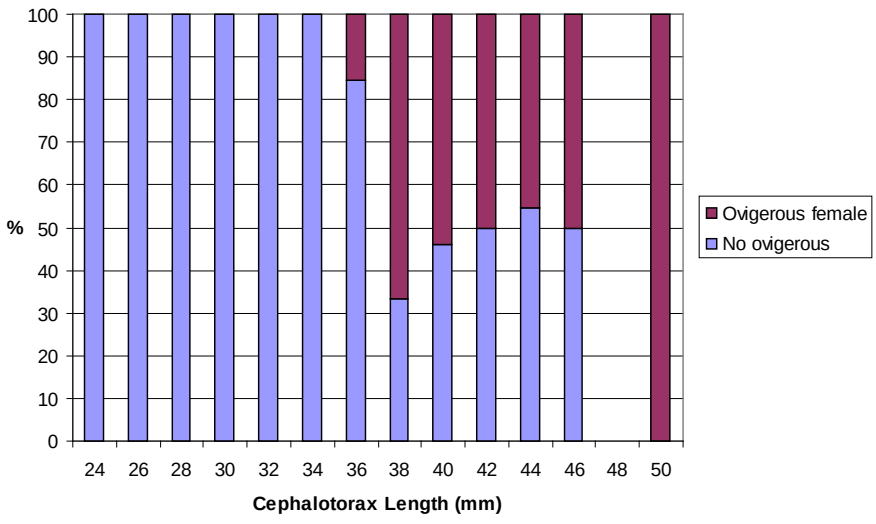


Figure 33. Proportion between ovigerous females versus non-ovigerous individuals of *Acanthephyra eximia*.

3.- Sample classification

A multivariate hierarchical classification analysis was carried out with a qualitative matrix of hauls/species in the haul direction. Different indexes or measures were applied and the Jaccard index was chosen as representative of the most numerous group with identical results. The cluster of the haul using the Jaccard Measure and complete linkage is shown in Figure 1.

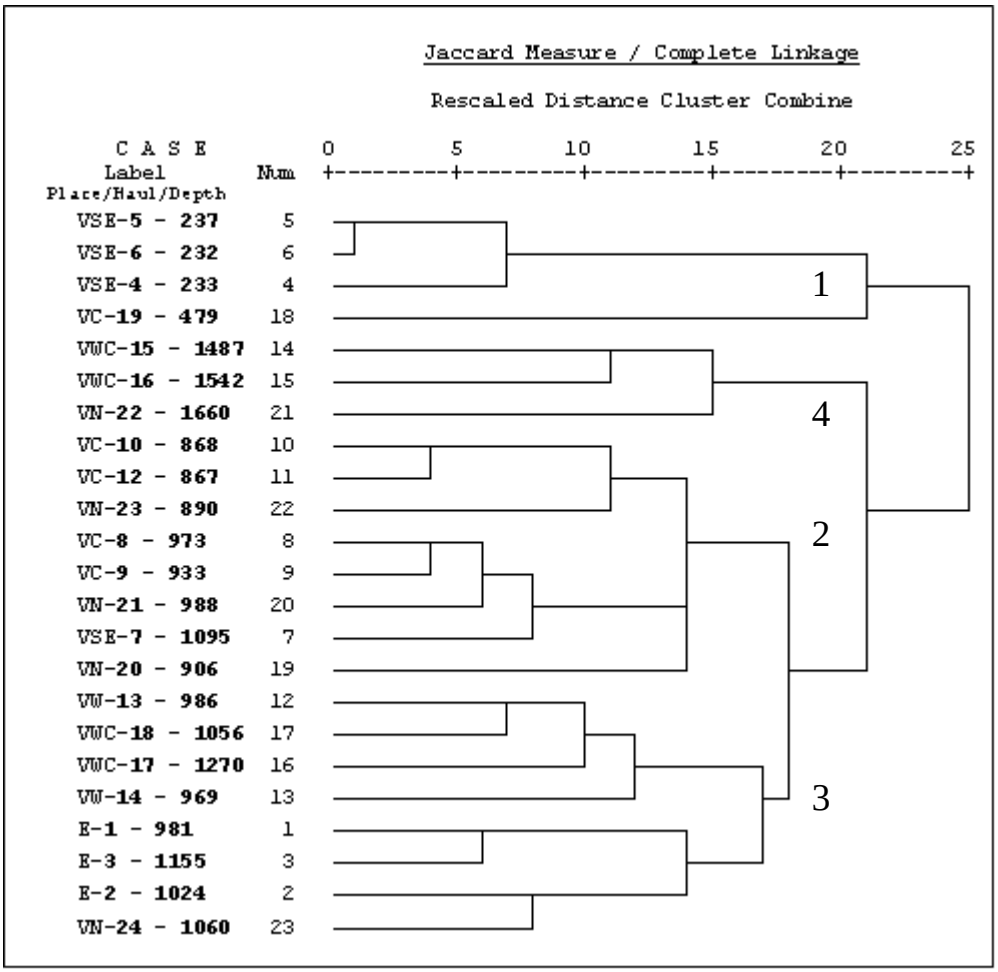


Figure 1.- Haul cluster obtained by hierarchical classification with the label showing the place, number and mean depth of hauls.

Place correspondence:

E	- Ewing
VSE	- Valdivia South East
VW	- Valdivia West
VC	- Valdivia Central
VWC	- Valdivia West Central
VN	- Valdivia North

In Figure 2 the area of study with the places and hauls considered in the current analysis is represented. Areas are described above.

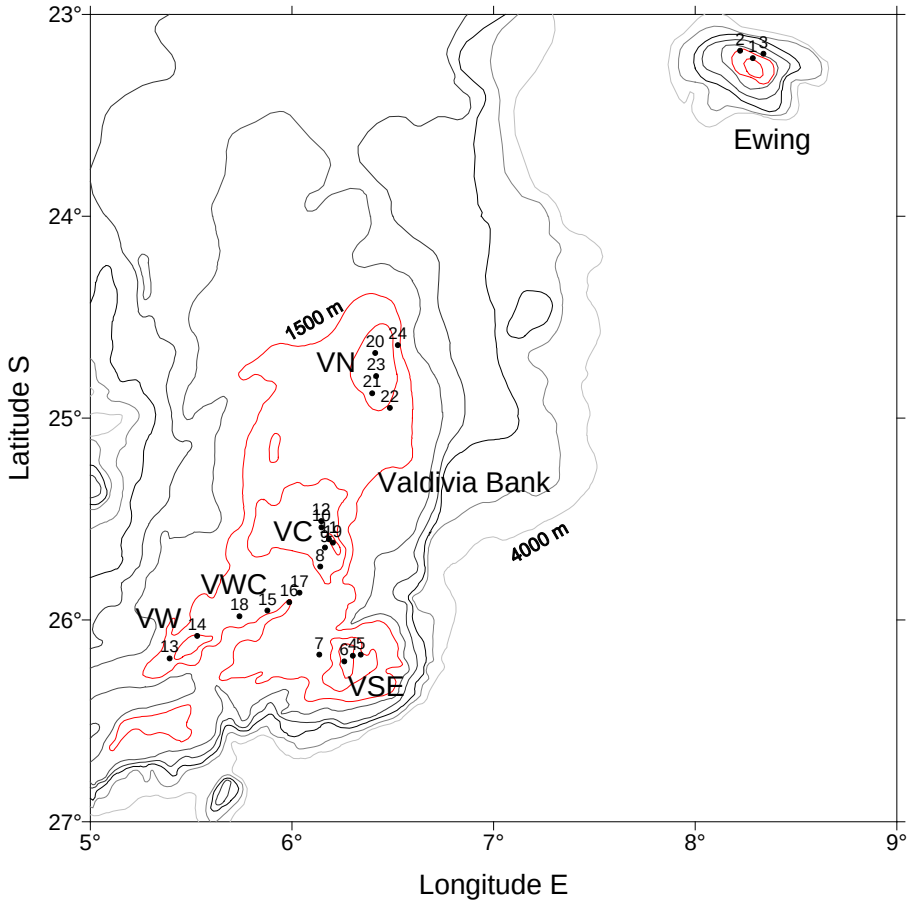


Figure 2.- Area studied and places considered in the analysis and sampling haul locations

Haul classification shows a clear relationship with depth and four assemblages have been identified that correspond to the following criteria:

1 - Shallower assemblage (200-500 m) from Valdivia Bank (Figure 1 and Table 1).

2 - 800 - 1100 m assemblage from Valdivia Bank (Figure 1 and Table 2).

3 - 900 - 1300 m assemblage from Ewing and Valdivia Bank (Figure 1 and Table 3).

4 - Deeper assemblage (1300 – 1700 m) from Valdivia Bank (Figure 1 and Table 4).

The first dichotomy differentiates the shallower group (1) from deeper groups (2, 3 and 4) from hauls (Figure 1). In the deeper assemblages, groups 2 and 3 are closer to each other with respect to the deepest group 4.

The most representative fish species of the shallower stratum (200-500 m) were the boarfish (*Pseudopentaceos richardsoni*) and the blackbelly rosefish (*Helicolenus*

mouchezi) (Table 1). *Macroramphosus scolopax* and *Notopogon xenosoma* also show an important presence in this assemblage but only from hauls shallower than 300 m depth.

Table 1. Species presence in Valdivia shallower assemblage (200-500 m)

Family	Species	Hauls			
		4	5	6	19
BERYCIDAE	*Beryx splendens*				*
CAPROIDAE	*Antigonia rubescens*			*	
CENTRISCIDAE	*Macroramphosus scolopax*	*	*	*	
	Notopogon xenosoma	*	*	*	
CONGRIDAE	*Conger cinereus*				*
	Gnathophis capensis	*			
EMMELICHTHYIDAE	*Emmelichthys nitidus nitidus*		*		
EPIGONIDAE	*Epigonus denticulatus*				*
GEMPYLIDAE	*Promethichthys prometheus*				*
MACROURIDAE	*Lucigadus ori*				*
	Nezumia brevibarbata				*
MACROURIDAE	*Coelorinchus polli*				*
MERLUCCIIDAE	*Macruronus magellanicus*				*
MORIDAE	*Gadella imberbis*				*
OREOSOMATIDAE	*Allocyttus verrucosus*				*
PENTACEROTIDAE	*Pseudopentaceros richardsoni*	*	*	*	*
SEBASTIDAE	*Helicolenus mouchezi*	*	*	*	*
TETRAODONTIDAE	*Sphoeroides pachygaster*	*			
HOMOLIDAE	*Paromola* sp.				*
SERGESTIDAE	*Sergestes atlanticus*	*			

Fish species that are present in the 800-1100 m assemblage are shown in Table 2. In this depth stratum, species of the Macrouridae family, such as *Bathygadus favosus, Cetonurus globiceps, Coelorinchus labiatus, Gadomus capensis* and *Nezumia brevibarbata* are the most representative. Other species that characterize this assemblage are; fishes such as *Etmopterus brachyurus, Alepocephalus productus, Guttigadus globiceps* and the orange roughy (*Hoplostethus atlanticus*); and crustaceans such as *Chaceon erytheiae, Nematocarcinus longirostris* and *Acanthephyra acanthitelsonis.*

Table 2. Species presence in Valdivia 800-1100 m assemblage

Family	Species	Hauls							
		7	8	9	10	12	20	21	23
ALEPOCEPHALIDAE	*Alepocephalus australis*	*	*	*					
	Alepocephalus productus	*	*	*	*	*	*	*	*
	Rouleina attrita	*	*						
	Talismania longifilis						*		
BATHYLAGIDAE	*Bathylagus antarcticus*	*	*		*				
BATHYSAURIDAE	*Bathysaurus ferox*				*				
CERATIIDAE	*Ceratias holboelli*	*							
	Ceratias sp.					*			
	Cryptopsaras couesii							*	
DIRETMIDAE	*Diretmichthys parini*	*				*	*	*	*
	Diretmus argenteus								*
ETMOPTERIDAE	*Etmopterus bigelowi*		*						
	Etmopterus brachyurus	*	*	*	*		*	*	*
EVERMANELLIDAE	*Coccorella atlantica*								*
GEMPYLIDAE	*Nealotus tripes*					*			
GONOSTOMATIDAE	*Cyclothone* sp.						*	*	
LIPARIDIDAE	*Paraliparis* sp.					*	*		
MACROURIDAE	*Bathygadus favosus*	*	*	*	*	*	*	*	
	Cetonurus globiceps	*	*	*	*	*	*	*	*
	Coelorhinchus braueri								*
	Coelorhinchus karrerae			*	*	*	*		*
	Coelorinchus acanthiger		*	*	*	*	*		*
	Coelorinchus labiatus	*	*	*	*	*	*	*	*

Table 2. Species presence in Valdivia 800-1100 m assemblage

Family	Species	Hauls							
		7	8	9	10	12	20	21	23
	Coryphaenoides striaturus	*	*	*				*	
	Gadomus capensis	*	*	*	*	*	*	*	*
	Malacocephalus laevis						*		
	Nezumia brevibarbata	*	*	*	*	*	*	*	*
	Sphagemacrurus hirundo		*	*	*	*		*	
	Squalogadus modificatus	*	*						
MELAMPHAIDAE	*Poromitra megalops*				*	*			
	Scopelogadus beanii								*
	Scopelogadus mizolepis bispinosus	*							
MELANOCETIDAE	*Melanocetus johnsonii*				*				
MORIDAE	*Antimora rostrata*		*	*	*	*	*	*	
	Guttigadus globiceps	*	*	*	*	*	*	*	
	Halargyreus johnsonii	*		*	*	*		*	*
MYCTOPHIDAE	*Electrona risso*				*	*			
	Hygophum sp.			*					
	Lampaneda dea				*		*		
	Lampanyctus sp.	*	*		*	*		*	*
	Myctophum phengodes								*
NEMICHTHYIDAE	*Avocettina acuticeps*						*	*	
	Nemichthys curvirostris						*		
NOTACANTHIDAE	*Notacanthus sexspinis*			*					
OREOSOMATIDAE	*Allocyttus guineensis*							*	
	Allocyttus verrucosus	*	*	*			*	*	*
	Neocyttus rhomboidalis								*
PHOSICHTHYIDAE	*Photichthys argenteus*		*	*	*			*	*
SCOMBROLABRACIDAE	*Scombrolabrax heterolepis*						*		
SCORPAENIDAE	*Trachyscorpia eschmeyeri*				*	*			*
SOMNIOSIDAE	*Scymnodon squamulosus*		*						
STERNOPTYCHIDAE	*Argyropelecus gigas*	*		*	*	*		*	*
	Sternoptyx pseudodiaphana	*						*	*
	Sternoptyx sp.			*					
STOMIIDAE	*Chauliodus sloani*	*	*	*	*		*	*	*
	Echiostoma barbatum	*							
	Eustomias trewavasae								*
	Idiacanthus atlanticus								*
	Malacosteus niger		*		*	*			
	Stomias boa boa	*							*
SYNAPHOBRANCHIDAE	*Diastobranchus capensis*	*				*			*
	Synaphobranchus kaupii							*	
TRACHICHTHYIDAE	*Hoplostethus atlanticus*		*	*	*	*	*	*	*
TRICHIURIDAE	*Aphanopus microphthalmus*			*					
ARISTEIDAE	*Aristaeopsis edwardsiana*	*		*			*		*
	Austropenaeus nitidus	*	*	*	*	*	*	*	*
GERYONIDAE	*Chaceon erytheiae*	*	*	*	*	*	*	*	*
LOPHOGASTRIDAE	*Gnathophausia zoea*	*			*				
NEMATOCARCINIDAE	*Nematocarcinus exilis*						*	*	
	Nematocarcinus longirostris	*	*	*	*	*		*	*
OPLOPHORIDAE	*Acanthephyra acanthitelsonis*	*	*	*	*	*	*	*	*
	Acanthephyra eximia	*	*	*		*	*	*	
	Notostomus auriculatus							*	
	Notostomus gibbosus				*		*		
PANDALIDAE	*Heterocarpus grimaldii*					*			*
PASIPHAEIDAE	*Pasiphaea semispinosa*								*
	Pasiphaea sp.				*		*		
PENAEIDAE	*Funchalia woodwardi*	*							*
POLYCHELIDAE	*Polycheles* sp.		*				*	*	
SERGESTIDAE	*Sergestes atlanticus*	*		*	*				*
	Sergestes nudus						*		

Species from assemblage 3 are presented in Table 3 below and among those which stand out as more representative of this group are fishes such as *Alepocephalus productus, Coryphaenoides striaturus, Gadomus capensis, Antimora rostrata, Apristurus* sp., *Argyropelecus gigas, Diastobranchus capensis* and the warty oreo (*Allocyttus verrucosus*); and crustaceans such as *Austropenaeus nitidus, Chaceon*

erytheiae (and possibly *C. chuni*) and *Nematocarcinus longirostris.* This assemblage contains hauls from Valdivia Bank and also the three hauls taken at Ewing seamount.

Table 3. Species presence in Ewing-Valdivia 900-1300 m assemblage

Family	Species	Hauls							
		1	2	3	13	14	17	18	24
ALEPOCEPHALIDAE	*Alepocephalus australis*			*			*		
	Alepocephalus productus		*	*	*	*	*	*	*
	Conocara fiolenti		*	*			*		
	Rouleina attrita	*	*	*			*		
ANOPLOGASTERIDAE	*Anoplogaster cornuta*		*						*
BATHYLAGIDAE	*Bathylagus antarcticus*		*						*
BATHYSAURIDAE	*Bathysaurus ferox*	*				*	*	*	*
BYTHITIDAE	*Cataetyx laticeps*								*
CARISTIIDAE	*Caristius groenlandicus*								*
CERATIIDAE	*Ceratias* sp.			*					
CHIASMODONTIDAE	*Chiasmodon niger*		*						
DIRETMIDAE	*Diretmichthys parini*				*			*	
ETMOPTERIDAE	*Etmopterus brachyurus*				*	*	*	*	*
	Etmopterus princeps	*	*	*					
	Etmopterus pusillus	*							
GEMPYLIDAE	*Ruvettus pretiosus*					*			
GIGANTACTINIDAE	*Gigantactis meadi*								*
GONOSTOMATIDAE	*Cyclothone* sp.				*	*	*		
	Diplophos taenia		*						
GONOSTOMIDAE	*Gonostoma bathyphilum*						*		
HALOSAURIDAE	*Aldrovandia affinis*	*		*				*	
	Aldrovandia phalacra					*			
HOWELLIDAE	*Howella sherborni*		*						
LINOPHRYNIDAE	*Linophryne* sp.				*				
MACROURIDAE	*Bathygadus favosus*	*			*		*	*	*
	Cetonurus globiceps	*			*	*	*	*	*
	Coelorinchus acanthiger	*							
	Coelorinchus labiatus	*	*	*		*		*	
	Coryphaenoides striaturus	*	*	*	*	*	*	*	*
	Gadomus capensis	*	*	*	*	*		*	*
	Malacocephalus laevis					*			
	Mesobius antipodum	*				*		*	
	Nezumia brevibarbata	*	*	*			*	*	*
	Sphagemacrurus hirundo		*		*		*	*	*
	Squalogadus modificatus		*	*					
MELAMPHAIDAE	*Poromitra megalops*		*			*			
	Scopeloberyx robustus		*		*			*	
	Scopelogadus beanii					*	*		*
	Scopelogadus mizolepis bispinosus		*						
MELANOCETIDAE	*Melanocetus johnsonii*		*			*	*		*
MELANONIDAE	*Melanonus zugmayeri*		*			*			*
MORIDAE	*Antimora rostrata*	*	*	*	*	*	*	*	*
	Gadella imberbis					*			
	Guttigadus globiceps		*	*				*	*
	Halargyreus johnsonii				*	*	*	*	
	Lepidion sp.		*						
MYCTOPHIDAE	*Ceratoscopelus warmingii*							*	
	Electrona risso		*		*		*	*	
	Lampaneda dea								*
	Lampanyctus sp.		*		*	*	*	*	*
	Symbolophorus boops				*				
NEMICHTHYIDAE	*Avocettina acuticeps*					*			
	Avocettina infans							*	
NOTACANTHIDAE	*Notacanthus sexspinis*	*		*					
OPHIDIIDAE	*Lamprogrammus shcherbachevi*	*							
OREOSOMATIDAE	*Allocyttus verrucosus*	*	*	*	*	*	*	*	*
	Neocyttus rhomboidalis	*	*	*					
PARALEPIDIDAE	*Lestidium atlanticum*				*		*		
	Macroparalepis affinis		*						
PHOSICHTHYIDAE	*Photichthys argenteus*	*	*		*		*		*
PLATYTROCTIDAE	*Platytroctes apus*		*						
SCOMBROLABRACIDAE	*Scombrolabrax heterolepis*	*	*						
SCYLIORHINIDAE	*Apristurus manis*	*							
	Apristurus sp.	*	*	*	*	*	*	*	*
SERRIVOMERIDAE	*Serrivomer beanii*		*					*	*
SOMNIOSIDAE	*Scymnodon squamulosus*		*				*		
STEPHANOBERYCIDAE	*Acanthochaenus luetkenii*						*		
STERNOPTYCHIDAE	*Argyropelecus aculeatus*				*				
	Argyropelecus gigas	*	*		*	*	*	*	*
	Argyropelecus sladeni	*	*						
	Sternoptyx pseudodiaphana							*	

Table 3. Species presence in Ewing-Valdivia 900-1300 m assemblage

Family	Species	Hauls							
		1	2	3	13	14	17	18	24
STOMIIDAE	*Chauliodus sloani*	*	*		*		*	*	*
	Eustomias trewavasae				*				
	Idiacanthus atlanticus				*	*			
	Leptostomias sp.					*			
	Melanostomias sp.		*						*
	Stomias boa boa							*	
SYNAPHOBRANCHIDAE	*Diastobranchus capensis*	*	*	*	*	*	*	*	*
	Ilyophys blachei	*		*			*		
	Simenchelys parasitica	*		*					
	Synaphobranchus kaupii		*	*		*			*
TRACHICHTHYIDAE	*Hoplostethus atlanticus*	*		*		*			
ARISTEIDAE	*Aristaeopsis edwardsiana*	*	*	*					
	Austropenaeus nitidus	*	*	*	*	*	*	*	*
CRANGONIDAE	*Pontophilus gracilis*	*							
GERYONIDAE	*Chaceon erytheiae*		*	*	*	*	*	*	*
LOPHOGASTRIDAE	*Neognathophausia ingens*					*			*
NEMATOCARCINIDAE	*Nematocarcinus longirostris*	*	*	*	*	*	*	*	*
OPLOPHORIDAE	*Acanthephyra acanthitelsonis*	*	*	*	*	*			*
	Acanthephyra eximia	*	*	*	*	*		*	*
	Acanthephyra sp.						*		
	Notostomus auriculatus							*	
	Notostomus gibbosus				*				
	Oplophorus sp.	*	*	*					
PANDALIDAE	*Heterocarpus grimaldii*	*							
PENAEIDAE	*Funchalia woodwardi*	*	*	*					*
POLYCHELIDAE	*Polycheles* sp.	*	*	*					

Finally, the assemblage 4 (Table 4), which contains the deepest hauls carried out in the survey and it is characterize by the following fish species of fish; *Alepocephalus productus, Conocara murrayi, Rouleina attrita, Bathysaurus ferox, Bathygadus favosus, Coryphaenoides striaturus, Nezumia brevibarbata, Scopelogadus beanie and Chauliodus sloani;* and crustaceans such as *Austropenaeus nitidus, Chaceon chuni, Glyphocrangon longirostris, Nematocarcinus longirostris* and *Gordonella kensleyi.*

Table 4.- Species presence in Valdivia deeper assemblage (1300-1700 m)

Family	Species	Hauls		
		15	16	22
ALEPOCEPHALIDAE	*Alepocephalus productus*	*	*	*
	Bathytroctes microlepis	*		*
	Conocara murrayi	*	*	*
	Leptoderma sp.	*	*	
	Narcetes stomias		*	
	Rouleina attrita	*	*	*
ASTRONESTHIDAE	*Borostomias antarcticus*	*		
BATHYSAURIDAE	*Bathysaurus ferox*	*	*	*
	Bathysaurus mollis			*
BYTHITIDAE	*Cataetyx laticeps*	*	*	
CHIASMODONTIDAE	*Kali macrura*		*	
CHIMAERIDAE	*Hydrolagus affinis*			*
EURYPHARYNGIDAE	*Eurypharynx pelecanoides*	*	*	
GONOSTOMATIDAE	*Bonapartia pedaliota*	*		
	Cyclothone sp.		*	*
GONOSTOMIDAE	*Gonostoma bathyphilum*			*
HALOSAURIDAE	*Aldrovandia affinis*		*	
	Aldrovandia oleosa			*
HOWELLIDAE	*Howella sherborni*		*	
IPNOPIDAE	*Bathypterois filiferus*	*		*
	Bathypterois phenax		*	
MACROURIDAE	*Bathygadus favosus*	*	*	*
	Cetonurus globiceps		*	*
	Coelorinchus labiatus	*		
	Coryphaenoides striaturus	*	*	*
	Nezumia brevibarbata	*	*	*
	Sphagemacrurus hirundo		*	
MELAMPHAIDAE	*Melamphaes simus*			*

Table 4.- Species presence in Valdivia deeper assemblage (1300-1700 m)

Family	Species	Hauls		
		15	16	22
	Melamphaes suborbitalis		*	
	Poromitra crassiceps	*		*
	Poromitra megalops	*		
	Scopelogadus beanii	*	*	*
MORIDAE	*Antimora rostrata*		*	*
	Halargyreus johnsonii	*	*	
MYCTOPHIDAE	*Ceratoscopelus warmingii*			*
	Electrona risso	*		
	Hygophum sp.		*	
	Lampanyctus sp.			*
NOTACANTHIDAE	*Notacanthus sexspinis*	*		
	Polyacanthonotus africanus	*		
OMOSUDIDAE	*Omosudis lowii*		*	
ONEIRODIDAE	*Chaenophryne draco*		*	
OPHIDIIDAE	*Porogadus milles*	*		
	Porogadus sp.			*
	Spectrunculus grandis		*	*
OREOSOMATIDAE	*Allocyttus verrucosus*	*		*
	Oreosoma atlanticum			*
PHOSICHTHYIDAE	*Photichthys argenteus*		*	*
SERRIVOMERIDAE	*Serrivomer beanii*			*
STEPHANOBERYCIDAE	*Acanthochaenus luetkenii*	*	*	
STERNOPTYCHIDAE	*Argyropelecus aculeatus*	*		
	Argyropelecus gigas	*	*	
	Sternoptyx pseudobscura	*		
	Sternoptyx pseudodiaphana		*	
STOMIIDAE	*Chauliodus sloani*	*	*	*
	Eustomias trewavasae	*		
	Idiacanthus atlanticus		*	
	Stomias boa boa	*		
SYNAPHOBRANCHIDAE	*Ilyophys blachei*	*		*
ARISTEIDAE	*Austropenaeus nitidus*	*	*	*
GERYONIDAE	*Chaceon chuni*	*	*	
	Chaceon erytheiae			*
GLYPHOCRANGONIDAE	*Glyphocrangon longirostris*	*	*	
LOPHOGASTRIDAE	*Gnathophausia zoea*	*		
	Neognathophausia ingens	*	*	
NEMATOCARCINIDAE	*Nematocarcinus ensifer*	*	*	
	Nematocarcinus longirostris	*	*	*
OPLOPHORIDAE	*Acanthephyra eximia*	*	*	
	Acanthephyra sp.	*	*	
	Notostomus sp.			*
	Oplophorus sp.	*		
	Systellaspis cristata	*		
SERGESTIDAE	*Sergestes atlanticus*		*	
	Sergestes nudus	*		
SOLENOCERIDAE	*Gordonella kensleyi*	*	*	*

The analysis excludes one important depth stratum which is located between 300 (only 1 sample at between 400-500m) and 800 m depth and which was inaccessible to trawl sampling as mentioned before. This depth stratum includes the seamount cliffs in the study area which is the habitat, for instance, of species of the Berycidae and Centrolophidae fish families.

ANNEX A

SPECIES LIST

Species list

Fishes

Family	Species
ALEPOCEPHALIDAE	
	Alepocephalus australis Barnard, 1923
	Alepocephalus productus Gill, 1883
	Bathytroctes microlepis Gunther, 1878
	Conocara fiolenti Sazonov & Ivanov, 1979
	Conocara murrayi (Koefoed, 1927)
	Leptoderma sp.
	Narcetes stomias (Gilbert, 1890)
	Rouleina attrita (Vaillant, 1888)
	Talismania longifilis (Brauer, 1902)
ANOPLOGASTERIDAE	
	Anoplogaster cornuta (Valenciennes, 1833)
ASTRONESTHIDAE	
	Borostomias antarcticus (Lonnberg, 1905)
BATHYLAGIDAE	
	Bathylagus antarcticus Gunther, 1878
BATHYSAURIDAE	
	Bathysaurus ferox Günther, 1878
	Bathysaurus mollis Gunther, 1878
BERYCIDAE	
	Beryx splendens Lowe, 1834
BYTHITIDAE	
	Cataetyx laticeps Koefoed, 1927
CAPROIDAE	
	Antigonia rubescens (Günther, 1860)
CARISTIIDAE	
	Caristius groenlandicus Jensen, 1941
CENTRISCIDAE	
	Macroramphosus scolopax (Linnaeus, 1758)
	Notopogon xenosoma Regan, 1914
CERATIIDAE	
	Ceratias holboelli Krøyer, 1845
	Ceratias sp.
	Cryptopsaras couesii Gill, 1883
CHIASMODONTIDAE	
	Chiasmodon niger Johnson, 1864
	Kali macrura (Parr, 1933)
CHIMAERIDAE	
	Hydrolagus affinis (de Brito Capello, 1868)

Family	Species
CONGRIDAE	
	Conger cinereus Rüppell, 1830
	Gnathophis capensis (Kaup, 1856)
DIRETMIDAE	
	Diretmichthys parini (Post & Quéro, 1981)
	Diretmus argenteus Johnson, 1864
EMMELICHTHYIDAE	
	Emmelichthys nitidus nitidus Richardson, 1845
EPIGONIDAE	
	Epigonus denticulatus Dieuzeide, 1950
ETMOPTERIDAE	
	Etmopterus bigelowi Shirai & Tachikawa, 1993
	Etmopterus brachyurus Smith & Radcliffe, 1912
	Etmopterus princeps Collett, 1904
	Etmopterus pusillus (Lowe, 1839)
EURYPHARYNGIDAE	
	Eurypharynx pelecanoides Vaillant, 1882
EVERMANELLIDAE	
	Coccorella atlantica (Parr, 1928)
GEMPYLIDAE	
	Nealotus tripes Johnson, 1865
	Promethichthys prometheus (Cuvier, 1832)
	Ruvettus pretiosus Cocco, 1833
GIGANTACTINIDAE	
	Gigantactis meadi Bertelsen, Pietsch & Lavenberg, 1981
GONOSTOMATIDAE	
	Bonapartia pedaliota Goode & Bean, 1896
	Cyclothone sp.
	Diplophos taenia Günther, 1873
GONOSTOMIDAE	
	Gonostoma bathyphilum (Vaillant, 1884)
HALOSAURIDAE	
	Aldrovandia affinis (Günther, 1877)
	Aldrovandia oleosa Sulak, 1977
	Aldrovandia phalacra (Vaillant, 1888)
HOWELLIDAE	
	Howella sherborni (Norman, 1930)
IPNOPIDAE	
	Bathypterois filiferus Gilchrist, 1906
	Bathypterois phenax Parr, 1928
LINOPHRYNIDAE	
	Linophryne sp.

Family	Species
LIPARIDIDAE	
	Paraliparis sp.
MACROURIDAE	
	Bathygadus favosus Goode & Bean, 1886
	Cetonurus globiceps (Vaillant, 1888)
	Coelorhinchus braueri Barnard, 1925
	Coelorhinchus karrerae Trunov, 1984
	Coelorinchus acanthiger Barnard, 1925
	Coelorinchus labiatus (Koehler, 1896)
	Coelorinchus polli Marshall & Iwamoto, 1973
	Coryphaenoides striaturus Barnard, 1925
	Gadomus capensis (Gilchrist & von Bonde,1924)
	Lucigadus ori (Smith, 1968)
	Malacocephalus laevis (Lowe, 1843)
	Mesobius antipodum Hubbs & Iwamoto, 1977
	Nezumia brevibarbata (Barnard, 1925)
	Sphagemacrurus hirundo (Collett, 1896)
	Squalogadus modificatus Gilbert & Hubbs, 1916
MELAMPHAIDAE	
	Melamphaes simus Ebeling, 1962
	Melamphaes suborbitalis (Gill, 1883)
	Poromitra crassiceps (Günther, 1878)
	Poromitra megalops (Lütken, 1878)
	Scopeloberyx robustus (Gunther, 1887)
	Scopelogadus beanii (Gunther, 1887)
	Scopelogadus mizolepis bispinosus (Gilbert, 1915)
MELANOCETIDAE	
	Melanocetus johnsonii Günther, 1864
MELANONIDAE	
	Melanonus zugmayeri Norman, 1930
MERLUCCIIDAE	
	Macruronus magellanicus Lönnberg, 1907
MORIDAE	
	Antimora rostrata (Günther, 1878)
	Gadella imberbis (Vaillant, 1888)
	Guttigadus globiceps (Gilchrist, 1906)
	Halargyreus johnsonii Günther, 1862
	Lepidion sp.
MYCTOPHIDAE	
	Ceratoscopelus warmingii (Lütken, 1892)
	Electrona risso (Cocco, 1829)
	Hygophum sp.
	Lampaneda dea Fraser-Brunner, 1949
	Lampanyctus sp.
	Myctophum phengodes (Lütken, 1892)
	Symbolophorus boops (Richardson, 1845)

Family	Species
NEMICHTHYIDAE	
	Avocettina acuticeps (Regan, 1916)
	Avocettina infans (Günther, 1878)
	Nemichthys curvirostris (Strömman, 1896)
NOTACANTHIDAE	
	Notacanthus sexspinis Richardson, 1846
	Polyacanthonotus africanus (Gilchrist & von Bonde, 1924)
OMOSUDIDAE	
	Omosudis lowii Günther, 1887
ONEIRODIDAE	
	Chaenophryne draco Beebe, 1932
OPHIDIIDAE	
	Lamprogrammus shcherbachevi Cohen & Rohr, 1993
	Porogadus milles Goode & Bean, 1885
	Porogadus sp.
	Spectrunculus grandis (Günther, 1877)
OREOSOMATIDAE	
	Allocyttus guineensis Trunov & Kukuev, 1982
	Allocyttus verrucosus (Gilchrist, 1906)
	Neocyttus rhomboidalis Gilchrist, 1906
	Oreosoma atlanticum Cuvier, 1829
PARALEPIDIDAE	
	Lestidium atlanticum Borodin, 1928
	Macroparalepis affinis Ege, 1933
PENTACEROTIDAE	
	Pseudopentaceros richardsoni (Smith, 1844)
PHOSICHTHYIDAE	
	Photichthys argenteus Hutton, 1873
PLATYTROCTIDAE	
	Platytroctes apus Günther, 1878
SCOMBROLABRACIDAE	
	Scombrolabrax heterolepis Roule, 1921
SCORPAENIDAE	
	Trachyscorpia eschmeyeri Whitley, 1970
SCYLIORHINIDAE	
	Apristurus manis (Springer, 1979)
	Apristurus sp.
SEBASTIDAE	
	Helicolenus mouchezi (Delaroche, 1809)
SERRIVOMERIDAE	
	Serrivomer beanii Gill & Ryder, 1883
SOMNIOSIDAE	
	Scymnodon squamulosus (Günther, 1877)

Family	Species
STEPHANOBERYCIDAE	
	Acanthochaenus luetkenii Gill, 1884
STERNOPTYCHIDAE	
	Argyropelecus aculeatus Valenciennes, 1850
	Argyropelecus gigas Norman, 1930
	Argyropelecus sladeni Regan, 1908
	Sternoptyx pseudobscura Baird, 1971
	Sternoptyx pseudodiaphana Borodulina, 1977
	Sternoptyx sp.
STOMIIDAE	
	Chauliodus sloani Bloch & Schneider, 1801
	Echiostoma barbatum Lowe, 1843
	Eustomias trewavasae Norman, 1930
	Idiacanthus atlanticus Brauer, 1906
	Leptostomias sp.
	Malacosteus niger Ayres, 1848
	Melanostomias sp.
	Stomias boa boa (Risso, 1810)
SYNAPHOBRANCHIDAE	
	Diastobranchus capensis Barnard, 1923
	Ilyophys blachei Saldanha & Merret, 1982
	Simenchelys parasitica Gill, 1879
	Synaphobranchus kaupii Johnson, 1862
TETRAODONTIDAE	
	Sphoeroides pachygaster (Müller & Troschel, 1848)
TRACHICHTHYIDAE	
	Hoplostethus atlanticus Collett, 1889
TRICHIURIDAE	
	Aphanopus microphthalmus Norman, 1939

Crustaceans

Family	Species
ARISTEIDAE	
	Aristaeopsis edwardsiana (Johnson, 1867)
	Austropenaeus nitidus (Barnard, 1947)
CRANGONIDAE	
	Pontophilus gracilis Smith, 1882
GERYONIDAE	
	Chaceon chuni (Macpherson, 1983)
	Chaceon erytheiae (Macpherson, 1984)
GLYPHOCRANGONIDAE	
	Glyphocrangon longirostris (S.I. Smith, 1882)
HOMOLIDAE	
	Paromola sp.
LOPHOGASTRIDAE	
	Gnathophausia zoea Willemoes-Suhm, 1873
	Neognathophausia ingens (Dohrn, 1870)
NEMATOCARCINIDAE	
	Nematocarcinus ensifer (S. I. Smith, 1882)
	Nematocarcinus exilis (Bate, 1881)
	Nematocarcinus longirostris (Bate, 1888)
OPLOPHORIDAE	
	Acanthephyra acanthitelsonis Bate, 1888
	Acanthephyra eximia Smith, 1884
	Acanthephyra sp.
	Notostomus auriculatus Barnard, 1950
	Notostomus gibbosus Milne-Edwards, 1882
	Notostomus sp.
	Oplophorus sp.
	Systellaspis cristata (Faxon, 1893)
PANDALIDAE	
	Heterocarpus grimaldii Milne Edwards y Bouvier, 1900
PASIPHAEIDAE	
	Pasiphaea semispinosa Holthuis, 1951
	Pasiphaea sp.
PENAEIDAE	
	Funchalia woodwardi Johnson, 1868
POLYCHELIDAE	
	Polycheles sp.
SERGESTIDAE	
	Sergestes atlanticus Milne Edwards, 1830
	Sergestes nudus Illig, 1914
SOLENOCERIDAE	
	Gordonella kensleyi Crosnier, 1988

Cephalopods

Family	Species
Cephalopods	
AMPHITRETIDAE	
	Amphitretidae
CHIROTEUTHIDAE	
	Chiroteuthis sp.
CIRROTEUTHIDAE	
	Cirroteuthidae
CRANCHIIDAE	
	Cranchiidae
	Galiteuthis sp.
	Teuthowenia sp.
	Megalocranchia sp.
HISTIOTEUTHIDAE	
	Histioteuthis sp.
LYCOTEUTHIDAE	
	Lycoteuthis sp.
MASTIGOTEUTHIDAE	
	Mastigoteuthis sp.
OCTOPOTEUTHIDAE	
	Octopoteuthis sp.
OMMASTREPHIDAE	
	Ommastrephes bartramii (Lesueur, 1821)
	Todarodes sagittatus (Lamarck, 1798)
ONYCHOTEUTHIDAE	
	Moroteuthis robsoni Adam, 1962
TREMOCTOPODIDAE	
	Tremoctopus sp.

ANNEX B

CATCHES BY SPECIES

Fishes	Number	Weight (kg)
Notopogon xenosoma	5398	194.716
Cetonurus globiceps	3009	646.496
Pseudopentaceros richardsoni	1805	3163.200
Allocyttus verrucosus	1567	1071.212
Alepocephalus productus	1344	1016.236
Rouleina attrita	1047	725.855
Helicolenus mouchezi	624	420.700
Gadomus capensis	346	25.520
Bathygadus favosus	221	3.202
Macroramphosus scolopax	181	4.236
Epigonus denticulatus	174	5.045
Nezumia brevibarbata	168	4.535
Sphagemacrurus hirundo	151	2.498
Etmopterus princeps	130	95.480
Coelorinchus labiatus	114	25.788
Guttigadus globiceps	99	1.735
Hoplostethus atlanticus	92	44.783
Coryphaenoides striaturus	85	16.976
Antimora rostrata	71	21.308
Diastobranchus capensis	63	32.000
Halargyreus johnsonii	55	31.216
Coelorhinchus karrerae	49	1.682
Cyclothone sp.	46	0.029
Argyropelecus gigas	38	0.527
Conocara murrayi	35	14.240
Etmopterus brachyurus	33	21.158
Photichthys argenteus	32	0.637
Conocara fiolenti	30	10.603
Apristurus sp.	28	26.685
Lampanyctus sp.	28	0.897
Chauliodus sloani	28	0.688
Alepocephalus australis	27	23.124
Coelorinchus acanthiger	26	2.626
Bathysaurus ferox	24	12.600
Neocyttus rhomboidalis	24	5.808
Scopelogadus beanii	18	0.300
Promethichthys prometheus	17	12.500
Coelorinchus polli	16	1.020
Scopelogadus mizolepis bispinosus	16	0.183
Bathytroctes microlepis	12	1.590
Bathypterois filiferus	12	1.127
Diretmichthys parini	11	6.392
Aldrovandia affinis	11	0.500
Conger cinereus	10	9.145
Bathysaurus mollis	10	0.804
Ilyophys blachei	9	4.292
Synaphobranchus kaupii	9	2.764
Squalogadus modificatus	9	2.708
Acanthochaenus luetkenii	8	0.182
Lucigadus ori	8	0.080
Electrona risso	8	0.068
Sternoptyx pseudodiaphana	7	0.063
Poromitra megalops	7	0.040
Mesobius antipodum	6	3.750
Idiacanthus atlanticus	6	0.052
Cataetyx laticeps	5	16.826
Melanocetus johnsonii	5	0.341

Melanonus zugmayeri	5	0.311
Antigonia rubescens	5	0.168
Bathylagus antarcticus	5	0.166
Serrivomer beanii	5	0.152
Scopeloberyx robustus	5	0.075
Stomias boa boa	5	0.070
Sphoeroides pachygaster	4	1.600
Notacanthus sexspinis	4	0.290
Aldrovandia phalacra	4	0.228
Malacosteus niger	4	0.061
Lampaneda dea	4	0.041
Argyropelecus sladeni	4	0.023
Spectrunculus grandis	3	28.450
Hydrolagus affinis	3	16.560
Scymnodon squamulosus	3	7.670
Allocyttus guineensis	3	1.836
Trachyscorpia eschmeyeri	3	1.400
Scombrolabrax heterolepis	3	0.410
Ceratias sp.	3	0.161
Echiostoma barbatum	3	0.138
Leptoderma sp.	3	0.070
Emmelichthys nitidus nitidus	3	0.052
Eustomias trewavasae	3	0.042
Avocettina acuticeps	3	0.034
Ceratoscopelus warmingii	3	0.014
Apristurus manis	2	3.150
Coelorhinchus braueri	2	0.434
Gadella imberbis	2	0.311
Simenchelys parasitica	2	0.280
Anoplogaster cornuta	2	0.116
Malacocephalus laevis	2	0.102
Poromitra crassiceps	2	0.090
Melanostomias sp.	2	0.080
Howella sherborni	2	0.033
Eurypharynx pelecanoides	2	0.020
Paraliparis sp.	2	0.017
Hygophum sp.	2	0.016
Gonostoma bathyphilum	2	0.014
Argyropelecus aculeatus	2	0.012
Lestidium atlanticum	2	0.007
Kali macrura	2	0.006
Lamprogrammus shcherbachevi	1	4.500
Ruvettus pretiosus	1	3.600
Macruronus magellanicus	1	2.184
Aphanopus microphthalmus	1	2.174
Lepidion sp.	1	1.657
Etmopterus bigelowi	1	0.880
Narcetes stomias	1	0.858
Etmopterus pusillus	1	0.660
Beryx splendens	1	0.598
Ceratias holboelli	1	0.277
Omosudis lowii	1	0.220
Gnathophis capensis	1	0.218
Caristius groenlandicus	1	0.152
Gigantactis meadi	1	0.146
Macroparalepis affinis	1	0.123
Chaenophryne draco	1	0.106
Polyacanthonotus africanus	1	0.092
Porogadus milles	1	0.077
Talismania longifilis	1	0.068

Borostomias antarcticus	1	0.060
Platytroctes apus	1	0.060
Leptostomias sp.	1	0.054
Coccorella atlantica	1	0.046
Nemichthys curvirostris	1	0.036
Bathypterois phenax	1	0.032
Nealotus tripes	1	0.032
Diretmus argenteus	1	0.029
Melamphaes suborbitalis	1	0.029
Melamphaes simus	1	0.021
Porogadus sp.	1	0.019
Myctophum phengodes	1	0.018
Diplophos taenia	1	0.016
Linophryne sp.	1	0.011
Aldrovandia oleosa	1	0.010
Oreosoma atlanticum	1	0.008
Sternoptyx pseudobscura	1	0.008
Avocettina infans	1	0.006
Cryptopsaras couesii	1	0.006
Chiasmodon niger	1	0.005
Bonapartia pedaliota	1	0.003
Sternoptyx sp.	1	0.003
Symbolophorus boops	1	0.002

Crustaceans	Number	Weight (kg)
Austropenaeus nitidus	534	5.051
Chaceon spp.	515	116.764
Nematocarcinus longirostris	435	4.536
Acanthephyra eximia	414	7.973
Acanthephyra acanthitelsonis	145	0.844
Nematocarcinus ensifer	126	0.663
Acanthephyra sp.	67	0.410
Gordonella kensleyi	39	0.502
Notostomus gibbosus	33	0.368
Aristaeopsis edwardsiana	19	0.190
Polycheles sp.	18	0.293
Sergestes atlanticus	8	0.017
Neognathophausia ingens	7	0.065
Notostomus sp.	7	0.036
Funchalia woodwardi	6	0.049
Glyphocrangon longirostris	6	0.045
Nematocarcinus exilis	5	0.010
Gnathophausia zoea	5	0.006
Oplophorus sp.	5	0.004
Pasiphaea sp.	4	0.062
Heterocarpus grimaldii	4	0.045
Notostomus auriculatus	3	0.033
Paromola sp.	2	1.530
Sergestes nudus	2	0.001
Pasiphaea semispinosa	1	0.003
Systellaspis cristata	1	0.003
Pontophilus gracilis	1	0.001

Cephalopods	Number	Weight (kg)
Histioteuthis sp.	9	0.408
Cranchiidae	6	0.103
Chiroteuthis sp.	3	0.023
Todarodes sagittatus	2	7.240
Mastigoteuthis sp.	2	0.181
Octopoteuthis sp.	2	0.122
Amphitretidae	1	9.300
Moroteuthis robsoni	1	2.410
Ommastrephes bartramii	1	2.100
Tremoctopus sp.	1	0.110
Teuthowenia sp.	1	0.050
Lycoteuthis sp.	1	0.049
Cirroteuthidae	1	0.010
Megalocranchia sp.	1	0.010
Galiteuthis sp.	1	0.005

ANNEX IV

HYDROGRAPHY

HIDROGRAFÍA DEL ÁREA DE ESTUDIO DE LA CAMPAÑA NAMIBIA-0802

Carmen Presas Navarro *
Eugenio Fraile Nuez *
María Ferrer Marco *
con
la colaboración de
Steffen Oesterle **

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** National Marine Information & Research Centre - Namibia

Introducción

Teniendo en cuenta el objetivo principal de la campaña (detección de bio-construcciones) y la amplia zona de estudio, los trabajos de toma de muestras de datos hidrográficos se planificaron sobre zonas muy concretas de las principales montañas submarinas, siguiendo un sistema de radiales en aspa de estaciones hidrográficas sobre las mismas.

En el presente documento se presentan los resultados preliminares de los estudios relacionados con la hidrografía de la zona y aquellos aspectos más relevantes observados en los mismos.

Material y métodos

Para la obtención de datos se utilizó una batisonda *CTD* modelo *Sea-Bird 25*, que permitió realizar medidas de las propiedades físico-químicas de la columna de agua como temperatura, salinidad, fluorescencia, oxígeno, densidad y presión. La profundidad máxima a la que se puede utilizar este equipo es de 6800 metros, sin embargo, la profundidad máxima a la que se largó el *CTD* fue 1700 metros y la mínima 200 metros.

Se realizaron un total de 50 estaciones de *CTD* cuya distribución geográfica por zonas y transectos se muestra en la figuras 1, 2 y 3. Se dividió el área de estudio en dos zonas: montaña submarina de Edwin y montañas submarinas del Banco de Valdivia, sobre las que situaron los transectos o radiales.

El estudio hidrográfico se realizó siguiendo transectos perpendiculares sobre cada monte submarino, con una rejilla (*grid*) regular de 2' x 2' en las zonas menos profundas, aumentando la distancia entre estas al aumentar la profundidad.

Las diferentes estaciones hidrográficas se agruparon en los siguientes transectos:

1: estaciones nº 14, 13, 11, 8, 5, 1, y 2; zona de Ewing.

2: estaciones nº 3, 4, 6, 7, 8, 9, 10, y 12; zona de Ewing.

3: estaciones nº 15, 16, 17, 22, 18, 19, 20, y 21; zona del Banco de Valdivia Sureste.

4: estaciones nº 26, 25, 24, 18, 23, 27, y 28; zona del Banco de Valdivia Sureste.

5: estaciones nº 33, 32, 31, 30, y 29; zona del Banco de Valdivia Centro.

6: estaciones nº 34, 31, y 35; zona del Banco de Valdivia Centro.

7: estaciones nº 49, 45, 48, 46, 50, y 47; zona del Banco de Valdivia Norte.

8: estaciones nº 37, 38, 44, 41, 42, 43 y 15; zona del Banco de Valdivia Oeste.

Algunas de las estaciones hidrográficas que se realizaron no estaban previstas inicialmente y se realizaron al final de cada lance de pesca, ante la imposibilidad de cubrir esas nuevas zonas con el protocolo establecido en el plan de campaña.

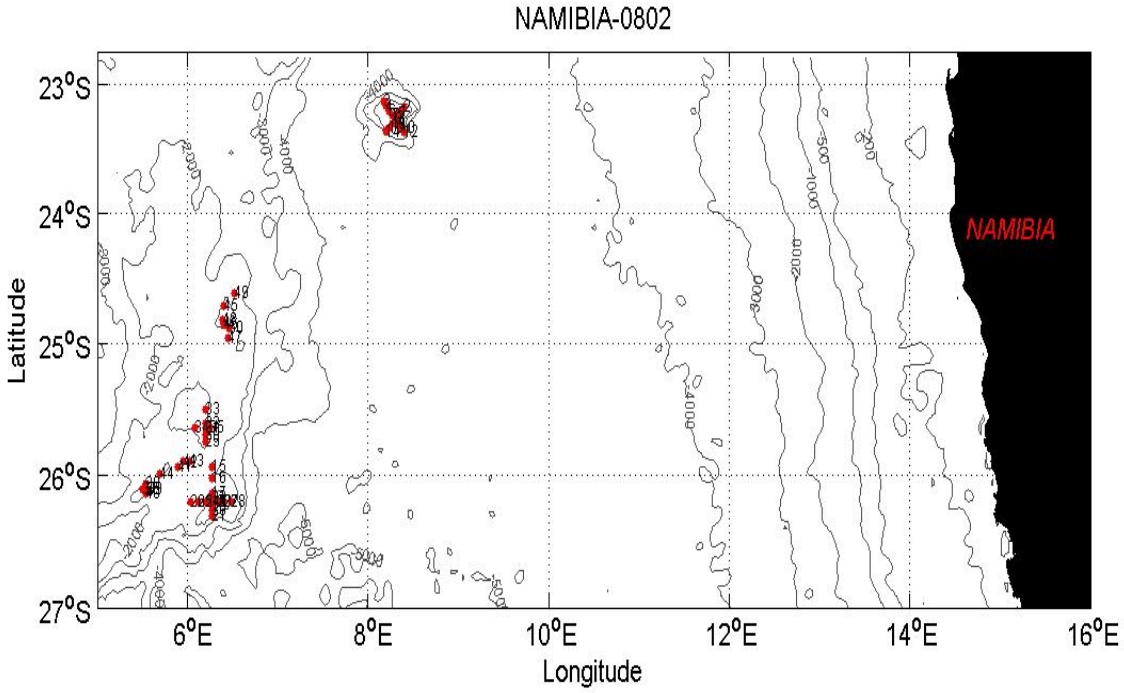


Figura 1. Localización de las estaciones hidrográficas en la zona de estudio / **Location of the hydrographic stations in the zone of study**

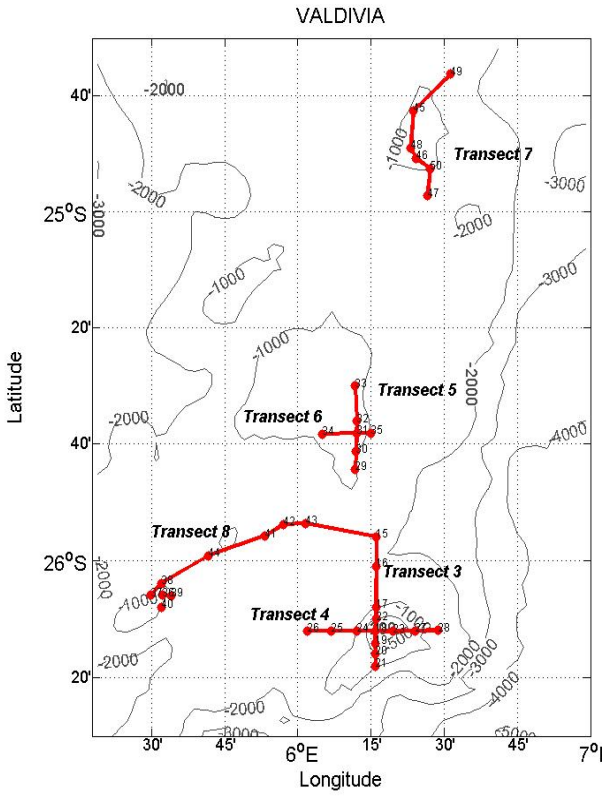


Figura 2. Transectos realizados en el Banco de Valdivia / **Transects considered in the Valdivia Bank.**

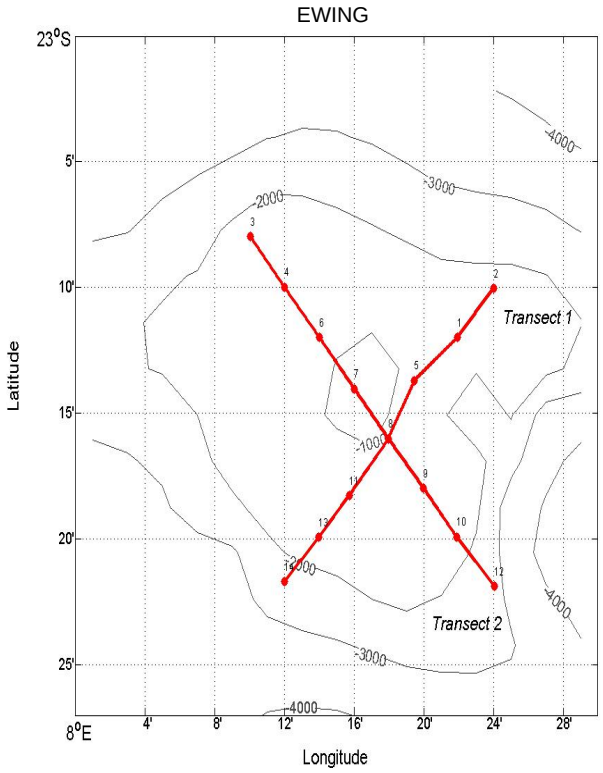


Figura 3. Transectos realizados en la montaña submarina de Ewing / **Transects considered in the Ewing seamount.**

Para el procesado de los datos hidrográficos se ha utilizado el software de la propia casa *Seabird*, con él que se ha realizado el filtrado e interpolado de los datos. A continuación se utilizó el programa informático *MATLAB* para realizar los cálculos numéricos necesarios para obtener y representar las variables oceanográficas en dos y tres dimensiones.

Obtenidos los ficheros correspondientes para cada estación, con los perfiles de bajada y subida del *CTD*, ficheros originales en código binario con extensión *.hex*; se transformaron en variables físicas en formato *.cnv* para aplicar a continuación una serie de filtros que permitieron calcular la desviación estándar, suavizado de variables (presión), alineación de datos de conductividad y oxígeno disuelto con los de temperatura, así como, corregir errores de *T*ª propios del equipo asociados a su inercia térmica, calcular las variables derivadas (densidad, salinidad, *T*ª potencial….), etc.

Posteriormente se examinaron cada uno de los ficheros, se eliminaron los registros correspondientes a los tiempos de atemperamiento del *CTD* y se convirtió cada perfil a formato *MatLab*, obteniéndose ficheros con extensión *.mat*. Los pasos sucesivos del procesado de datos se realizaron directamente sobre estos ficheros, excepto errores puntuales de formato en las cabeceras que se corrigieron directamente sobre ficheros *.hex* y *.cnv*.

Cada una de las variables oceanográficas (temperatura potencial, salinidad, fluorescencia, oxígeno, etc) de los perfiles hidrográficos realizados durante la campaña fueron graficados frente a la presión para así conocer la estructura vertical de cada estación; esto ha permitido comparar las propiedades hidrográficas de las distintas estaciones y zonas de estudio.

Resultados

Cada uno de estos perfiles que se representan a continuación, corresponde al total de las 50 estaciones permite observar los resultados de manera conjunta y poder establecer similitudes y diferencias entre éstas o grupos de las mismas. Esto ha permitido apreciar que el comportamiento de los perfiles es similar para las variables de temperatura, salinidad y fluorescencia, no siendo así en el caso del oxígeno disuelto como se puede observar en la figura 4.

Asimismo, se puede observar en las gráficas de la temperatura y salinidad (figura 4), que en los primeros 60db de la columna de agua aparece una capa de mezcla claramente diferenciada. Es frecuente existencia una capa superficial de temperatura más elevada y relativamente uniforme, al igual que ocurre en los valores de salinidad.

La temperatura alcanza valores entre 23 ºC y 21.5 ºC en las aguas de mezcla superficiales. Por debajo inicia un acusado descenso hasta los 90 db de presión y alcanza los 16 ºC . Continúa con un descenso más lento hasta llegar a los 1000 db y se sitúa entre los 4 ºC y 5 ºC . Por último, y hasta alcanzar la presión máxima de 1700 db, toma valores mas uniformes y relativamente mas bajos hasta alcanzar lo valores mínimos de 3.2 ºC y 3.5ºC en aguas profundas.

La salinidad alcanza sus valores máximos en la capa de mezcla superficial con valores comprendidos entre 35.3 y 35.7. Luego inicia un descenso hasta los 690db de presión, donde alcanza los valores mínimos de 34.3. A partir de aquí comienza un ligero ascenso hasta llegar a los 1700 db y alcanzar el valor de 34.85.

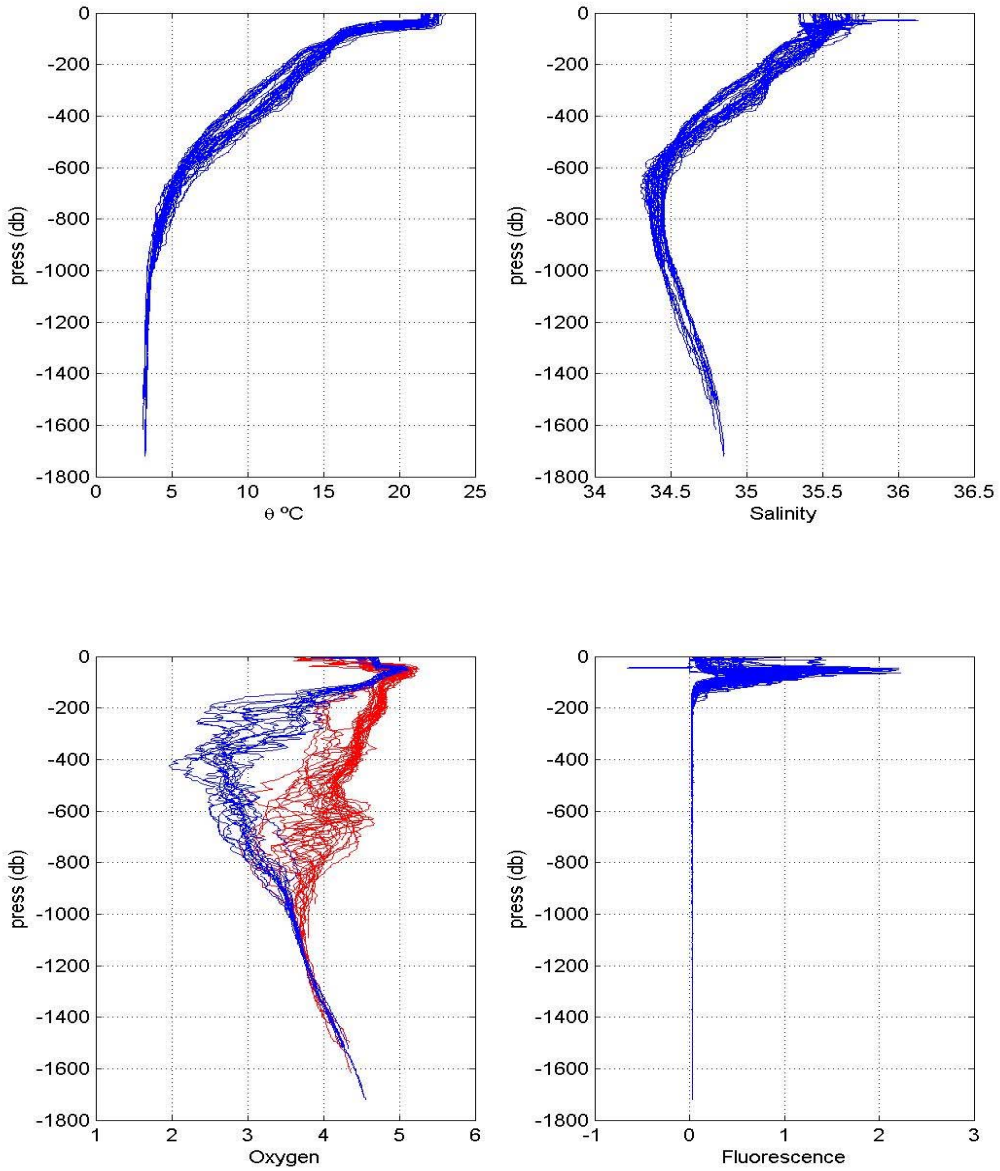


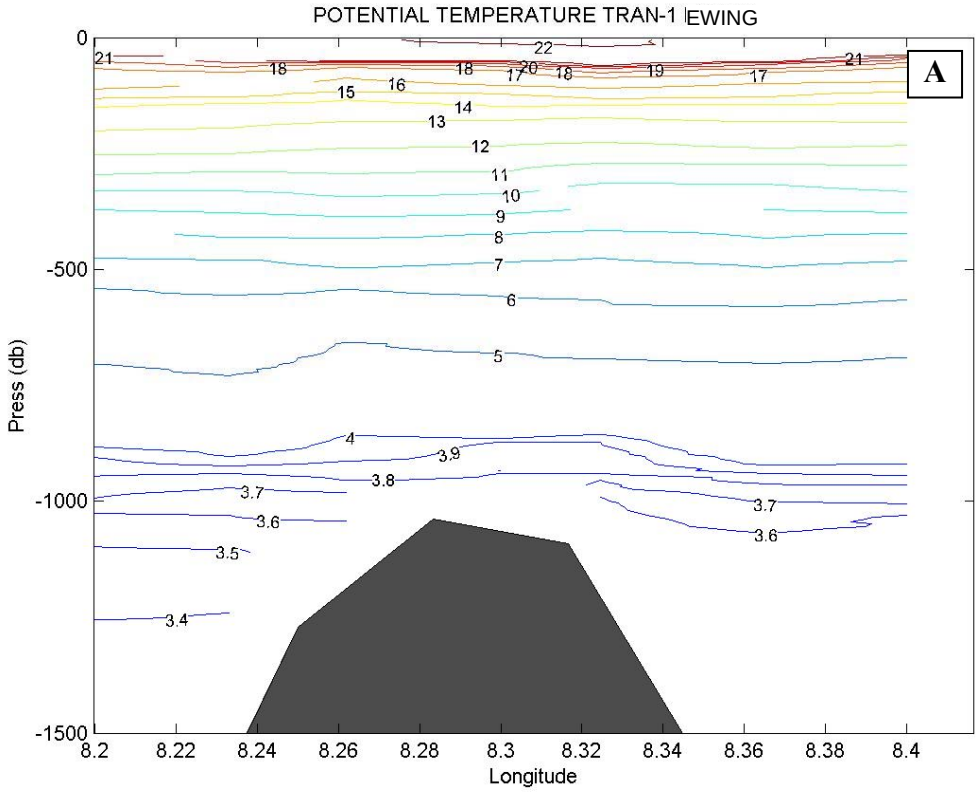
Figura 4. Perfiles hidrográficos de las distintas variables frente a la presión para el total de las estaciones / **Hydrographic profiles of the different variables by pressure for all the stations**

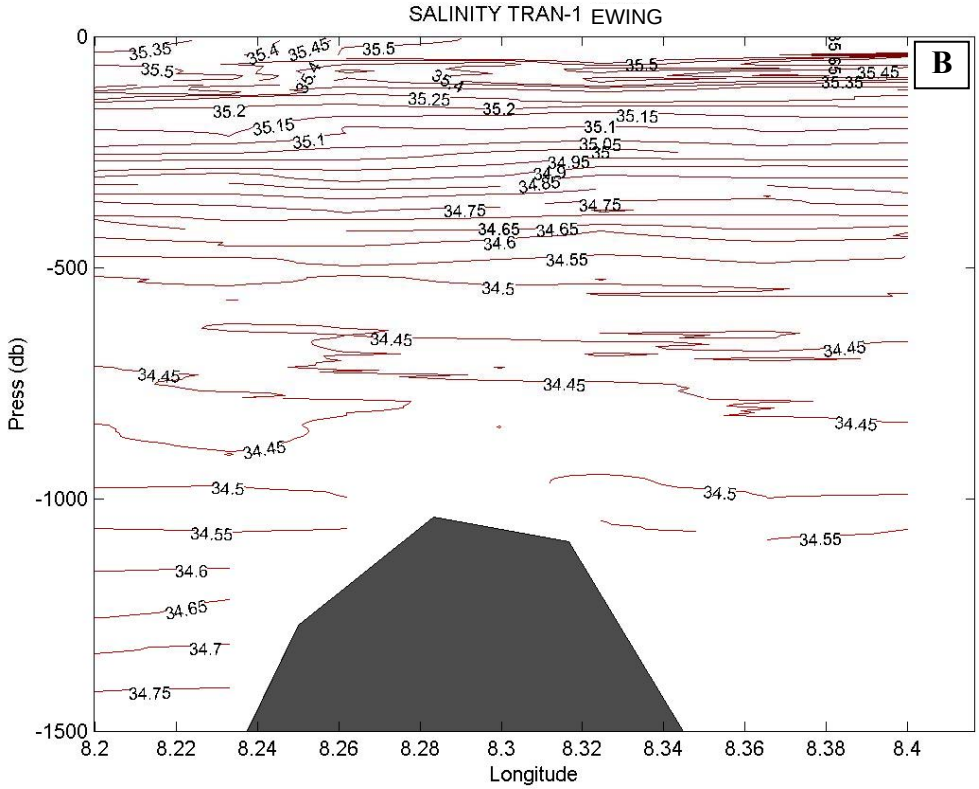
La fluorescencia tiene una distribución apreciable hasta los 100-150 db de presión. En superficie los valores de fluorescencia son bastante oscilantes entre 0.05 y 0.8, alcanzando incluso valores próximos a 1. Sus valores máximos (2.2) se localizan entre los 45 y 65 db. A partir de este punto, inicia un descenso alcanzando su valor mínimo (0.03) entre las presiones de 100-150 db, que se mantiene casi constante en el resto de la columna de agua.

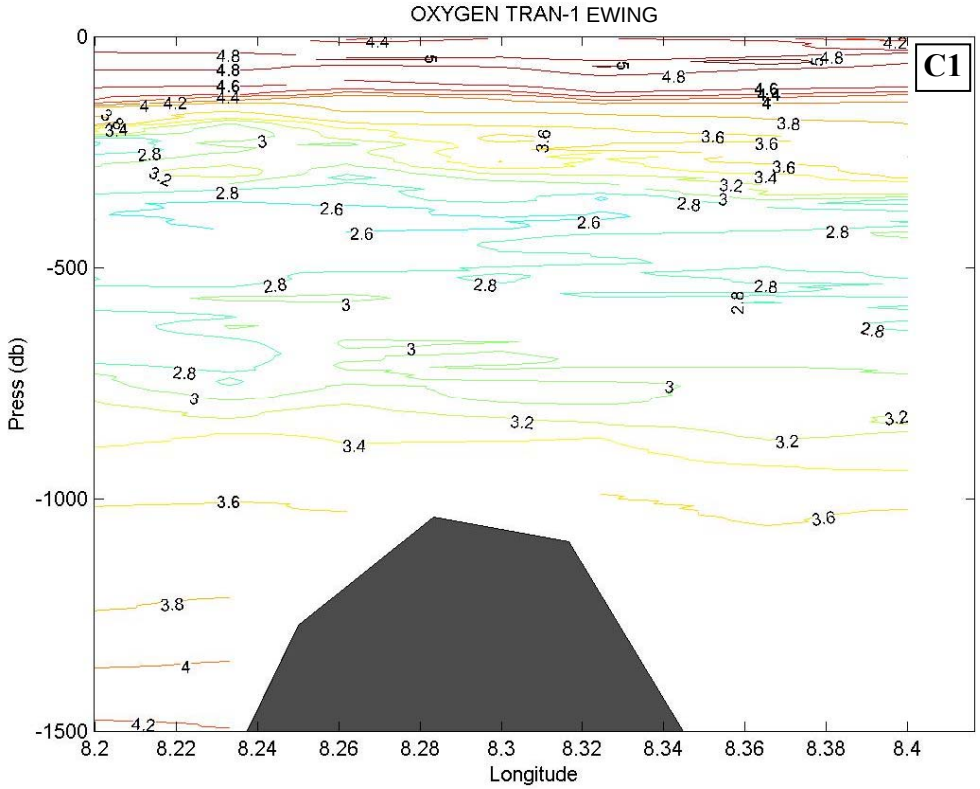
En la representación de la concentración de oxígeno disuelto se puede observar que en los primeros 50 db aparecen valores relativamente bajos, debido posiblemente a una alta producción primaria. Por debajo, en los 100 db de presión aproximadamente, alcanza su máximo valor (5.2 ml/l). A continuación inicia un nuevo y ligero descenso hasta los 200db en que alcanza valores entre 4 y 4.5 ml/l. A partir de ahí, se observan dos curvas diferentes en función de la presión. Si se representan los valores que alcanzan los datos de concentración de oxígeno obtenidos en las estaciones de Ewing (en color azul), y por otro, los valores de concentración de oxígeno obtenidos en la estaciones del Banco de Valdivia (representados en color rojo), se observa entre ambos conjuntos que existe una clara diferencia en su recorrido. Los valores de la montaña submarina de Ewing son claramente inferiores a los obtenidos en el Banco de Valdivia; en Ewing se alcanzan valores mínimos de 2 ml/l en 400db, mientras en el Banco de Valdivia se alcanza el valor mínimo (3 ml/l) a mayor profundidad (750 db). Llegados los 1000 db, ambos grupos se unen nuevamente con valores en el rango 3.7-3.8 ml/l, para iniciar un ligero ascenso conjunto de la concentración de oxígeno hasta alcanzar los 4.55 ml/l en los 1700 db.

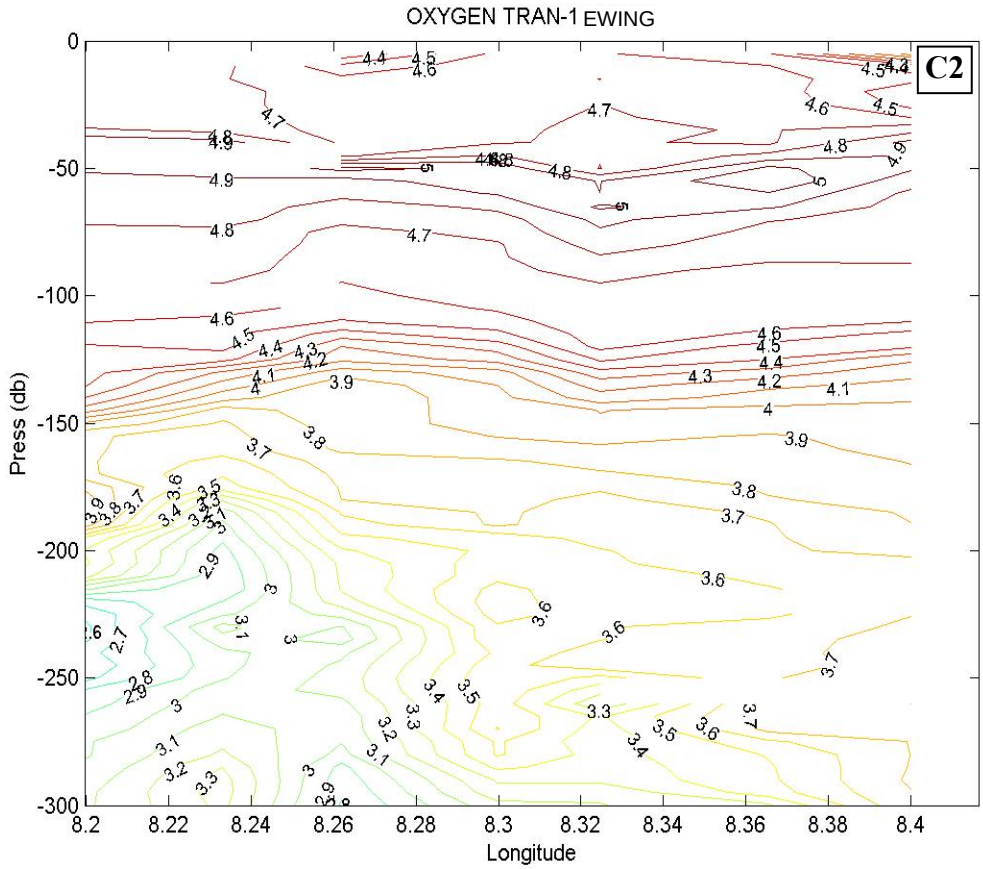
Para cada transecto se realizaron contornos verticales de cada una de las variables físico-químicas hasta la máxima profundidad registrada, excepto para la fluorescencia, que sólo fue representada hasta los 100-200 metros. En las figuras 5 y 6, se presentan los contornos de las interpolaciones verticales del transecto 1 (Ewing) y el transecto 4 (Banco de Valdivia Sureste), con los datos de temperatura potencial (A), salinidad (B), oxígeno (C), fluorescencia (D) y densidad (E)).

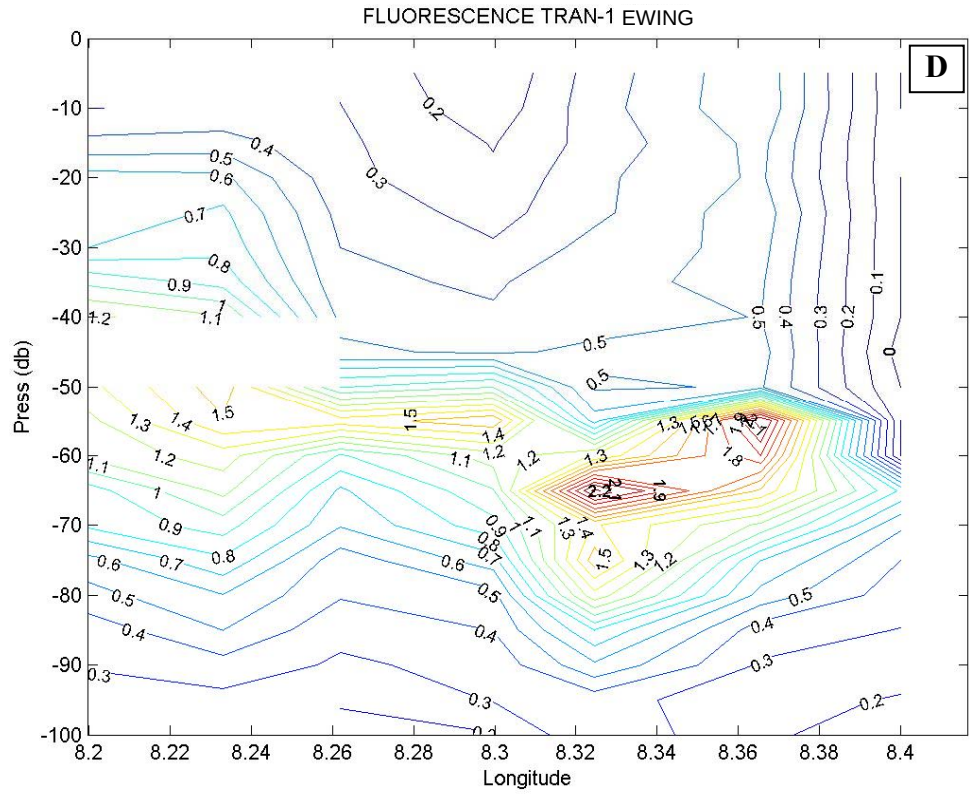
SERIE DE CONTORNOS DEL TRANSECTO 1 / **CONTOURS SERIES OF TRANSECT 1**




SALINITY TRAN-1 EWING
B
Press (db)
Longitude
0
-500
-1000
-1500
8.2
8.22
8.24
8.26
8.28
8.3
8.32
8.34
8.36
8.38
8.4


OXYGEN TRAN-1 EWING
C1
Press (db)
Longitude
0
-500
-1000
-1500
8.2
8.22
8.24
8.26
8.28
8.3
8.32
8.34
8.36
8.38
8.4


OXYGEN TRAN-1 EWING
C2
Press (db)
Longitude
0
-50
-100
-150
-200
-250
-300
8.2
8.22
8.24
8.26
8.28
8.3
8.32
8.34
8.36
8.38
8.4


FLUORESCENCE TRAN-1 EWING
D
Press (db)
Longitude
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
8.2
8.22
8.24
8.26
8.28
8.3
8.32
8.34
8.36
8.38
8.4

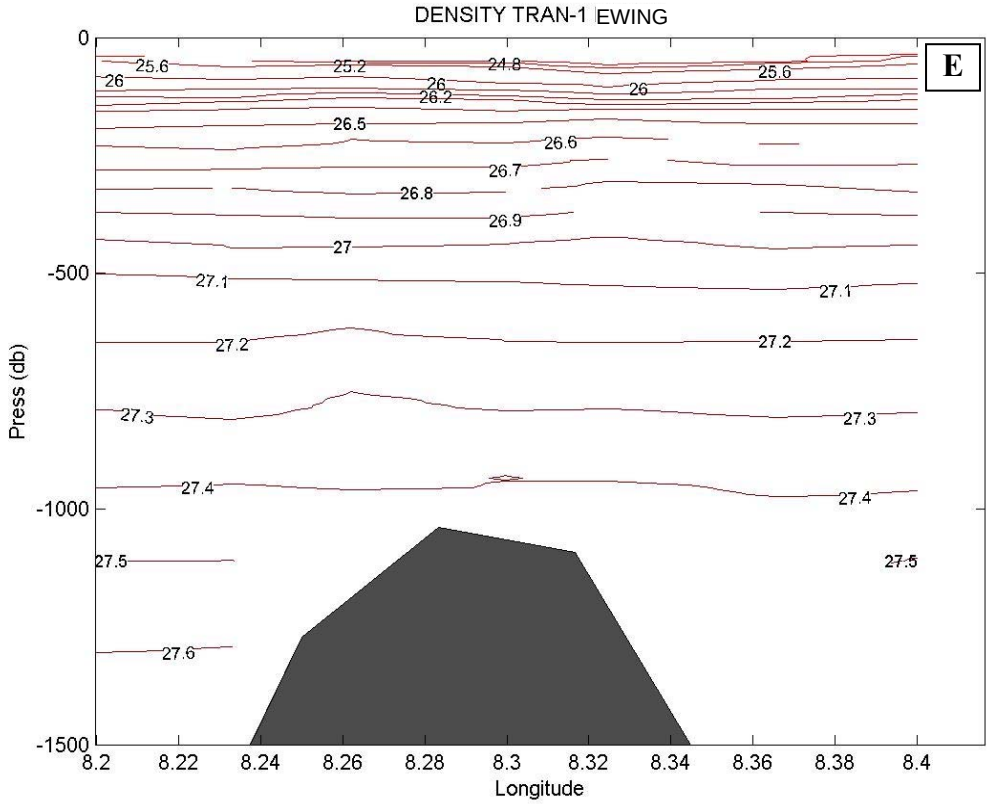
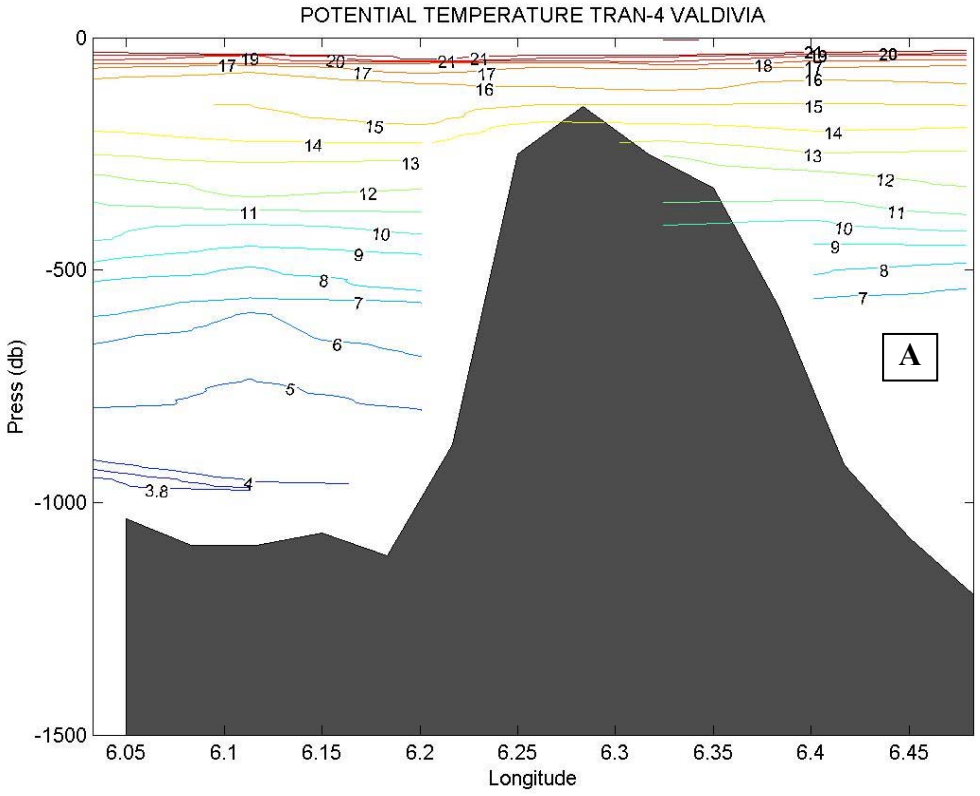
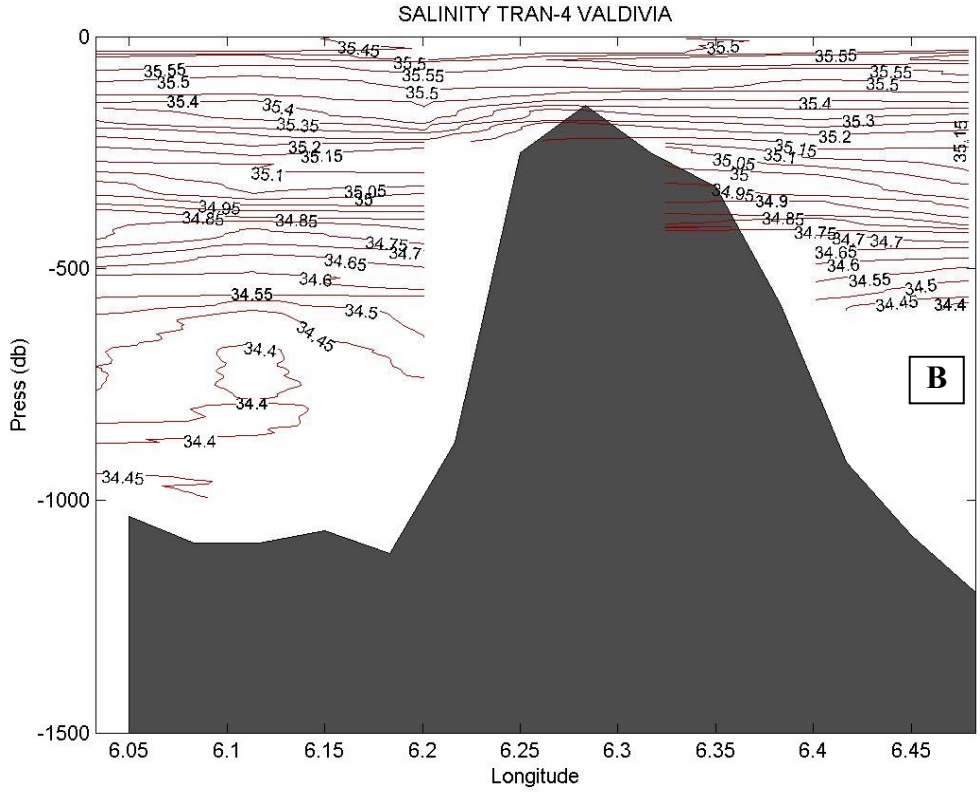
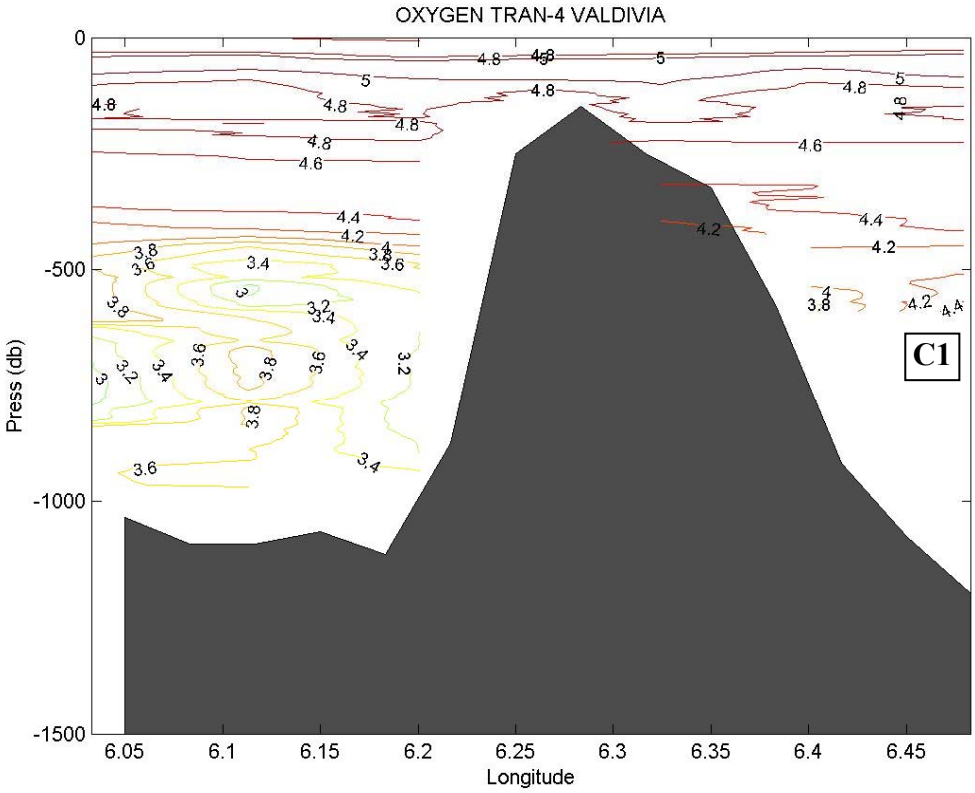


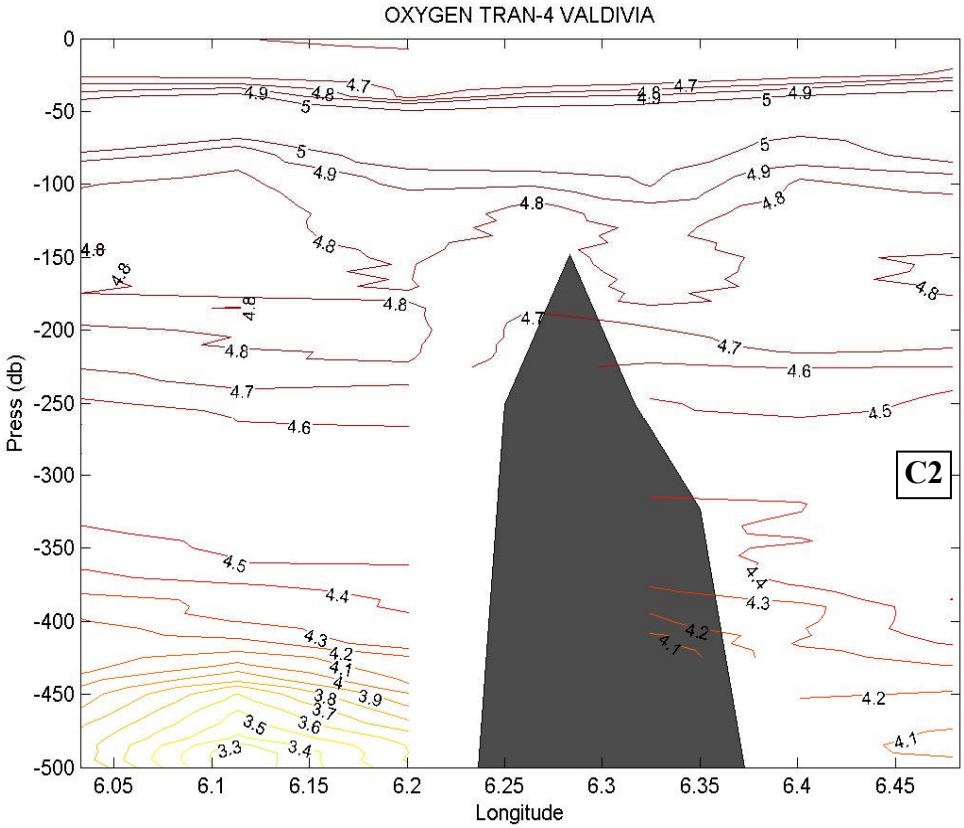
Figura 5. Contornos verticales del transecto 1 (Ewing) de la temperatura potencial (A), salinidad (B), oxígeno (C), fluorescencia (D) y densidad (E). En C2 se representa la distribución del oxígeno en las capas superiores a 300 db / **Vertical contours of transect 1 (Ewing) of potential temperature (A), salinity (B), oxygen (C), fluorescence (D) and density (E). Oxygen distribution up to layer of 300 db is presented in C2.**

SERIE DE CONTORNOS DEL TRANSECTO 4 / **CONTOURS SERIES OF TRANSECT 4**






OXYGEN TRAN-4 VALDIVIA
Press (db)
Longitude
C1


OXYGEN TRAN-4 VALDIVIA
Press (db)
Longitude
C2

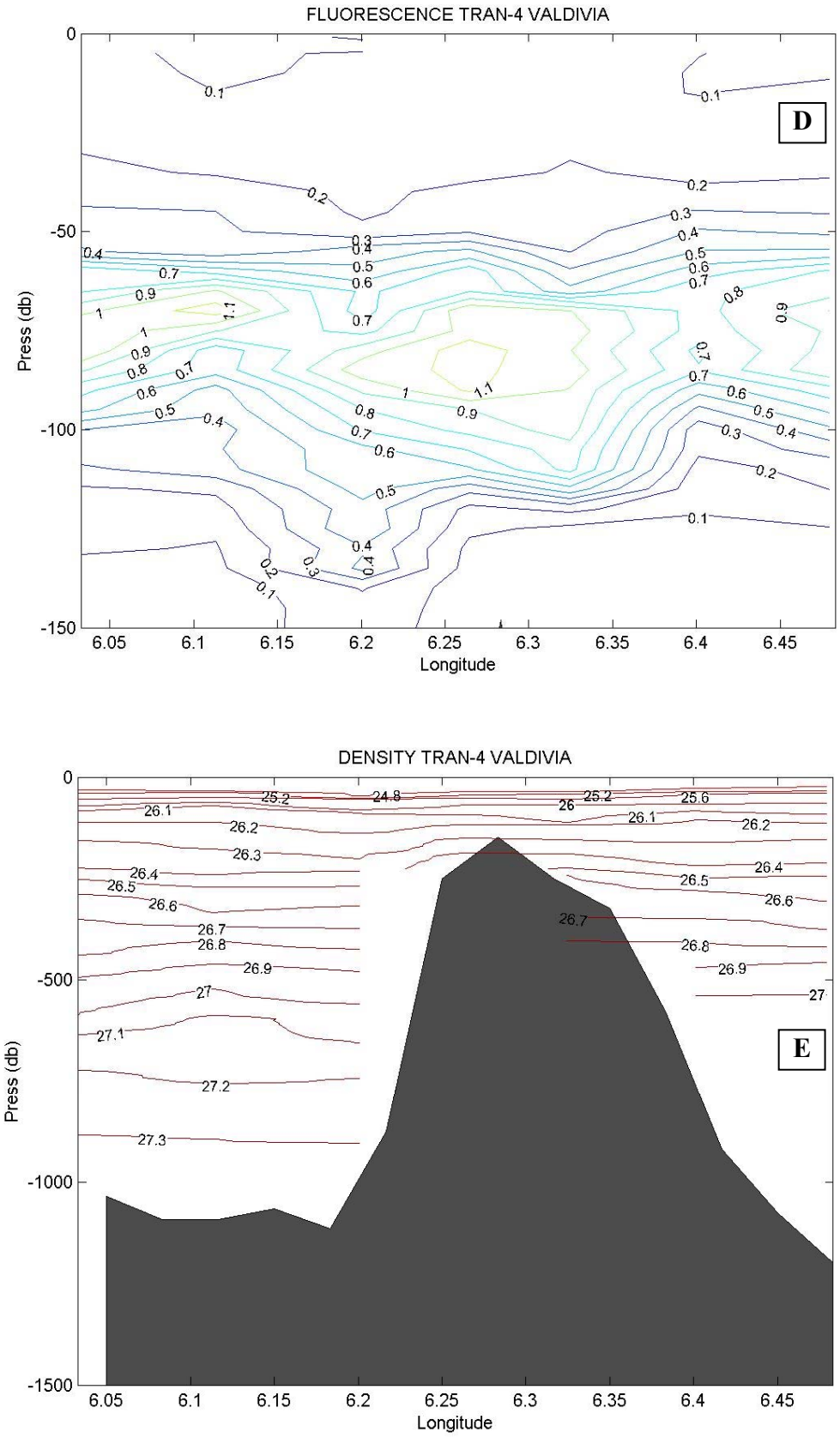


Figura 6. Contornos verticales del transecto 4 (Banco de Valdivia) de la temperatura potencial (A), salinidad (B), oxígeno (C), fluorescencia (D) y densidad (E). En C2 se representa la distribución del oxígeno en las capas superiores a 500 db / **Vertical contours of transect 4 (Valdivia Bank) of potential temperature (A), salinity (B), oxygen (C), fluorescence (D) and density (E). Oxygen distribution up to layer of 500 db is presented in C2.**

A partir de los contornos de densidad de las montañas submarinas del Banco de Valdivia y Edwin, se aprecia, como estos montes submarinos suponen obstáculos al paso de las corrientes marinas y producen alteraciones en la corriente principal, pudiendo generar corrientes locales.

La corriente incidente en el monte es dispersada a ambos lados del monte submarino en toda la columna de agua, incluso en superficie, aunque el monte no alcance las capas superficiales. Este fenómeno es conocido como Columna de Taylor o Cono de Taylor. En el centro del monte submarino se produce por tanto, una zona de "calma", es decir, de ausencia de corrientes, que propicia la concentración de producción primaria y el enriquecimiento de las aguas superficiales, que en ausencia de monte submarino tendría propiedades de aguas oceánicas inicialmente "oligotróficas". Estas zonas, se convierten por tanto, en pequeños "oasis" de vida respecto a zonas circundantes, que suelen mantener una biomasa y diversidad mucho más bajas.

Además, ocasionalmente, alrededor de estas estructuras se pueden localizar flujos verticales que originan afloramientos de aguas profundas más densas y ricas en nutrientes (afloramiento/upwelling), enriqueciendo aún más la zona fótica próxima a los montes. Estos desplazamientos verticales son ocasionados por remolinos mesoescalares asociadas a estos montes de tipo ciclónico, que en el hemisferio sur giran en el sentido horario. Observando las inclinaciones de las isopicnas en los contornos de densidad iniciales, podemos deducir la existencia de remolinos ciclónicos alrededor de las montañas.

En los contornos de oxígeno disuelto, sobre todo en la representación de concentración de oxígeno hasta los 300 db de profundidad en la zona de Edwin y 500db en la de Valdivia, se observan ciertas anomalías porque aparecen unos valores muy bajos en los primeros 50db de la capa fótica, debido posiblemente a una alta producción primaria.

Entre 60 y 80 db la fluorescencia llega a 1.1 y la concentración de oxígeno es de 5 ml/l entre 50 y 100 db en el Banco de Valdivia. En Edwin, el comportamiento es similar salvo que los valores de fluorescencia llegan a 2.2 y en un rango de presión más amplio (40 - 80 db). La concentración de oxígeno es igual a la del Banco de Valdivia, con valores de 5 ml/l entre 50 y 100 db.

Para cada transecto se realizaron diagramas T/S, temperatura potencial frente a salinidad, lo que permitió identificar las diferentes masas de agua predominantes de la zona de estudio (figura 7).

Este diagrama corresponde a todos los perfiles del total de las estaciones, y permite apreciar que el comportamiento es similar en todas y cada una de las estaciones hidrográficas que han sido representadas.

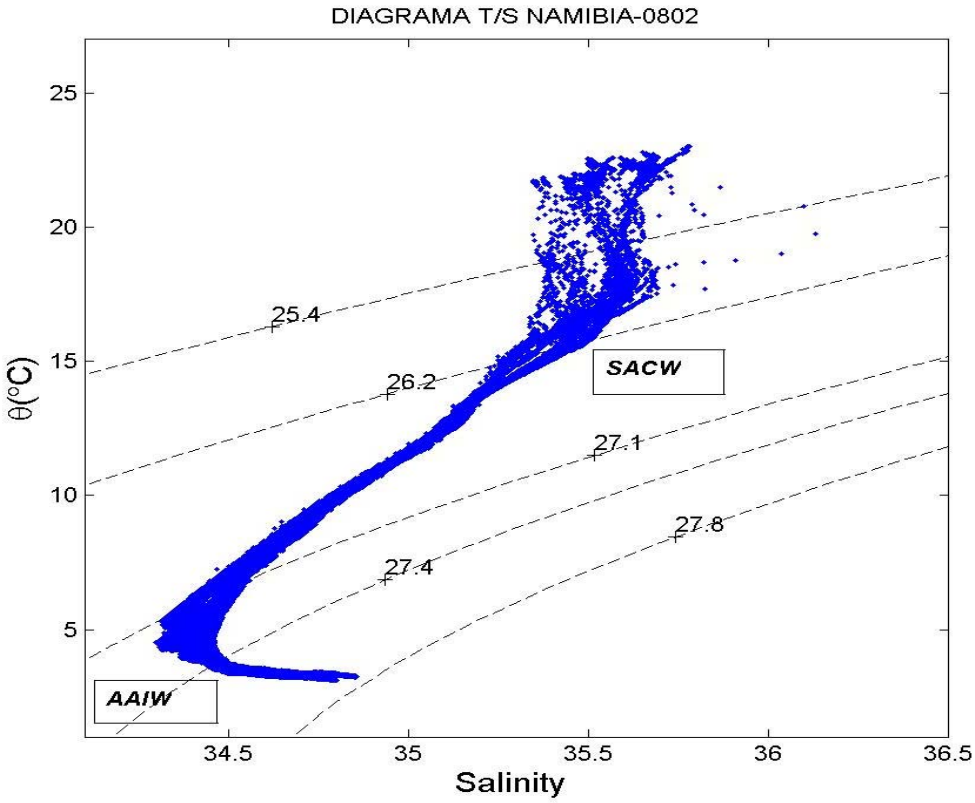


Figura 7. Diagramas θ/S, temperatura potencial frente a salinidad / **θ/S diagram, potential temperature by salinity.**

En aguas sub-superficiales hasta 120 db de presión y valor de densidad 26.2 kg m^{-3}, se encuentra una capa de agua con una gran dispersión de valores de salinidad y temperatura, influenciada por los procesos o fenómenos de evaporación-precipitación.

Por debajo y entre los valores de densidad de 26.2 y 27.1 kg m^{-3}, que equivalen a 120 y 590 db de presión respectivamente, se observa una masa de agua que se corresponde a la **SACW** (South Atlantic Central Water), en la que los datos de temperatura y salinidad se comportan de manera lineal con la presión.

A continuación, por debajo de esta densidad y hasta aproximadamente 27.8 kg m^{-3}, los 1700 db, se localiza la **AAIW** (Antarctic Atlantic Intermediate Water), caracterizada por presentar los valores mínimos de salinidad y temperatura. Esta masa de agua, generada en el Océano Austral, viaja hacia el norte y en su camino se va hundiendo por variaciones en su densidad. En la latitud de estudio (23º-26º Sur) se localiza a una presión media de entre 590 y 1700 db.

ANNEX V

SEABIRD AND CETACEAN OBSERVATIONS

Seabird Inventory and Cetacean Observations Namibia – 0802

*Pete Bartlett** (Observations)
*Jessica Kemper** (Report)

*Lűderitz Marine Research Centre – Namibia

Aims:

To make an inventory of seabirds and marine mammals present in the survey area.

To analyze the patterns of distributions and abundance in relation to oceanographic features and known fish distribution.

Methods:

Counts of seabirds were made during daylight hours, usually from 08h00 to 20h00 local time. When possible, standard "10-minute-counts" of the birds seen around the vessel were done while the vessel was cruising. During each count period, all individuals of each noted species were counted. Birds seen actively following the vessel (within an arc of 60^{o} aft) were recorded separately from birds flying elsewhere around the vessel, sitting on the water or feeding. During the standard counts, scans (using binoculars) were made at least once every 2 min to detect inconspicuous species. Care was taken to count individual birds only once.

Additional, incidental, observations were made between counts, when unusual species were observed and while the vessel was on station or trawling. Observations of marine mammals (Cape fur seals, whales and dolphins) and turtles were recorded following the same format.

The time and duration of each observation and count was recorded with a watch which was adjusted to the vessel's electronic log watch, in order to match the bird data with the data recorded by the electronic log (position, speed, depth, heading, sea temperature etc.).

Results:

A total of 319 standard "10-minute counts" were done between 3 February and 1 March 2008. Of these, 233 counts were effected while the vessel was cruising, 16 during CTD stations and 70 during trawl operations. And additional 134 incidental observations were recorded. The summary of the bird species and numbers identified during all 453 observation periods is given in Table 1.

In general, bird abundance and densities (in terms of species as well as individuals) were poor. Abundance and densities were highest close to Walvis Bay. No major feeding frenzies were observed, except for one large group of terns (*Sterna sp*.) feeding together with two large groups of seals near Pelican Point. No more than seven individuals of up to three species were seen at the Valvdivia Bank at any time and no more than ten individuals of up to three species were noted at the Ewing Seamount. The most commonly seen seabirds were White-chinned Petrels (mostly following the vessel), Cory's Shearwaters and Leach's Storm Petrels.

Of notable interest are several sightings of the endangered Spectacled Petrel. This species only breeds at Inaccessible Island, Tristan da Cunha group, with an estimated breeding population of 3000 – 4000 pairs. This species is relatively scarce in southern African waters. A surprise visitor, a Warbler (*cf*. *Acrocephalus sp*.) rested on deck, intermittently feeding on insects on the trawl nets on 9 February at 26º09'S, 06º15'E.

Few marine mammals were seen during the entire survey. By far the most common species, the Cape Fur Seal *Arctocephalus pusillus pusillus* was observed in small to large groups of up to 300 individuals on 14 and 15 February, feeding close to shore (in the vicinity of 22º56'S, 14º09'E). No seals were observed further offshore.

Other sightings included two large unidentified whales at 23º47'S, 12º07'E, one large whale, possibly a Humbacked Whale (*Megaptera novaeangliae*)at 23º49;S, 12º03'E, one large unidentified whale at 23º55'S, 11º52'E and one (Grey?) dolphin at 24º11'S, 11º16'E; all three sightings were noted on 13 February. Two unidentified whales were seen at 23º03'S, 11º56'E on 1 March. One unidentified, medium-sized turtle (carapace length *c.* 50cm) was seen on 25 February at 24º49'S 06º25'E.

The relative abundance and distribution of seabirds along surveyed areas need to be further analyzed, as well as the link between seabird distribution with oceanographic features and prey distribution.

Conservation concern:

Some pollution was recorded during the survey. This included floating buoys, mesh netting, ropes, plastic bottles and boxes, a 200 litre plastic drum and surgical gloves. All items were recorded offshore (between longitudes 06º01'E and 08º26'E).

Of particular conservation concern are ropes and netting, which can cause the entanglement and subsequent drowning or starvation of marine mammals and turtles. Ingestion of foreign matter, particularly plastics and rubber is known to result in mortalities. Surgical gloves and plastic bottles resemble prey (e.g. jellyfish) and could be ingested by a range of seabirds (and potentially subsequently fed to chicks) as well as turtles. The extent of plastic pollution and its effect on seabird populations is

monitored at a number of seabird breeding colonies worldwide. However, data on the extent (and distribution) of pollution at sea are lacking; this should be routinely monitored during seabird-, marine mammal- or turtle surveys at sea.

Table 1: Seabird species and numbers of individuals identified during the 10 minute observation periods and in total (including incidental sightings).

Species	Common name	10-min count	total
Diomedea chlororhynchos	Yellow-nosed Albatross (adult)	13	19
Diomedea chlororhynchos	Yellow-nosed Albatross (immature)	20	21
Diomedea cauta	Shy Albatross	9	12
Diomedea melanophris	Black-browed Albatross	1	3
Diomedea sp.	Yellow-nosed or Black-browed Albatross	3	7
Morus capensis	Cape Gannet (adult)	2	2
Morus capensis	Cape Gannet (immature)	0	2
Puffinus puffinus	Manx Shearwater	0	1
Calonectris diomedea	Cory´s Shearwater	74	125
Puffinus griseus	Sooty Shearwater	10	19
Puffinus sp. 1	Shearwater (med. dark)	24	24
Puffinus sp. 2	Shearwater (all dark)	0	3
Procellaria aequinoctialis	White-chinned Petrel	150	176
Procellaria conspicillata	Spectacled Petrel	21	30
Catharacta antarctica	Sub-antarctic Skua	5	5
Stercorarius pomarinus	Pomarine Skua	19	21
Stercorarius parasiticus	Arctic Skua	14	16
Stercorarius longicaudus	Long-tailed Skua	0	1
Oceanites oceanicus	Wilson´s Storm-Petrel	1	3
Oceanites leucorhoa	Leach´s Storm-Petrel	56	84
Oceanites sp.	Storm Petrel (dark with white rump)	30	42
Phalaropus sp.	Phalarope	2	2
Sterna sp.	Terns (mixed; Arctic? Common?)	135	135
Larus dominicanus vetula	Kelp Gull	6	6