

**Abstract**—Feeding habits and feeding strategy of red rockfish (*Sebastes capensis*) were studied from fish captured along most of the range of this species in coastal waters of South America. Stomach contents of 613 individuals, collected during 2003, were analyzed. Fish were obtained from six locations along the Chilean (23°S to 46°S) and Argentinian (43°S) coasts. The main prey items were Mysidacea (75.06% IRI), Osteichthyes (6.29% IRI), and *Rhynchocinetes typus* (6.03% IRI). Predator sex and size did not significantly affect the diet, but significant differences were found between locations. Four geographical areas, discriminated by prey occurrence and frequencies, were determined: three on the Pacific coast and one on the Atlantic coast. These areas correspond roughly with biogeographic zones described for the Chilean and southern Argentinian coasts. The feeding strategy index (FSI) indicated a specialized feeding strategy for *S. capensis* for most of its range. However, the FSI does not include the behaviour of a predator, and the FSI must be interpreted carefully for fishes like *S. capensis* that are passive ambush feeders. The abundance and availability of different prey may explain both the geographic differences in dietary composition and the specialized feeding strategy of *S. capensis*.

## Geographical differences in the feeding patterns of red rockfish (*Sebastes capensis*) along South American coasts

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The feeding habits of a species, determined by its physiological, and behavioral adaptations, form a basic aspect of its biology; they provide a way to understand the trophic interactions between predators and their prey (Herrán<sup>1</sup>). Throughout the evolution of behavior and morphological adaptation there have been strong selective pressures toward those characteristics that allow a species to capture its prey and to escape from predators (Hixon and Beets, 1993; Reznick et al., 1997; Abrams, 2000).

Most trophic studies in fishes are carried out only on a local scale (e.g., Moreno and Zamorano, 1980; Ojeda and Fariña, 1996), and rarely consider the predator's entire distributional range. Thus, conclusions about the species' trophic patterns can reflect local conditions rather than a generalized feeding habit. In the Southern Hemisphere, red rockfish (*Sebastes capensis* (Gmelin, 1788)) is the only known species within this genus. It is distributed from the Pacific coast (the coast of Peru and Chile), to east of the Falkland Islands, to east of Tristan da Cunha, and as far as the southwestern coast of South Africa (Chen, 1971; Kong, 1985). *Sebastes capensis* is an ovoviviparous species that inhabits the waters over the continental shelf between 20 and 200 m in depth (Pequeño, 2000). Despite the economic importance of this species along the north and central coast of

Chile, where it is exploited by local fisherman, there is little information about its biology and ecology. Currently, there is only one known study describing the diet of this species from the central Chilean coast (Ojeda and Fariña, 1996).

In our study, the feeding habits of *S. capensis* are described and its feeding strategy is analyzed along its geographic range in South America in order to understand whether the feeding pattern and the trophic behavior of this species are maintained at the regional scale. Moreover, the ability of the feeding strategy index of Amundsen et al. (1996) is evaluated for a predator like *S. capensis* that is a passive ambush feeder.

### Materials and methods

#### Sampling

The area of study included most of the distributional range for *S. capensis* (Fig. 1) along the Chilean coast—Antofagasta (23°11'S; 70°29'W), Coquimbo (29°58'S; 71°19'W), Val-

<sup>1</sup> Herrán, R. A. 1988. Stomach contents in fishes: bibliographic revision of objectives and methods. Technical report of the Instituto Oceanográfico Español, number 63, 74 p. Muelle de Poniente s/n; Apartado 291; 07015 Palma de Mallorca; Islas Baleares; Spain. [In Spanish.]

paraíso (32°54'S; 71°44'W), Talcahuano (36°44'S; 73°07'W), Valdivia (39°45'S; 73°08'W), and Aysén Fjord (45°34'S; 72°05'W—and in the Golfo Nuevo (42°45'S; 65°01'W) on the Argentinian coast.

Fish were captured between April and November of 2003. Details for each sampling period in each location are given in Table 1. The depths of capture varied from 15 to 50 m. Fish were captured 1) with hand lines from artisanal boats, 2) by submarine divers, or 3) they were acquired from local fishermen. Overall, a total of 613 specimens were analyzed, of which 375 were males and 238 were females.

#### Laboratory analysis

Immediately upon being captured, the fish were transferred from the sampling location to the laboratory, where they were frozen until analysis. The total length (TL) of each fish was measured to the nearest 1 cm of precision, total weight was recorded to the nearest 0.5 g precision, and sex was determined by macroscopic observation of the gonads.

The prey items found in the stomachs were sorted, counted, weighed, and identified to the lowest possible taxonomic level, according to Holthuis,<sup>2</sup> Garth,<sup>3</sup> Holmquist,<sup>4</sup> and Retamal (1981) for crustaceans, and according to Moreno and Castilla<sup>5</sup> for fishes.

#### Dietary analysis

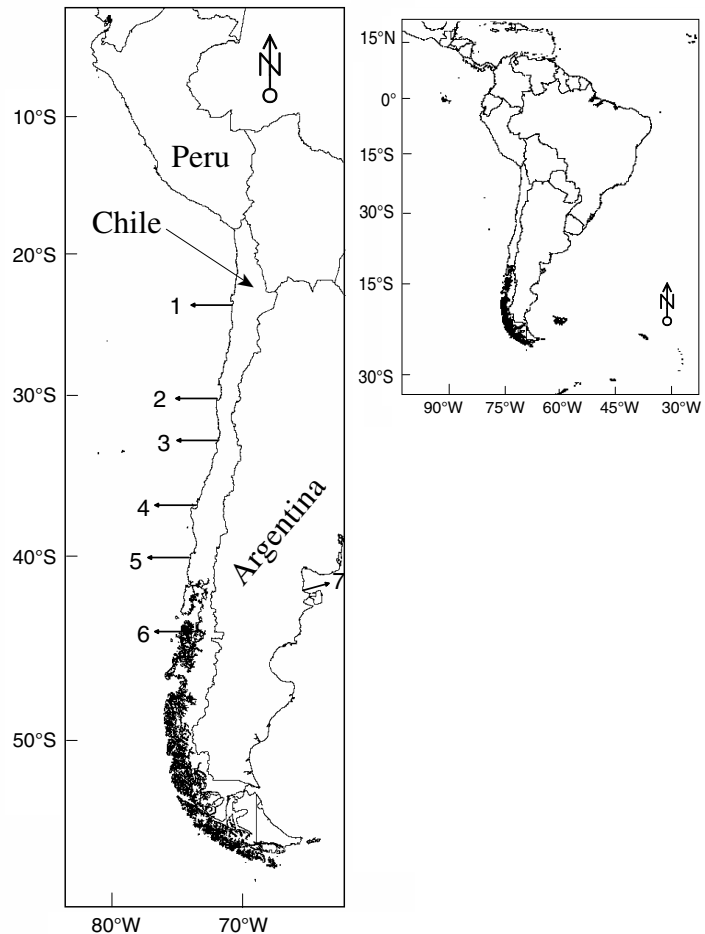
Traditional methods of dietary analysis (counts, frequencies of occurrence, and weights of individual prey [Hyslop, 1980]) were used. These methods can either underestimate or overestimate the results. For this reason, a compound method of analysis was used. One of the most widely used compound indices in fish diet studies is the index of relative importance, IRI (Pinkas et al., 1971), which is expressed as a percentage, % IRI (Cortés, 1997). This index was calculated at the species and phylum level.

<sup>2</sup> Holthuis, L. 1952. The Crustacea Decapoda Macrura of Chile. Reports of the Lund University Expedition 1948–49. Lunds Universitets Arsskrift 247(10):1–110. Lunds Universitets, Lund, Sweden.

<sup>3</sup> Garth, J. 1957. The Crustacea Decapoda Brachyura of Chile. Reports of the Lund University Expedition 1948–49. Lunds Universitets Arsskrift. number 7, 125 p. Lunds Universitets, Lund, Sweden.

<sup>4</sup> Holmquist, C. 1957. Mysidacea of Chile. Reports of the Lund University Expedition 1948–49. Lunds Universitets Arsskrift. number 6, 52 p. Lunds Universitets, Lund, Sweden.

<sup>5</sup> Moreno, C., and J. Castilla. 1978. Guide for the recognition and observation of fish from Chile. Expedition of Chile, 120 p. Universidad Austral de Chile, Casilla 567-Isla Teja, Valdivia, Chile. [In Spanish.]



**Figure 1**

Sampling locations for red rockfish (*Sebastes capensis*) along the Chilean and Argentinian coasts. 1=Antofagasta, 2=Coquimbo, 3=Valparaíso, 4=Talcahuano, 5=Valdivia, 6=Aysen, and 7=Golfo Nuevo (Argentina).

#### Feeding strategy

The analysis of dietary composition proposed by Amundsen et al. (1996) was used.

This is based on a graphic representation; prey-specific abundance is plotted against the prey's frequency of occurrence on a two-dimensional space:

$$P_i = \frac{\sum S_i}{\sum S_{ti}} \times 100,$$

where  $P_i$  = the prey-specific abundance of prey  $i$ ;

$S_i$  = the stomach contents (by weight) comprising prey  $i$ ; and

$S_{ti}$  = the total stomach contents (by weight) in only those predators with prey  $i$  in their stomachs.

This index gives information about prey importance (dominant versus rare) and the feeding strategy (gen-

**Table 1**

Sampling period and mean sizes (mean, in cm) of red rockfish (*Sebastes capensis*) examined by location and latitude.  $n$ =number of stomachs with prey; SD=size standard deviation, and  $P$ =probability associated with Kruskal-Wallis test. ns=no significant differences.

Location	Latitude	Sampling period	$n$	Total length		$P$
				Mean	SD	
Antofagasta	24°S	May–June 2003	29	24.8	1.74	ns
Coquimbo	30°S	May 2003	21	26.2	4.39	ns
Valparaíso	33°S	April–May 2003	50	22.2	3.02	ns
Talcahuano	36°S	April–May 2003	59	26.8	1.66	<0.05
Valdivia	40°S	April–May 2003	87	26.2	3.34	<0.05
Aysen fjord	45°S	July, November 2003	25	25.1	2.15	ns
Golfo Nuevo	43°S	June 2003	23	27.1	2.60	ns

eralist versus specialist) of the predator. The vertical axis of a hypothetical index represents the feeding strategy of the predator in terms of specialization or generalization. Prey points located at the upper left of the diagram would be indicative of specialization of individual predators, and those in the upper right would represent specialization of the predator population. Data seen in the upper right of the diagram (population specialization) necessarily restricted to a single point or to a few points, would reflect a predator population with a narrow niche diet. If all prey points were located along or below the diagonal from the upper left to the lower right, the predator population would have a broad niche width. Prey points located in either the upper left or the lower right corner would represent prey that make the same overall contributions to the population diet, but they would be indicative of totally different feeding strategies for the individual predators. Prey with high specific abundance and low occurrence (upper left) would be consumed by a few individuals displaying specialization, whereas prey with a low specific abundance and a high occurrence (lower right) would be eaten occasionally by most individuals. These differences in feeding strategy are related to the between- and within-phenotypic contributions to the niche width. In a population with a high between-phenotypic component, individuals specialize on different resource types. In a population with a high within-phenotype component, most of the individuals use many resource types simultaneously.

#### Statistical analysis

The Mann Whitney test was used to compare the sizes of fish between sexes, and the Kruskal-Wallis test was performed to compare the sizes of fish from different locations (Zar, 1999). The  $\chi^2$  contingency tables were used to evaluate the possible differences in the prey items clustered by phylum (Arthropoda, Chordata, and Mollusca) among locations. In addition, the  $G$ -statistic was used to evaluate differences in the occurrences

of different prey types between sexes (Zar, 1999) and among the different size classes of fish defined arbitrary (class 1: fish between 18 and 25 cm, and class 2: fish between 26 and 38 cm) (Zar, 1999).

A correspondence analysis was used to evaluate the association between occurrences of prey items and the different locations, allowing the ordination of samples in a reduced space (two dimensions) (Digby and Kempton, 1987).

## Results

### Fish characteristics

A total of 613 specimens were analyzed and of those 296 stomachs contained some prey, 189 had empty stomachs, and 128 had everted stomachs (48.29%, 30.83% and 20.88%, respectively). Table 1 summarizes the characteristics of the fish analyzed by location. There was no significant difference in body size between males and females ( $U=9854.5$ ,  $P=0.26$ ). The size of fish differed significantly among locations: fish from Talcahuano and Valdivia did not differ significantly in size but were significantly larger than those from the others locations (Table 1).

### Diet analysis

Across the geographical range, a total of 60 prey items were identified (Table 2): 40 crustaceans, 9 fishes, 3 cephalopods, 7 snails, and 1 polychetes. Crustaceans were the predominant prey in the diet of *S. capensis*. The low occurrence of other prey items allowed us to designate this species as carcinophagous (=feeding mainly on crustaceans).

Overall, the most important prey item was Mysidacea unident. (75.06% IRI), followed by Osteichthyes unident. (6.29% IRI), the rock shrimp *Rhynchocinetes typus* (6.03% IRI), deep red crab (*Petrolisthes desmarestii*) (4.67 % IRI), the rock crab *Cancer setosus* (2.32%

**Table 2**

Index of relative importance (IRI %) of each prey item recorded by location. Bold numbers show the most important prey items in each location. ANF=Antofagasta; COQ=Coquimbo; VAP=Valparaíso; THN= Talcahuano; VAD=Valdivia; AYS=Aysen channels; GNU=Golfo Nuevo. Unid.=unidentified.

Item prey	ANF	COQ	VAP	THN	VAD	AYS	GNU
Phylum Arthropoda							
Class Crustacea							
<i>Rhynchocinetes typus</i>	<b>40.76</b>	<b>92.15</b>	<b>27.38</b>	0.08			
<i>Cancer setosus</i>	1.17	0.17	<b>34.32</b>	5.09	0.19		
<i>Cancer edwardsi</i>				0.31			
<i>Petrolisthes desmarestii</i>	<b>48.68</b>	1.03	19.09	6.40			
<i>Petrolisthes tuberculatus</i>					0.29		
<i>Pilumnoides perlatus</i>	0.88	0.20	0.19	3.80	0.21		
<i>Pagurus</i> sp.		0.17					
<i>Paguristes</i> sp.				0.01			
<i>Pagurus edwardsi</i>			0.19		0.01		
<i>Pagurus villosus</i>						0.07	
<i>Eurypanopeus crenatus</i>					0.06		
<i>Pseudocorystes sicarius</i>						<b>94.63</b>	
<i>Eurypodius latreillei</i>				3.69	0.06		
<i>Gaudichaudia gaudichaudi</i>			0.46	0.01			
<i>Taliepus</i> sp.			0.21				
<i>Pachycheles chubutensis</i>							0.50
<i>Pisoides edwardsi</i>			0.25				
<i>Pinnixa</i> sp.						0.19	
<i>Pterygosquilla armata</i>		0.22			0.41		
<i>Munida gregaria</i>							<b>15.84</b>
<i>Munida subrugosa</i>							<b>32.07</b>
<i>Halicarcinus planatus</i>			0.65				<b>23.53</b>
<i>Betaeus</i> sp.	0..23						
<i>Bateaus truncatus</i>				<b>6.97</b>	0.04		
<i>Synalpheus spinifrons</i>	4.01		0.65				
<i>Nauticaris magellanica</i>			0.60	0.10	0.02		
<i>Pleuroncodes monodon</i>				0.04			
<i>Austrapandalus grayi</i>				0.04			
<i>Exosphaeroma</i> sp.							0.29
Mysidacea unid.				<b>71.94</b>	<b>92.13</b>		
Amphipoda unid.				0.05	0.005		
Euphausiacea unid.					0.002		
Alpheidae unid.				0.01			
Cirolanidae unid.							1.17
Porcellanidae unid.			0.23				
Cirripedia unid.				0.01			
Decapoda unid.		0.22					
Macruridae unid.			2.60	0.67	0.002	0.90	0.79
Braquiuridae unid.			0.65	0.61			

continued

Table 2 (continued)

Item prey	ANF	COQ	VAP	THN	VAD	AYS	GNU
Phylum Chordata							
Class Osteichthyes							
<i>Engraulis ringens</i>	0.52				0.37		
<i>Chromis crusma</i>		<b>3.54</b>		0.01			
<i>Helcogramoides cumungamii</i>					0.10		
<i>Hipsoblennius sordidus</i>					0.04		
<i>Merluccius gayi</i>				0.09			
<i>Normanichthyes crokeri</i>					0.06		
<i>Odonthestes regia</i>			0.25	0.01	0.36		
Osteichthyes unid.	1.25	2.12	8.49	0.03	<b>5.49</b>	<b>4.15</b>	<b>22.47</b>
Scorpaeniformes unid.					0.09		
Phylum Mollusca							
Class Cephalopoda							
<i>Enteroctopus megalocyathus</i>							0.74
<i>Robsonella fontaniana</i>			1.01				
Teuthoidea unid.					0.01		
Class Gastropoda							
<i>Bittium peruvianum</i>					0.002		
<i>Turritella cingulata</i>			2.60				
<i>Nassarius dentifer</i>	0.88						
<i>Nassarius gayi</i>	1.42						
<i>Nassarius</i> sp.		0.17					
<i>Tricolia</i> sp.				0.01	0.05		
Gastropoda unid.						0.03	1.17
Phylum Annelida							
Class Polychaeta							
Polychaetae unid.	0.21		0.19	0.03	0.002	0.03	1.19

IRI), and the megalop larvae of *Pseudocorystes sicarius* (1.78% IRI).

At the phylum level, the IRIs indicated that the most important prey group was Arthropoda (96.6%) followed by Chordata (2.93%), Mollusca (0.07%), and a low representation of Annelida (0.029%).

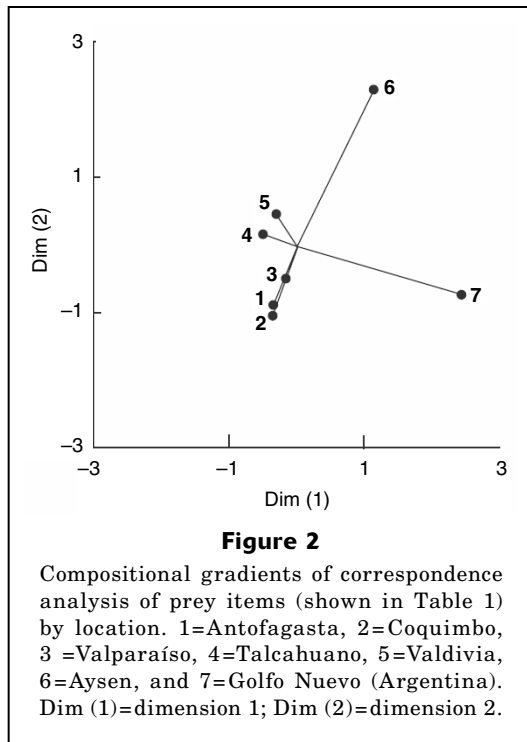
There were no differences between the sexes in the diet of *S. capensis*. Males and females both ate similar proportions of prey items ( $G=3.3$ ;  $P>0.05$ ). Neither sex was observed to show ontogenetic dietary changes: fish of the 19–25 cm size class, and fish between 26 and 38 cm TL showed no significant differences in prey items ( $G=2.27$ ;  $P>0.05$ ). On the other hand, there were significant differences in the diet of *S. capensis* among locations ( $\chi^2=44.94$ ,  $P<0.05$ ). The correspondence analysis (Fig. 2) indicated that fish from Antofagasta, Coquimbo, and Valparaíso fed on similar prey items; whereas the fishes from Talcahuano and Valdivia fed mainly on other prey (Mysidacea spp.). Fish from the Aysén chan-

nels and the Argentina coast showed qualitatively different diets. The diet of fish from the Aysén channels was characterized by the absence of those prey (e.g., *R. typus*; *P. desmarestii*) recorded in the fish from the northern locations. On the other hand, fish from the Argentina coast, fed on prey that are distributed only in higher latitudes (e.g., *Munida* spp.).

Table 2 summarizes the IRI % for each prey item in each location.

**Antofagasta** In this location, 29 specimens had stomach contents, from which 13 prey items were identified. The most important prey was the crab *P. desmarestii* (48.68% IRI), followed by the rock shrimp, *R. typus* (40.76% IRI), and low occurrences of shrimp *Synalpheus spinifrons* (4.01% IRI) and rock crab *C. setosus* (1.17% IRI).

**Coquimbo Only** 10 types of prey were identified from this location. The most predominant was *R. typus* (92.15%



IRI), followed by the fish *Chromis crusma* (3.54 % IRI) and unidentified Osteichthyes (2.12 % IRI). Polychaetes were not found in this area, and only one type of prey belonging to the phylum Mollusca was recorded.

**Valparaíso** Nineteen prey items were identified; of those, 14 were crustaceans. In this location, three prey items were predominant: the crab *C. setosus* (34.32% IRI), the shrimp, *R. typus* (27.38% IRI), and the crab, *P. desmarestii* (19.09% IRI). The fishes were relatively well represented (unidentified Osteichthyes 8.49% IRI). The Mollusca (2.60% IRI) were represented by the small octopus *Robsonella fontaniana*, and the snail *Turritella cingulata*.

**Talcahuano** A total of 24 prey items were identified from this location: 18 crustaceans, four fishes, one snail, and one polychaetae. The most important prey item was Mysidacea spp. (70.94% IRI), followed in importance by the crabs *P. desmarestii* (6.4% IRI) and *C. setosus* (5.09% IRI).

**Valdivia** Twenty four prey items were identified from this area. Mysidacea spp. was the most important in this location (92.13% IRI). However, six of the fish species we identified were represented in this area.

**Aysén Fjord** Despite the importance of unidentified prey items in this area, we observed an absence of most of the prey items found in the other locations. However, the trend of the predominance of crustaceans continued. The most important prey item was the megalop

of *P. sicarius* (94% IRI) and unidentified Osteichthyes (4.15%). The larval stage of *P. sicarius* occurs seasonally; therefore, their importance in the diet of *S. capensis* from this geographical area can be associated with the sampling period (November).

**Golfo Nuevo** In this area, 12 prey items were identified. Lobster krill *Munida subrugosa* (32.07% IRI), the brachyuran crab *Halicarcinus planatus* (23.53% IRI), and *Munida gregaria* (15.84% IRI) were the most important prey items. The percentage of unidentified Osteichthyes (22.47% IRI) was higher than in other locations on the Chilean coast.

### Feeding strategy

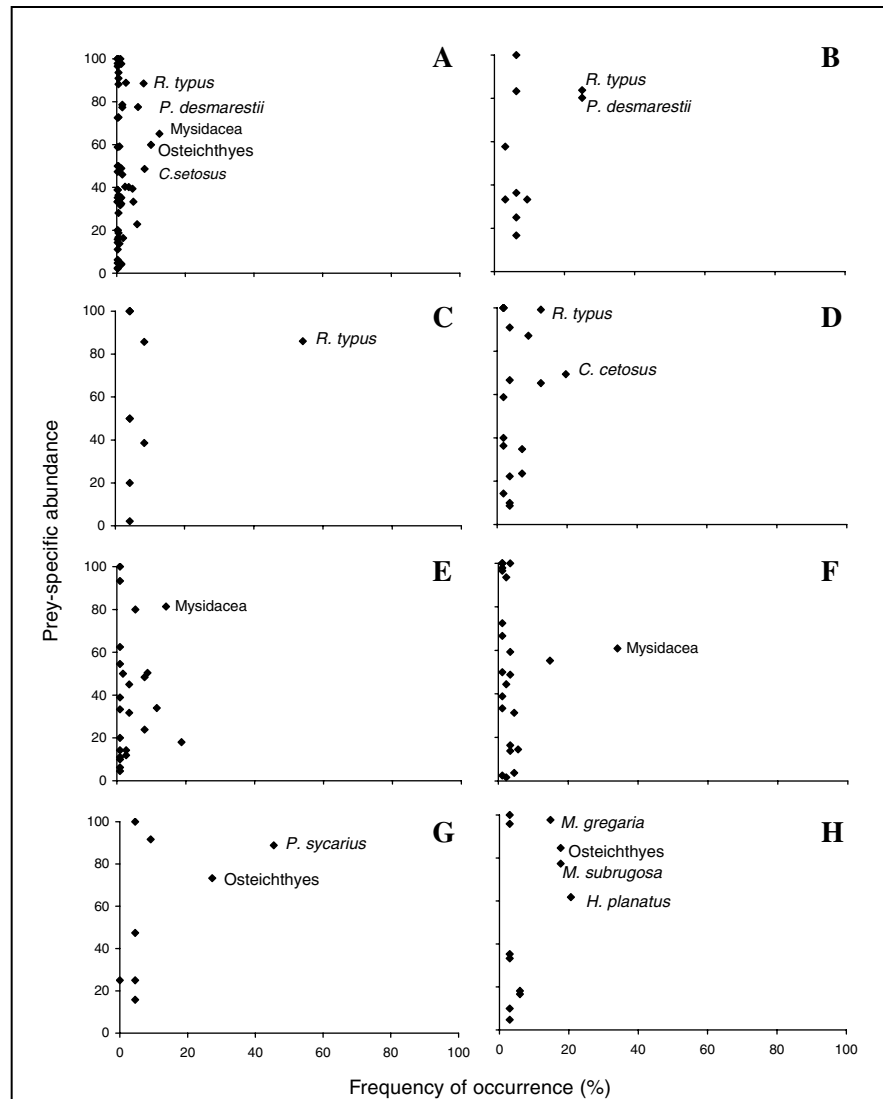
Figure 3 shows prey-specific abundance plotted against frequency of occurrence of prey items for *S. capensis* in the entire study area (Fig. 3A), and in each subarea (termed “location” in this article) (Fig. 3, B–H). This pattern of point distributions was similar for almost all locations. Most of the points (frequency of occurrence) were close to the left side of the *x* axis, and they tended to be positioned towards the upper left corner of the graph (specific abundance). There was a high between-phenotype contribution (BPC) to the niche width in Antofagasta (3B), Coquimbo (3C), Valparaíso (3D), Aysén fjord (3G), and Golfo Nuevo (3H) (i.e., individual predators specialized on different prey types and each food category was consumed by only a limited fraction of the predators). A more mixed feeding strategy, with varying degrees of specialization and generalization for different prey types was observed in Talcahuano (3E) and Valdivia (3F) (i.e., a high BPC and lower within-phenotype contribution (WPC) to the niche width). On the other hand, predominant prey items were observed only in Coquimbo, Valdivia, and Aysén fjord (*R. typus*, Mysidacea gen. sp., and the megalops of *P. sicarius*, respectively); rare or occasional prey items (crustaceans, fishes, mollusks, and polychaetes) were found in all locations.

### Discussion

To determine the dietary variability of a predator, in order to describe its feeding pattern over its entire geographical range, is a difficult task because of the need for large sample sizes in a number of locations. Additionally, fish, such as *S. capensis*, whose percentages of empty or everted stomachs are high (50%), make an assessment of diet variability yet more difficult. We managed these difficulties by sampling fish during the same season, sampling over a similar depth range, and by using known information about the geographical distribution of prey items.

### Geographical variation in the diet

The high percentage of crustaceans in the diet of *S. capensis* indicates that is primarily a carcinophagous fish,



**Figure 3**

Prey-specific abundance (Pi) plotted against frequency of occurrence (%F) of prey items for red rockfish (*Sebastes capensis*) from the Chilean and Argentinean coasts. (A) entire geographic area, (B) Antofagasta, (C) Coquimbo, (D) Valparaíso, (E) Talcahuano, (F) Valdivia, (G) Aysen Fjord, and (H) Golfo Nuevo. *R. typus*= the rock shrimp *Rhynchocinetes typus*; *P. desmarestii*=deep red crab (*Petrolisthes desmarestii*); *C. setosus*=the rock crab *Cancer setosus*; *M. gregaria*=the lobster krill *Munida gregaria*; *M. subrugosa*=the lobster krill *Munida subrugosa*; *H. planatus*=the brachyuran crab *Halicarcinus planatus*.

and secondarily, a piscivorous species. Sixty prey items were recorded in the entire study area, including Mysidacea (75.06% IRI), the most important prey, followed by Osteichthyes (6.29% IIR), *Rhynchocinetes typus* (6.03% IRI), and *Petrolisthes desmarestii* (4.67% IRI).

The composition of prey species for *S. capensis* showed clear geographic variation. These changes were reflected by the relative importance of the different prey items in each of the study locations (Table 2) and were most

evident in the fjords of Aysén and on the Argentinian coast, where all of the prey items found (except for *Halicarcinus planatus*) were unique to those locations. The crustacean *R. typus* was one of the most important prey items (50% IRI) between 23°S and 33°S. The rock shrimp *R. typus* is distributed from 10°S in Perú to 38°S on the Chilean coast (Retamal, 1981). Therefore, this prey species is not available on the southern Chilean coast (southward from 38°S). Between 37°S and 40°S,

Mysidacea was the most important prey item. In this geographic area, the mysids are also the most important prey item for other rocky bottom fishes (González and Oyarzún, 2003). Mysids are found in large and dense patches a few centimeters from the benthos (Silva and Stuardo, 1985).

The changes in prey types and their differences in IRI were also supported by a correspondence analysis (Fig. 2), which separated the sampling locations into four major areas according to recorded prey types as follows: 1) 23°S–33°S, 2) 37°S–40°S, 3) 45°S, and 4) Golfo Nuevo (43°S), Argentina. These geographic areas agree well with the proposed biogeographic units for this region by Briggs (1995) and by Camus (2001). According to Briggs (1995), two faunistic provinces are recognized in the southeastern Pacific: the Peruvian province, which extends from Perú (ca. 10°S) down to the northern Chilean coast (ca. 30°S), and the Magellanic province located on the southern Chilean coast (ca. 43°S). Between these provinces a transitional zone is found, in which species typical of the Peruvian province and the Magellanic province overlap (Brattström and Johanssen, 1983; Lancelloti and Vasquez, 2000). Additionally, Camus (2001) recognized five areas of distributional discontinuities along the Chilean coast: (1) 30°S; (2) 33°S; (3) 37°–38° S; (4) 41°–43°S, and (5) 52°–53°S. Thus prey, such as *R. typus*, are distributed along the Peruvian province and transitional zone, whereas prey like mysids are present mainly between latitudes 37°S and 40°S.

Alternatively, Balech (1954) and Pequeño (2000) considered all of South America's southern extremity as the same biogeographic province. The records of prey items (i.e., *Munida gregaria* and *M. subrugosa*) in Golfo Nuevo (Argentina coast) support the existence of a connection between the southeastern Pacific and the southwestern Atlantic. These prey species are also distributed along the Chilean coast from Chiloé (42°S) southward. However, these prey items were not found in Aysén fjord, which could be explained by the presence of two zones in the Aysén area with different physical and faunistic conditions: the fjord channels and a marine zone (Arntz et al., 1999). Fish were sampled in the Aysén channels, where species of *Munida* are absent (Retamal, 1981). Therefore, abundance and availability of prey may be a factor explaining the differences in the dietary composition of *S. capensis* between biogeographical regions.

The present study indicates the existence of geographic variations in the dietary composition of *S. capensis*, and these variations generally agree with the zoogeographic limits proposed in the literature. However, the interpretation of this result is limited because of the absence of an adequate background on the abundance and biogeography of each prey item.

### Feeding strategy

According to Ojeda and Fariña (1996), *S. capensis* is a nocturnal predator that feeds selectively on the decapod

crustaceans *R. typus* and *P. perlatus* in the rocky subtidal shores of the central Chilean coast. Ojeda and Fariña suggested that these species are consumed preferentially from a large array of potentially abundant invertebrate prey items. Crustaceans are more active at night than during the day, which could explain their large rate of consumption by rockfishes that are active a night. Decapod crustaceans have the highest caloric content (Duarte et al., 1980), therefore Ojeda and Fariña (1996) proposed that the specialized diet of *S. capensis* reflects an optimal foraging alimentary strategy based on the maximization of available energy. On the other hand, Moreno and Zamorano (1980) indicated that the feeding strategy of a species has a direct relationship with its morphological and behavioral adaptations that preclude being preyed upon, and these adaptations could restrict the potential prey items that they could capture. In this context, Moreno et al. (1979) and Moreno (1981) studied the bathymetric distribution of six species of fishes from the rocky subtidal shore of the Valdivian coast, including *S. capensis*. They established that the fishes segregate by habitats in order to take refuge from predators, mainly the sea lion *Otaria flavescens*; such segregation was not related to the bathymetric distribution of their most important prey items.

*Sebastes capensis* shows buccal traits characteristic of carnivorous species; it has a good protrusion capacity and its teeth are inclined in a dorsal-caudal orientation that prevents the escape of prey once they have been caught (Alvarado, 1985). *Sebastes capensis* is a poor swimmer; its anatomy conforms to that of sedentary species in that its head and mouth are big in comparison to the rest of the body, and it has big eyes that allow an extensive angle of vision facilitating the capture of their prey and the detection of their predators. Therefore, their capacity to catch prey depends mainly on characteristics of their prey. All prey species of *S. capensis* show similar behavioral traits (i.e., swimming organisms that move between rocky intertidal and subtidal zones) and *S. capensis* waits to capture them. The specialized feeding strategy of *S. capensis* may be a consequence of the availability of prey species moving in the vicinity of the refuges of this fish.

The feeding strategy index, as defined by Amundsen et al. (1996), has been used successfully for active predators like sharks (e.g., Lucifora et al., 2000; Vogler et al. 2003). However, this index does not integrate either predator behavior or the availability of prey in a given environment. Therefore, the criteria used to differentiate specialist from generalist predators must be clarified. According to the feeding strategy index of Amundsen et al. (1996), *S. capensis* is a specialized predator (preying mainly on crustaceans, although it consumes some prey species, and other rare prey species in almost all locations analyzed). In reality, *S. capensis* is an ambush predator that does not actively search for its prey. Because this fish waits in rocky refuges for mobile prey, the probability of it encountering prey depends, to a large extent, on prey abundances, prey distributions, and prey behaviors.



## Acknowledgments

The authors thank to Carlos Jara for the collaboration in the identification of crustaceans prey. This study was realized under the sponsorship of D.I.D. (Dirección de Investigación y Desarrollo) of the Universidad Austral de Chile (Project D-2003-09). M.T.G. was supported by a CONICYT fellowship of the Chilean Government.

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