(Sunyé 1993). The elasmobranch fauna of southern Brazil is a "laboratory of evolution", and there is an urgent need to preserve this fauna, which is being severely threatened by the fishery industry.

6.17 Cephalopods

M. Haimovici

Early reviews on the taxonomy and zoogeography of Brazilian cephalopods are based on museum collections of expeditions during the 19th and the beginning of the 20th century as collated by Palacio (1977). More recent studies have re-examined the octopus *Eledone massyae* (Voss 1964) and the abundant *Loligo sanpaulensis* (=*L. brasiliensis;* Brackoniecki 1984), as well as described a new genus and one member (*Vosseledone charrua;* Palacio 1978) and a new species of *Eledone* (*E. gaucha;* Haimovici 1988c). Based on the revision of cephalopod collections (Haimovici et al. 1989c; Perez and Haimovici 1991a; Haimovici and Perez 1991a,b), the study of cephalopod beaks in the stomachs of predators (Santos 1992), as well as macrozooplankton samples of paralarvae and juveniles (Haimovici and Perez 1991a; Haimovici et al. 1994b), the knowledge concerning southern Brazilian cephalopods has improved (Palacio 1977; Juanicó 1980; Roper et al. 1984; Haimovici 1985; Haimovici and Perez 1991b; Haimovici et al. 1994b).

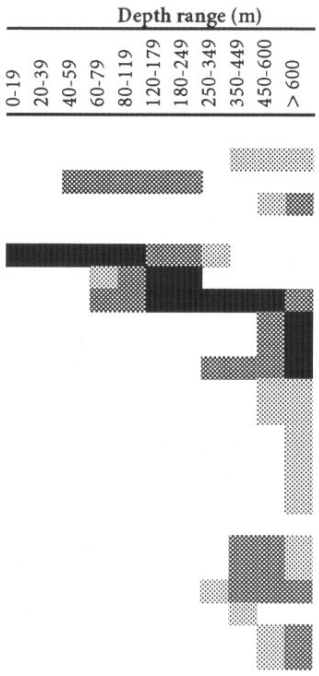
Faunistic Composition and Ecology of Dominant Species

For much of the cephalopod fauna, the Brazilian coast between 20° and 34° S represents a biogeographic transition zone. This region appears to be the centre of temperate coastal species with a relatively restricted distribution, like the frequent *Loligo sanpaulensis*, *Eledone massyae*, *Eledone gaucha*, and *Octopus tehuelchus*. Temperate species with a wide distribution (tropical species *Loligo plei* and *Semirossia tenera*, and the cosmopolitan *Octopus vulgaris*) are rare (Palacio 1982). Compared with more northern regions, the southern Brazilian shelf and slope exhibit an apparently impoverished cephalopod fauna (Haimovici and Andriguetto 1986; Haimovici et al. 1989c; Haimovici and Perez 1991a). The low diversity of benthic shelf habitats and pronounced seasonal water temperature oscillations, owing to largely sandy bottoms and to the influence of the Brazil and Malvinas Currents, respectively, do not favour the occurrence of tropical neritic species like *Loligo plei*, *Pickfordiateuthis,* and *Lolliguncula brevis*, nor of cold temperate coastal species like *Loligo gahi.*

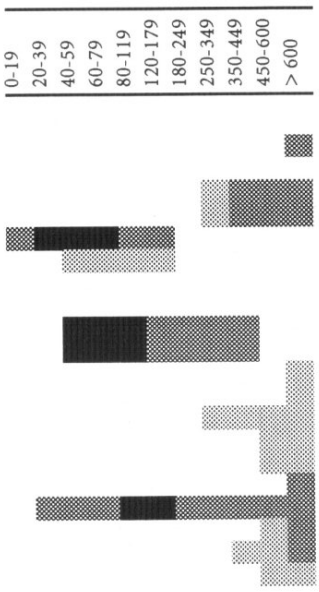
Over 40 cephalopod species have been recorded for the southern Brazilian shelf and slope between Santa Marta Grande Cape and Chuí (28° 30'-34° 40' S; Appendix; Haimovici and Andriguetto 1986; Haimovici and Perez 1991b; Perez and Haimovici 1993; Fig. 6.17.1). *Octopus tehuelchus* is the most abundant benthic species in shelf waters down to 50 m depth, whilst *Semirossia tenera* and *Octopus vulgaris* occur in deeper waters. Between 50 m depth and the shelf break (200 m), the Octopodidae *Eledone massyae* and *Eledone gaucha* are the most frequent and dominant benthic species (Haimovici and Andriguetto 1986; Haimovici and Perez 1991a). The life-cycle of *Eledone massyae* extends approximately 2 years. Males reach sexual maturity prior to females in the fall, followed by reproduction in the spring. Intraovaric fecundity with 27-126 ovocytes in *Eledone massyae* (Perez and Haimovici 1991b) and 5-58 in *Eledone gaucha* (Perez et al., unpubl.) is low. In contrast to other Octopodidae, the oviductal gland in females of both species lacks the function of a spermatheca since sperms are stocked in filaments of the intraovaric maturing oocytes (Perez et al. 1990). Adults of *Eledone massyae* and *Eledone gaucha* appear to explore different food sources. While the diet preference of *Eledone massyae* changes with age from amphipods to portunid crabs and polychaetes, *Eledone gaucha* continues to feed on amphipods and isopods (Perez and Haimovici 1995). In the deeper slope regions species of subantarctic origin (Voss 1988), like *Pareledone charrua*, *Pareledone turqueti*, and eledonids occur on sandy bottoms, in contrast to *Vosseledone charrua*, which is probably restricted to consolidated bottoms of relict corals.

Loligo sanpaulensis is the most abundant neritic species in shelf waters during the entire year (Haimovici and Andriguetto 1986; Andriguetto and Haimovici 1991). The highest densities and largest individuals occur south of 32° S in waters between 40 and 80 m depth at less than 18°C. Since the spring biomass may reach 3500 tons, *Loligo sanpaulensis* stocks are of potential commercial value. The southern Brazilian shelf waters appear to be a spawning area of the species, with smaller and larger individuals spawning in shallower (<40 m) and deeper waters, respectively. Smaller individuals are more common in the summer and fall, whilst mature females are found throughout the entire year but are less frequent in the fall (Andriguetto and Haimovici, in press). The availability of food, largely composed of fish and crustaceans, is likely to influence the distribution patterns of *Loligo sanpaulensis* (Juanicó 1979; Costa and Fernandes 1993). Other pelagic species of the shelf water, especially during the summer, are *Argonauta nodosa* and *Loligo plei.*

Illex argentinus is the most frequent and abundant species over the southern Brazilian outer shelf and upper slope (Haimovici and Perez 1991b). The species has a life-cycle of 1 year (Arkhipkin 1990) and reproduces essentially during the winter and spring when spawning adults are commonly found along the shelf break. Based on their size and the absence



Species and genera	Families	Habitat
Order SEPIOIDEA		
Spirula spirula	Spirulidae	Mesopelagic
Semirossia tenera	Sepiolidae	Demersal,muddy and sandy bottoms
Heteroteuthis atlantis	Sepiolidae	Mesopelagic
Order TEUTHOIDEA		
Loligo sanpaulensis	Lolliginidae	Demersal-pelagic
Loligo plei	Lolliginidae	Demersal-pelagic in the warm season
Illex argentinus	Ommastrephidae	Demersal-pelagic
Ornithoteuthis volatilis	Ommastrephidae	Epipelagic
Ornithoteuthis antillarum	Ommastrephidae	Epipelagic
Ommastrephes bartramii	Ommastrephidae	Epipelagic
Todarodes angolensis	Ommastrephidae	Demersal-pelagic
Thysanoteuthis rhombus	Thysanoteuthidae	Epipelagic
Onychoteuthis banksi	Onychoteuthidae	Epipelagic
Moroteuthis ingens	Onychoteuthidae	Demersal-pelagic
Moroteuthis robsoni	Onychoteuthidae	Demersal-pelagic
Onychia carribaea	Onychoteuthidae	Mesopelagic
Abraliopsis pfefferi	Enoploteuthidae	Mesopelagic-bathypelagic
Abralia veranyi	Enoploteuthidae	Mesopelagic-bathypelagic
Abralia redfieldi	Enoploteuthidae	Mesopelagic-bathypelagic
Ancistrocheirus alessandrini	Enoploteuthidae	Mesopelagic-bathypelagic
Pterygioteuthis giardi	Enoploteuthidae	Mesopelagic-bathypelagic
Histioteuthis dofleini	Histioteuthidae	Mesopelagic
Histioteuthis atlantica	Histioteuthidae	Mesopelagic



Species and genera	Families	Habitat
Liocranchia reinhardti	Cranchiidae	Mesopelagic-bathypelagic
Megalocranchia sp	Cranchiidae	Mesopelagic-bathypelagic
Chiroteuthis veranyi	Chiroteuthidae	Mesopelagic-bathypelagic
Lycoteuthis diadema	Lycoteuthidae	Bathyal, mesopelagic
Order OCTOPODA		
Octopus tehuelchus	Octopodidae	Benthic, muddy and rocky bottoms
Octopus vulgaris	Octopodidae	Benthic, rocks and coral reefs
Scaeurgus unicirrhus	Octopodidae	Benthic,sand and coraline bottoms
Pteroctopus tetracirrhus	Octopodidae	Benthic, muddy bottoms
Eledone massyae	Octopodidae	Benthic, sandy and muddy bottoms
Eledone gaucha	Octopodidae	Benthic, sandy and muddy bottoms
Pareledone turqueti	Octopodidae	Benthic, mud
Pareledone charcoti	Octopodidae	Benthic, sandy bottoms
Vosseledone charrua	Octopodidae	Benthic, on rocky and coraline bottoms
Eledonella pigmea	Bolitaenidae	Bathypelagic
Japetella diaphana	Bolitaenidae	Bathypelagic
Allopsus mollis	Allopsidae	Epipelagic - bathypelagic
Argonauta nodosa	Argonautidae	Epipelagic in warm waters
Tremoctopus violaceous	Tremoctopodidae	Epipelagic
Ocythoe tuberculata	Ocythoidae	Epipelagic
Thysanoteuthis rhombus	Thysanoteuthidae	Epipelagic

Fig. 6.17.1. Depth ranges and habitats of neritic and upper slope cephalopods along the southern Brazil coast (*black* abundant; *dark gray* frequent; *light grey* infrequent)

of didymozoid parasites in their digestive tract, spawning adults from southern Brazil, Uruguay, and northern Argentine may belong to the same group (Santos and Haimovici, in press). Paralarvae and juveniles of less than 50 mm mantle length exhibit three growth phases. They concentrate principally during the winter and spring in shelf waters (>100 m, >12°C) of tropical origin and at the convergence with the Malvinas Current (Haimovici and Perez 1990; Vidal 1994a,b; Haimovici et al. 1995; Vidal and Haimovici, unpubl.). The diet preference of *Illex argentinus* changes during development. Recently hatched paralarvae appear to feed on micro-organisms, whilst crustaceans are the preferred diet of older paralarvae. During continued growth, the relative importance of crustaceans changes in favour of a diet of fish and other cephalopods, which includes cannibalism (Santos 1992). *Illex argentinus* represents an important food source for the tunafish *Thunnus obesus*, the swordfish *Xiphias gladius*, and the wreckfish *Polyprion americanus* (Santos 1992; Santos and Haimovici, unpubl.). Although *Illex argentinus* is of considerable economic importance worldwide (Csirke 1987; Haimovici et al., in press), the potential value of the southern Brazilian stocks still needs to be evaluated (Haimovici and Perez 1991a). Other typical slope species include *Abralia verany*, *Abralia redfieldi*, *Lychoteuthis diadema*, and *Ancistrocheirus lesueuri* (syn. *A. alessandrini*) which are abundant during the winter (Haimovici and Perez 1990), as well as oceanic species with wide distribution in temperate and tropical waters, like *Ornithoteuthis antillarum* and *Ommastrephes bartrami* (Santos 1992; Santos and Haimovici, unpubl.).

6.18 Marine Mammals and Turtles

M. C. Pinedo

Species Composition and Distribution

Of the approximately 78 known worldwide cetaceans and the 13 endemic pinnipeds of South America and the Antarctic, 27 and 7, respectively, occur along the southern Brazilian coast between the latitudes 25° 14' and 33° 45' S (Castello and Pinedo 1977b; Pinedo 1990; Pinedo et al. 1992; Appendix). The pinnipeds, some of which (*Arctocephalus gazella*, *Hydruga leptonyx*, *Lobodon carcinophagus*) have a circumpolar distribution, follow the Malvinas Current to reach the Brazilian coast (Castello and Pinedo 1977a). The cetaceans *Hyperoodon planifrons*, *Phocoena spinipinnis*, *Sotalia fluviatilis*, *Australophocaena dioptrica*, and *Pontoporia blainvillei* are restricted to the Southern Hemisphere, the last being endemic to the Southwestern Atlantic. Five cetaceans (*Mesoplodon densirostris*, *Stenella coeruleoalba*, *Stenella attenuata*, *Steno bredanensis*, *Kogia simus*) and two pinnipeds (*Arctocephalus tropicalis*,

U. Seeliger C. Odebrecht J. P. Castello (Eds.)

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With 66 Figures

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Dr. ULRICH SEELIGER
Dr. CLARISSE ODEBRECHT
Lic. JORGE PABLO CASTELLO

Department of Oceanography
Universidade do Rio Grande
96201 Rio Grande, RS
Brazil

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