Feeding habits and prey selection by the skate
*Dipturus chilensis* (Elasmobranchii: Rajidae)
from the south-western Atlantic

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The diet of *Dipturus chilensis* was composed mainly of the nototheniid fish *Pangasianodon hamangi*, squid *Illex argentinus*, hake *Merluccius hubbsi*, serolid isopods, and crustaceans. Our results suggest that *D. chilensis* feeds selectively on some teleosts and rejects cel-like fishes; Total length of consumed *P. hamangi* was significantly correlated with the skate’s mouth width.

The skate *Dipturus chilensis* (Guichenot, 1848) ranges from Uruguay to central Chile, around southern South America. The diet of *D. chilensis* from a south-western Atlantic scallop bed is described, and compared with the availability of prey in its habitat to assess possible prey selection habits.

Sampling was carried out on a commercial trawler targeting Patagonian scallop, *Zoanchias patagonica*, between 41°36’ and 42°04’S, and between 56°00’ and 58°22’W off Argentina, during April and May 1998. Depth range was 89.8–124 m. Trawls were performed with two nets fishing simultaneously, one for each side of the vessel. Each net had a mesh size of 70 mm and a height of 1.3 m. The footrope of the nets were 17 m long and had chains. Tow speed was 4 knots. Total length (TL), to the nearest cm and mouth width (to the nearest 0.1mm) were measured for all skate caught. The stomachs were removed, frozen, and subsequently analysed in the laboratory. Prey was identified to the lowest taxonomic level possible, with number, weight (to the nearest 0.01g) and volume (measured by water displacement) being recorded.

The gravimetric index of relative importance (IRI) was calculated as:

\[
\text{IRI}_k = \%F \times (\%N + \%W)
\]

where \%F is the per cent frequency of occurrence (i.e. the number of stomachs in which a given prey was found as percentage of the number of stomachs with food); \%N is the number of a given prey as percentage of the total number of prey; and \%W is the number of a given prey as percentage of the total weight of prey. Volumetric IRI (IRI) was calculated as was IRI, but replacing \%W with percentage volume.

Prey-specific abundance (\(P_i\)) was calculated as the number of prey \(i\) divided by the total number of prey in the stomachs which contained the prey \(i\) (Amundsen et al., 1996). We plotted \(P_i\) against \%F to know the feeding strategy of the predator (Amundsen et al., 1996). Size-frequency distributions of *Pangasianodon hamangi* from the catch and from the stomachs of skates were estimated, and compared by using the Kolmogorov–Smirnov test. The Spearman Rank correlation coefficient was calculated between skate mouth width and *P. hamangi* TL.

One hundred and sixteen specimens were examined (from 57 trawls) of *Dipturus chilensis* ranging from 43 to 93 cm TL. Of these, 96 contained food. *Pangasianodon hamangi* was the most abundant teleost (93% of the total catch), while *Merluccius hubbsi*, *Bassanago alboescens* and *Genypterus blacodes* comprise the remaining 5%.

The principal prey was *P. hamangi* (IRI, 6570.1; IRI, 6586.6), followed by unidentifiable teleost (IRI, 2654.6; IRI, 2636.6) and the squid *Illex argentinus* (IRI, 138.3; IRI, 139.4). Other prey included hake, *M. hubbsi* (IRI and IRI, 10.6), crustaceans (IRI and IRI, 1.6), unidentifiable remains (IRI, 3.3; IRI, 3.2) and serolid isopods (IRI and IRI, 3.2). Several remains of *I. argentinus* and *M. hubbsi* discarded from commercial fishing vessels were observed. This was inferred from the cutting marks made during processing of the fish. The P–%F plot shows that *P. hamangi* was the main prey, followed by unidentifiable teleost remains, *I. argentinus* was a secondary prey and few skates consumed crustaceans or hake (Figure 1).

Size-frequency distributions of *P. hamangi* from the catch and from the stomachs of *D. chilensis* were significantly different (Kolmogorov–Smirnov test, \(d_{max} = 21.12, N = 45, k = 34, P < 0.001\)). No *P. hamangi* larger than 25 cm TL were observed in skate stomachs and *P. hamangi* between 14 and 22 cm TL were highly consumed (Figure 2). The scallop net may however affect the observed size-distribution of both predators and prey.

The correlation between predator’s mouth width and TL of consumed *P. hamangi* was significantly different from 0 \(y = 0.48, N = 45, P < 0.001\).

Our results show that *D. chilensis* preys primarily on teleosts. The scallop fishery from which we have taken our data takes a large amount of invertebrate bycatch (up to 70% of the total catch, Bremer et al., 1998). Invertebrates were under-represented in the diet of *D. chilensis*, as inferred from invertebrate abundances on south-western Atlantic scallop beds presented by Bremer et al. (1998); Thus, we concluded that fishes are the preferred prey of these skates. The piscivorous nature of the diet was confirmed by the method of Amundsen et al. (1996). The smallest individuals we sampled were 45 cm TL, and our data will be biased to the piscivorous individuals. As the gear employed caught high numbers of juveniles 10–20 cm TL of other skates (e.g. *Amblyraja bowdleri*, *Bathyraja brachyuroidea* and *Rhinoraja acutirostris*), the absence of *D. chilensis* < 45 cm TL may be due to a size-based spatial segregation, rather than to sampling bias.

Of seven species of *Bathyraja* studied in the north-west Pacific, only *Bathyraja parvimera* consumed predominantly fishes (Orlov, 1998). The diet of at least 11 species of skates from European

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capture and handling. The feeding behaviour of *D. chilensis* would likely differ between feeding on *P. ramsayi* and eel-like fishes. Given a small mouth in relation to its orobranchial cavity, *D. chilensis* (like most skates) is presumably well suited for suction feeding. This specialization may explain the under-representation of eel-like fishes in the diet of *D. chilensis*.

Robichaud et al. (1991) found no correlation between the size of *Amblyraja radiata* and their crab prey. In contrast, larger individuals of *D. chilensis* feed on larger individuals of *P. ramsayi* (up to a size of 25 cm TL) and small individuals of *P. ramsayi* were absent from the diet of large skates. We suggest that the upper size limit of prey consumed by *D. chilensis* is imposed by morphological constraints, which can have profound effects on ecological aspects such as feeding.

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