

RACER: Ichthyoplankton abundance, species composition, and distribution in Gerlache Strait, Antarctica, October to November 1989

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The antarctic fish fauna is dominated by coastal forms associated with continental and island shelf waters. Prominent are numerous species representing families of notothenioid fish endemic to antarctic waters: Nototheniidae, Channichthyidae, Bathydraconidae, Artedidraconidae, and Harpagiferidae. Although the adults of most of these species are bottom dwelling and produce demersal eggs, the larvae are pelagic (Loeb et al. in press; North 1991). Plankton surveys in the Antarctic Peninsula region have shown that these larvae are generally confined to shelf and slope waters. Although most of the coastal and mesopelagic fish species reported from this region have been represented in the samples, the larvae of some known abundant species are rarely encountered (Kellermann and Kock 1988; Kellermann 1989a). This dearth could result in part from retention of the larvae of some species within coastal spawning areas and the paucity of inshore sampling by the surveys. High primary production and plankton biomass in coastal areas may also support elevated larval fish abundance relative to offshore waters (Loeb 1991).

The detailed study in Gerlache Strait during 1989 by the research on antarctic coastal ecosystem rates (RACER) program (Huntley et al. 1990) makes it possible to examine the

importance of coastal environments to larval fish, including aspects of abundance, composition, and retention in nearshore waters.

Larval fish were obtained from vertically stratified multi-opening closing net and environmental sensing system (MOCNESS) samples collected in Gerlache Strait and adjacent Bransfield Strait waters between 30 October and 24 November 1989. Tows were made at stations arranged in a grid pattern across a 4,000-square-kilometer (km²) survey area at approximately 1-week intervals for a period of 1 month (figure 1). Replicated tows were made at a time-series station (station A) located in the eastern Gerlache Strait during three of the four sampling intervals. Larval fish were sorted from 1,732 samples resulting from 103 tows. Tow depths were to 290 meters (m) or to within 40 m of the seafloor in shallower waters (Huntley et al. 1990). Combined sample data for the whole water column are presented here. Abundance, expressed as numbers per 10 m², was derived from the summed sample abundance for each tow. Average values for each of the 22 grid stations and for the replicated tows at station A are used to describe overall ichthyoplankton abundance and species composition during the study.

Only one of the 103 tows did not contain larval fish; the other tows had between 2 and 88 larvae and yielded a total of 1,578 larvae. The overall averaged abundance of 19.0 larvae per 10 m² (table) is similar to that found in the northern Gerlache Strait during the December 1986 RACER cruise (18.8 larvae per 10 m²; Loeb 1991). Nineteen larval fish taxa were represented in the collections (table). Nineteen is a relatively large number of taxa, especially given the restricted sampling area. Ichthyoplankton collections from a much greater area of the Antarctic Peninsula region during three spring (October–December) sampling periods by Kellermann (1989a) yielded between 13 and 19 species and a cumulative total of 24 species.

Three Nototheniid species, *Lepidonotothen larseni*, *Trematomus newnesi*, and *T. lepidorhinus*, numerically dominated and constituted 84 percent of the total averaged abundance. Two mesopelagic species, *Bathylagus* sp. (Bathylagidae) and *Electrona antarctica* (Myctophidae), together represented 8 percent of the total. The Channichthyid *Chionodraco rastrospinosus* was also relatively abundant (3 percent). Two other channichthyids, *Champocephalus gunnari* and *Chionobathyscus dewitti*, were collected. *L. larseni*, *T. newnesi*, *C. rastrospinosus*, and *E. antarctica* typically are the dominant species in ichthyoplankton collections from the Antarctic Peninsula region during October–December (Kellermann and Kock 1988; Kellermann 1989a,b). *T. lepidorhinus*, *C. gunnari*,

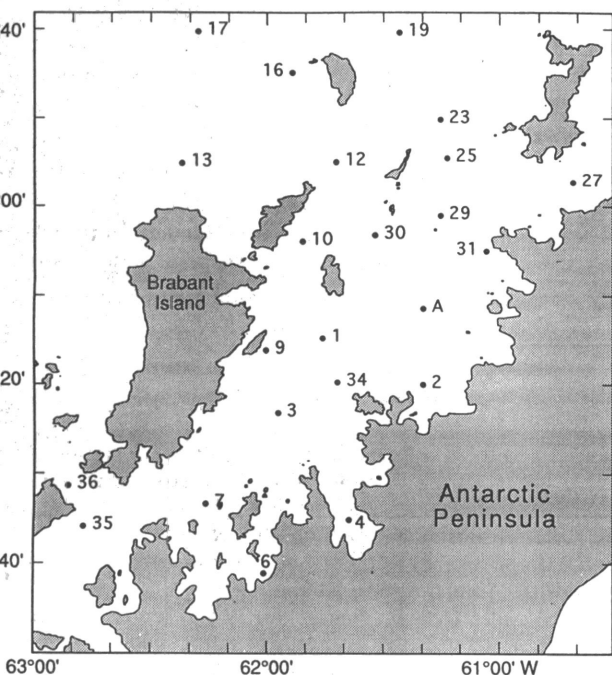


Figure 1. RACER study area and station locations, 20 October–24 November 1989. Numbers denote survey grid stations; A is the time series station.

Young fish abundance and composition in the RACER samples collected in Gerlache Strait, October–November 1989. Presence in the percent of the total 23 stations at which each species was collected.

Species	Mean no./10m ²	Percent	Total	Presence (%)
<i>Lepidonotothen larseni</i>	10.74	57.63	538	100.0
<i>Trematomus newnesi</i>	3.72	19.97	599	82.6
<i>Trematomus lepidorhinus</i>	1.25	6.69	242	65.2
<i>Electrona antarctica</i>	0.89	4.77	19	56.5
<i>Bathylagus sp.</i>	0.65	3.51	44	52.2
<i>Chionodraco rastrospinosus</i>	0.63	3.36	34	47.8
Bathydraconid #1	0.23	1.24	7	26.1
<i>Champscephalus gunnari</i>	0.16	0.88	9	17.4
<i>Lepidonotothen nudifrons</i>	0.12	0.66	10	26.1
<i>Racovitzia glacialis</i>	0.07	0.37	2	13.0
<i>Artedidraco skottsbergi</i>	0.07	0.35	21	26.1
<i>Gobionotothen gibberifrons</i>	0.04	0.22	14	13.0
<i>Chionobathyscus dewitti</i>	0.03	0.14	6	4.3
<i>Notolepis sp.</i>	0.01	0.04	2	8.7
<i>Harpagifer antarcticus</i>	<0.01	0.04	2	8.7
Unidentified B	<0.01	0.02	1	4.3
Unidentified A	<0.01	<0.01	1	4.3
Unidentified C	<0.01	<0.01	1	4.3
Bathydraconid #2	<0.01	0.01	1	4.3
<i>Pleuragramma antarcticus</i> (juvenile)	0.01	0.05	1	4.3
<i>Lepidonotothen kempfi</i> (juvenile)	0.01	0.04	1	4.3
Damaged/unidentified	0.33		23	
TOTAL	18.97		1,578	
Number of stations			23	
Number of tows			103	

and *C. dewitti* have been rare and *Bathylagus sp.* uncommon in previous collections. The relatively high abundance of *Bathylagus sp.* may in part result from sampling depth: previous collections (Kellermann and Kock 1988; Kellermann 1989a) were generally from tow depths less than or equal to 200 m and substantial proportions of *Bathylagus sp.* in Gerlache Strait were found to occur between 200 and 290 m (Loeb 1992). Reported nearshore distributions of adult *T. lepidorhinus* (DeWitt, Heemstra, and Gon 1990) and inshore spawning migrations by channichthyids (Kock and Kellermann 1991) suggest that proximity to coastal source areas may explain their elevated larval abundance in Gerlache Strait.

The more abundant species demonstrated extensive but characteristic distributions (table, figure 2). *L. larseni* was collected at all stations but was most abundant to the west and downstream of a strong current flowing northeast along the axis of Gerlache Strait (Amos, Jacobs, and Hu 1990; Niiler, Illeman, and Hu 1990). *T. newnesi* was present at more than 80 percent of the stations and was uniformly distributed across Gerlache Strait. *T. lepidorhinus* was also widely distributed across the Strait (present at 65 percent of stations) but was

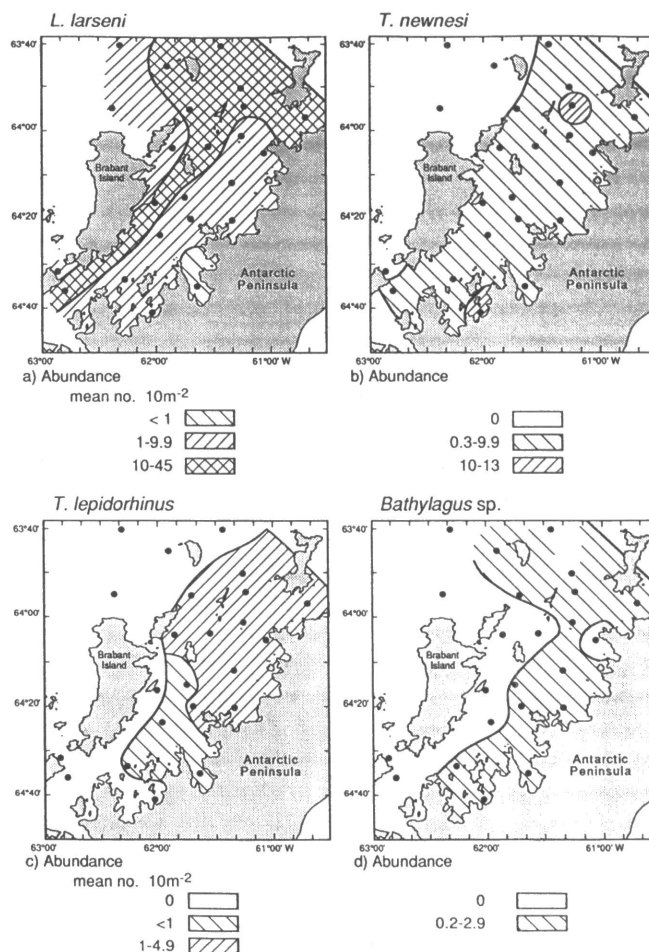


Figure 2. Distribution patterns of four relatively abundant larval fish species in Gerlache Strait during October–November 1989.

more abundant in the north. *Bathylagus sp.* was distributed in the eastern and downstream areas of the strait; it was collected at about half of the stations. These differing distribution patterns probably reflect an interaction of various parameters including bathymetry, the location of spawning areas, hydrographic features such as currents and gyrls, and larval vertical distribution patterns and behavior.

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RACER: Larval feeding ecology of three species of antarctic fishes (*Lepidonotothen larseni*, *Trematomus newnesi*, and *T. lepidorhinus*) from Gerlache Strait, Antarctica, November 1989

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Relatively few studies have investigated the feeding ecology of antarctic larval fishes. Kellermann (1986, 1990) reviewed the early biology and feeding habits of five species of notothenioid fishes from the Antarctic Peninsula region and performed a detailed analysis of the seasonal and diel feeding habits as well as food preferences of larval *Lepidonotothen* (*Nototheniops*) *larseni*. North and Ward (1989) described the larval feeding habits of four fish species from South Georgia (*Trematomus hansonii*, *Harpagifer georgianus*, *Parachaenichthys georgianus*, *Pseudochaenichthys georgianus*). North and Ward (1990) investigated the larval feeding ecology of *Champscephalus gunnari* and other species collected from Cumberland East Bay; these species are important to the finfish industry at South Georgia. By contrast, a cursory literature search for feeding studies of larval fishes from tropical and temperate regions yielded more than 3,000 references.

We present here the preliminary results from feeding studies on larval fishes collected in Gerlache Strait during November 1989 by the research on antarctic coastal ecosystem rates (RACER) program (Huntley et al. 1990). During this program, vertically stratified MOCNESS (multiple opening-closing net environmental sensing system) tows were made at stations arranged in a grid pattern across a 4,000-square-kilometer (km²) survey area (see Loeb, *Antarctic Journal*, in this issue). The survey was repeated at approximately 1-week intervals for a period of 1 month. Replicated tows were made at a time-series station (station A) located in the eastern Gerlache Strait during three of the weekly sampling intervals. The feeding studies concentrate on three numerically dominant species in the samples: *Lepidonotothen larseni*, *Trematomus newnesi*, and *T. lepidorhinus* (Loeb 1992; Loeb, *Antarctic Journal*, in this issue). In addition to conventional feeding-habit analysis, which involves recording feeding incidence and prey

identification, number, and volume, our studies include aspects of larval fish nutritional condition and the ecological role of yolk reserves. A new method will be used to evaluate feeding success based on a combined analysis of yolk reserves and larval condition factor as defined by various morphometric indices.

Kellermann (1990) noted long yolk resorption times among antarctic fish larvae relative to the larvae of temperate or boreal fish and hypothesized the importance of yolk reserves to enable the larvae to survive extended periods of poor food availability in the highly variable antarctic environment. Kellermann (1990) also suggested that observed differences in the incidence and size of yolk reserves of *L. larseni* larvae may result from spatial and temporal variations in the planktonic environment and early feeding success. The sampling coverage of the 1989 RACER program permits an examination of variations in the rate of yolk utilization in conjunction with feeding success within Gerlache Strait over a 1-month period.

Preliminary analyses of the yolk reserves were made using image analysis software (Image 1.37; National Institute of Health) applied to larval fish displayed on a Macintosh IIcx computer screen via television microscopy. The initial measurements were taken as area from a lateral view of the yolk reserve. This was done by outlining the yolk, which is easily visible on the screen, and employing an area-estimation function. The results for *L. larseni* and *T. lepidorhinus* are presented in the table. *T. newnesi* is not included here because none of the 41 larvae examined had visible yolk remains. It must be noted that yolk utilization is a dynamic process and that all of the larvae so far examined were obtained at station A near the end of sampling period (19–22 November). The *T. newnesi* in samples collected 3 weeks earlier had obvious, and at times large, yolk reserves.