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Occurrence of Scorpaeniformes Larvae during Spring in a Fjord, Resurrection Bay, Southcentral Alaska

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Resurrection Bay, near Seward, Alaska, is one of many glacially influenced fjords that exist along the northern Gulf of Alaska. No ichthyofaunal surveys have been carried out in the region and as a result the noncommercial fish fauna is poorly described. Collections of ichthyoplankton during a biological study of commercial fishes provided this opportunity to describe for the first time the Scorpaeniformes larvae present during spring, providing some information into the species in this group that inhabit the fjord.

Materials and Methods

Study site.—Three sampling stations R1, R2.5 and R4 were designed in Resurrection Bay (Fig. 1). Resurrection Bay is a fjord estuary of approximately 30 km long, 6 to 8 km wide and oriented in a north-south direction. An inner basin, 290 m deep, is separated from the outer reaches of the fjord by a sill at approximately 250 m deep and the outer basin opens directly onto the Gulf of Alaska. Previous information on the physical oceanography of the study area was described in Heggie et al. (1977) and Müter (1992). Generally there is temperature and salinity stratification in the upper water column beginning in April resulting from summer warming, snow melt and freshwater runoff. Much of the melt water comes from glaciers, for this reason that the temperature of upper water column are not more than 10°C during summer. By the end of May there is usually a strong pycnocline in the depths of 20–25 m. Station R1 is usually covered by a layer of silty low salinity surface water originating from glaciers and snow fields, while R2.5 is only occasionally silty. Station R 4 is strongly influenced by the Alaska Coastal current and the surface water is not silty.

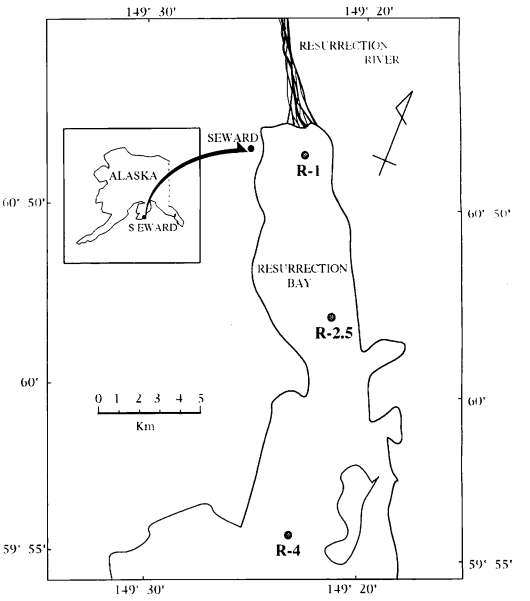

Fig. 1. Map of sampling stations for fish larvae in Resurrection Bay, northern Gulf of Alaska.

Collection of larval fish.—Larval fishes were collected with a 1 m^2 National Institute of Oceanography Tucker trawl towed double obliquely from depth to the surface during April 2 to July 9, 1991. Samples were collected at intervals of about one week, with one sample collected at each of the three stations. The net was equipped with a depth gauge. The depth for the samples was 82±20, 86±13 and 86±10 m ($\bar{x}\pm SD$, $n=14$) at R1, R2.5 and R4, respectively. The mesh size of the net was 505 μm and a flowmeter was placed in the middle of the net opening. The volume filtered was calculated from the flowmeter. The average amount of water filtered during all the tows was 170 m^3 (SD=38; $n=42$). The samples were preserved in 10% formalin, and Scorpaeniformes larvae were sorted from each sample and identified as close to the species level as possible using Matarese et al. (1989). Populations of each taxon were converted to density (number/1000 m^3).

Results and Discussion

A total of 75 Scorpaeniformes larvae were collected from 42 tows. They included 10 cottid, and 1 agonid, anoplomatid and cyclopterid types (Table 1). All but *Anoplopma fimbria* of the 13 species identified are thought to produce adhesive demersal eggs (Breder and Rosen, 1966). Surface flow in the

Table 1. Density of scorpaeniform larval fishes collected weekly from the Ressurection Bay in the spring season

Species	Mean density: No. of larvae/1000 m^3							No. of larvae (No. of yolk-sack larvae)
	April	May	June & early in July	R1	R2.5	R4	Mean	
Whole	1.21	12.13	18.08	9.31	12.38	9.56	10.50	75 (29)
Cottidae								
Radulinus aspellus	0	4.49	4.42	3.64	3.30	1.74	2.94	21 (3)
Malacocottus sp.	0.40	4.94	2.41	0.81	5.37	1.30	2.52	18 (12)
Artedius harringtoni	0	0	3.62	0.81	0.41	2.61	1.26	9 (4)
A. fenestralis	0.40	0	1.61	1.21	0.83	0	0.70	5 (2)
A. meanyi	0	0	0.40	0.40	0	0	0.14	1 (1)
Clinocottus type A	0	0.45	0.80	0	0.83	0.43	0.42	3 (1)
Clinocottus type B	0	0	1.21	0	1.24	0	0.42	3 (1)
Leptocottus armatus	0	0	0.80	0.81	0	0	0.28	2 (1)
Cottidae type C	0	0.45	0	0	0	0.43	0.14	1 (1)
Cottidae type D	0	0.45	0	0.40	0	0	0.14	1 (0)
Agonidae								
Agonidae sp.	0.40	0.90	1.61	0.81	0.41	1.74	0.98	7 (1)
Anoplomatidae								
Anoplopoma fimbria	0	0.45	0.40	0.40	0	0.43	0.28	2 (0)
Cyclopteridae								
Aptocyclus ventricosus	0	0	0.80	0	0	0.87	0.28	2 (2)

fjord is slow, less than 10 cm/s and at 80 m depth it is less than 2 cm/s (Heggie et al., 1977; Müter, 1992). Some of larvae sampled were in the yolk-sack larval stage. Thus, it is likely that the larvae observed resulted from local spawning. They included *Artedius* and *Clinocottus* which are known to be intertidal and subtidal spawners (Yoshiyama et al., 1992). Both fishes must have located suitable spawning sites even in the brackish waters of the fjord because their larvae appeared late in the sampling when glacial melt was occurring.

The number of individuals ranged from 1 to 21 depending on the species (Table 1). The most abundant types were *Radulinus aspellus* and *Malacocottus* sp. In terms of density the number of Scorpaeniformes larvae ranged from 0.28 to 8.96/1000 m^3. These larvae were several times less abundant during April than during later samples. This suggests that they hatch after the spring copepod bloom has started (Smith et al., 1991).

Compared to the density of other fish species the Scorpaeniformes larvae are not very abundant in the fjord. *Theragra chalcoglamma* larvae are often found at 0.3–12/m^3 (Müter, 1992) and *Clupea harengus* occur at 0.1–0.2/m^3 (Smith et al., 1991) while Scorpaeniformes larvae never exceeded 0.01 /m^3. This survey suggests that Scorpaeniformes larvae play a minor role as planktonic consumers during the spring in this glacially influenced fjord. However, in Auke Bay southeastern Alaska and near Kodiak Island out in the northern Gulf of Alaska where there is no glacial influence cottid fishes are common in the ichthyoplankton (Haldorson et al., 1993; Kendall and Ferraro, 1988). The dearth of Scorpaeniformes larvae suggests that the glacially influenced fjords provide few suitable habitat for this group.

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Literature Cited

Breder, C. M. and D. E. Rosen. 1966. Modes of reproduction in fishes. The American Museum of Natural History, New York. 941 pp.

Haldorson, L., M. Pritchett, D. Sterritt and J. Watts. 1993.

Abundance patterns of marine fish larvae during spring in a southeastern Alaskan bay. Fish. Bull. U.S., 91: 36–44.

Heggie, D. T., D. W. Boissen and D. C. Burrell. 1977. Hydrography, nutrient chemistry and primary productivity of Resurrection Bay, Alaska 1972–1975. Alaska Sea Grant Report 77–9. University of Alaska, Fairbanks. 111 pp.

Kendall, Jr, A. W. and P. Ferraro. 1988. Ichtyoplankton of the gulf of Alaska near Kodiak Island, March to June 1985. NWAFC processed report 88-03. 88 pp.

Matarese, A. C., A. W. Kendall, Jr., D. M. Blood and B. M. Vinter. 1989. Laboratory guide to early life history stages of northeast Pacific fishes. U.S. Dep. Comm., NOAA Tech. Rep. NMFS 80, 652 pp.

Müter, F. J. 1992. Distribution, abundance, and growth of larval walleye pollock (*Theragra chalcogramma*) in a glaciated fjord. M. Sc. thesis, University of Alaska, Fairbanks. 91 pp.

Smith, R., A. J. Paul and J. M. Paul. 1991. Timing and abundance of herring and other fish larvae in an Alaskan glaciated fjord. Pages 25–35 *in* Proceedings of the International Herring Symposium. Alaska Sea Grant Report 91-01. Anchorage.

Yoshiyama, R. M., K. B. Gaylord, M. T. Philippart, T. R. Moore, J. R. Jordan, C. C. Coon, L. L. Schalk, C. J. Valpey and I. Tosques. 1992. Homing behavior and site fidelity in intertidal sculpins (Pisces: Cottidae). J. Exp. Mar. Biol. Ecol., 160: 115–130.

南中央アラスカの氷河フィヨルド地帯，リザレクション湾の春季におけるカサゴ目仔稚魚の出現

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アラスカ湾北部，氷河フィヨルド地帯，リザレクション湾において，春季のカサゴ目仔稚魚の出現状況を調査した．標本採集はNIOTトロールを用い，湾内3地点において1991年4月2日から7月9日まで，ほぼ毎週行なった．42回の曳網でカジカ科10，トクビレ科1，クサウオ科1，およびギンダラ，合計13タイプ75個体のカサゴ目仔稚魚が採集された．これらのうち，ギンダラを除く12種は，沈性粘着卵を産むこと，および湾内の流速などから判断して，湾内で繁殖しているものと考えられた．調査期間中の各タイプの平均分布密度 0.28–8.96/1000 m^3 は，同様の方法で同時期に採集されるスケトウダラおよびニシンの数値と比べて極端に低く，カサゴ目仔稚魚は本調査海域における春季のプランクトン消費者としての役割は小さいとみなされた．しかし，氷河の影響がないアラスカ湾南東部のオーク湾およびアラスカ湾西部のコディアック島周辺では，カサゴ目魚類，特にカジカ科魚類は主要な出現仔稚魚となっており，これらのことから，低温，低塩分濃度，大量にシルトを含んでいることなどで特徴づけられる氷河フィヨルド地帯は，北太平洋東岸に生息するカサゴ目魚類にとって，好適な棲み場ではないことが示唆された．

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