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New Discriminative Characters between Juveniles of Two Osmerid Fishes, *Spirinchus lanceolatus* and *Osmerus eperlanus mordax*

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Abstract

The juveniles of two osmerid fishes, *Spirinchus lanceolatus* and *Osmerus eperlanus mordax* obtained together from Hokkaido are indistinguishable from each other by morphological characters, which are used for the discrimination of the adult fish at present. Some characters such as the number of the abdominal vertebrae, the pigmentation on the tongue, and general shapes of the snout and tongue were found to be very useful for the discrimination of the juveniles of these two species.

Introduction

Two osmerid fishes, *S. lanceolatus* and *O. e. mordax*, usually living near the sea shore, are anadromous only in the spawning season, i.e., in winter (November and December) for the former¹⁾²⁾ and in spring (May) for the latter.³⁾ The juvenile fishes of *S. lanceolatus* and *O. e. mordax* are found together in the coastal waters of Hokkaido during summer and autumn. Since they look exactly alike, it is difficult to make a distinction between the juveniles of the two species. In adulthood, the two species are clearly classified by such morphological characters as skull, teeth, anal fin and so on.⁴⁾⁵⁾⁶⁾ But these characters can't enough be applied to the juveniles, since they are not well developed at that early stage. Therefore, the author studied in order to find new discriminative characters between these two osmerid fishes, which can be applied throughout all growth stages.

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Material and Methods

The adult and juvenile specimens used for this study were collected from the coastal region of Kushiro, Hokkaido (Table 1). Their vertebral counts were examined by radiography. The caudal vertebrae were counted from the vertebra

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Table 1. Sampling data of adults and juveniles in two osmerid fishes obtained from Hokkaido.

Species	Locality	Date	Number of specimen	Stage
<i>Spirinchus lanceolatus</i>	Coast of Akan River	Nov. 7, 1970	56	Adult
	Coast of Shinfuji	Oct. 11, 1971	14	Adult
	Coast of Otanoshike	Oct. 15, 1971	58	Adult
	Coast of Kushiro	Oct. 22, 1973	12	Juvenile
<i>Osmerus eperlanus mordax</i>	Coast of Shinfuji	Oct. 8, 1971	44	Adult
	Coast of Otanoshike	Oct. 14, 1971	48	Adult
	Coast of Otanoshike	Oct. 15, 1971	17	Adult
	Coast of Kushiro	Apr. 25, 1972	16	Adult
	Coast of Kushiro	Oct. 22, 1973	10	Juvenile

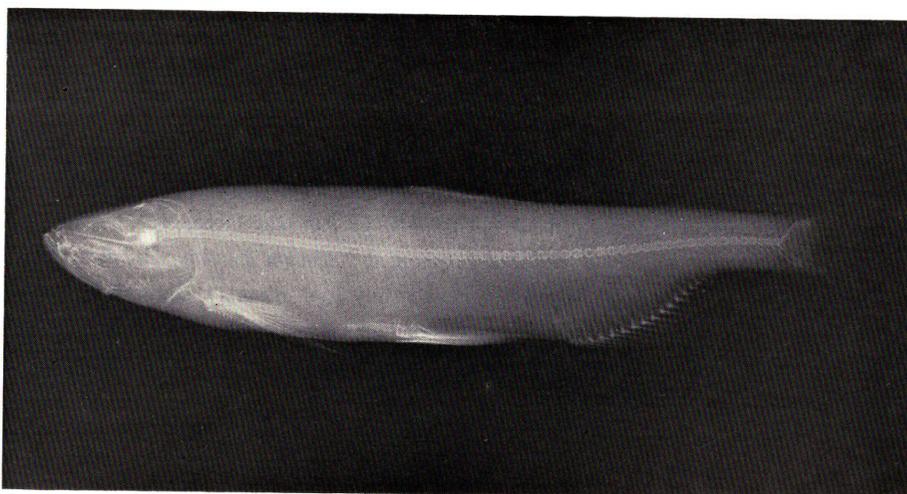


Fig. 1. Radiograph showing distinction between abdominal and caudal vertebrae in *Spirinchus lanceolatus*.

with a long and clear fused haemal spine to the urostyle (Fig. 1)

Results

1. The number of vertebrae and their regression equations in adults

S. lanceolatus has a range of 60–65 vertebrae in total, out of which 24–28 are caudal. The abdominal vertebrae are 32–38, and more than 90% of the specimens have 35–37 vertebrae with a mode of 36. Whereas *O. e. mordax* has a range of 64–68 vertebrae in total, out of which 21–25 are caudal. The abdominal vertebrae are 42–45, and about 90% of the specimens have 42–43 vertebrae with a mode of 43 (Table 2).

The numbers of total-abdominal and total-caudal vertebrae relationships are

expressed in the following linear equations, $T = -4.71 + 0.65a$ (total-abdominal vertebrae) and $T = 4.71 + 0.35c$ (total-caudal vertebrae) in *S. lanceolatus*, and $T = 13.65 + 0.45a$ (total-abdominal vertebrae) and $T = -13.65 + 0.55c$ (total-caudal vertebrae) in *O. e. mordax*, where T is the total number of vertebrae, a is the number of abdominal vertebrae and c is the number of caudal vertebrae (Fig. 2).

When the slopes of the two equations in a F-test are compared to each other, there is a significant difference at the 1% level in the former species, whereas there is no significant difference at the 1% level in the latter species.

Table 2. Range and mode of number of total, abdominal and caudal vertebrae of adults and juveniles in two species of osmerid fishes.

Species	Total number of vertebrae		Number of abdominal v.		Number of caudal v.		Number of specimen	Stage
	Range	Mode	Range	Mode	Range	Mode		
<i>Spirinchus lanceolatus</i>	60-65	63	32-38	36	24-28	26	128	Adult
	61-64	63	34-37	36, 37	26-28	27	12	Juvenile
<i>Osmerus eperlanus mordax</i>	64-68	66	42-45	43	21-25	23	125	Adult
	65-67	66	43-44	43	21-23	23	10	Juvenile

2. The number of vertebrae and other characters in juveniles

Based on the ranges of total counts, caudal and abdominal vertebrae, they are divided into two groups; one group has a total of 61-64 vertebrae, of which 26-28 are caudal and 34-37 are abdominal, and the other group has 65-67, 21-23 and 43-44 respectively. Moreover, in the former, the tongue is stained with many blackish pigments, and the tongue and snout are blunt. Whereas in the latter, it completely lacks pigments, and the tongue and snout are rather slender (Fig. 3). The juveniles are identified as *S. lanceolatus* in the former group and as *O. e. mordax* in the latter group on the basis of the number of vertebrae, especially the number of abdominal vertebrae.

Discussion

Three species of osmerid juveniles, i.e., *Hypomesus japonicus*, *S. lanceolatus* and *O. e. mordax* were sampled from the Pacific coastal waters east of Hokkaido in summer and autumn. The first species was easily discriminated from the latter two by many morphological characters. But it was difficult to define clearly the differences between the juveniles of *S. lanceolatus* and *O. e. mordax*. In adulthood, *O. e. mordax* is easily distinguishable from *S. lanceolatus* in having two large canine-like teeth, short anal fin rays, and some osteological characters.⁴⁾⁵⁾⁶⁾ However, these characters can't be applied well to juvenile fishes, because the characters are

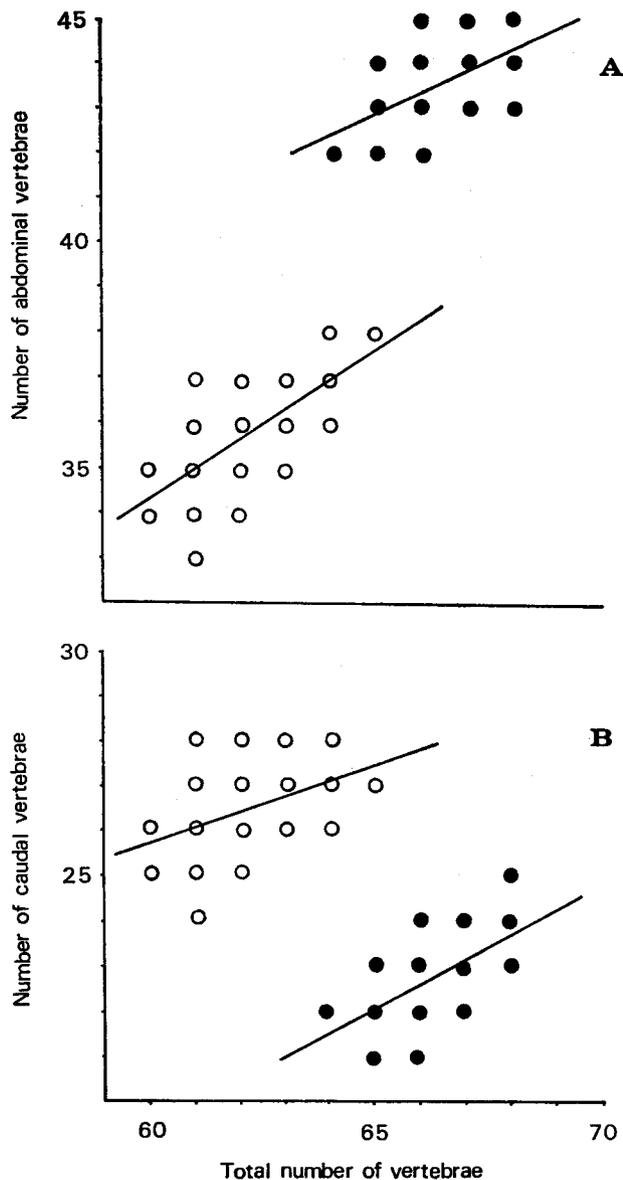


Fig. 2. Relationships and their regression equations between total and abdominal (A), and between total and caudal number of vertebrae (B) in adults of *Spirinchus lanceolatus* and *Osmerus eperlanus mordax*.
 ○— *S. lanceolatus* ●— *O. e. mordax*

not well developed in the juveniles yet.

Concerning the present results, the numbers of total and caudal vertebrae have ranges of 60–65 and 24–28 in *S. lanceolatus*, and of 64–68 and 21–25 in *O. e.*

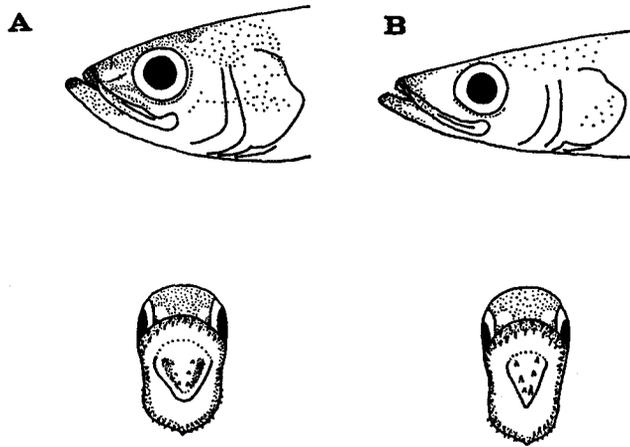


Fig. 3. Lateral views of head (upper) and the pigmentation on the tongue (lower) of the juveniles of two osmerid fishes. Scale 0.5 mm.

A: *Spirinchus lanceolatus*, 71.5 mm in standard length.

B: *Osmerus eperlanus mordax*, 62.3 mm in standard length.

mordax, and slightly overlap each other. However, the numbers of abdominal vertebrae are 32–38 in *S. lanceolatus* as against 42–45 in *O. e. mordax*. The count shows clear differences between the two species. Since it is said that the number of vertebrae is determined at an early period of the development of the fishes,⁷⁾⁸⁾ this character is most useful for the classification of these fishes throughout all growth stages.

In general, the caudal vertebrae are more affected than the abdominal vertebrae by environmental conditions. However, when the slopes of regression equations of the total-abdominal and total-caudal vertebral numbers of the two osmerid fishes are compared, it seems to be considered that the total number of vertebrae is more affected by the abdominal vertebrae than by the caudal vertebrae in *S. lanceolatus*, while the total number is affected equally by abdominal and caudal vertebrae in *O. e. mordax*.

On the observation of the juveniles, the pigmentation on the tongue and general shapes of the snout and tongue are found useful to classify the juvenile fishes of these two species.

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