Japanese Journal of Ichthyology
Vol. 33, No. 4 1987

魚類学雑誌
33巻4号 1987年

Variations in Meristic Characters of *Nematalosa nasus* from Iraqi and Kuwaiti Waters

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(Received March 15, 1986)

A clupeoid fish *Nematalosa nasus* (Bloch), inhabiting the Gulf of Aden, Arabian Sea, Hongkong (Whitehead, 1972) is considered an important commercial fish in these regions. This species enters the Shatt al-Arab River in spring and sometimes reaches further north to the Hor al-Hammar marsh (Whitehead, 1965). The species is found year round in Khor al-Zubair, the north west extension of the Arabian Gulf.

N. nasus is caught in the Shatt al-Arab and Khor area and is estimated to contribute 50% of the combined annual clupeoid production.

Variations in meristic characters have been used as a basic tool in separating populations of different fish species (Seymour, 1959; Anthony, 1968). Meristic differences between populations of fishes may be influenced by genetic or environmental factors, or both (Bailey and Gosline, 1955). Different workers attributed the difference in meristic characters to environmental factors such as light, temperature and disolved oxygen during the period from fertilization to hatching (Tåning, 1952; Wallace, 1973; Kwain, 1975).

This study was undertaken to determine whether one or more populations of *N. nasus* occur in Iraqi and Kuwaiti waters by analyzing variations in meristic characters.

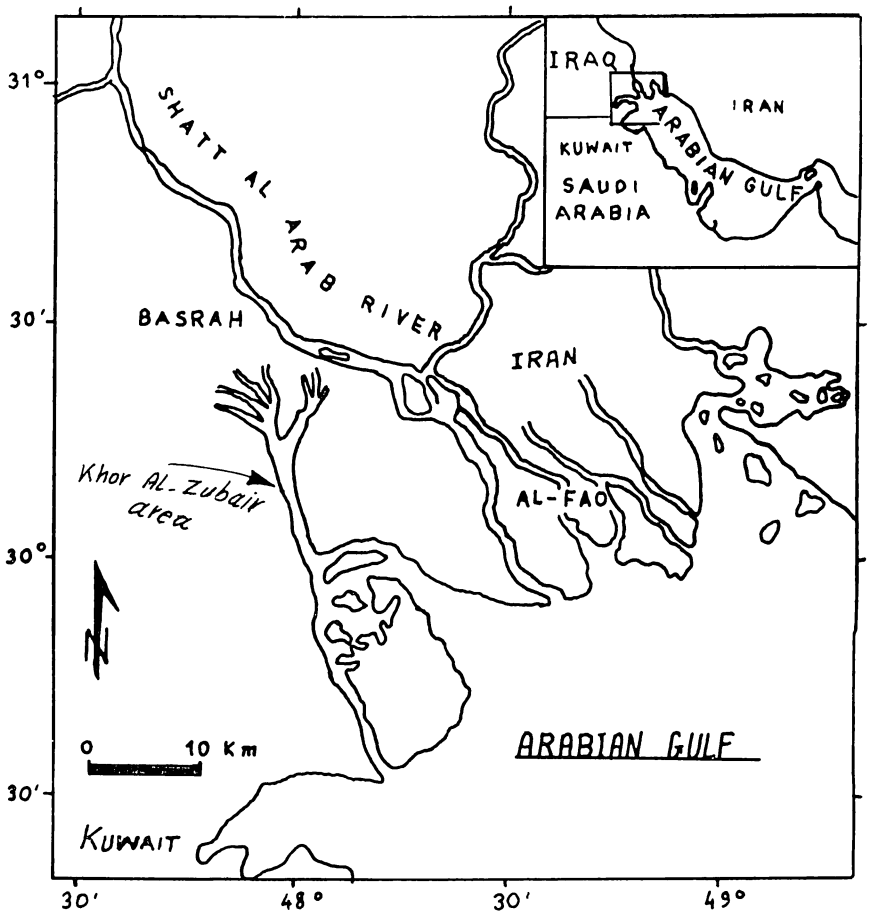

Fig. 1. Map showing the study area.

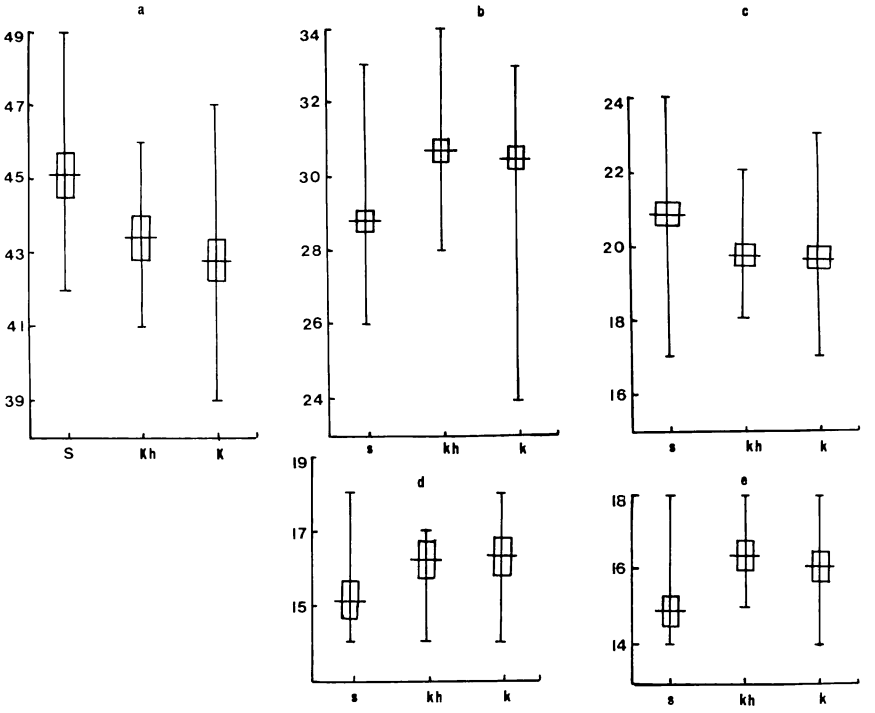

Fig. 2. Variation in: (a) number of anal fin rays; (b) number of pectoral fin rays; (c) number of vertebrae; (d) number of abdominal scutes and (e) number of dorsal fin rays of *Nematalosa nasus* from Shatt al-Arab (S), Khor al-Zubair (Kh) and Kuwaiti waters (K). For graphical display of the results obtained by this method, the ranges of the meristic characters are shown by vertical lines, the mean by small horizontal lines, which LSD represented by an open bar on each side of the mean.

Material and methods

Adult specimens of *N. nasus* collected by beach seines from the Shatt al-Arab River, Khor al-Zubair and Kuwaiti water were studied (Fig. 1).

Meristic characters examined included number of vertebrae, abdominal scutes, and pectoral, dorsal and anal fin rays. Vertebral counts were made from specimens prepared by boilling the whole fish prior to counting. Vertebral number included the total segments between, but not including, the basioccipital and hypural. Counts of abdominal scutes and fin rays were done under a dissecting microscope. Ray counts included all rays. In some cases fin rays were stained with alizarine red and comparisons made of counts before and after staining.

All five variables were compared using least significant difference (LSD) test (Snedecor and Cochran, 1967). The meristic variables were then subjected to cluster analysis (WPGM) using

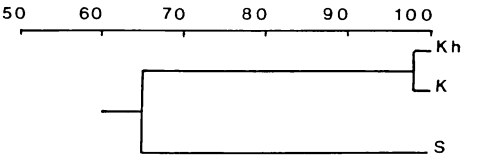

Fig. 3. Dendrogram of the relations among three populations of *Nematalosa nasus* from Shatt al-Arab, Khor al-Zubair and Kuwaiti waters based on the WPGM clustering procedure of correlation coefficient (S=Shatt al-Arab, Kh=Khor al-Zubair, K=Kuwaiti waters).

average of distance coefficients (Blackith and Reyment, 1971).

Results

Distribution of the five meristic characters studied are shown in Fig. 2. Dorsal and pectoral fin rays proved to be the least variable of the five meristic characters examined.

Comparison of the means showed highly signifi-

cant heterogeneity of the populations from different localities, indicating that more than two populations were represented in the samples (Fig. 2). Two main groups were distinguished from the cluster analysis (Fig. 3). One group was comprised by two populations from Khor al-Zubair sample and Kuwait, while the other group was represented by the Shatt al-Arab River sample.

Discussion

In several clupeoid species, there appear to be an inverse relationship between the average number of meristic characters and water temperature (Rounsefel and Dahlgress, 1923). In this study, it is possible that the observed differences in meristic counts of *N. nasus* may have also been induced by water temperature during the time of spawning and early larval development. The annual average water temperature in the Shatt al-Arab River ranges between 9.1°C in winter and 27°C in summer, while in Kuwaiti waters and Khor al-Zubair, it ranges from 14.4 to 30.0°C and from 11.6 to 23.3°C, respectively. The water temperature in Shatt al-Arab appeared to be lower than in the other two localities. The reverse relationship between the average number of meristic characters and water temperature was not applicable to all characters studied, and was found true only for the number of vertebrae and anal fin rays. The Shatt al-Arab population of *N. nasus* showed a mean of 45.1 and 20.8 for the number of vertebrae and anal fin rays, respectively. The non applicability of reverse relationship hypothesis in the case of dorsal and pectoral fin rays and abdominal scutes may be due to the difference in the time of development of each character.

It is not clear if the observed differences in meristic characters are due to genetic factors. However, the data showed that the populations of Kuwaiti waters and Khor al-Zubair area are completely independent from that of Shatt al-Arab River.

The differences in the meristic characters studied between the populations may throw light on the problems of races in *N. nasus*. The cluster analysis suggested the presence of different races (Fig. 3).

Acknowledgments

My sincere thanks are due to Dr. P. J. P. Whitehead of British Museum (Nat. Hist.), and to Dr. G. Nelson of the American Museum of Natural History, New York for their invaluable advice and suggestions.

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イラクとクウェート水域に生息する *Nematalosa nasus* の計数形質の変異

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イラクの Shatt al-Arab, Khor al-Zubair およびクウェート沿岸で漁獲されたコノシロ亜科の 1 種 *Nematalosa nasus* の計数形質（脊椎骨数，腹中線稜鱗数，背鰭鰭条数，臀鰭鰭条数，胸鰭鰭条数）を比較し，これらの水域における本種の系群構造について検討した．クラスター分析法による解析の結果，Shatt al-Arab 川に遡上する群は他の 2 水域の群と明瞭な差異が認められ，これらは互いに別系群であると考えられた．