

## Comparative Osteology of the Sciaenid Fishes from Japan and Its Adjacent Waters—III. Premaxillary and Dentary

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**Abstract** The sciaenid fishes collected from the waters around Japan and the China Sea are divided into three groups on the basis of characteristics of the premaxillary: the *Johnius*-form is represented by the fishes of two genera *Johnius* and *Wak*; *Nibea*-form by the genera *Nibea*, *Megalonibea*, *Miichthys*, *Argyrosomus*, and *Atroubucca*; *Pseudosciaena*-form by the genera *Pseudosciaena* and *Collichthys*. These fishes are also grouped into two forms by the features of the dentary: the *Nibea*-form is represented by the genera *Nibea*, *Megalonibea*, *Johnius*, *Wak*, and *Argyrosomus*; *Pseudosciaena*-form by the genera *Pseudosciaena*, *Collichthys*, *Miichthys*, and *Atroubucca*. The grouping of those bones does not conflict fundamentally with those of the sagitta, cranium, and vertebrae.

### Introduction

The jaw bones are considered to be an important character to separate the group of allied species in teleostean fishes, although they are remarkably variable in shape correlated to the feeding behavior.

Chu et al. (1963), who have extensively studied the classification of the sciaenid fishes of China, described the arrangement of mental pores on the outer margin of the lower jaw, classifying the sciaenid fishes examined by them into four forms based on the character. Kim and Kim (1965) described and figured the characteristics of jaws, when they exactly compared many osteological characters for seven species of the sciaenid fishes from Korea.

In this paper, the author described the differences both of the premaxillary and dentary found in 16 species of Japanese sciaenid fishes represented by 9 genera, and discussed the phylogenetic significance in relation to other important characters such as the sagitta, cranium, vertebrae, and gas-bladder.

### Materials and Method

Materials and method used in this study are quite the same as those used in Taniguchi (1969a).

To show the relationships and tendency of variation found in the premaxillary of 16 species, the dimensions of some parts of the premaxillary were measured (Fig. 1–F): length of the lower margin of the horizontal part of the premaxillary (L), length of the vertical part of the premaxillary along the ascending process (M), and length from the anterior corner of the postmaxillary process to posterior tip of the horizontal part of the premaxillary (N).

### Description and Comparison

**Premaxillary:** The premaxillary of the sciaenid fishes is generally unspecialized in shape like many other perciform fishes. The premaxillary bears a row of conical teeth and a band of villiform teeth on its inner side. The conical teeth of the anterior part are

usually larger than the posterior ones. The premaxillary is L-like in shape in lateral view. The vertical part of the premaxillary (premaxillary pedicel) is diverged terminally into two parts; the anterior slender bar (ascending process) and the posterior flattish plate (articular process). A process situated at the upper margin of the horizontal bar of the premaxillary is postmaxillary process.

By the features of both ascending and postmaxillary processes, 16 species are divided into three forms, namely *Johnius*-, *Nibea*-, and *Pseudosciaena*-form respectively. These three forms are shown in Fig. 1.

(1) *Johnius*-form: This form includes all

members of the genera *Johnius* and *Wak*; the ratio  $M/L$  is in a range between 0.60 and 0.68. The postmaxillary process is moderate in horizontal length and comparatively high; the ratio  $N/L$  between 0.38 and 0.43.

(2) *Nibea*-form: This form includes all members of the genera *Nibea*, *Megalonibea*, *Miichthys*, *Argyrosomus*, and *Atrobucca*. The ascending process is moderate in length in comparison with that of the *Johnius*-form; the ratio  $M/L$  between 0.43 and 0.53. The postmaxillary process well agrees with that of the *Johnius*-form in both length and shape; the ratio  $N/L$  between 0.34 and 0.47.

(3) *Pseudosciaena*-form: This form includes

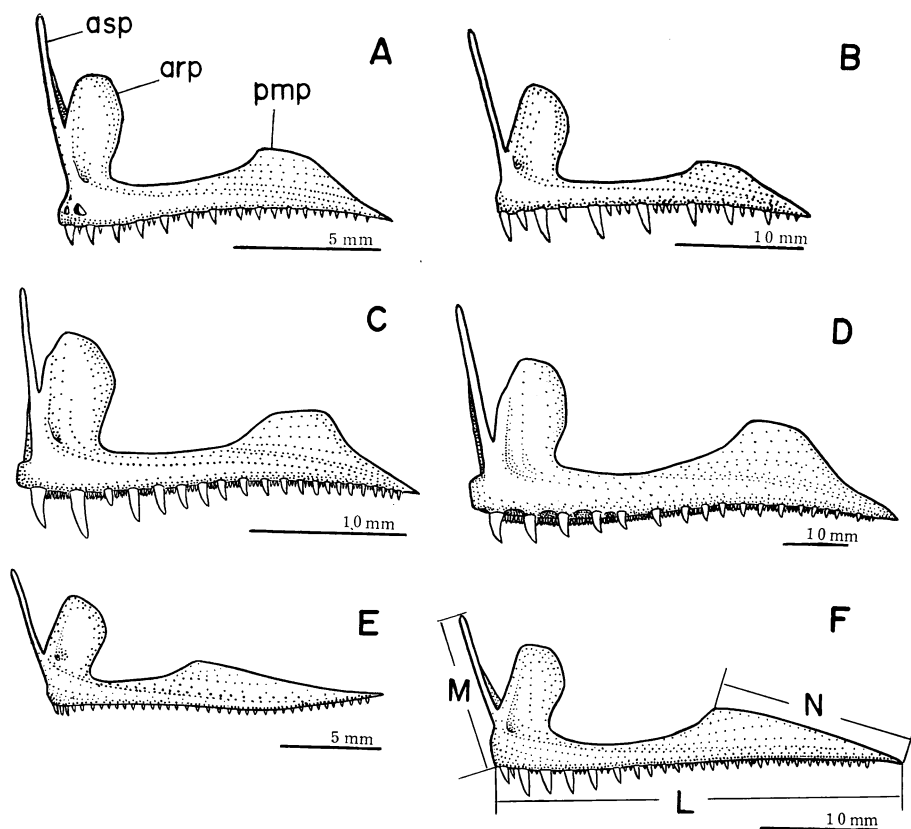


Fig. 1. Lateral view of premaxillary of the sciaenid fishes. A, *Johnius belangerii*; B, *Wak tingi*; C, *Nibea semifasciata*; D, *Megalonibea fusca*; E, *Pseudosciaena polyactis*; F, *Collichthys niveatus*. asp, ascending process; arp, articular process; pmp, postmaxillary process. L, length of the lower margin of the horizontal part of the premaxillary; M, length of the vertical part of the premaxillary along the ascending process; N, length from the anterior corner of the postmaxillary process to posterior tip of the horizontal part of the premaxillary.

Table 1. Ratios M/L and N/L calculated on the premaxillary of 16 species of sciaenid fishes giving the average and in parentheses the range. See Fig. 1 for the parts (L, M and N) measured.

Species	M/L	N/L	No. of specimens
<i>Nibea albiflora</i>	0.46 (0.45-0.48)	0.44 (0.43-0.45)	3
<i>Nibea mitsukurii</i>	0.43 (0.41-0.44)	0.46 (0.43-0.49)	3
<i>Nibea semifasciata</i>	0.51	0.47	1
<i>Nibea diacanthus</i>	0.53 (0.51-0.55)	0.41 (0.39-0.42)	2
<i>Nibea japonica</i>	0.44 (0.43-0.46)	0.34 (0.34)	3
<i>Megalonibea fusca</i>	0.53 (0.51-0.55)	0.40 (0.34-0.44)	3
<i>Miichthys miuy</i>	0.44 (0.42-0.46)	0.35 (0.34-0.36)	4
<i>Johnius belengerii</i>	0.68 (0.62-0.73)	0.43 (0.40-0.46)	4
<i>Wak tingi</i>	0.60 (0.58-0.60)	0.38 (0.35-0.41)	3
<i>Argyrosomus argentatus</i>	0.48 (0.46-0.52)	0.42 (0.40-0.45)	7
<i>Argyrosomus macrocephalus</i>	0.52 (0.48-0.55)	0.44 (0.41-0.49)	3
<i>Atroubucca nibe</i>	0.45 (0.44-0.45)	0.39 (0.38-0.40)	3
<i>Pseudosciaena crocea</i>	0.38 (0.38)	0.49 (0.46-0.52)	3
<i>Pseudosciaena polyactis</i>	0.35 (0.33-0.36)	0.48 (0.46-0.52)	8
<i>Collichthys niveatus</i>	0.42 (0.40-0.45)	0.63 (0.58-0.70)	3
<i>Collichthys lucidus</i>	0.44 (0.40-0.49)	0.58 (0.53-0.61)	2

members of two genera *Pseudosciaena* and *Collichthys*. The ascending process is comparatively short; the ratio M/L between 0.35 and 0.44, the postmaxillary process being remarkably long and low; the ratio N/L between 0.48 and 0.63.

Based on the ratios M/L and N/L (Table 1), each species is marked with a dot in Fig. 2. This figure makes out the relationships and tendency of variations of the premaxillary of 16 species which belong in three forms.

**Dentary:** The dentary bears two rows of conical teeth except for the tip where conical teeth form a patch. Teeth of the outer row are usually larger than those of the inner anteriorly, but shorter posteriorly. The ven-

tral surface of the dentary is deeply gouged through its entire length in connection with the development of the cephalic sensory canal. On this gouged part of the dentary, the mandibular canal runs. The groove is covered anteriorly with osseous roof, where three orifices open outwards. The number of the mental pores opening on the skin of the chin does not always conform with that of the orifices of the dentary. Of these orifices, the foremost one is the smallest and round in shape, but the hindermost is the largest and elliptical in shape, and the second is intermediate in size. The foremost orifice is located on front edge of the dentary (Fig. 3-C, D) in some species, but located on the

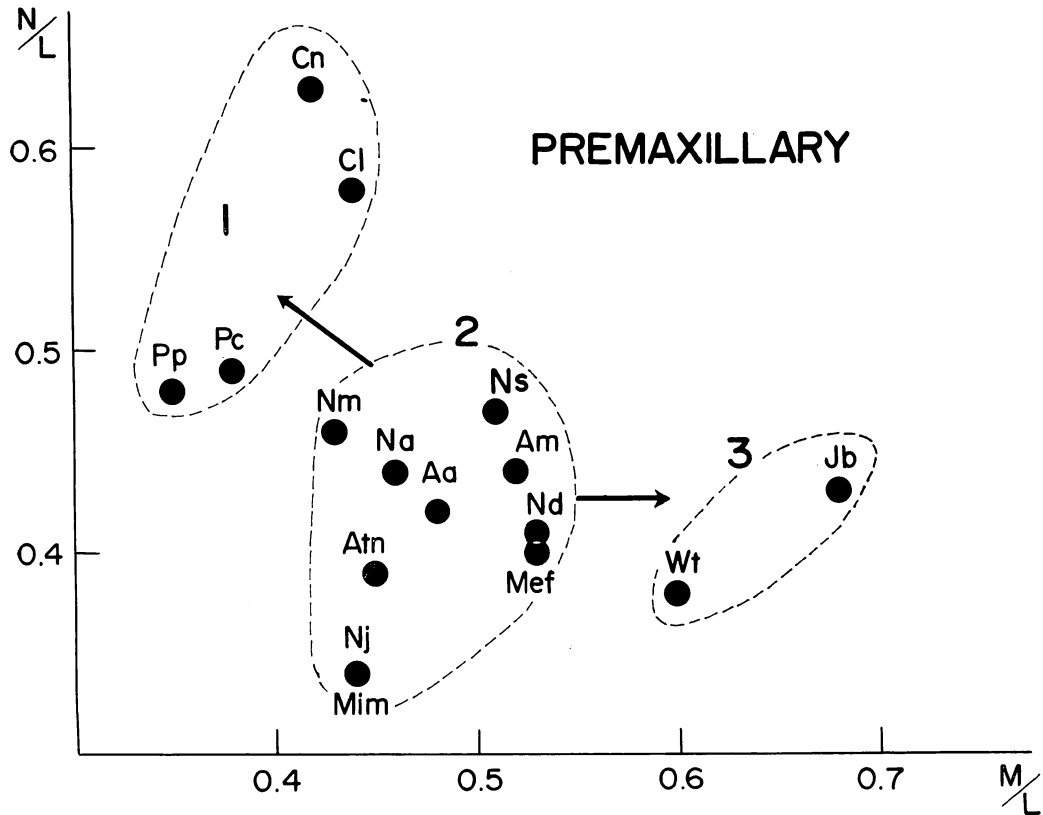


Fig. 2. Allocation of the sciaenid fishes based on the ratios of three parts (see Fig. 1) of the premaxillary. Arrows show speculated direction of specialization. 1, *Pseudosciaena*-form; 2, *Nibea*-form; 3, *Johnius*-form. Cn, *Collichthys niveatus*; Cl, *C. lucidus*; Pc, *Pseudosciaena crocea*; Pp, *P. polyactis*; Aa, *Argyrosomus argentatus*; Am, *A. macrocephalus*; Atn, *Atrobuca nibe*; Na, *Nibea albiflora*; Nm, *N. mitsukurii*; Ns, *N. semifasciata*; Nd, *N. diacanthus*; Nj, *N. japonica*; Mef, *Megalonibea fusca*; Mim, *Miichthys miuy*; Jb, *Johnius belengerii*; Wt, *Wak tingi*.

anteroventral part of the osseous roof (Fig. 3-A, B) in other species. The former type is named the *Pseudosciaena*-form and the latter the *Nibea*-form. The *Nibea*-form comprises the fishes of the genera *Nibea*, *Megalonibea*, *Johnius*, *Wak*, and *Argyrosomus*. The *Pseudosciaena*-form includes the fishes of the genera *Miichthys*, *Atrobuca*, *Pseudosciaena*, and *Collichthys*. *Argyrosomus argentatus* is different from other members of the *Nibea*-form in having the foremost orifice opened at the tip of the anteroventral part of the dentary. Though *Wak tingi* has a small orifice opening at the front edge of the dentary, this species apparently belongs to the *Nibea*-form by having three orifices on its antero-

ventral part.

### Discussion

Kim and Kim (1965) classified the premaxillaries into three forms by the angle formed by the ascending process and the horizontal bar. This angle is obtuse in the genera *Pseudosciaena* and *Collichthys*, rectangular in the genera *Nibea* and *Miichthys*, and intermediate in the genus *Argyrosomus*. The author observed the premaxillaries of more numerous species than those observed by them and consequently classified these bones into three forms based on the aforementioned characters. As the angle shows continuous variation, he cannot distinguish the pre-

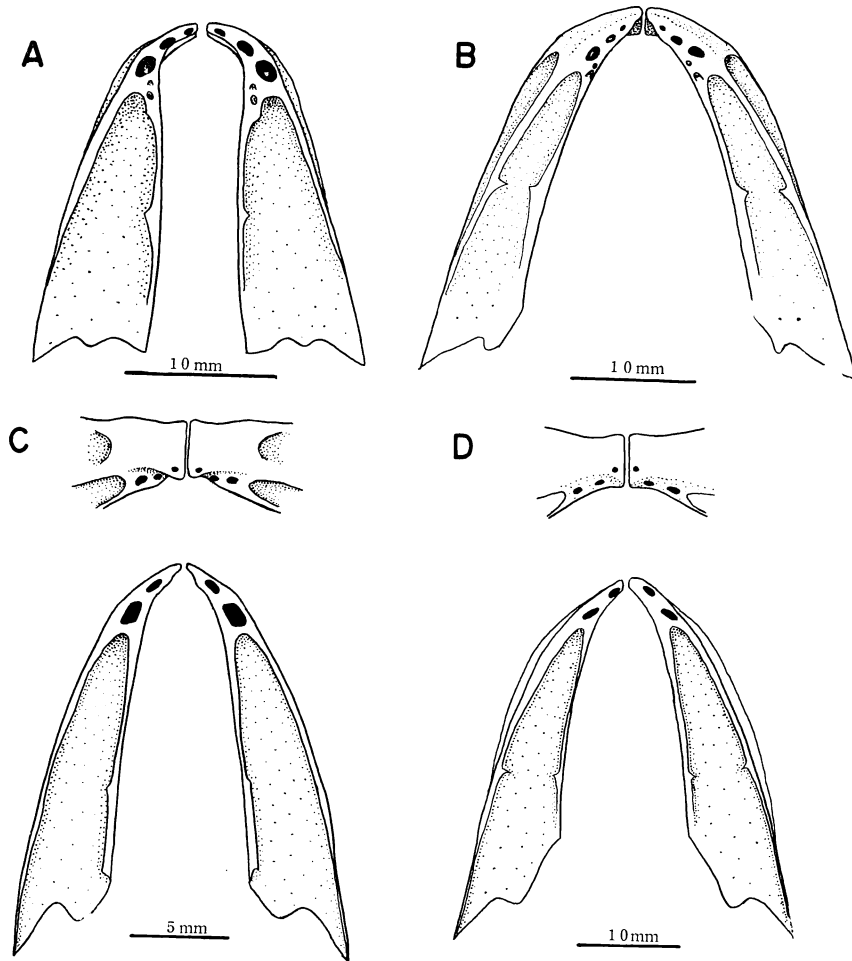


Fig. 3. Ventral and anterior views of the dentary of the sciaenid fishes. A, *Johnius belengerii*; B, *Nibea albiflora*; C, *Atroubucca nibe*; D, *Pseudosciaena crocea*.

maxillary of the *Argyrosomus* from that of the *Nibea*. Of these three forms on the premaxillary, the *Nibea*-form is thought to be the most unspecialized because the premaxillary of this form is quite within the bounds of possibility to differentiate into remaining two forms and the premaxillary of many perciform species accords with this form. The premaxillary of the *Johnius*-form and *Pseudosciaena*-form are regarded to be derivatives from the *Nibea*-form.

Kim and Kim (1965) described that two orifices open on the anteroventral part of the dentary in the genus *Pseudosciaena*, an orifice

in the genera *Argyrosomus*, *Nibea*, and *Miichthys*, and nothing in the genus *Collichthys*. But the author could observed three orifices fundamentally and classified the dentary into two groups based on the arrangement of them.

Except *Atroubucca nibe* and *Miichthys miuy* belonging to the *Pseudosciaena*-form on the dentary, the fishes of the *Nibea*- and *Johnius*-form on the premaxillary fit into the *Nibea*-form on the dentary. The fishes of the *Pseudosciaena*-form on the premaxillary fit into the *Pseudosciaena*-form on the dentary.

The grouping based on the premaxillary

does not conflict fundamentally with those on the sagitta, neurocranium, and vertebrae (Chu et al., 1963, Taniguchi, 1969a, b). The grouping based on the dentary does not accord partially with those of sagitta, neurocranium, and vertebrae, e.g. *Mi. miuy* and *At. nibe* belonging to the *Pseudosciaena*-form in the dentary, referable to the *Nibe*-form in the case of the other characters. These two species also are provided with the gas-bladder comparatively resembling to that of the genus *Pseudosciaena*. Judging from the fact that these two species possess the unspecialized characters in other osteological features, this discordance occurs by the convergence in the arrangement of the orifices with relation to the similar feeding behavior.

Tominaga (1968) described that the Pempheridae resemble to the Sciaenidae in having a well-developed sagitta, modified haemaphysae of the several abdominal vertebrae and the same basic number of the vertebrae (25). The premaxillary of the Pempheridae is similar to those of the *Pseudosciaena*-form.

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#### 日本およびその近海産ニベ科魚類の骨格の比較研究

#### III. 前上顎骨および歯骨 谷口 順彦

ニベ科魚類 16 種の顎骨を比較観察した結果、前上顎骨および歯骨に著しい変異が見られたので、それらの形態の特徴を記述し、その分化の状態および他の形質との関連を考察した。前上顎骨は前部の上向突起と後部の山形の突起(後上顎骨突起)に注目すれば 3 類型(ニベ型、コニベ型、キングチ型)に分類される。コニベ型の上向突起は他の型に比して著しく長く、キングチ型の後上顎骨突起は低くて前方へ長く延長している。ニベ型の両形質はいずれもコニベ型およびキングチ型に比して短い。歯骨前面から前部下面にかけて 3 対の小孔がどの種の場合にも認められた。この小孔の配列に 2 類型が認められた(ニベ型、キングチ型)。キングチ型の場合、最前部 1 対の小孔は歯骨前面に位置しているが、ニベ型の場合では 3 対とも歯骨前部下面に位置している。前上顎骨におけるコニベ型およびニベ型のうちホンニベとクログチを除いた種はニベ型の歯骨を具えている。ホンニベ、クログチおよびキングチ型の前上顎骨を有する種はキングチ型の歯骨を具えている。

前上顎骨の 3 類型の種組成は耳石、頭蓋骨および脊椎骨の各類型の種組成に基本的にはよく類似していることが判明した。ホンニベおよびクログチがキングチ型の歯骨を具えていることは他の形質による分類傾向と異なる。

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