

Chromosomes of Three Species of Cottid Fishes from Japan

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WATANABE (1960) reported 36 genera and 74 species of the family Cottidae from Japan. As regards their chromosomes, karyotypes of six species of freshwater cottids have been reported (ABE, 1972, 1976), but those of marine cottids from Japan have not been studied.

Recently, chromosomes of two genera and three species of marine cottids, i.e., *Ocynectes maschalis*, *Pseudoblennius cottoides* and *P. marmoratus*, were observed. Their karyotypes will be reported in the following lines.

Method of chromosome preparation is the same as that of ARAI (1973). Classification of chromosomes is adopted from LEVAN *et al.* (1964). Metacentrics and submetacentrics are described as two-arm chromosomes, and subtelocentrics and acrocentrics as one-arm chromosomes. The definition of new arm number (NAN) is referred to ARAI and NAGAIWA (1976).

All the specimens used for the experiments are deposited in the fish collection of the Department of Zoology, National Science Museum, Tokyo.

Ocynectes maschalis JORDAN et STARKS "Idaten-kajika"

(Figs. 1 A, C)

A male (No. E·61·3) and a female (No. E·61·2), 55.9 and 53.6 mm in total length, were collected at Shiba-zaki, Hayama, Miura Peninsula, Kanagawa Prefecture (Table 1).

As shown in Table 2, the diploid chromosome number of this species is 46 in both the male and the female. The karyotype comprises 2 pairs of metacentric, 3 pairs of submetacentric, and 18 pairs of subtelocentric-acrocentric chromosomes. The arm number is 56. There were found no differences between male and female karyotypes.

Table 1. Characters of material fishes.

| Species | Sex | No. of fish | S. L. (mm) | D. | A. | P. | V. | VN |
|----------------------------------|-----|-------------|------------|----------------|-------|----|------|-------------|
| <i>Ocynectes maschalis</i> | ♂ | 1 | 46.5 | IX, 14 | 11 | 14 | I, 2 | 11+22 |
| | ♀ | 1 | 45.5 | IX, 13 | 10 | 14 | I, 2 | 11+23 |
| <i>Pseudoblennius cottooides</i> | ♀ | 1 | 78.7 | X, 19 | 18 | 16 | I, 2 | 13+24 |
| <i>P. marmoratus</i> | ♂ | 3 | 69.6-105.4 | IX, 20 | 16-17 | 13 | I, 2 | 13+24-25 |
| | ♀ | 3 | 71.7-110.1 | VIII-IX, 19-20 | 16-18 | 13 | I, 2 | 12-13+24-25 |

Table 2. Frequency distributions of diploid chromosome counts in material fishes.

| Species | 2n | | | | | | | Total |
|----------------------------------|----|----|----|----|----|----|----|-------|
| | 42 | 43 | 44 | 45 | 46 | 47 | 48 | |
| <i>Ocynectes maschalis</i> | | | 1 | 2 | 14 | 3 | 1 | 21 |
| <i>Pseudoblennius cottooides</i> | 2 | 1 | 2 | 3 | 13 | 2 | 1 | 24 |
| <i>P. marmoratus</i> | 1 | 2 | 5 | 3 | 10 | 2 | 1 | 24 |

***Pseudoblennius cottooides* (RICHARDSON) "Asahi-anahaze"**

(Figs. 1 B, D)

A female specimen (No. E·20·6), 94.2 mm in total length, was collected at Kariyaga-saki, Miura Peninsula (Table 1).

The diploid chromosome number is 46 (Table 2). The karyotype comprises 2 pairs of metacentric, 4 pairs of submetacentric, and 17 pairs of subtelocentric-acrocentric chromosomes. The arm number is 58. The diploid chromosome number of this species agrees with that of *Ocynectes maschalis*.

***Pseudoblennius marmoratus* (DÖDERLEIN) "Aya-anahaze"**

(Fig. 2)

Two males (Nos. E·81·32 and E·81·33), 89.7 and 85.8 mm in total length, and two females (Nos. E·54·3 and E·81·34), 96.0 and 86.1 mm in total length, were caught at Amatsu-kominato, Awa, Chiba Prefecture. A male (No. E·31·2), 127.5 mm in total length, and a female (No. E·31·1), 129.0 mm in total length, were collected at Ara-saki, Miura Peninsula. Characters of material fishes are shown in Table 1.

As shown in Table 2, the diploid chromosome number is 46 in both males and females. Three types of karyotypes were observed (Table 3). Type A comprises 4 metacentric, 8 submetacentric, and 34 subtelocentric-acrocentric chromosomes. This type of karyotype is similar to that of *Pseudoblennius cottooides*. Type B comprises 4 metacentric, 7 submetacentric, and 35 subtelocentric-acrocentric chromosomes. Type C comprises 4 metacentric, 6 submetacentric, and 36 subtelocentric-acrocentric chromosomes. Arm number of this species is 58 in Type A, 57 in Type B, and 56

in Type C. Variation of karyotypes within a species was reported in the freshwater cottid, *Cottus nozawae* (ABE, 1972).

Table 3. Three types of karyotypes in *Pseudoblennius*.

| Species | Type A (NF=58) | Type B (NF=57) | Type C (NF=56) |
|---------------------------------|-------------------|-------------------|-------------------|
| <i>Pseudoblennius cottoides</i> | female | ? | ? |
| <i>P. marmoratus</i> | female | male & female | male |

Table 4. Chromosomes of the order Scorpaeniformes.

| Species | 2n | Two arm | One arm | NF | NAN | Literature |
|------------------------------------|-----|---------|---------|-------|----------|---------------------------------|
| Scorpaenidae | | | | | | |
| Sebastinae | | | | | | |
| <i>Sebastes hubbsi</i> | 46 | 4 | 42 | 50 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| <i>S. inermis</i> | 48 | 2 | 46 | 50 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| <i>S. longispinis</i> | 48 | 2 | 46 | 50 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| <i>S. schlegeli</i> | 48 | 2 | 46 | 50 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| <i>S. tazanowskii</i> | 48 | 2 | 46 | 50 | 48 | SASAKI & SAKAMOTO, 1977 |
| <i>Sebastes marmoratus</i> | 48 | 2 | 46 | 50 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| Scorpaeninae | | | | | | |
| <i>Scorpaena neglecta neglecta</i> | 48 | 38 | 10 | 86 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| <i>S. porcus</i> | 42 | | | | | CATAUDELLA <i>et al.</i> , 1973 |
| <i>Scorpaenodes littoralis</i> | 36 | 32 | 4 | 68 | | ARAI & KATSUYAMA, 1973 |
| Pteroinae | | | | | | |
| <i>Pterois lunulata</i> | 48 | 30 | 18 | 78 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| Synancejidae | | | | | | |
| <i>Inimicus japonicus</i> | 48 | 16 | 32 | 64 | 48 | NISHIKAWA <i>et al.</i> , 1977 |
| Congiopodidae | | | | | | |
| <i>Hypodytes rubripinnis</i> | 48 | 4 | 44 | 52 | 48 | ARAI & KATSUYAMA, 1973 |
| Cottidae | | | | | | |
| <i>Clinocottus analis</i> | 48* | | | | | CHEN, 1967 |
| <i>Oligocottus snyderi</i> | 48* | | | | | CHEN, 1967 |
| <i>Ocynectes maschalis</i> | 46 | 10 | 36 | 56 | 46 | This paper |
| <i>Pseudoblennius cottoides</i> | 46 | 12 | 34 | 58 | 48 | This paper |
| <i>P. marmoratus</i> | 46 | 10-12 | 34-36 | 56-58 | 48 | This paper |
| <i>Cottus gobio</i> | 48* | | | | | POST, 1965 |
| " " | 52 | 6 | 46 | 58 | | STARMACH, 1967 |
| <i>C. poecilopus</i> | 48 | 8 | 40 | 56 | 48 | STARMACH, 1967 |
| <i>C. hangiongensis</i> | 48 | 6 | 42 | 54 | 48 | ABE, 1972 |
| <i>C. nozawae**</i> | 48 | 10 | 38 | 58 | 48 | ABE, 1972 |
| <i>C. pollux***</i> | 48 | 10 | 38 | 58 | 48 | ABE, 1976 |
| <i>C. reini</i> | 48 | 12 | 36 | 60 | 48 | ABE, 1976 |
| <i>C. kazika</i> | 40 | 18 | 22 | 58 | 48 or 50 | ABE, 1976 |
| <i>Trachidermus fasciatus</i> | 40 | 24 | 16 | 64 | 48 | ABE, 1976 |

* Calculated from haploid chromosome number.

** Japanese name, Hana-kajika.

*** Japanese name, Kajika.

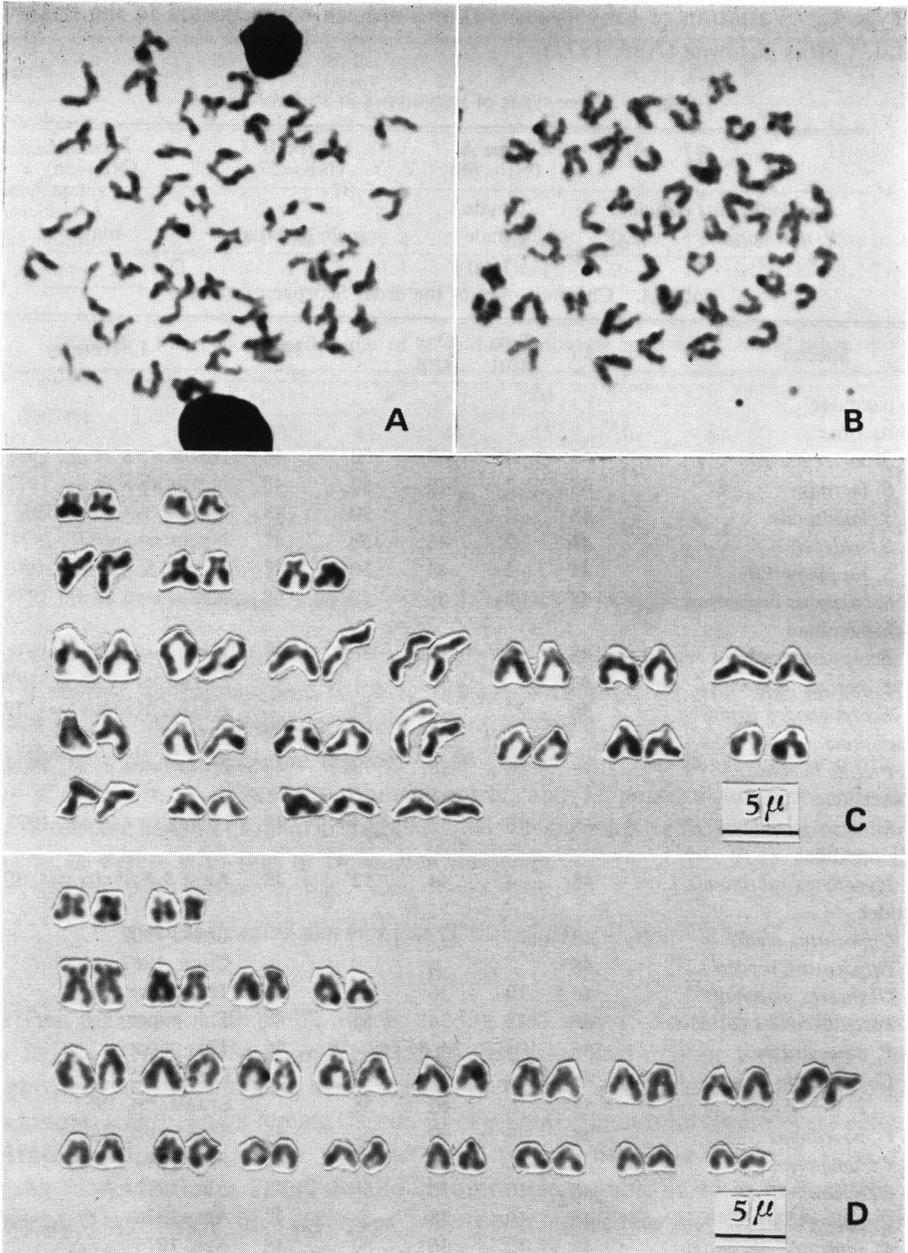


Fig. 1. Photomicrographs of mitotic metaphase chromosomes and karyotypes from gill epithelial cells of marine cottids. — A, *Ocyneustes maschalis*, $2n=46$, $\times 2,010$; B, *Pseudoblennius cottoides*, $2n=46$, $\times 1,860$; C, *Ocyneustes maschalis*, from Fig. A, NF=56, $\times 2,010$; D, *Pseudoblennius cottoides*, from Fig. B, NF=58, $\times 1,860$.

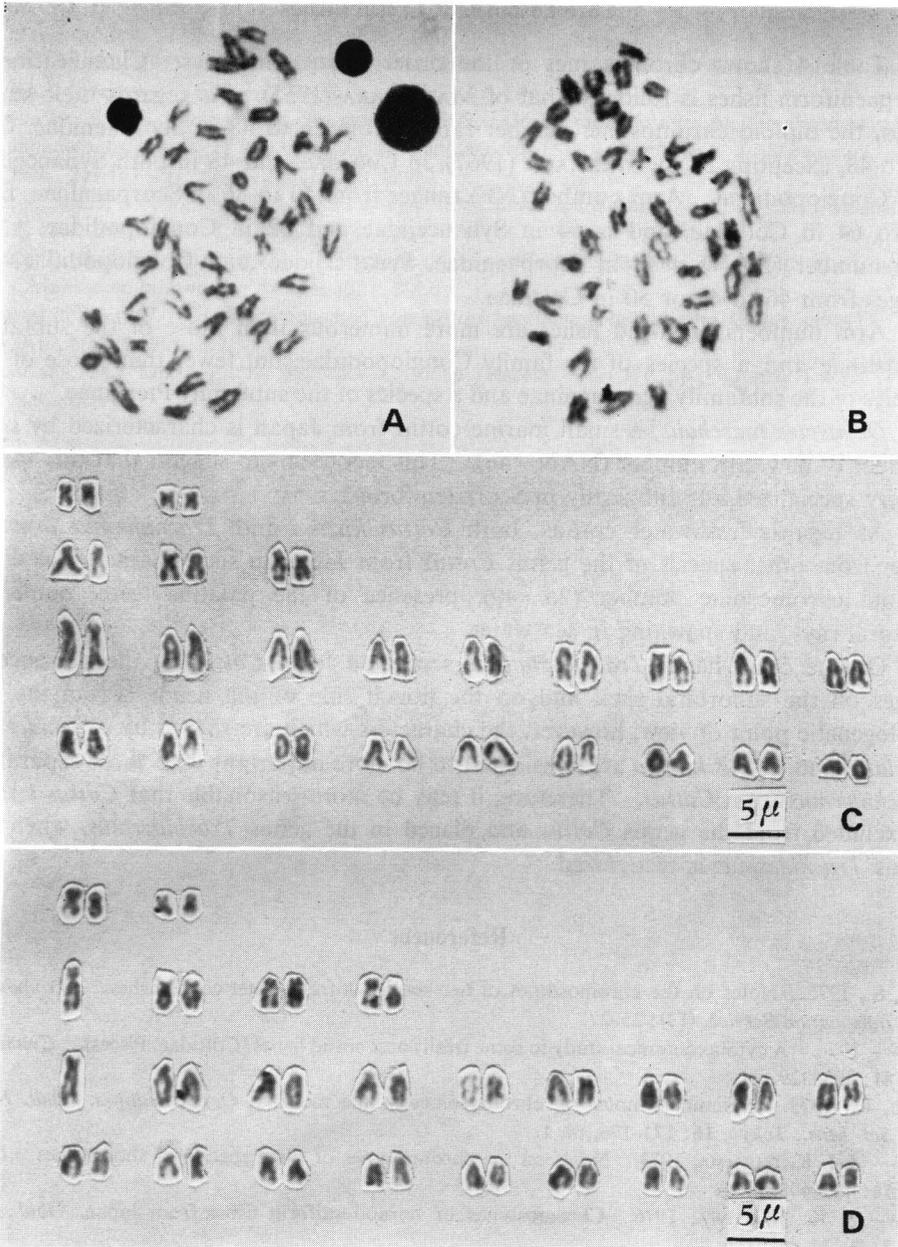


Fig. 2. Photomicrographs of mitotic metaphase chromosomes and karyotypes from gill epithelial cells of *Pseudoblennius marmoratus*. — A, male (No. E·81·32), $2n=46$, $\times 1,470$; B, female (No. E·54·3), $2n=46$, $\times 1,470$; C, male karyotype (Type C), from Fig. A, $NF=56$, $\times 1,470$; D, female karyotype (Type B), from Fig. B, $NF=57$, $\times 1,470$.

Chromosomes of Cottid Fishes

Table 4 shows chromosomes of the order Scorpaeniformes. Classification of scorpaeniform fishes is followed that of MATSUBARA (1955). As regards their karyotypes, the diploid chromosome number ranges from 36 to 48 in Scorpaenidae, from 40 to 48, excepting 52 by STARMACH (1967), in Cottidae, and 48 in both Synancejidae and Congiopodidae. Arm number (NF) ranges from 50 to 86 in Scorpaenidae, from 54 to 64 in Cottidae, and is 64 in Synancejidae and 52 in Congiopodidae. New arm number (NAN) is 48 in Scorpaenidae, Synancejidae, and Congiopodidae, and ranges from 46 to 48 or 50 in Cottidae.

Arm numbers of cottid fishes are more numerous than those of the subfamily Sebastinae and a species of the family Congiopodidae, but fewer than those of two species of the subfamily Scorpaeninae and a species of the subfamily Pteroinae.

Ocynectes maschalis, a small marine cottid from Japan is characterized by small number of new arm number (NAN=46). This fact seems to suggest that this species is very specialized karyologically in Scorpaeniformes.

As regards freshwater cottids, both *Cottus kazika* and *Trachidermus fasciatus* differ from other species of the genus *Cottus* from Japan in such characters as small diploid chromosome number ($2n=40$), presence of the palatine teeth, numerous pectoral rays, and spawning in sea water.

On the other hand, *Trachidermus* is separated from *Cottus* by the presence of ridges on the suborbital shelf and on the dorsal side of the head. From the fish phylogenetic point of view, however, the characters which are shared by *Trachidermus fasciatus* and *Cottus kazika* are considered to be more important than those separating *Trachidermus* from *Cottus*. Therefore, it may be more reasonable that *Cottus kazika* is excluded from the genus *Cottus* and placed in the genus *Trachidermus*, when the genus *Trachidermus* is recognized.

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