

Chromosomes of Four Species of the Family Hexagrammidae (Scorpaeniformes)

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The hexagrammid fishes are widely distributed in the North Pacific and in the adjacent Bering Sea, Sea of Okhotsk, and Sea of Japan (Gorbunova, 1970). Taxonomy, osteology and systematics of this family have been studied by several investigators (Matsubara, 1955; Quast, 1965; Rutenberg, 1970; etc.). Concerning its karyology, however, only *Hexagrammos octogrammus* and *H. otakii* have been studied by Makino (1937) and Nogusa (1960). Both authors used the gonad section method.

In this paper, the karyotypes of *Pleurogrammus azonus*, *Agrammus agrammus*, *Hexagrammos stelleri* and *H. lagocephalus* are described.

Material and methods

Data on specimens examined here are shown in Table 1. Fishes were kept in aquaria for a short period. An intraperitoneal injection of colchicine was given to each specimen (1~10 µg/g body weight) 4 to 5 hours before sacrificing. Pieces of kidney were removed, minced with a pair of scissors in a shalnet and suspended in a 0.075 M KCl hypotonic solution for 30~40 minutes at room temperature. The dispersed cells were collected in a centrifuge tube and fixed with 2:1 or 3:1 methanol-acetic acid for 40 minutes. Slides were prepared according to routine air-drying

method and stained with a Giemsa solution.

Classification of chromosomes is after Levan et al. (1964). The arm number was established by assigning a value of one to all acrocentric chromosomes, and a value of two to all metacentric, submetacentric and subtelocentric chromosomes.

Specimens used in the present study are deposited in Shimonoseki University of Fisheries and Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University (HUMZ).

Results

Pleurogrammus azonus Jordan et Metz; Japanese name: Hokke (Figs. 1A, 2A): The diploid chromosome number is 48 (Table 2). The karyotype consists of 18 metacentrics, 8 submetacentrics, 12 subtelocentrics and 10 acrocentrics. The arm number is 86.

Agrammus agrammus (Temminck et Schlegel); Japanese name: Kujime (Figs. 1B, 2B): The diploid chromosome number is 48 (Table 2). The karyotype comprises 8 metacentrics, 26 submetacentrics and 14 subtelocentrics. The arm number is 96. Satellites are observed at the last pair of subtelocentric chromosomes.

Hexagrammos stelleri Tilesius; Japanese name: Ezo-ainame (Figs. 1C, 2C): The diploid chromosome number is 48 (Table 2). The karyotype consists of 4 metacentrics, 12 submetacentrics, 12 subtelocentrics and 20 acrocentrics. The arm number is 76. The largest pair of acrocentric chromosomes have satellites.

Hexagrammos lagocephalus (Pallas); Japanese name: Usagi-ainame (Figs. 1D, 2D): The diploid chromosome number is 48 (Table 2). The karyotype comprises 2 metacentrics, 6 submetacentrics, 28 subtelocentrics and 12 acrocentrics. The arm number is 84.

Table 1. Materials used in the present study.

Species	Number of specimens	Catalogued number	Sex	Total length (mm)	Location
<i>Pleurogrammus azonus</i>	1	HUMZ 74849	unknown	252.4	Hakodate Bay, Hokkaido
<i>Agrammus agrammus</i>	1	HUMZ 72195	unknown	214.0	Hakodate Bay, Hokkaido
	6	uncatalogued	unknown	about 150	Off Yoshimi, Yamaguchi Pref.
<i>Hexagrammos stelleri</i>	1	HUMZ 63511	female	218.1	Off Usujiri, Hokkaido
	1	HUMZ 78597	unknown	215.2	Odaitô, Hokkaido
<i>H. lagocephalus</i>	1	HUMZ 87439	unknown	324.0	Off Abashiri, Hokkaido

Table 2. Karyotypes and frequency distribution of diploid chromosome numbers in hexagrammids examined. m, metacentrics; sm, submetacentrics; st, subtelocentrics; a, acrocentrics.

Species	Karyotype				Number of diploid chromosomes						Total cell count
	m	sm	st	a	44	45	46	47	48	49	
<i>Pleurogrammus azonus</i>	18	8	12	10			1	4	18		23
<i>Agrammus agrammus</i>	8	26	14	0	3	6	6	21	158	2	196
<i>Hexagrammos stelleri</i>	4	12	12	20		1	3	3	23	1	31
<i>H. lagocephalus</i>	2	6	28	12			1	3	9		13

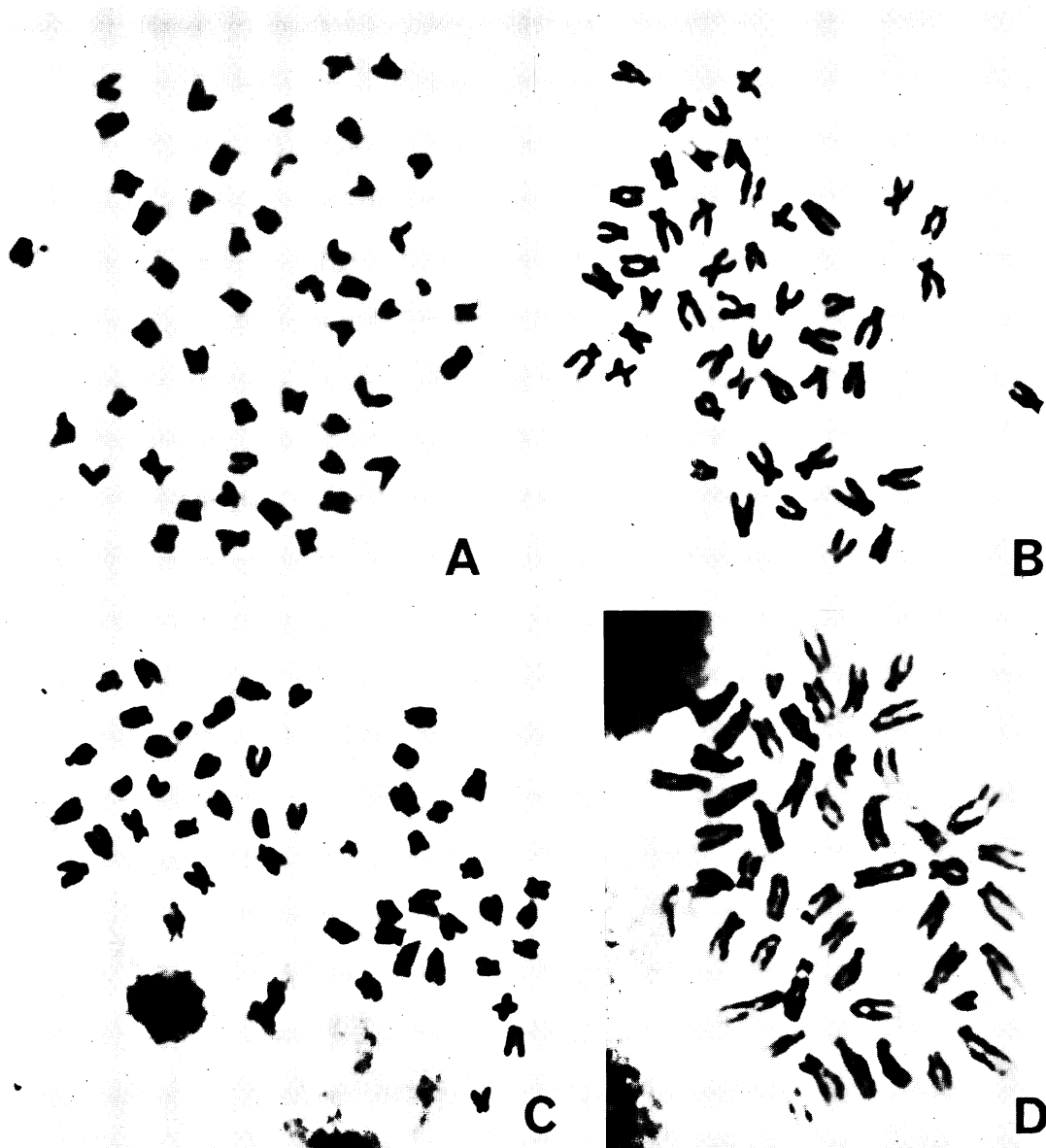


Fig. 1. Photomicrographs of mitotic metaphase chromosomes. A: *Pleurogrammus azonus*. $\times 3010$. B: *Agrammus agrammus*. $\times 2560$; C: *Hexagrammos stelleri*. $\times 2200$; D: *H. lagocephalus*. $\times 2880$.

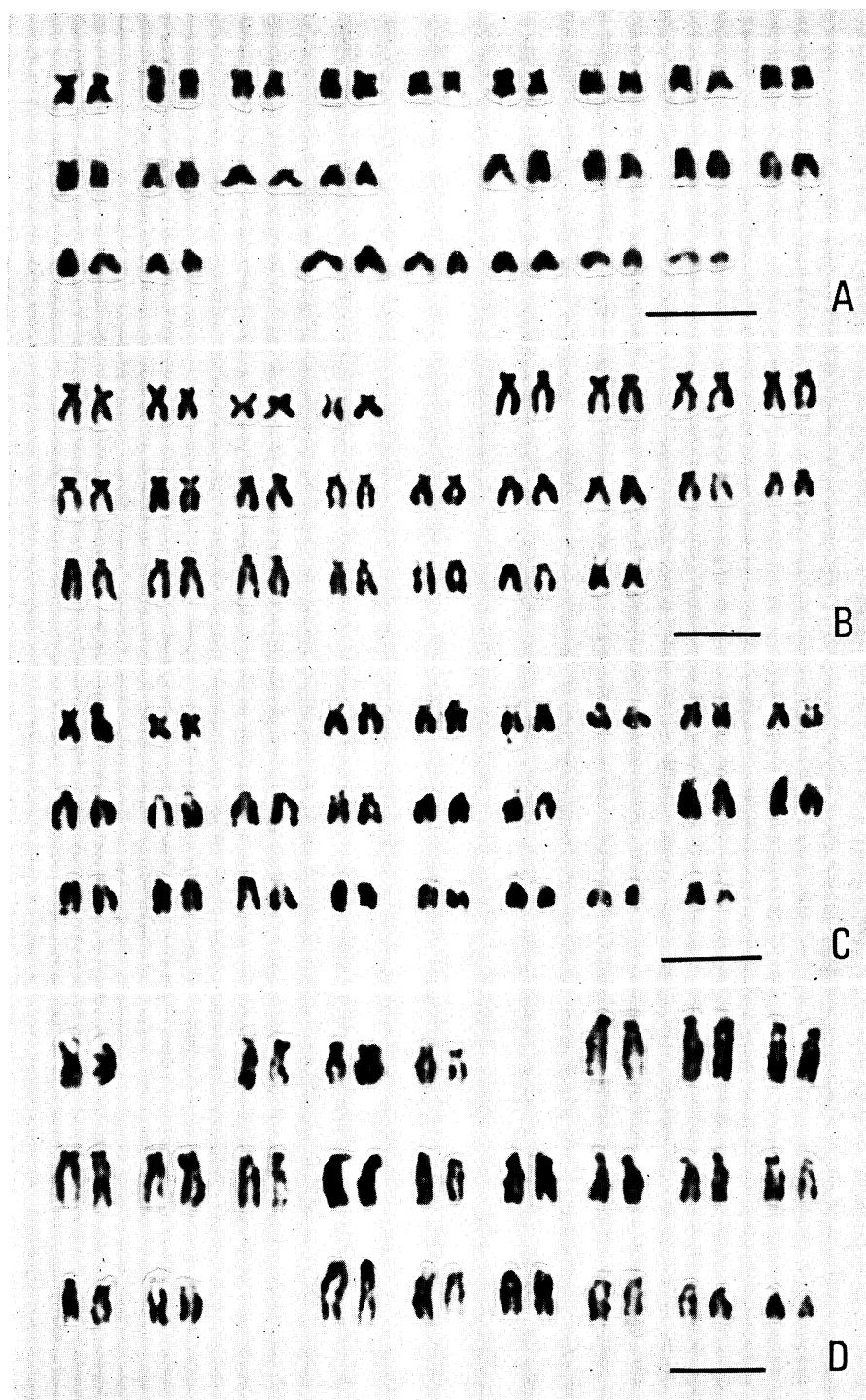


Fig. 2. Karyotypes of four hexagrammid fishes. A: *Pleurogrammus azonus*, from Fig. 1A. $\times 3040$. B: *Agrammus agrammus*, from Fig. 1B. $\times 2470$. C: *Hexagrammos stelleri*, from Fig. 1C. $\times 2730$; D: *H. lagocephalus*, from Fig. 1D. $\times 2630$. Scales indicate 5 μm .

Discussion

In the family Hexagrammidae, the karyotypes of six species including four species described in this study have been presented. The diploid chromosome number is 48 in all species, and the arm number ranges from 76 to 96. Nogusa (1960) reported that the karyotype of *Hexagrammos otakii* did not differ from that of *H. octogrammus* (Makino, 1937), both having the same arm number, 48. However, these results cannot be compared directly with our findings because of the difference in study methods. The karyotypes of the four hexagrammids studied by us have larger arm numbers than those of the two hexagrammids previously studied. Also, these hexagrammids are karyologically distinguishable from each other. Among scorpaeniform fishes so far studied, particularly, the chromosomal constitution of *Agrammus agrammus* is peculiar in having only two-arm chromosomes.

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アイナメ科魚類 4 種の染色体

松宮隆志・坂本一男・西川昇平

日本産アイナメ科魚類 4 種、ホッケ、クジメ、エゾアイナメおよびウサギアイナメの体細胞染色体を通常の air-drying 法により観察した。染色体数は 4 種とも $2n=48$ である。各種の染色体構成を表に示した。クジメの最も小さい次端部着糸染色体対には付随体が観察された。これら 4 種の核型は種類により明瞭に異なり、有効な分類形質となり得ること、および他のカサゴ目魚類のそれらと比較してかなり複雑であることが判明した。

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