

Chromosomes of a Sweeper and a Goatfish (Teleostei, Percoidei) from Japan

By

Ryoichi ARAI

Department of Zoology, National Science Museum, Tokyo

and

Akemi KOIKE

College of Agriculture and Veterinary Medicine, Nihon University, Tokyo

When the fish phylogeny is studied on the basis of the method synthesizing character phylogenies on diagnostic characters, comparative karyology is a useful device for analysing the morpho-cline as defined by MASLIN (1952).

In several fish groups, karyological approach to fish systematics has been attempted, *e.g.*, western North American trouts (GOLD, 1977), North American cyprinid fishes (GOLD *et al.*, 1978), Japanese bitterlings (ARAI, 1978), Japanese damselfishes (ARAI *et al.*, 1976), and Japanese tetraodontiform fishes (ARAI and NAGAIWA, 1976).

For pursuing these studies, it is necessary to examine karyotypes of as many taxa as possible within given genera, families or higher groups. However, there are still many families in which no karyological studies have been made. So far as we are aware, Pempheridae and Mullidae are the families of the examples of this.

As we had opportunities of observing chromosomes of two species of percoid fishes from Japan, *Pempheris xanthoptera* (Pempheridae) and *Parupeneus spilurus* (Mullidae), we are going to describe the karyotypes of these species in this paper.

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 the 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.

Pempheris xanthoptera TOMINAGA "Minami-hatanpo"

(Figs. 1 A, C)

Five specimens (Nos. E·73·52–E·73·54 and E·73·68–E·73·69), 63.0 to 76.5 mm in total length, were collected at Shimama, Tanegashima Island, off southern Kyushu. Characters of material fishes are shown in Table 1.

Table 1. Characters of two species of material fishes.

Species	No. of fish	S. L. (mm)	D	A	VN
<i>Pempheris xanthoptera</i>	5	47.6–59.0	VI, 9	III, 38–39	10+15
<i>Parupeneus spilurus</i>	2	52.8–141.0	VIII, i, 8	I, i, 6	10+14

As shown in Table 2, the diploid chromosome number of this species is 48. The karyotype comprises one pair of submetacentric and 23 pairs of subtelocentric-acrocentric chromosomes. The arm number is 50.

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

Species	2n											Total
	38	39	40	41	42	43	44	45	46	47	48	
<i>Pempheris xanthoptera</i>	1		1	3		1	1	2	6	7	13	35
<i>Parupeneus spilurus</i>	3	1	3	8	1	16	44		2	1		79

Karyotypes similar to that of this species (2n=48, NF=50) is reported in various families of the suborder Percoidei, i. e., *Coreoperca herzi* and *Morone saxatilis* in Percichthyidae (UENO and OJIMA, 1977; RACHLIN *et al.*, 1978), *Etheostoma blennioides blennioides* in Percidae (ROSS, 1973), *Plesiops coeruleolineatus* in Plesiopidae (ARAI *et al.*, 1976), *Seriola quinqueradiata* in Carangidae (IDA *et al.*, 1978), *Oplegnathus fasciatus* in Oplegnathidae (NISHIKAWA and KARASAWA, 1972), *Megaprotodon strigangulus* and *M. plebeius* in Chaetodontidae (ARAI and INOUE, 1975), *Microcanthus strigatus* in Scorpidae (ARAI and INOUE, 1975), and *Abudefduf notatus* in Pomacentridae (ARAI and INOUE, 1976).

Parupeneus spilurus (BLEEKER) “Okina-himeji”

(Figs. 1 B, D)

Two specimens (Nos. E·69·30 and E·81·40), 65.0 and 170.8 mm in total length, were caught at Amatsu-kominato, Awa, Chiba Prefecture (Table 1).

The diploid chromosome number is 44 (Table 2). The karyotype comprises 4 pairs of metacentric, 4 pairs of submetacentric, 2 pairs of larger subtelocentric, and 12 pairs of smaller subtelocentric-acrocentric chromosomes. One pair of smaller subtelocentrics have satellites. The arm number is 60. Larger subtelocentric chromosomes seem to be formed by centric fusion, and the new arm number (NAN) is 48.

As regards large chromosomes by centric fusion, two types of chromosomes, i. e., two-arm chromosome type (Type A) and one-arm chromosome type (Type B) have been reported in acanthopterygian fishes. Type A is found in *Micropterus punctulatus*,

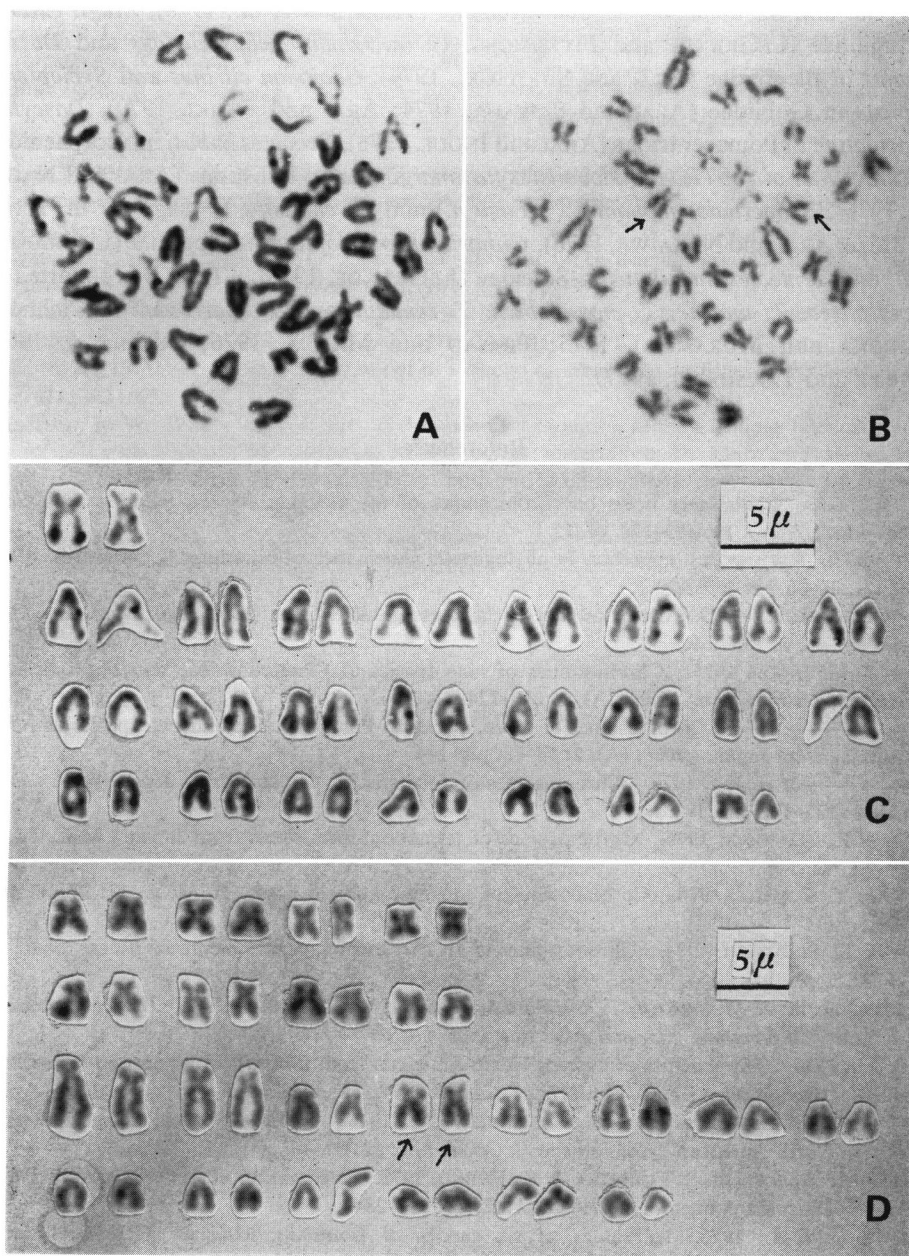


Fig. 1. Photomicrographs of mitotic metaphase chromosomes and karyotypes from gill epithelial cells of a sweeper and a goatfish from Japan. Arrows show chromosomes which have satellites. — A, *Pempheris xanthoptera* (No. E·73·54), $2n=48$, $\times 2,160$; B, *Parupeneus spilurus* (No. E·81·40), $2n=44$, $\times 1,440$; C, *Pempheris xanthoptera*, from Fig. A, $NF=50$, $\times 2,460$; D, *Parupeneus spilurus*, from Fig. B, $NF=60$, $\times 1,860$.

M. treculi and *M. dolomieu* in Centrarchidae (THOMPSON *et al.*, 1978), *Mugil curema* in Mugilidae (LEGRANDE and FITZSIMONS, 1976), *Omobranchus elegans* and *Dasson trossulus* in Blenniidae (ARAI and SHIOTSUKI, 1974), *Gobiodon citrinus* and *Syciopterus japonicus* in Gobiidae (ARAI and SAWADA, 1974; ARAI and FUJIKI, 1979), *Dascyllus trimaculatus* in Pomacentridae (ARAI and INOUE, 1976), *Sebastes hubbsi* in Scorpaenidae (NISHIKAWA *et al.*, 1977), *Pseudobalistes flavimarginatus* in Balistidae (ARAI and NAGAIWA, 1976), *Sphoeroides niphobles* (= *Fugu n.*) and *S. chrysops* (= *Fugu c.*) in Tetraodontidae (ARAI and NAGAIWA, 1976), *Citharichthys spilopterus* in Bothidae (LEGRANDE, 1975), and *Trinectes maculatus* in Soleidae (LEGRANDE, 1975). Type B is reported in *Tilapia aurea*, *T. mariae*, *T. mossambica*, *T. rendalli*, and *T. sparrmanii* in Cichlidae (FUKUOKA and MURAMOTO, 1975; PRASAD and MANNA, 1976; THOMPSON, 1976; MICHELE and TAKAHASHI, 1977).

References

- ARAI, R., 1973. Preliminary notes on chromosomes of the medaka, *Oryzias latipes*. *Bull. Natn. Sci. Mus., Tokyo*, **16**: 173–176, pl. 1.
- 1978. Karyological approach to phylogenetic systematics of bitterlings (Cyprinidae). *Iden*, **32** (7): 39–46. (In Japanese.)
- & A. FUJIKI, 1979. Chromosomes of Japanese gobioid fishes (IV). *Bull. Natn. Sci. Mus., Tokyo*, (A), **5**: 153–159.
- & M. INOUE, 1975. Chromosomes of nine species of Chaetodontidae and one species of Scorpidae from Japan. *Ibid.*, (A), **1**: 217–224, pls. 1–4.
- & ——— 1976. Chromosomes of seven species of Pomacentridae and two species of Acanthuridae from Japan. *Ibid.*, (A), **2**: 73–78, pls. 1–4.
- , ——— & H. IDA, 1976. Chromosomes of four species of coral fishes from Japan. *Ibid.*, (A), **2**: 137–142, pls. 1–2.
- & K. NAGAIWA, 1976. Chromosomes of tetraodontiform fishes from Japan. *Ibid.*, (A), **2**: 59–72, pls. 1–6.
- & Y. SAWADA, 1974. Chromosomes of Japanese gobioid fishes (I). *Ibid.*, **17**: 97–102, pls. 1–3.
- & K. SHIOTSUKI, 1974. Chromosomes of six species of Japanese blennioid fishes. *Ibid.*, **17**: 261–268, pls. 1–3.
- FUKUOKA, H., & J. MURAMOTO, 1975. Somatic and meiotic chromosomes of *Tilapia mossambica* PETERS. *Chromosome Information Service*, (18): 4–6.
- GOLD, J. R., 1977. Systematics of western North American trout (*Salmo*), with notes on the redband trout of Sheepheaven Creek, California. *Can. J. Zool.*, **55**: 1858–1873.
- , W. D. WOMAC, F. H. DEAL & J. A. BARLOW, JR., 1978. Gross karyotypic change and evolution in North American cyprinid fishes. *Genet. Res.*, **32**: 37–46.
- IDA, H., M. MUROFUSHI, S. FUJIWARA & K. FUJINO, 1978. Preparation of fish chromosomes by *in vitro* colchicine treatment. *Jap. J. Ichthyol.*, **24**: 281–284.
- LEGRANDE, W. H., 1975. Karyology of six species of Louisiana flatfishes (Pleuronectiformes: Osteichthyes). *Copeia*, **1975**: 516–522.
- & J. M. FITZSIMONS, 1976. Karyology of the mullets *Mugil curema* and *M. cephalus* (Perciformes: Mugilidae) from Louisiana. *Ibid.*, **1976**: 388–391.
- LEVAN, A., K. FREDGA & A. A. SANDBERG, 1964. Nomenclature for centromeric position on chromosomes. *Hereditas*, **52**: 201–220.

- MASLIN, T. P., 1952. Morphological criteria of phyletic relationships. *Syst. Zool.*, 1: 49-70.
- MICHELE, J. L., & C. S. TAKAHASHI, 1977. Comparative cytology of *Tilapia rendalli* and *Geophagus brasiliensis* (Cichlidae, Pisces). *Cytologia*, 42: 535-537.
- NISHIKAWA, S., & T. KARASAWA, 1972. A comparative study of the chromosomes in Japanese fishes—I. A study of the somatic chromosomes of three species of scups. *J. Shimonoseki Univ. Fish.*, 20: 235-240. (In Japanese.)
- , M. HONDA & A. WAKATSUKI, 1977. Comparative studies on the chromosomes in Japanese fishes—II. Chromosomes of eight species in scorpionfishes. *Ibid.*, 25: 187-191, pls. 1-2. (In Japanese.)
- PRASAD, R., & G. K. MANNA, 1976. Chromosomes of the fishes, *Tilapia mossambica* and *Notopterus notopterus*. *Chromosome Information Service*, (21): 11-13.
- RACHLIN, J. W., A. P. BECK & J. M. O'CONNOR, 1978. Karyotypic analysis of the Hudson River striped bass, *Morone saxatilis*. *Copeia*, 1978: 343-345.
- ROSS, M. R., 1973. A chromosome study of five species of etheostomine fishes (Percidae). *Copeia*, 1973: 163-165.
- THOMPSON, K. W., 1976. Some aspects of chromosomal evolution of the Cichlidae (Teleostei: Perciformes) with emphasis on neotropical forms. Ph. D. dissertation, The Univ. of Texas at Austin.
- , C. HUBBS & R. J. EDWARDS, 1978. Comparative chromosome morphology of the black-basses. *Copeia*, 1978: 172-175.
- UENO, K., & Y. OJIMA, 1977. Chromosome studies of two species of the genus *Coreoperca* (Pisces: Perciformes), with reference to the karyotypic differentiation and evolution. *Proc. Jap. Acad.*, (B), 53: 221-225.

