

A New Middle Miocene Righteye Flounder *Hippoglossoides naritai* from Tokoro, Hokkaido, Japan

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Abstract A head, trunk and anterior caudal region of a righteye flounder was found in the Middle Miocene Tokoro Formation, Hokkaido, Japan. It is described here as *Hippoglossoides naritai* sp. nov. in the family Pleuronectidae on the basis of characters such as a large size of the mouth, shape and arrangement of teeth on the upper jaw, 13 abdominal vertebrae, and the sharper angle between the enlarged first proximal pterygiophore of the anal fin and the body axis.

Introduction

A head, trunk and anterior caudal region of a righteye flounder was found at the breakwater of Tokoro fishing port along the Okhotsk coast of Hokkaido, Japan. The fossil was discovered in the Middle Miocene rock belonging to the Tokoro Formation. It was judged to be a new species of the genus *Hippoglossoides* in the family Pleuronectidae, Pleuronectiformes, because of its large mouth, teeth arranged in a single row on the upper jaw, and having 13 abdominal vertebrae.

In the present paper, the fossil is described and compared in detail with Recent specimens of all species of the genus *Hippoglossoides* species.

Locality

The specimen was collected by the late Mr. Katsuo NARITA at the breakwater of Tokoro fishing port along the Okhotsk coast of Hokkaido, Japan. It was discovered in a rock dredged from the bottom of the sea at the port (Fig. 1). The rock matrix indicates that it belongs to the Tokoro Formation in the Middle Miocene.

Systematic Paleontology

Class Osteichthyes
Order Pleuronectiformes
Suborder Pleuronectoidei
Family Pleuronectidae
Subfamily Pleuronectinae

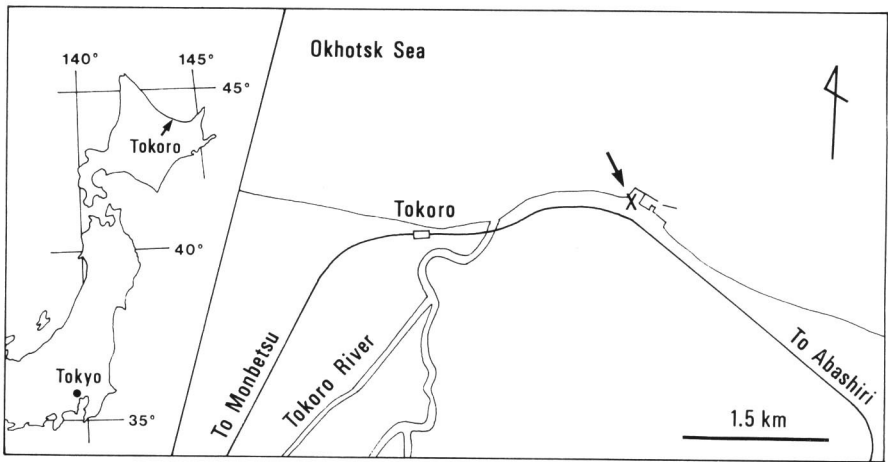


Fig. 1. A map of the locality yielded a new Middle Miocene righteye flounder, *Hippoglossoides naritai* sp. nov.

Genus *Hippoglossoides* GOTTSCHKE, 1835

Hippoglossoides naritai sp. nov.

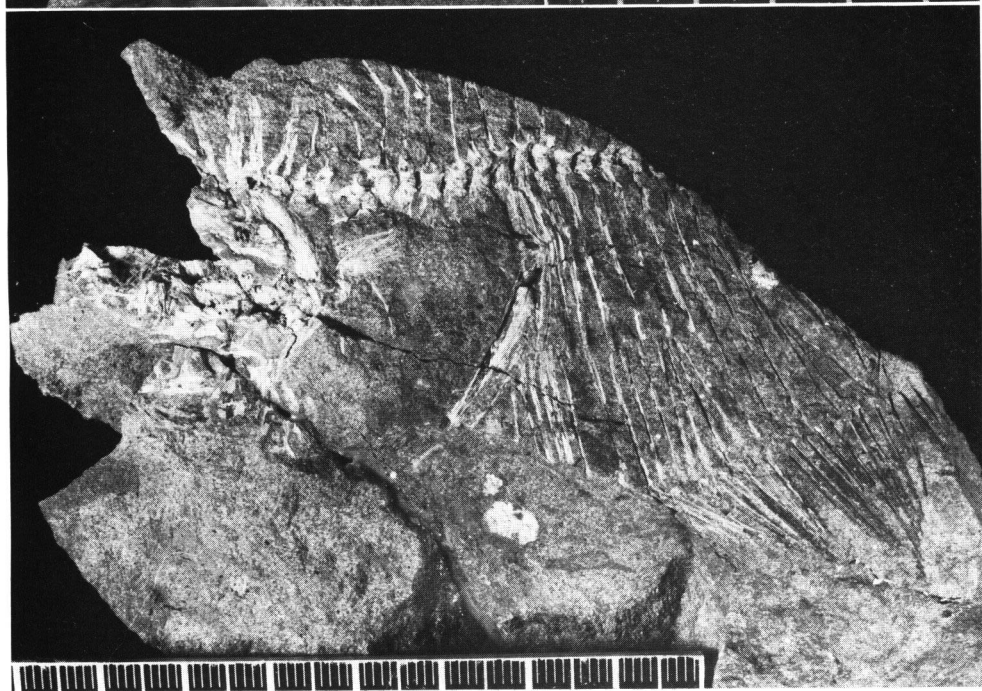
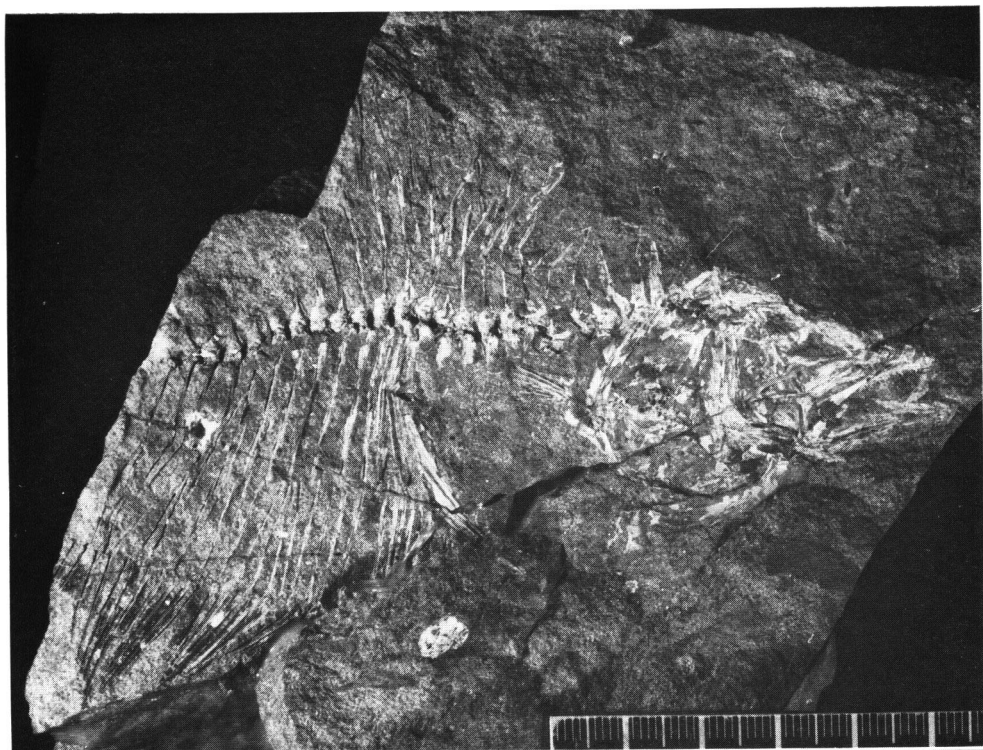
(Figs. 2–4)

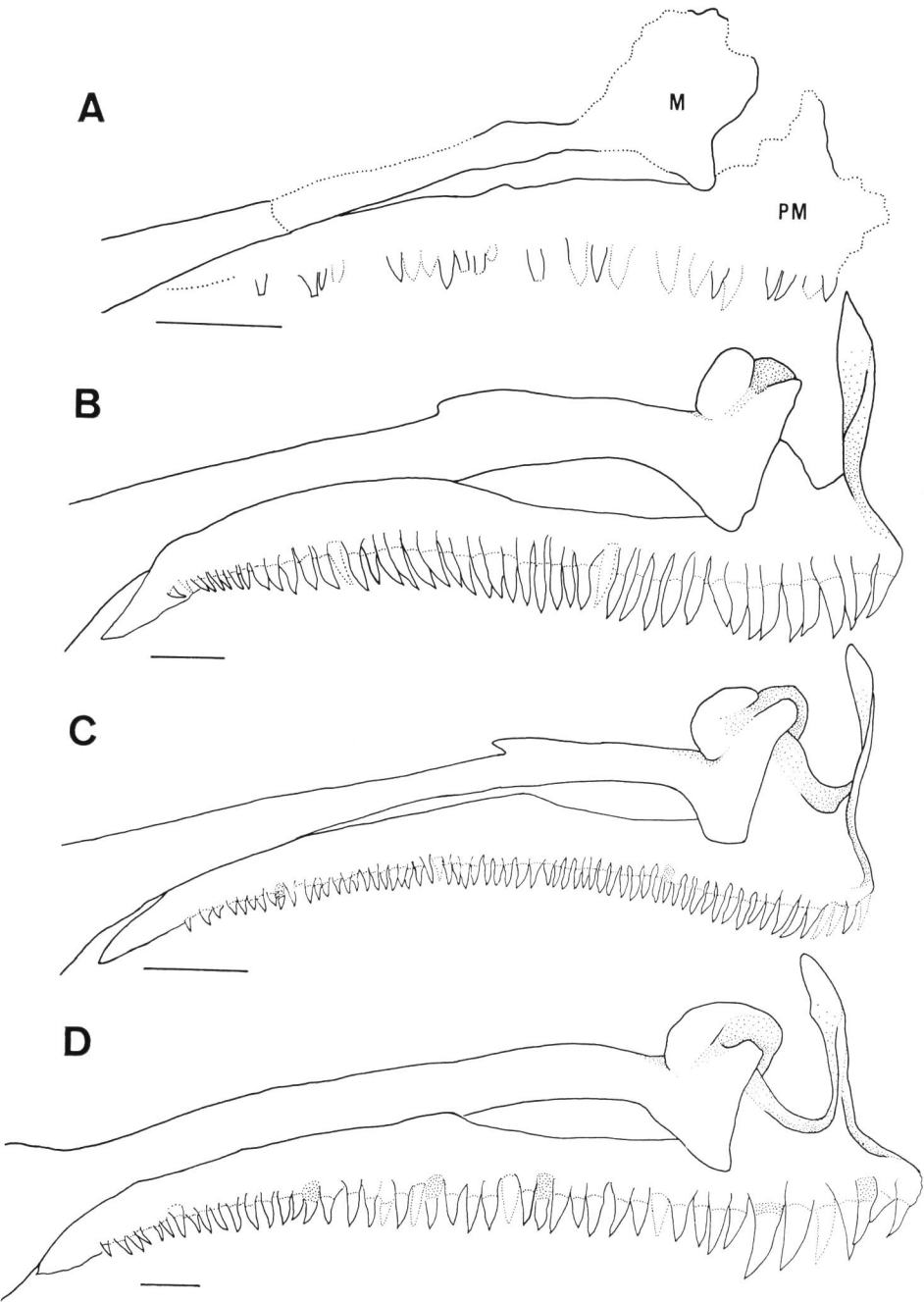
Holotype. National Science Museum catalogue number NSM PV-19592. Head length is about 48.5 mm.

Diagnosis. A *Hippoglossoides* with slightly less slender conical teeth on the upper jaw (Fig. 3), 13 abdominal vertebrae, and the angle of about 80° between the enlarged first proximal pterygiophore of the anal fin and the body axis.

Description. The specimen is incomplete and consists of head, trunk and anterior caudal region. The head region is fairly well preserved, and some constituting bones are identifiable. The mouth is large: the upper jaw length of the blind (left) side is about 2.8 in the head length (in the present study it is measured from the anterior tip of the premaxillary to the base of the pectoral fin). In the upper jaw, the premaxillary and maxillary of the blind side are observed. Several slightly less slender conical teeth and their traces are observable on the premaxillary (from the inner side of the bone) (Fig. 3). They become slightly larger forwards, but enlarged teeth (canine-like as in Fig. 3D) are not found in the anterior part. They are arranged in a single row. In the lower jaw, only the dentary and articular of the blind side are observed, but teeth are not recognizable. Observable bones in the suspensorial and opercular regions on the blind side are ectopterygoid, entopterygoid, quadrate, metapterygoid, symplectic,

Fig. 2. A new Middle Miocene righteye flounder, *Hippoglossoides naritai* sp. nov., NSM PV-19592, from the Middle Miocene Tokoro Formation, Tokoro, Hokkaido, Japan. About 48.5 mm in head length.





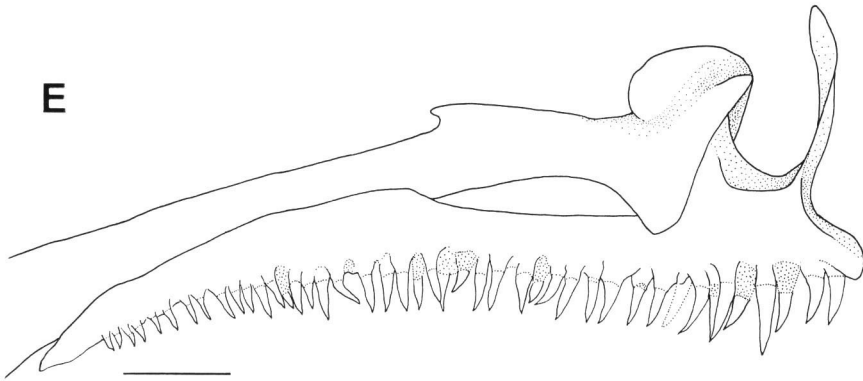


Fig. 3. Teeth on the upper jaw in *Hippoglossoides* with 13 abdominal vertebrae (inner lateral view of the blind side). A, *Hippoglossoides naritai* sp. nov., NSM PV-19592; B, *H. platessoides*, HUMZ (Laboratory of Marine Zoology, Hokkaido University) 87212, 218.5 mm in standard length (SL), North Atlantic; C, *H. elassodon*, HUMZ 85223, 140.2 mm SL, Bering Sea; D, *H. dubius*, HUMZ 52983, 246.5 mm SL, Sakhalin; E, *H. robustus*, HUMZ 54472, 155.0 mm SL, Okhotsk Sea. M, maxillary; PM, premaxillary. Scales indicate 2 mm.

hyomandibular, preoperculum, operculum and interoperculum, though their shapes are not clear. Four incomplete branchiostegal rays are observed. Several upper and lower conical pharyngeal teeth with blunt tips are found between the operculum and the cleithrum on both sides. The cranium is observable, but each element can not be identified because of the poor condition of this part of the head. The dorsal contour is nearly straight.

Ten dorsal fin rays are preserved only at the posterior portion of the fossil (probably middle part of the body). Their proximal pterygiophores number 13, which lack the anterior ones, are distorted. Two pterygiophores are usually inserted between each of the adjacent neural spines.

The anterior anal fin rays are missing and only 20 rays are countable. Of the proximal pterygiophores preserved in the fossil, two are usually inserted between two adjacent haemal spines, excepting approximately 7 anterior ones. The anteriormost pterygiophore, which is longest and stoutest, is missing its anteroventral end. It is attached to the anterior margin of the first haemal spine. The angle between the first proximal pterygiophore and the body axis is about 80° .

Of the pectoral fin rays, all that remains are 7 in number. The cleithrum is missing, but its ventral end is observed. A long and slender postcleithrum directed posteroventrally is observable beneath and under the pectoral fin. A part of the coracoid is preserved.

Of the pelvic fin, a dorsal part of the pelvis is observed.

The abdominal vertebrae are 13 in number. They are slightly distorted, and

Table 1. Abdominal vertebral counts and number of rows of teeth in upper jaw in pleuronectines with large mouth. Data from Norman (1934) and Sakamoto (1984b). Abdominal vertebral counts of *Hippoglossus hippoglossus* (known from Atlantic Ocean) were not available. According to Norman (1934), *H. hippoglossus* has 2 or more tooth rows in the upper jaw.

Species	Abdominal vertebral counts										Tooth rows in upper jaw
	10	11	12	13	14	15	16	17	18	19	
<i>Atheresthes stomias</i>			19	1							2
<i>A. evermanni</i>			26								2
<i>Reinhadtius hippoglossoides</i>								1	18	4	2
<i>Hippoglossus stenolepis</i>							14	3			2 or more
<i>Eopsetta exilis</i>			15	1							2
<i>E. jordani</i>		4									2
<i>E. grigorjewi</i>		20	1								2
<i>Verasper variegatus</i>					14						2
<i>V. moseri</i>					11						2
<i>Psettichthys melanosticus</i>		10									1
<i>Hippoglossoides platessoides</i>				11							1
<i>H. elassodon</i>			3	17	1						1
<i>H. dubius</i>				26							1
<i>H. robustus</i>			2	19							1
<i>H. naritai</i> sp. nov.				1							1
<i>H. pinetorum</i>	2	32	2								1
<i>Acanthopsetta nadeshnyi</i>	1	27									1
<i>Paralichthodes algoensis</i>	7										2 or more

thus the anterior part of the vertebrate column is somewhat concave. Each centrum possesses a well developed neural spine. The first 4 spines are broad. All the neural spines incline more or less posterodorsally because of the distortion of the vertebral column. Intermuscular bones such as the epicentral, epimeral, hypomeral and myorabdoi are not observed.

Only the first 12 caudal vertebrae are observed. Each centrum has well developed neural and haemal spines.

Consideration

The present species is a member of the order Pleuronectiformes in having the following characters: a great body depth and the almost consistent presence of two proximal pterygiophores of the dorsal and anal rays between two adjacent neural and haemal spines. It is included in the suborder Pleuronectoidei (comprizing Citharidae, Scopthalmidae, Paralichthyidae, Bothidae and Pleuronectidae), because it has a well developed postcleithrum and the enlarged first proximal pterygiophore of the anal fin (NORMAN, 1934; AMAOKA, 1969; HENSLEY and AHLSTROM, 1984).

As we could not observe most of family characters in the suborder described by

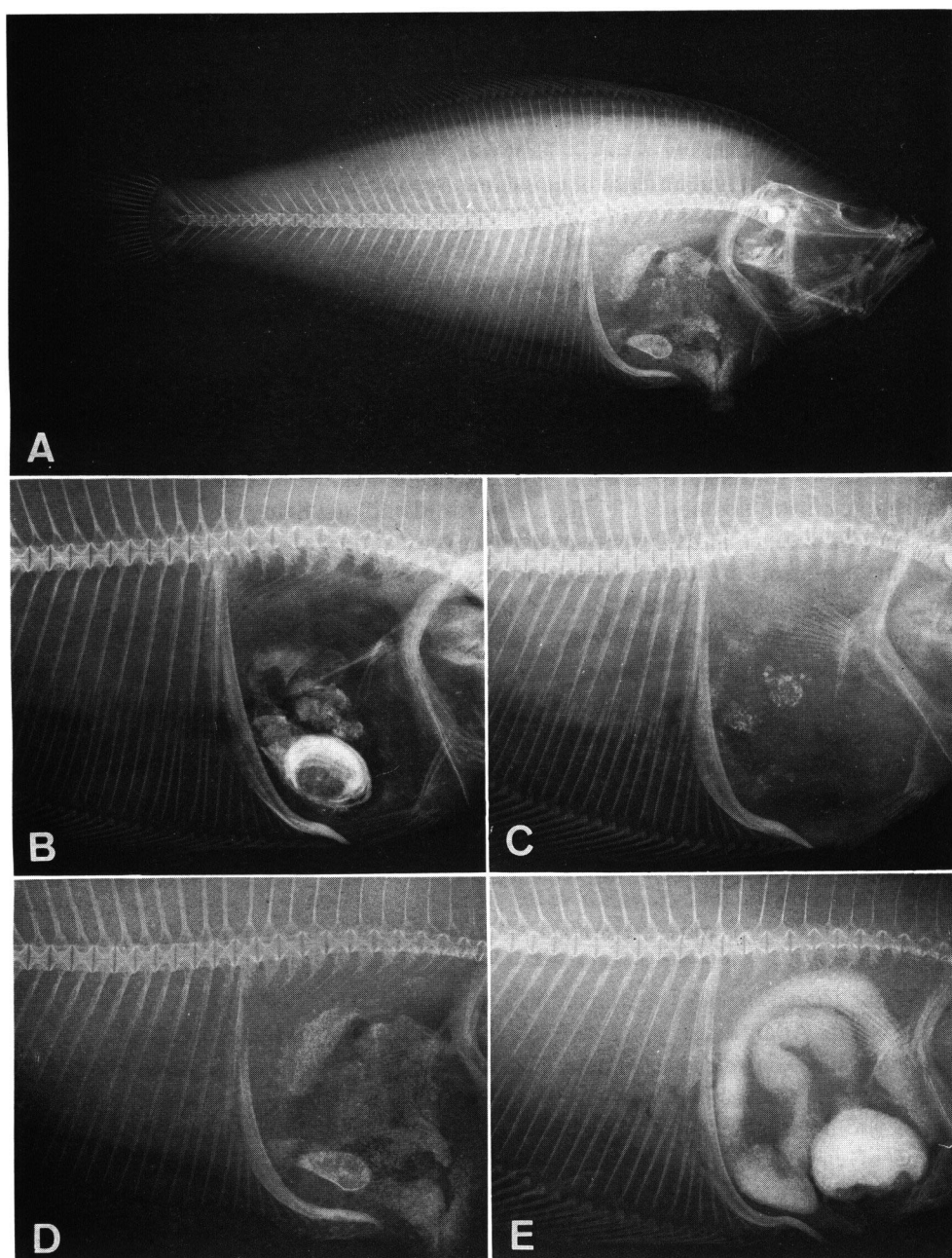


Fig. 4. X-rayed photographs showing the enlarged first proximal pterygiophore and the body axis. A, D, *Hippoglossoides dubius*, HUMZ uncatalogued, 228.0 mm SL, Okhotsk Sea; B, *H. platessoides*, HUMZ 87213, 296.0 mm SL, North Atlantic; C, *H. elassodon*, HUMZ 85175, 228.7 mm SL, Bering Sea; E, *H. robustus*, HUMZ 85559, 197.0 mm SL, Bering Sea.

previous workers (NORMAN, 1934; OCHIAI, 1966; AMAOKA, 1969; HENSLEY and AHLSTROM, 1984; SAKAMOTO, 1984b) in the present fossil, it is hardly possible that the present species is a scophthalmid because of their limited distribution in North Atlantic and Mediterranean. Other families of the suborder Pleuronectoidei are distributed around Japan today. However, possession of 13 abdominal vertebrae and the pectoral fin and absence of epimeral, hypomeral and myorabdoi indicate that the present fossil belongs to the family Pleuronectidae (AMAOKA, 1969; HENSLEY and AHLSTROM, 1984; SAKAMOTO, 1984b). Further, it is included in the subfamily Pleuronectinae because it has a well developed first neural spine (SAKAMOTO, 1984b).

The pleuronectine fishes are divided into two groups for convenience: large and small mouth groups. The present species is clearly a member of the large mouth group. So, we compared it with following Recent large mouth pleuronectine fishes in several characters which are observable in the fossil: *Atheresthes*, *Reinhardtius*, *Hippoglossus*, *Eopsetta*, *Verasper*, *Psettichthys*, *Hippoglossoides*, *Acanthopsetta* and *Paralichthodes* (SAKAMOTO, 1984b). According to SAKAMOTO (1984a, b), the following characters are taxonomically important for identifying living pleuronectine genera: presence or absence of dark spots or bars on vertical fins, shape of caudal fin, shape and arrangement of tooth, dorsal origin, presence or absence of prolongation of anterior dorsal rays, presence or absence of scales on eye balls and others. As almost all these characters except tooth character can not be observed in the fossil, the followings were used for comparison of the fossil with Recent species: shape and arrangement of tooth on upper jaw, and number of abdominal vertebrae. In its conical teeth and having a single tooth row on the upper jaw, the present fossil is similar to the species of *Psettichthys*, *Hippoglossoides* and *Acanthopsetta*, though the tooth shape varies within a genus (whereas two or more tooth rows on the upper jaw in the other genera) (Fig. 3: Table 1). Thirteen abdominal vertebral counts of the present fossil falls into the range of the species of *Hippoglossoides* (except *H. pinetorum*), *Atheresthes stonias* and *Eopsetta exilis* (Table 1). Based on these comparisons, we concluded that it is most reasonable to classify the present species into the genus *Hippoglossoides*.

Four *Hippoglossoides* species with 13 abdominal vertebrae (*H. platessoides* known from North Atlantic, *H. elassodon*, *H. dubius* and *H. robustus* from North Pacific) are distinguished from one another in: number of branchiostegal rays, dorsal and anal ray counts, number of gill rakers, presence or absence of anterior canine-like teeth, width of interorbital space, number of scale rows in interorbital space, and shape of caudal fin (NORMAN, 1934; SAKAMOTO, 1984a). Although these are not preserved in the fossil, it was found that the present species differs from the four species in the angle between the enlarged first proximal pterygiophore of the anal fin and the body axis (Fig. 4). In the present species and North Atlantic species, *H. platessoides*, the angle is clearly less than 90° , whereas nearly 90° in the other three species. Moreover, its angle in the present species is slightly less than that in *H. platessoides*. Also, the shape of the tooth on the upper jaw is slightly less slender

than that in the four Recent species (Fig. 3). By the lack of the anterior canine-like teeth, it is easily distinguishable from *H. dubius* in particular. Consequently, we recognized the present species as a new species in *Hippoglossoides*.

As far as we know in the fossil records of the present genus, *Protopsetta* (synonym of *Hippoglossoides*) *kubotai* NIINO, 1951 is reported from Gunma Prefecture, central Honshu, Japan in the Tertiary (the specimen was lost by World War II) (NIINO, 1951). However, *H. naritai* differs from it in having 13 abdominal vertebrae (10 in that species).

Etymology. The species name, *naritai*, is derived from the late Mr. Katsuo NARITA who collected the present specimen.

Acknowledgments We are grateful to Mrs. Masako NARITA who donated the present fossil specimen to the National Science Museum, Tokyo, and Mr. Kohichi OHMI of Hokkaido Kitahiroshima Senior High School, who provided us informations on the specimen, and accompanied us to the site where Mr. NARITA found the fossil. We wish to thank Professor Kunio AMAOKA and associate Professor Kazuhiro NAKAYA of the Laboratory of Marine Zoology, Hokkaido University, for the loan of many pleuronectid specimens.

The present study was partly supported by a grant-in-aid (No. 62480025) to T. UYENO from the Ministry of Education, Science and Culture, Japan.

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