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Osteology and Relationships of the Citharid Flatfish *Brachypleura novaezeelandiae*

Kunio Amaoka

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Abstract Skeletal elements of *Brachypleura novaezeelandiae* Günther of the family Citharidae collected from the South China Sea were examined. This species has been known as a transitional form between the primitive genus *Psettodes* and typical members of flatfishes. Osteological features of *B. novaezeelandiae* were compared with those of two citharids, *Citharoides macrolepidotus* Hubbs and *Lepidoblepharon ophthalmolepis* Weber. The definition of the family Citharidae which includes *Brachypleura* was revised.

Introduction

The dextral flounder genus *Brachypleura* contains only a single species, *Brachypleura novaezeelandiae* Günther, 1862, which inhabits deep waters of the Indo-Pacific region. This species has been recognized as a member of the subfamily Samarinae of the family Pleuronectidae (Norman, 1934).

Hubbs (1945, 1946) established the family Citharidae for the five genera *Citharus, Citharoides, Paracitharus, Brachypleura*, and *Lepidoblepharon*, stating that they are a primitive group among the more typical flatfishes in having a pelvic spine, a supplementary maxillary, overlapping branchiostegal membranes, vomerine teeth, and so on. The family was regarded as intermediate, and transitional, between the most primitive flatfish family Psettodidae (Regan, 1910; Norman, 1934), and the main groups of flat fishes.

Amaoka (1969) showed that two citharids, *Citharoides macrolepidotus* Hubbs, 1915, and *Lepidoblepharon ophthalmolepis* Weber, 1913, are so similar to each other that their kinships can hardly be questioned on osteological features. Though the former is sinistral and the latter dextral, both of them are transitional between the family Psettodidae and other flatfishes in characters of the cranium, orbital bones, gillrakers, urohyal, branchial apparatus, vertebrae and their accessory bones, caudal rays, and caudal skeleton.

Recently, I have examined specimens of *Brachypleura novaezeelandiae* collected from the South China Sea, and compared the osteological characters of the species with those of other flat fishes to clarify its relationships among flatfishes.

Material and methods

Thirteen specimens measuring 55–120 mm in standard length (7 males, 6 females) were collected by Dr. Hirotoshi Asano from Tonking Bay (June 4 to August 6, 1957), and deposited in the Department of Fisheries, Faculty of Agriculture, Kyoto University.

Two specimens, 113 and 120 mm in standard length were dissected. The skeleton was examined with a binocular microscope after the sample had been cleared and stained with alizarin red. Most of the specimens were also observed by sort X-ray. A single specimen of three species, *Psettodes erumei* (Bloch and Schneider, 1801), *Lepidoblepharon ophthalmolepis* Weber, and *Bothus myriaster* (Temminck and Schlegel, 1846), were also examined by the same methods to determine their relationships to the genus *Brachypleura*.

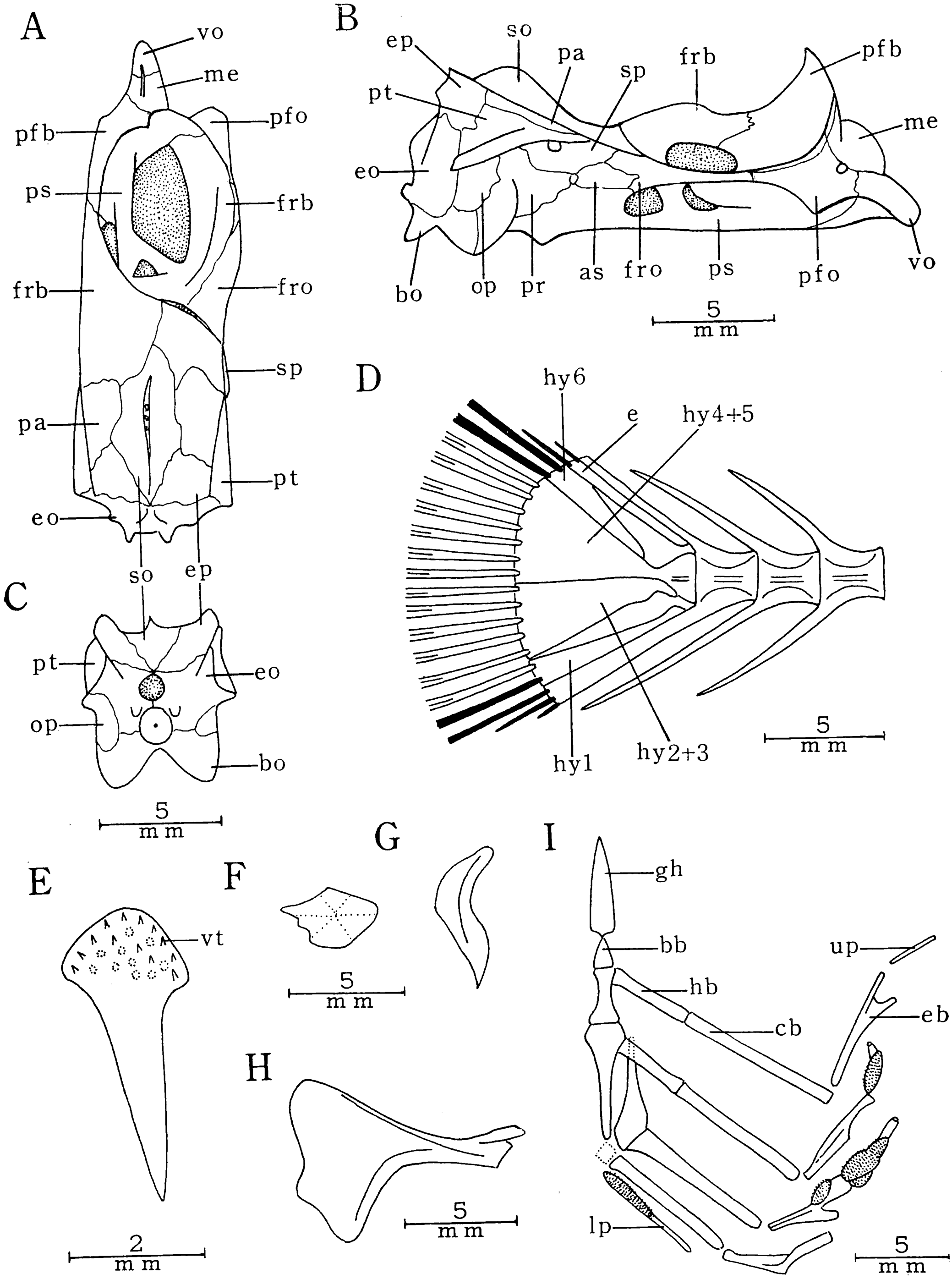
Fig. 1. Lateral view of *Brachypleura novaezeelandiae*, male, 98 mm in standard length.

Description and Comparison of the bones

In order to examine the relationships of the genus *Brachypleura*, its essential osteological characters were compared with those previously studied in the comparative anatomy of the Japanese sinistral flounders (Amaoka, 1969).

Cranium: The vomer is moderate in size, provided with about 20 strong teeth on its ventral surface (Fig. 2, E). At the connection of the supraoccipital, epiotic and exoccipital, the supraoccipital is expanded backward and connected to the exoccipitals at the tip, so that the epiotics are narrowly separated from each other (Fig. 2, A, C). The zygapophysis of the exoccipital for the reception of the atlas is broadly joined to its fellow of the opposite side between the foramen magnum and the socket for the first vertebra (Fig. 2, C). The alisphenoid on the ocular side is rectangular and very large, its anterior part separated from the posterior portion of the orbital cavity by a narrow suture between the frontal and parasphenoid (Fig. 2, B). At the joint of the mesethmoid, prefrontal and frontal, the rod-like interorbital bone is formed by the connection of the interorbital process (frontal on blind side) and the interorbital bar (frontal on ocular side), the process coming in contact anteriorly with the prefrontal on each side and with the mesethmoid, and the bar being connected anteriorly to the prefrontal on the ocular side only (Fig. 2, A, B). In the connection of the five bones on the ocular side (pterotic, exoccipital, basioccipital, prootic, and opisthotic) rather large opisthotic is rectangular and surrounded by the pterotic

Fig. 2. *Brachypleura novaezeelandiae*. Cranium, A (dorsal view), B (lateral view), C. (posterior view). Caudal rays and skeleton, D (lateral view). Vomer, E (ventral view). Orbital bones, F and G (lateral view). Urohyal, H (lateral view). Branchial apparatus, I (dorsal view). bo, basioccipital; eo, exoccipital; ep, epiotic; fro, frontal on ocular side; frb, frontal on blind side; pfo, prefrontal on ocular side; pfb, prefrontal on blind side; me, mesethmoid; op, opisthotic; ps, parasphenoid; pa, parietal; pr, prootic; pt, pterotic; sp, sphenotic, so, supraoccipital; as, alisphenoid; vo, vomer; hyl, hypural 1; hy2+3, hypural 2+3; hy4+5, hypural 4+5; hy6, hypural 6; e, epural; gh, glossohyal; bb, basibranchial; hb, hypobranchial; cb, ceratobranchial; eb, epibranchial; up, upper pharyngeal; lp, lower pharyngeal; vt, vomerine teeth.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dorsally, exoccipital posteriorly, basioccipital ventrally, and prootic anteriorly. The exoccipital is widely separated from the prootic due to wide gap between the opisthotic and basioccipital (Fig. 2, B).

Most osteological structure in the cranium of the genus *Brachypleura* are characteristic to the transitional genera, *Citharoides* and *Lepidoblepharon*, as discussed by Amaoka (1969). But two of the outstanding features by which *Brachypleura* diverges from these two genera are the presence of vomerine teeth and the way of arrangement of the pterotic, exoccipital, basioccipital, prootic, and opisthotic.

Vomerine teeth are developed in the primitive genus *Psettodes* and in *Citharus* (Hubbs, 1945), a member of the family Citharidae, but not in *Citharoides* and *Lepidoblepharon* nor in the paralichthyids and bothids. The vomer with many strong teeth in *Brachypleura* will confirm the view that the genus is more primitive than other Japanese citharids, since the presence of vomerine teeth is believed a primitive feature (Hubbs, 1945).

The other significant difference is the relation of the pterotic, exoccipital, basioccipital, prootic, and opisthotic. The features of their connections are apparently distinguishable from the pattern represented by *Psettodes, Citharoides*, and *Lepidoblepharon*, and are not detectable in any Japanese sinistral flounders. As Amaoka (1969) has noted, those three genera agree well with the typical percoid fishes in having the exoccipital extending forward between the opisthotic and the basioccipital, connected anteriorly with the prootic (Katayama, 1959). It may be pointed out here that such connection of these bones will be the most generalized pattern found in flatfishes. In *Brachypleura* the floor part of the exoccipital extending forward between the opisthotic and the basioccipital becomes lost, but other connections of the five bones agree well with those of the genus *Psettodes* and Japanese citharids. This feature is unique among other sinistral flounders. From such fact, *Brachypleura* is likely to be the nearest relative of *Psettodes, Citharoides* and *Lepidoblepharon*, and to be a little more specialized than these genera in this character, which is not shared by other specialized sinistral flounders (Amaoka, 1969).

Orbital bones: The preorbital bone on each side of body is rigidly attached to the lateral process of the prefrontal by a ligament. The bone is sickle-like on the ocular side (Fig. 2, G), but is rhombic on the blind side (Fig. 2, F). The infraorbital bones are lacking entirely on each side.

In *Psettodes*, four infraorbital bones are present on the ocular side, and in the Japanese citharids and paralichthyids, scaly nodules are present on the ocular side (Amaoka, 1969), but in *Brachypleura* the orbital bone on the ocular side is completely lacking. In respect to the presence or absence of the orbital bones on the ocular side, *Brachypleura* is thus similar to members of the family Bothidae but differs from *Psettodes*, other Japanese citharids and the family Paralichthyidae.

The infraorbital bones on the blind side are five in *Citharoides* and *Lepidoblepharon*, but entirely lacking in *Psettodes*. The genus *Brachypleura*, like *Psettodes*, is apparently unique among all sinistral flounders in this respect. The feature suggests a closer relationship to the genus *Psettodes* than to the Japanese citharid members.

Gillrakers: Gillrakers on the lower limb are rather long, bearing numerous, very feeble denticles, arranged irregularly in a band. Those on the upper limb are short, strongly protruding, wart-like and disk-like, and thickly covered with numerous spinules on the surface. Viewed from the inner side, the main tubercles strongly protrude into a prominent wart, and well overlap the inner side of each gillraker, and they are thickly covered with spinules except along the basal margin, but the accessory tubercle is entirely lacking.

The genus *Brachypleura* presents a somewhat primitive picture by possessing gillrakers armed with denticles in bands and the main tubercles developed on the inner side of the

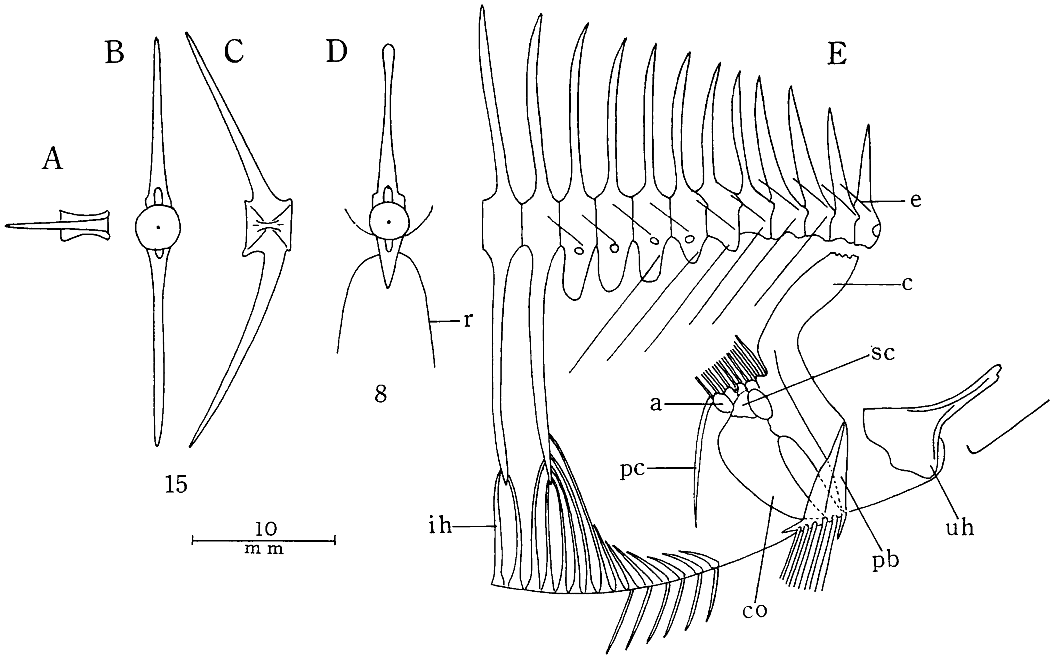

Fig. 3. *Brachypleura novaezeelandiae*. Abdominal and anterior caudal vertebrae and their accessory bones, E (lateral view). Fifteenth caudal vertebra (counted from the first), A (dorsal view), B (anterior view), C (lateral view). Eighth abdominal vertebra (counted from first), D (anterior view). e, epipleural; r, rib; c, cleithrum; sc, scapula; a, actinosts; pc, postcleithrum; co, coracoid; pb, pelvic bone; uh, urohyal; ih interhaemal spine.

gillarch, showing its close affinity to the Japanese citharids, *Citharoides* and *Lepidoblepharon* (Hubbs, 1945; Amaoka, 1969).

Branchial apparatus: The lower pharyngeal bone, elongate and rod-like, is parallel with the fourth ceratobranchial and densely armed with teeth on its broad upper surface. The second, third and fourth upper pharyngeal bones are densely armed with teeth in an irregular band on a broad surface. The first epibranchial is slender and bifurcate at the upper tip. The third epibranchial, like the first, is bifurcate at the upper tip, its dorsal surface being partly armed with many teeth (Fig. 2, I)

Brachypleura shares completely some characters with the Japanese citharids (Amaoka 1969). Teeth are absent in the glossohyal and the second and third hypobranchials; they are present in the most primitive genus *Psettodes*.

Urohyal: The bone is flattened, located between and connecting the hyoid arch and isthmus (Fig. 3, E). It is fan-like and bears on its lower border a pair of lateral ridges running horizontally. The posterior broadened part is nearly at a right angle to the narrow main body, supporting the slightly advanced isthmus (Fig. 2, H; Fig. 3, E).

In most sinistral flounders the bone is fishhook-like, though the development of the sciatic part differs greatly in shape by species. *Citharoides* and *Lepidoblepharon* are rather primitive among flatfishes having a fishhook-like urohyal and the tip of the sciatic part extending to posterior one third in distance from the tip of the main part to the angular portion (Fig. 4, C). *Psettodes*, however, has nearly rectangular urohyal which is slightly curved downward in the posterior portion (Fig. 4, A), as the most primitive character (Chabanaud, 1933; Hubbs, 1945; Amaoka, 1969). The fan-like urohyal in *Brachypleura* may be intermediate between the primitive *Psettodes* and

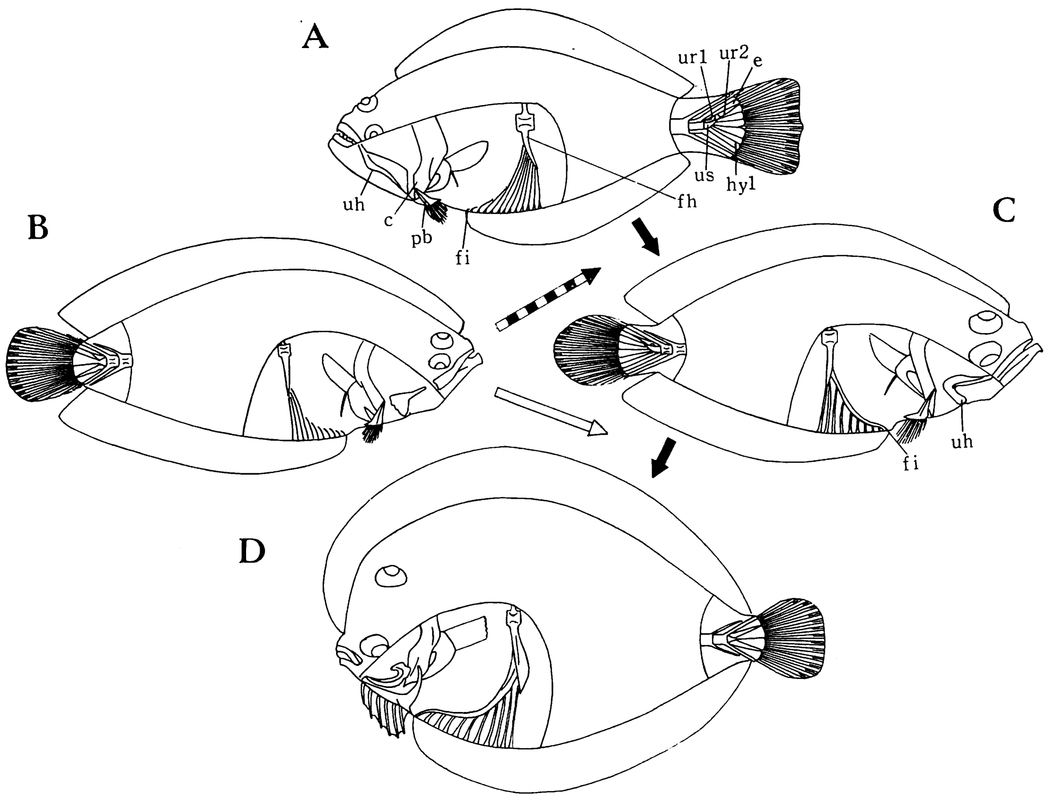

Fig. 4. Relationships of the genus *Brachypleura* to three typical forms of sinistral flounders and related flatfishes, showing changes in dorsal, anal, and pelvic fin origins, external and osteological characters of abdominal region and of caudal region. A, *Psettodes erumei*; B, *Brachypleura novaezeelandiae*; C, *Lepidoblepharon ophthalmolepis*; D, *Bothus myriaster*. Solid arrow, supposed evolutionary progress shown by three types; broken arrow, systematic affinity of *Brachypleura* shown by characters of abdominal region; open arrow, systematic affinity of *Brachypleura* shown by characters of caudal region. uh, urohyal; c, cleithrum; pb, pelvic bone; fi, first interhaemal spine; fh, first haemal spine; url, uroneural l; ur2, uroneural 2; e, epural; us, urostyle; hyl, hypural l.

the slightly specialized forms, *Citharoides* and *Lepidoblepharon*.

The author believes that the rectangular urohyal of *Psettodes* with its posterior part slightly downward is basic to the fishhook-like urohyal in the pleuronectid fishes. It is interesting to note that the urohyal in *Brachypleura* exactly fills the gap between both forms displaying an intermediate condition.

Vertebrae and their accessory bones: The first neural spine is very strong; neural spine in each of the first to the fourth vertebrae is moderately broad and is inclined slightly backward, but the spines posterior to the fourth are rather slender and more or less curved forward at the tip (Fig. 3, E). The first haemal spine is a little stronger than the others, supporting the several anterior interhaemal spines. The first interhaemal spine is not enlarged for supporting the several anterior interhaemal spines (Fig. 3, E). The parapophysis appears firstly on the sixth abdominal vertebra, and its stay is found in the sixth only. The triangular haemapophysis grows in each of the sixth to the tenth vertebrae. The neural postzygapophyses overlap the prezygapophyses from the first to the seventh vertebrae, but they are solitary on the other vertebrae showing no overlap. The ribs grow on the third vertebra and the followings, while the epipleurals on the first (Fig. 3, E). The vertebrae including the urostyle count 10+21 =31 in total number. The opening for the notochord is very small; the centrum is concave equally in depth both anteriorly and posteriorly (Fig. 3, B, D). The transverse apophysis, the epicentrum, the epimeral, the hypomeral and the myorhabdoi are lacking.

In the most of characters, except for the first interhaemal spine, the vertebrae of *Brachypleura* and their accessory bones are similar to those of the citharids, *Citharoides* and *Lepidoblepharon*. Then it can hardly be questioned that the genus may be regarded transitional between the family Psettodidae and the more typical members in the flatfishes.

A distinctive character which the genus *Brachypleura* does not share with other citharids is the first interhaemal spine which shows no distal enlargement. It is mentioned that the feature has been considered diagnostic of the family Psettodidae. Hubbs (1945) also stressed that the enlargement of the first interhaemal is a character that trenchantly separates the family Citharidae from the Psettodidae and aligns it with the Scophthalmidae, Bothidae, and Pleuronectidae. The pointed first interhaemal spine witnessed newly in *Brachypleura* led me to an interesting interpretation. Such a shape seems undoubtedly to be a feature of primitive flatfishes and suggestive of primitiveness of the genus *Brachypleura*.

Caudal rays and caudal skeleton: The caudal rays are 21 in total number, 13 branched rays in the middle part, four simple rays each in the upper and lower parts, thus, $4 + 13 + 4 = 21$ (Fig. 2, D). The urostyle is completely fused with the hypural $4 + 5$, forming a urostyle-hypural complex, though components are not clearly differentiated (Fig. 2, D). The neural and haemal spines related to the preterminal vertebra are not articulated to the centrum, but are completely fused with the latter. Hypurals are plate-like, four in number. Uroneurals 1 and 2 are entirely lacking, but one epural is present (Fig. 2, D).

In all the important characters of the caudal rays and the caudal skeleton, the present genus contrasts sharply with other citharids, *Citharoides* and *Lepidoblepharon*. The caudal rays in *Brachypleura* count fewer than in Japanese citharids. As the author has noted, the number of caudal rays tend to reduce in the more advanced forms. Since the total caudal rays number 24 in *Psettodes*, 23 in *Citharoides* and *Lepidoblepharon*, and 17(18) in the families Paralichthyidae and Bothidae, it is thought that *Brachypleura* is more advanced than the transitional Japanese citharids, but more primitive than the members of the Paralichthyidae and Bothidae.

Gosline (1961) reported that within and among many orders of the fishes, the caudal elements are reduced by loss and fusion in the more advanced forms, and finally reduced into a simple plate-like skeleton. As Amaoka (1969) has noted on the sinistral flounders, the Japanese citharids agree well with *Psettodes* except for having the last neural spine fused with its centrum, and those characters were stressed as an evidence of primitiveness of *Psettodes* as well as the Japanese citharids slightly more advanced than the former. From such a fact, *Brachypleura* is considerably more specialized than the Japanese citharids on those characters. The genus is also slightly more specialized than the genus *Paralichthys* possessing a small uroneural 1, but is more primitive than the most of other members in the family Paralichthyidae and all members of the family Bothidae in having an epural.

Relationships of the Genus *Brachypleura*

The family Citharidae, which was established by Hubbs (1945) for five genera *Citharus*, *Citharoides*, *Paracitharus*, *Brachypleura*, and *Lepidoblepharon*, was regarded as transitional

Table 1. Comparison of characters in *Brachypleura*, two citharids, and species of the families Psettodidae, Paralichthyidae, and Bothidae.

	Psettodidae	Citharidae		Paralichthyidae and Bothidae
	Psettodes	*Citharoides* and *Lepidoblepharon*	*Brachypleura*	all genera in Japan*
Abdominal region				
Urohyal	rectangular	fishhook-like	fan-like	fishhook-like
First haemal spine	not enlarged	slightly enlarged	not enlarged	enlarged
First interhaemal spine	not enlarged	enlarged	not enlarged	enlarged
Pelvic bone	percoid-type	pleuronectid-type	percoid-type	pleuronectid-type
Other regions				
Vomerine teeth	present	absent	present	absent
Infraorbital bones (blind side)	absent	5	absent	3–7
Rank in primitiveness**	1	3	2	4
Caudal region				
Caudal fin rays	5+15+4=24	4+15+4=23	4+13+4=21	2–4+9–13+2–4=17(18)
Urostyle	not fused	not fused	fused	fused
Last haemal spine	not fused	not fused	fused	fused
Hypurals	6	6	4	4
Other regions				
Exoccipital	extending to prootic	extending to prootic	not extending to prootic	not extending to prootic
Infraorbital bones (ocular side)	4	scaly nodules	absent	scaly nodules or absent
Rank in primitiveness**	1	2	3	4

* See Amaoka (1969)

** Rank 1 is most primitive, and 2, 3, and 4 follow in order, when some characters of the above columns are synthetically judged.

between the primitive family Psettodidae and all other flatfishes on the basis of the following characters: fin structure (pelvic spine), position of eyes and crossing of the optic nerve, degree of asymmetry, structure of the gill region, jaws and dentition, number of vertebrae, position of the anus and of the urinary papilla, nostrils, and coloration.

Amaoka (1969) showed that the two citharids, *Citharoides* and *Lepidoblepharon* have many primitive osteological characters which are also transitional between those of the Psettodidae and sinistral flounders.

In order to deduce the relationships of *Brachypleura*, many important characters described and discussed above are synthetically investigated. In most characters, *Brachypleura* is similar to the Japanese citharids of the transitional form, but is distinguishable from them in the important respects as shown in Table 1. These characters can be sharply divided into two groups: the first group is apparently primitive, and have been found in the ancestral form, *Psettodes*, and the second group is considered rather specialized and have been found in a little more advanced species than in the Japanese citharids. However, the characters of the first group are not more primitive than those of the genus *Psettodes*, and the characters in the second are not more advanced than those of the members of the families Paralichthyidae and Bothidae. The genus *Brachypleura* is therefore better to be considered as a member of the family Citharidae, and is transitional between *Psettodes* and other flatfishes.

In the next place, the two groups of characters suggesting the primitiveness and specialization in *Brachypleura* are discussed in relation to the mode of life of flatfishes. All of the primitive characters except two are concentrated in the abdominal region, which are closely related to the supporting of the anal and pelvic fins (Table 1). While most of specialized characters, are closely related to the caudal fin and its supporting skeleton. (Table 1). It is highly probable that the two groups of characters are originated from the special swimming method. The one occurs in the anal and pelvic fins as against the dorsal fin, the other is in upper and lower lobes in the caudal fin itself.

It was pointed out that the origin of the dorsal fin moves anteriorly in more specialized flatfishes (Norman, 1934, 14). In flatfishes, however, anterior extension of the dorsal fin alone may not obtain the desired results, but is may be more effective by the extension of the anal and pelvic fins opposing the dorsal fin. Now, it is possible that in flatfishes the symmetry of both fins (dorsal fin as against pelvic and anal fins) is necessary to maintain swimming balance.

In the primitive genus *Psettodes* the dorsal fin originates on the head posterior to the upper eye. The anal fin starts below the middle part of the pectoral fin, and the origin of the pelvic fin is below the interspace between both margins of the preopercle and opercle. In the Japanese citharids the dorsal fin originates above the anterior margin of the upper eye, or slightly in front of it. The origins of the anal and pelvic fins are somewhat anterior to that in *Psettodes*. In advanced groups such as some members of the Bothidae, the dorsal fin starts in front of the upper margin of the lower eye. The origin of the anal fin is below the posterior margin of the preopercle, and the pelvic fin originates below the anterior margin of the lower eye (Fig. 4).

The osteological characters of the abdominal region, all of which are needed to support the pelvic and anal fins appear to be closely related to the anterior extension of the dorsal fin. It can be said that the abdominal osteological characters are changed by anterior extension of the fins (Fig. 4). The first haemal spine becomes enlarged for supporting the strong and enlarged first interhaemal spine, which needs to support the remaining ones by more anterior extension of the anal fin. The pelvic bone becomes erected, and its lower part with six rays advances farther beyond the cleithrum. The rectangular urohyal is turned and shaped like fishhook, the sciatic part becoming much longer than the main part for supporting the dorsal surface of the pelvic bone which is situated in front of the cleithrum (Table 1)

The characters of the abdominal region, showing various degree of development among the sinistral flounders and developing in parallel with the other important characters, furnish me with certain grounds for assumption on the relationships among flounders. The genus *Brachypleura* is more primitive than the genera *Citharoides* and *Lepidoblepharon* on the osteological features, though it is similar to the two genera on the relative positions of dorsal, anal, and pelvic fins. When viewed from this fact alone, it may be assumed that the anterior extension took place first in the fins, and osteological features followed it.

On the other hand, it is probable that the caudal elements in flounders develop in response to the propelling of the body by means of the upper and lower motions of the caudal fin. The caudal fin is more symmetrical for the special swimming method and more reduced in the bottom living forms, which do not require strong power for swimming.

The genus *Psettodes* has a strong caudal fin and high number of caudal rays, and the fin is asymmetrical with five unbranched rays in upper lobe and four in lower. In the Japanese citharids, the caudal fin becomes slightly feebler than in the *Psettodes*, and the fin has four unbranched rays in each lobe. Most specialized members of the Bothidae have a symmetrical and feeble caudal fin, and total caudal rays are extremely reduced in number (Table 1). The caudal skeleton probably changed through symmetrization and reduction of the fin-ray number. The caudal skeleton in the primitive genus *Psettodes*, as seen in perciform fishes, is simplified and symmetrized through fusion and loss of caudal elements: the urostyle is completely fused with one of the hypurals resulting in four bony plates; the uroneurals 1 and 2 and epural are lacking; the last neural and haemal spines are entirely fused with their centrum (Table 1; Fig. 4). The characters of the caudal region show various degree of development in symmetrization among flounders. The genus *Brachypleura*, which is sharply distinguishable from the Japanese citharids in the features of the caudal rays and caudal skeleton, is an intermediate form between Japanese citharids and the members of the families Paralichthyidae and Bothidae.

It is interesting that two groups of characters found in *Brachypleura*, primitive and specialized, fill gaps between the genus *Psettodes* and the genera *Citharoides* and *Lepidoblepharon*, and between the Japanese citharids and more specialized flounders.

Redefinition of the family Citharidae

Amaoka (1969) defined the family Citharidae on the basis of osteological features which are transitional between those of the family Psettodidae and of the families Paralichthyidae and Bothidae. Certain important characters of the genus *Brachypleura*, however, were found to be different from those of the Japanese citharids. It might be necessary to erect a new subfamily or family for *Brachypleura*.

The genus *Brachypleura* however, is, treated here as a member of the family Citharidae by redefining the family. The revised characters of the family are summarized as follows: the urohyal is fan-like or fishhook-like, in the latter case the tip of the sciatic part extends to the posterior one third of the main part; the first interhaemal spine is enlarged for supporting some anterior interhaemal spines, or not enlarged; the exoccipital is articulated to the prootic or not articulated, and if articulated, the opisthotic is separated from the basioccipital; the infraorbital bones on the ocular side are scaly nodules, or absent, those on the blind side are five in number, or absent; the caudal fin rays are 21–23 in total number, of these 13–15 branched: the urostyle is fused with the hypural, or not fused; the last haemal spine is fused with the centrum, or not fused; the hypurals are plate-like, four or six in number; uroneurals 1 and 2 are present or absent; the epural is present.

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Literature cited

Amaoka, K. 1969. Studies on the sinistral flounders found in the waters around Japan. —Taxonomy, anatomy and phylogeny—. J. Shimonoseki Univ. Fish., 18(2) : 65–340, figs. 1–131.

Bloch, M. E. and J. G. Schneider. 1801. Systema ichthyologiae iconibus CX illustratus. Berolini, lx+584 pp.

Chabanaud, P. 1933. Contribution à l'ostéologie comparative des poissons, principalement des téléostéens hétérosomes. Bull. Soc. Zool. France, 58 : 140–168, figs. 1–21, pl. 1.

Gosline, W. A. 1961. Some osteological features of modern lower teleostean fishes. Smithsonian Misc. Collections, 142(3) : 1–42, figs. 1–8.

Günther, A. 1862. Catalogue of the fishes in the British Museum. 4. Brit. Mus. Nat. Hist., London, xxi+534 pp.

Hubbs, C. L. 1915. Flounders and soles from Japan collected by the United States Bureau of Fisheries Steamer "Albatross" in 1906. Proc. U. S. Nat. Mus., 48(2082) : 449–496, pls. 25–27.

Hubbs, C. L. 1945. Phylogenetic position of the Citharidae, a family of flatfishes. Misc. Publ. Mus. Zool., Univ. Michigan, (63) : 1–33, fig. 1.

Hubbs, C. L. 1946. Pertinence of the East Indian heterosomate fish genus *Lepidoblepharon* to the Citharidae. Copeia, 1946(2) : 97.

Katayama, M. 1959. Studies on the serranid fishes of Japan. (1). Bull. Fac. Edu., Yamaguchi Univ., 8(2) : 103–180, figs. 1–39.

Norman, J. R. 1934. A systematic monograph of the flatfishes (Heterosomata). 1, Psettodidae, Bothidae, Pleuronectidae. Brit. Mus. Nat. Hist., London, 459 pp., 317 figs.

Regan, C. T. 1910. The origin and evolution of the teleostean fishes of the order Heterosomata. Ann. Mag. Nat. Hist., (8)6 : 484–496, figs. 1–3.

Temminck, C. J. and H. Schlegel. 1842–1847. Pisces. Siebold's Fauna Japonica. Suppl. pl. A. Leiden, 323 pp., 143 pls.

Weber, M. 1913. Die Fische der Siboga-Expedition. Leiden, xii+710 pp., 123 figs., 12 pls.

(Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University, Hakodate, Hokkaido, Japan)

Brachypleura novaezeelandiae (コケビラメ科) の骨格と類縁関係

尼岡 邦夫

Citharus, Citharoides (コケビラメ属), *Paracitharus, Brachypleura*, および *Lepidoblepharon*(ウロコガレイ属) の5属の種類は最も原始的なボウズガレイ属のものと典型的なヒラメ・カレイ類との間の移行群であるとみなされ，コケビラメ科 (Citharidae) に含められている．日本産のコケビラメとウロコガレイをボウズガレイおよびヒラメ科，ダルマガレイ科のものと比較解剖することによってもこのことは支持されている．南支那海から得られたこの科の *Brachypleura novaezeelandiae* の類縁関係を明らかにするためにその骨格を調べ，日本産の2種と比較検討した．その結果，ほとんどすべての形質において日本産の種類と良く一致しているが，いくつかの形質では著しく違っている．それら違っている形質の中に日本産の2種と比較して原始性と特化性を示す2つの方向が認められる．前者は主として臀鰭と腹鰭に関係した骨格に認められ，これらの鰭は背鰭と共に前進化と関係して相称化へと進んでいる．後者は尾鰭とそれを支える骨格に関係し，それら自身の相称化に進んでいる．これらはヒラメ類全体の進化の方向からみた場合，いずれの形質もこの類の特殊な遊泳方法と関係した左右(背腹)相称化の過程として考えられる．これらの原始性と特化性の形質も含めてすべての形質から判断した場合，この種はやはりコケビラメ科に属すると考えられる．この種を含めたコケビラメ科の新しい定義を試みた．

(北海道函館市港町 3-1-1 北海道大学水産学部水産動物学教室)