Japan. J. Ichthyol.
41(1): 76–79, 1994

魚類学雑誌
41(1): 76–79, 1994

Body Anomalies due to Spinal Curvature in Two Species of Snappers *Lutjanus stellatus* and *L. russelli* from the Coast off Miyazaki, Southern Japan

Makoto Endo,[1] Kazuhiko Uehara[2] and Yukio Iwatsuki[1]

[1] Department of Animal Science, Faculty of Agriculture, Miyazaki University, 1–1 Gakuen-kibanadai-nishi, Miyazaki 889–21, Japan
[2] Osaka Freshwater Fisheries Station, 10–4 Koyamotomachi, Neyagawa, Osaka 572, Japan

(*Received January 10, 1994; in revised form February 25, 1994; accepted March 11, 1994*)

There have been numerous reports of body anomalies in fishes caused by various factors, including hereditary factors, unsuitable environmental conditions for embryo and larval development, pollutants, nutritional deficiencies, physical shocks, and infectious agents (Ferguson, 1989; Roberts and Bullock, 1989; Sindermann, 1990; Schäperclaus, 1992). In wild fishes, the visible anomalies are usually encountered through fishery activities, angling, and scientific studies, and they are also used as indicators of water pollution, because of their high incidence in polluted areas (Bengtsson, 1979). For this latter reasons, many surveys have focused on anomalies related to water pollutions (Slooff, 1982; Möller, 1983; Matsusato, 1986; Kimura, 1988; Loganathan et al., 1989). However, few scientific studies have dealt with body anomalies as a natural phenomenon in a biological context, particularly in Japan (Tsuda and Nakata, 1940; Komada and Moyer, 1983; Matsusato, 1986).

The grossly anomalous snappers reported in this study were found during a basic biological and faunal study on snappers in the coast of suthern Miyazaki, Japan (Iwatsuki et al., 1992). This report describes their rate of occurrence, gross and histological signs, and pathogeneses.

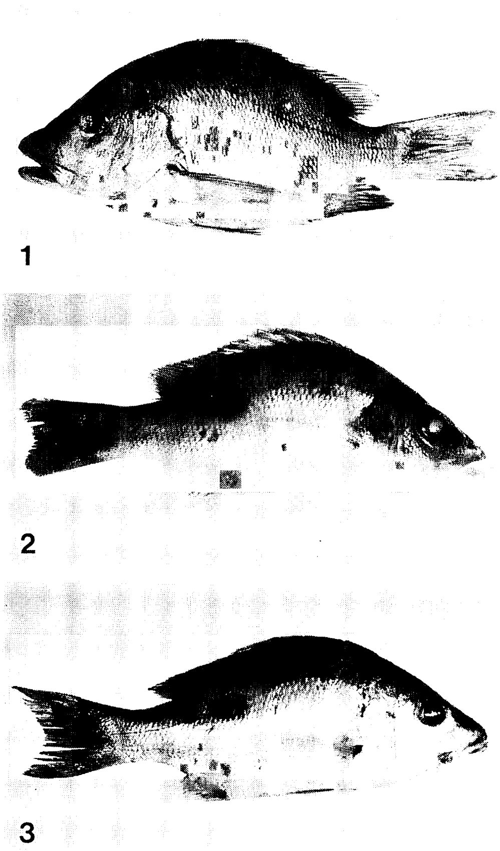
Materials and Methods

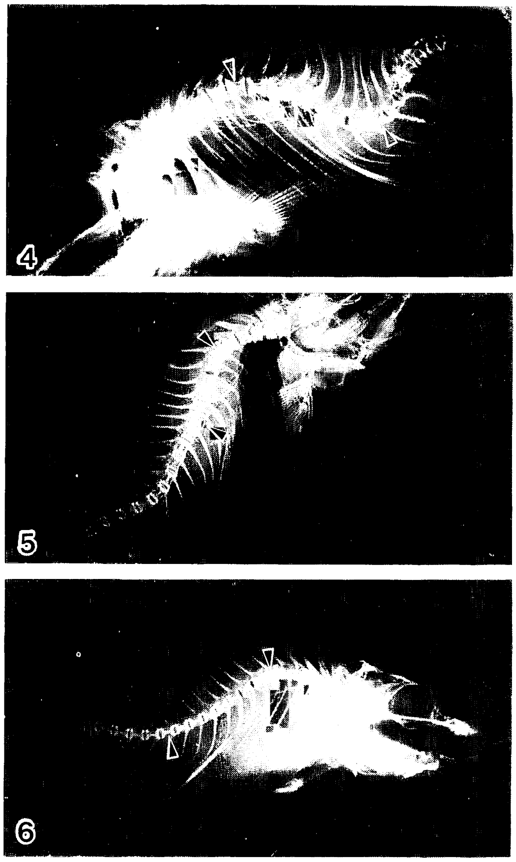
During January to December 1990, 169 specimens of *Lutjanus stellatus* and 408 specimens of *L. russelli* were primarily caught by set-nets and unloaded in Meitsu fish market of the Nango Fisheries Cooperative Association of Miyazaki under our confirmation. Three body anomalous specimens, one *L. stellatus* (body weight [BW] 1,442 g, body length [BL] 280 mm) and two *L. russelli* (specimen No. 1: BW 423 g, BL 220 mm; specimen No. 2: BW 74 g, BL 136 mm), were collected from the end of September to the beginning of October, the most active fishing season for snappers in the Miyazaki coast area. They were first studied by soft X-ray photograph, and fixed in 10% formalin. Their brains and spinal columns were dehydrated, embedded in paraffin, serially sectioned, and stained by hematoxylin-eosin or PAS-alcian blue using standard procedures. In addition, the brains of 20 normal *L. stellatus* (BL 147–382 mm) and 45 normal *L. russelli* (BL 142–440 mm) were also subjected to the histological examination for the etiological comparison.

Results

Anomalous *Lutjanus stellatus* showed serious body heightening and tail shortening (Fig. 1), whereas slightly shortened tails were noticed in both the specimens of *L. russelli* (Figs. 2 and 3). In soft X-ray survey, all the fish had kypho-lordotic spinal columns (Figs. 4, 5 and 6). The degrees of their spinal curvatures corresponded to the body anomalies. Their kypholordosis consisted of double major curves; the former kyphotic curves beginning from 2nd–3rd and lasting 11th vertebrae, and the later lordotic curves extending from 15th–17th to 20th–22nd vertebrae. The curved columns had wedge-shaped centra to some extents. However, there was no fusion, fracture, dislocation, or twisting of the vertebrae. In histological observation of the curved spinal columns, the wedging of the centra compressed the ligaments interposed between the centra, causing the ligaments to protrude into the notochord side (Fig. 7). The protruded ligaments were covered with a small amount of mucus. However, there were no pathological changes in the ossific tissues and their adjacent tissues. The same histological appearances were seen between *L. stellatus* and *L. ruselli*.

In each of the anomalous specimens, myxosporean cysts were invariably distributed around the 4th ventricles of the brain (Figs. 8 and 9), although they were also evident throughout the brain. In contrast, none of the normal fish possessd brain cysts. Mild fibroplastic reaction occurred to surround the cysts. The myxosporean was oval shaped, and had two valves and two polar capsules (Fig. 10).





Figs. 1, 2 and 3. Anomalous *Lutjanus stellatus* and *L. russelli* (specimen No. 1 and 2) showing body heightening and tail shortening. The anomaly is serious in *L. stellatus*, whereas No.1 and No. 2 of *L. russelli* exhibit the slight anomalies.

Figs. 4, 5 and 6. Soft X-ray photos showing spinal curvature of *Lutjanus stellatus* and *L. russelli* (specimen No. 1 and 2). Two major kyphotic and lordotic curves consist their spinal curvature. Arrows show wedge-shaped centra.

Discussion

Soft X-ray survey revealed that the spinal curvature brings about the body anomalies of the snappers. In farmed and wild fishes, it has been known that myxosporean infection in the brain causes the spinal curvature (Egusa, 1985; Langdon, 1987; Sakaguchi et al., 1987; Rothwell and Langdon, 1990; Maeno et al., 1990; Lom et al., 1991). According to Sakaguchi et al. (1987), the myxosporean cysts formed around the 4th ventricle compress the surrounding nervous tissues, leading the spinal curvature neurogeously. Because the myxosporean cysts were invariably distributed around the 4th ventricles in all the anomalous snappers, they are suspected as the primary cause in the spinal curvature. In the Japanese inshore areas, it has been known that *Myxobolus buri* and *M. spinacurvatura* belonging to myxosporea cause the spinal curvature in various marine fishes (Maeno and Sorimachi, 1992).

In the Meitsu fish market, 577 snappers were landed through 1990. The three anomalous specimens constituted around 0.5% of the total catch landed. In Australia, it has been reported that the finding rate of body anomalies due to the myxosporean infection in wild redfin perch, *Perca fluviatilis*, sampled by linefishing reached on incidence of over 4% (Langdon, 1987). On the other hand, the incidence of body anomalies among snappers is higher than a survey in the other area of Japan, which has reported 0.06% as the average rate in about 50 species (Matsusato, 1986). The myxosproean para-

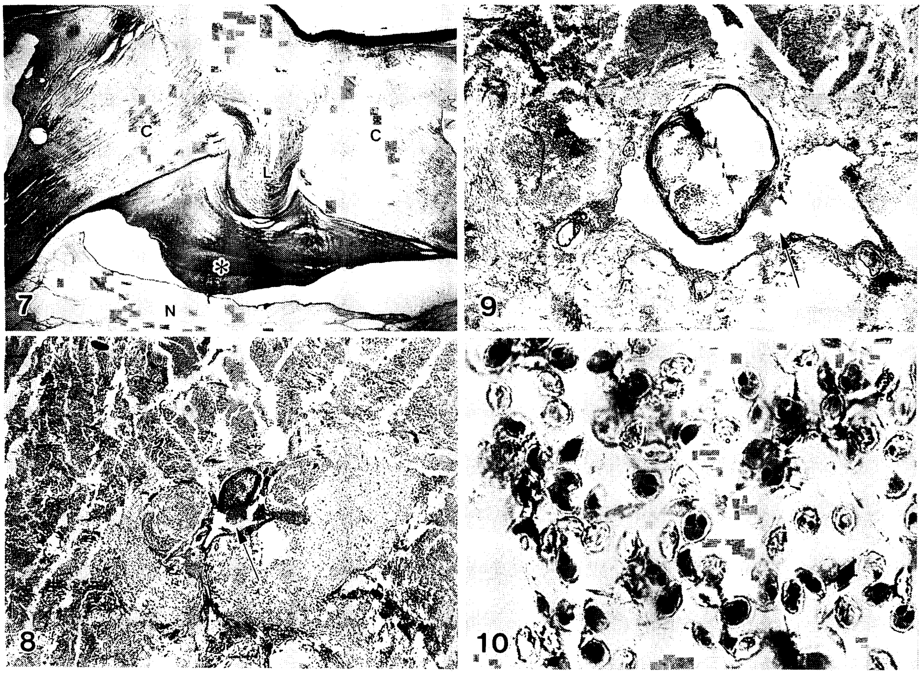


Fig. 7. A histology of wedge-shaped vertebrae and the interposed ligament in the spinal curvature of *Lutjanus stellatus.* Mucus (*) covers the ligament protruding into notochord side, although there is no change in the ossific tissue. (*C*—centrum, *L*—ligament, *N*—notochord). PAS-alcian blue stain. ×75.

Fig. 8. A myxosporean cyst seen around 4th ventricle (→) in the brain of *Lutjanus russelli* (specimen No. 1). H-E stain. ×75.

Fig. 9. A myxosporean cyst located in the 4th ventricle (→) in the brain of *Lutjanus stellatus.* H-E stain. ×750.

Fig. 10. The cyst seen in 4th ventricle contains many myxosporeans with oval-shapes, two valves and two capsules. ×1,750.

sitism may influence the incidence of the anomalies of snappers in the coast off Miyazaki.

Literature Cited

Bengtsson, B.-E. 1979. Biological variables, especially skeletal deformities in fish, for monitoring marine pollution. Phil. Trans. R. Soc. London, B., 286: 457–464.

Egusa, S. 1985. *Myxobolus buri* sp. n. (Myxosporea: Bivalvulida) parastic in the brain of *Seriola quinqueradiata* Temminck et Schlegel. Fish Pathol., 19: 239-244.

Ferguson, H. W. 1989. Systemic pathology of fish. A text and atlas of comparative tissue responses in diseases of teleosts. Iowa State Univ. Press., Iowa. 263 pp.

Iwatsuki, Y., A. Nakamura, K. Okabe, K. Hirano and M. Akazaki. 1992. Lutjanid and caesionid fishes in the superfamily Lutjanoidea from Miyazaki prefecture, southern Japan. Bull. Fac. Agr., Miyazaki Univ., 38: 91–98.

Kimura, I. 1988. Aquatic problems in Japan. Aquat. Toxicol., 11: 287–301.

Komada, N. and J. T. Moyer. 1983. Spinal curvature in carangid fish *Seriola aureovittata* from Miyake-jima, Japan. Japan. J. Ichthyol., 30: 313–317.

Langdon, J. S. 1987. Spinal curvatures and an encephalotropic myxosporean, *Triangula percae* sp. nov. (Myxozoa: Ortholineidae), enzootic in redfin perch *Perca fluviatilis* L., in Australia. J. Fish Dis., 10: 425–434.

Loganathan, B. G., S. Tanabe, R. Tatsukawa, K. Ogawa and M. Goto. 1989. Temporal changes of morphologic abnormalities and parasitic infestation in fishes from the river Nagaragawa, Japan. Nippon Suisan Gakkaishi, 55: 769–774.

Lom, J., A. W. Pike and I. Dykova. 1991. *Myxobolus sandrae* Reuss, 1906, the agent of vertebral column deformities of perch *Perca fluviatilis* in northeast Scotland. Dis. Aquat. Org., 12: 49–53.

Maeno, Y. and M. Sorimachi. 1992. Skeletal abnormalities of fishes caused by parasitism of myxosporea. NOAA Tech. Rep. NMFS Circ., 111: 113–118.

Maeno, Y., M. Sorimachi, K. Ogawa and S. Egusa. 1990. *Myxobolus spinacurvatura* sp.n. (Myxosporea: Bilvalvulida) parasitic in deformed mullet, *Mugill cephalus*. Fish Pathol., 25: 37–41. (In Japanese with English abstract.)

Matsusato, T. 1986. Studies on the skeletal anomaly of fishes. Bull Natl. Res. Inst. Aquacult., 10: 57–179. (In Japanese with English summary.)

Möller, H. 1983. High skeletal deformation rates of cod in the Elbe estuary. Bull. Eur. Ass. Fish. Path., 3: 7–8.

Roberts, R. J. and A. M. Bullock. 1989. Nutritional pathology. Pages 424–475 *in* J. E. Halver, ed. Fish Nutrition, 2nd ed. Academic Press, New York.

Rothwell, J. T. and J. S. Langdon. 1990. Spinal curvature associated with *Myxobolus* sp. cysts in the brain of sand-flathead (*Platycephalus bassensis* L.). J. Appl. Ichthyol., 6: 244–246.

Sakaguchi, S., T. Hara, T. Matsusato, T. Shibahara, Y. Yamagata, H. Kawai and Y. Maeno. 1987. Scoliosis of cultured yellowtail caused by parasitic *Myxobolus buri*. Bull. Natl. Inst. Aquacult., 12: 79–86. (In Japanese with Englisih abstract.)

Schäperclaus, W. 1992. Fish diseases, 5th ed. Fischkrankheiten, Akademie-Verlag. Berlin. 1398 pp.

Sindrermann, C. J. 1990. Principal diseases of marine fish and shellfish, Vol. 2, 2nd ed. Academic Press, New York. 516 pp.

Slooff, W. 1982. Skeletal anomalies in fish from polluted surface waters. Aqua. Toxicol., 2: 157–173.

Tsuda, M. and G. Nakata. 1940. Pughead of snakehead fish. Zool. Mag., 52: 251–254. (In Japanese.)

宮崎県下で見つかったフエダイ科魚類 2 種の体形異常

延東　真・上原一彦・岩槻幸雄

1990 年 1 月から 12 月にかけて，宮崎県南郷漁協目井津支所の魚市場においてフエダイ 196 尾，クロホシフエダイ 408 尾が水揚げされたのを確認した．その内，フエダイ 1 尾とクロホシフエダイ 2 尾に体形異常魚を発見し，それらの症状と原因について考察した．

体形異常魚はいずれも体高がやや高い，短躯症状を呈していた．脊柱の湾曲は後湾部と前湾部からなり，湾曲部の椎体は楔状化していたが，骨組織そのものには組織学的な異常はなかった．体形異常魚の脳の第 4 脳室周辺には必ず粘液胞子虫のシストが見つかった．一方，正常体形を示すフエダイ 20 尾とクロホシフエダイ 45 尾の脳には粘液胞子虫のシストを検出できなかった．第 4 脳室付近に形成された粘液胞子虫のシストが，魚類に脊柱湾曲を引き起こすことはすでに知られており，今回見つかったフエダイ科魚類 2 種の体形異常魚も，その原因が第 4 脳室付近に形成された粘液胞子虫のシストにあると推察された．

このフエダイ科魚類 2 種における体形異常の発生率は約 0.5% で，他の水域での過去の調査と比較して明らかに高かった．

(延東・岩槻：〒889-21 宮崎市学園木花台西 1-1　宮崎大学農学部動物生産学科；上原：〒572 大阪府寝屋川市木屋元町 10-4　大阪府立淡水魚試験場)