DOCUMENTATION OF THE CASE OF HYPEROSTOSIS IN THE SILVER BREAM, *Pagrus auratus* (FORSTER, 1801) SAMPLED FROM WATERS AROUND NEW ZEALAND

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ABSTRACT

In this study a case of hyperostosis was studied in teleost fish *Pagrus auratus* sampled from Bay of Plenty and the North Eastern coast of New Zealand. New characteristics of the hyperostosis (position and shape) were added to those previously given for the species *Pagrus auratus*. The hyperostosis was found in the neural spine of the sixth caudal vertebra and the haemal spine of the sixth, seventh, and eighth caudal vertebrae. The present study showed that shape of hyperostosis in the silver bream could be irregular-spherical, spherical, elongated, pear-shaped, and elongated pear-shaped.

Keywords: bone cell growth; neural and haemal spines; Leigh, vertebral column

RELATO DE HIPEROSTOSE EM *Pagrus auratus* (FORSTER, 1801) NA COSTA DA NOVA ZELÂNDIA

RESUMO

Foi relatado um caso de hiperostose no peixe teleósteo, *Pagrus auratus,* capturado na Baía de Plenty e costa nordeste da Nova Zelândia. Foram descritas novas características de hiperostose (posição e forma) para a espécie. A hiperostose foi encontrada no espinho neural da sexta vértebra caudal e no espinho hemal da sexta, sétima e oitava vértebras caudais. O presente estudo mostrou que a forma de hiperostose no *P. auratus* pode ser irregular-esférica, esférica, alongada, em forma de pera e pera alongada.

Palavras-chave: crescimento de células ósseas; espinhos neurais e hemais; coluna vertebral

Case Report/Relato de Caso: Recebido em 21/11/2014 – Aprovado em 05/10/2015

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INTRODUCTION

The constructive changes that happened to the bone tissue and which are distinguished by increase of the periosteal ossification with response to bony tissue are called hyperostosis (MEUNIER *et al*., 2010) and Worn, in 1655 (*apud* SCHLÜTER *et al*., 1992) named them as "*os vormianum*". Latter, in 1881 VAN BENEDEN described hyperostosis in fish bones as a "corps énigmatiques" (*apud* SCHLÜTER *et al*., 1992), and in 1982, it was designated by GRABDA (1982) as "like cystic growths". This change in bone tissue happens in specific thick bones, which develops into a swollen structure. Pterygiophores, skulls, and haemal, and neural spines are among bony elements that have shown hyperostosis in teleost fishes (SMITH-VANIZ *et al*., 1995).

A wide range of fish species belonging to about 22 families were indicated to have hyperostotic bony elements (see SMITH-VANIZ *et al*., 1995; MEUNIER *et al*., 1999; BÉAREZ *et al*., 2005; SMITH-VANIZ and CARPENTER, 2007; RAPISARDA *et al*., 2008; MEUNIER *et al*., 2010; GIARRATANA *et al*., 2012).

GAULDIE and CZOCHANSKÁ (1990) reported the case of hyperostosis in silver bream is considered the only study that document this case of bony tissue growth in this species and MATIC-SKOKO and FERRI (2009) detected in another sparid species, *Dentex dentex* from the Adriatic Sea. However, hyperostosis is known to the public in New Zealand as "Tilly Bone" and several specimens were captured having this case, but it is poorly documented. Hyperostosis is known from different fish species and from countries other than New Zealand (see SMITH-VANIZ *et al*. (1995), for species and localities). Recently, JAWAD (2013) recorded the presence of hyperostotic bone elements in *Drepane longimana*, *Platax teira,* and *Pomadasys stridens* collected from the Sea of Oman. JAWAD and BANNAI (2014) reported this case from *Platax teira* sampled from the Arabian Gulf coasts of Iraq.

YASUDA and MIZUGUCHI (1969) reported hyperostotic bone in the haemal spine of the 6th, 7th and 8th caudal vertebrae. On the other hand, GAULDIE and CZOCHANSKÁ (1990) reported the presence of hyperostotic bone in the haemal spine of the 6th and 7th caudal vertebrae. In this study, the gross morphology of the hyperostotic bones in the silver bream, *Pagrus auratus* is described from the same regions that YASUDA and MIZUGUCHI (1969) have reported from the neural spine of the 6th caudal vertebra. The neural spine position for hyperostotic bone is new for the silver bream, *P. auratus*. In addition to the measurement of the hyperostotic bones, which is considered new to report, the neural spine position of hyperostotic bone is considered another new information of hyperostotic bones in *P. auratus*.

MATERIAL AND METHODS

This study is based on two specimens, one (350 mm TL) (Figure 1) collected by the second and third authors from Bay of Plenty, Matakana Island (37°35′S 176°05′E) using long line on 16th July 2014; the second specimen (520 mm TL) (Figure 2) was sampled by Leigh Fisheries Company from off the north east coast of New Zealand (36°17′33″S, 174°48′13″E) with small trawler at depth of 20-60 m on March 2013. A normal specimen (420 mm TL) (Figure 3) was obtained from the same catch of the second specimen for morphological comparison. The vertebral column of the three specimens was obtained through boiling the fish and all the tissues were removed; then the vertebral column was dried at room temperature before labelling and storing. The skeletal deformities were documented, especially including the length of the major and minor axes of each deformity. All specimens were deposited in the fish collection of Auckland War Memorial (MA36702, for Bay of Plenty specimen, MA36703 for the abnormal specimen of north east coast of New Zealand, MA36704 for the normal specimen).

RESULTS AND DISCUSSION

The hyperostotic regions of the two species in question are present on the neural and haemal spines. In the specimen captured from Bay of Plenty, there is one hyperostotic neural spine of the 6th caudal vertebra and three hyperostotic haemal spines of the caudal vertebrae 7th-8th. The hyperostosis varies in size and shape on the spine

(Figure 1). The hyperostotic regions range in length between 6 and 11 mm and in width between 3 and 10 mm. The largest hyperostotic bone is that of the haemal spine of the seventh caudal vertebra and the smallest is that of the neural spine of the eighth caudal vertebra. The shapes are irregular-spherical, spherical and elongated pear-shaped, for the sixth, seventh and eighth caudal vertebrae respectively. It is thin pear-shaped for that of the neural spine of the eighth vertebra. The hyperostotic region of the neural spine is situated in the top third part of the spine, while those found on the haemal spines of the sixth, seventh and eighth caudal vertebrae are located in the first third, middle and in the last third of the haemal spines respectively.

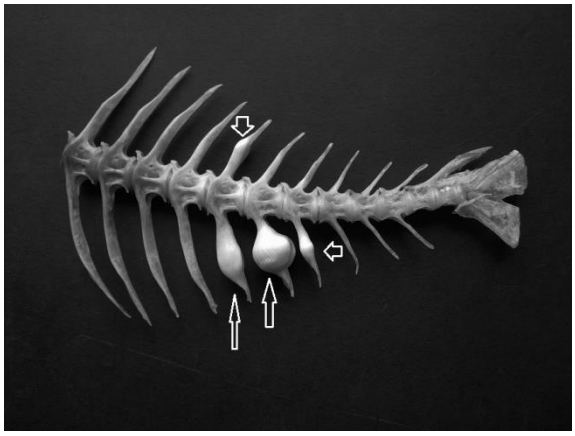

Figure 1. Vertebral column of *Pagrus auratus* (350 mm TL) with hyperostotic neural and haemal spines (arrows) of the caudal vertebrae.

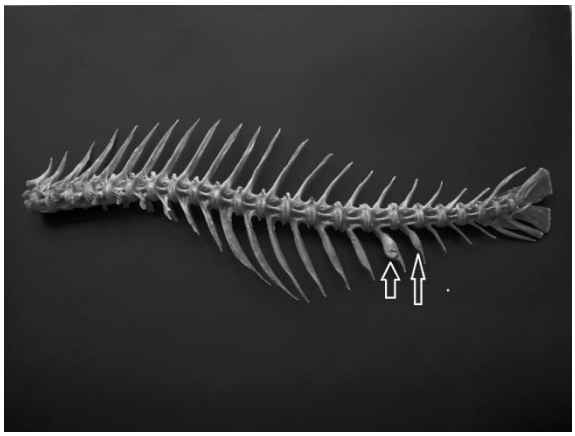

Figure 2. Vertebral column of *Pagrus auratus* (520 mm TL) with hyperostotic haemal spines (arrows) of the caudal vertebrae.

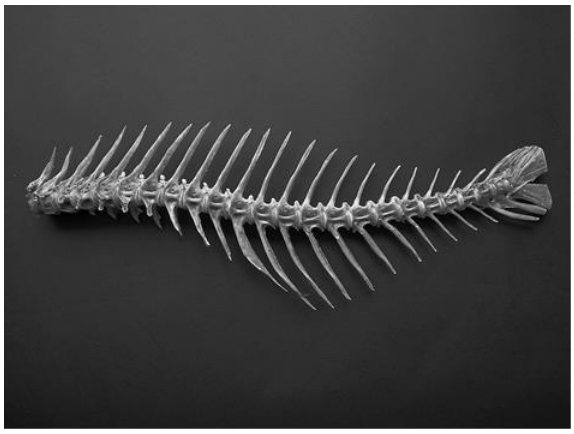

Figure 3. ***Vertebral column*** of normal *Pagrus auratus* (420 mm TL).

In the specimen captured from off the North East coast of New Zealand, the hyperostosis is present on the haemal spine of the sixth, seventh and eighth caudal vertebrae. Those of the sixth and eighth caudal vertebrae are elongated, while that of the seventh caudal vertebra is pear-shaped. The hyperostotic regions of the sixth and eighth caudal vertebrae are traversing nearly over all the surface of the haemal spine, while that of the seventh caudal vertebra is extending over the 2/3 of the length of the haemal spine. The hyperostotic regions range in length between 12 and 20 mm and 4 and 9 mm in width. Width wise, the hyperostotic region of the seventh vertebra is the largest, while that of the eighth caudal vertebra is the largest length wise (Figure 2). In both specimens of silver bream with hyperostosis the enlargement of the haemal spine of the 8th caudal vertebra is less than that of the 6th and 7th caudal vertebrae. This result in agreement with that of MATIC-SKOKO and FERRI (2009) on *Dentex dentex* from the Adriatic Sea in which the enlargement near the caudal fin was the smallest, but in contrary to that of, GAULDIE and CZOCHANSKÁ (1990) in which the farthest from the tail shows less enlargement.

In most fish species, SMITH-VANIZ *et al*. (1995) indicated that hyperostosis enlarges in mature individuals. Though, the present study shows two specimens with hyperostotic bone and with total length of 26 and 40% of the maximum total length reported for this species (RANDALL *et al*., 1990). GAULDIE and CZOCHANSKÁ (1990) stated that hyperostotic bones of the

snapper *Chrysophrys aurata* increased in size with fish size increment. Such a result is observed in the present study where the hyperostotic bones of the larger specimen (520 mm total length) is longer than the smaller specimen (350 mm total length), but the width of the two specimens does not follow such a relationship.

Hyperostosis is used by archaeologists and fish systematists as a diagnostic criterion and as a taxonomical tool, respectively. It has been reported from several groups of vertebrates (CAPASSO, 2005) and its presence and distribution in fishes were reported by SMITH-VANIZ *et al*. (1995). The size, shape, and position of the hyperostotic bones revealed in the two specimens of silver bream reported on herein are comparable with those given by GAULDIE and CZOCHANSKÁ (1990) and SMITH-VANIZ *et al*. (1995).

The results obtained in the present study add to those of GAULDIE and CZOCHANSKÁ (1990) a substantial information in regard of the position and shape of the hyperostosis. GAULDIE and CZOCHANSKÁ (1990) suggested that hyperostosis is usually found on the haemal spine of the seventh vertebra and in a rare case they found on sixth vertebra. The present work showed that hyperostosis case is present on the haemal spine of the sixth, seventh and eighth vertebrae. Also, it is found on the neural spine of the eighth vertebra (counting from the tail). As to the shape, these authors reported only the spherical shape, while the present study showed that shape of hyperostosis in the silver bream could be irregular-spherical, spherical, elongated, pear-shaped and elongated pear-shaped. The importance of the present study lies in the offered significant additions of information about the hyperostotic bones in the silver bream.

DESSE *et al*. (1981), GAULDIE and CZOCHANSKÁ (1990) and SMITH-VANIZ *et al*. (1995) have indicated that hyperostosis is considered as a non-pathological formation. The most acceptable reason to not consider hyperostosis as a pathological condition is that it is a species-specific characteristic.

In the present study, the hypothesis of CAPASSO (2005) in correlating fish length and weight with number of hyperostotic bones cannot be tested as only a single specimen from each region was obtained.

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