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STUDIES ON THE NEOPLASTIC GROWTH IN FISH *JOHNIUS DUSSUMIERI* (VALENCIENNES, 18883) DUE TO UNKNOWN ETIOLOGY

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ABSTRACT

The word tumor has often been used generally to signify any hump or swelling. But, scientifically the tumor is defined as new growth of cells which deviate from normal surrounding cells in shape, size, structure and organization. Fishes may also be susceptible to such tumourous growth like many other vertebrates especially the mammals, as observed in the present studies.

The fishes were collected from different fish markets in Karachi. A total of 538 fishes specimens *Johnius dussumieri* (Valenciennes, 1833) were examined for neoplastic growth. Out of 538 fishes 50 were found with tumourous growth, in the epithelial and mesenchymal layers. The etiology and factors which could be responsible for tumour or neoplastic growth are, however, unknown. In gross pathology tumourous region is rich in connective tissue and the tumour considerably deforms and compresses the viscera due to its extensive growth. Here, the tumour was well demonstrated, separated from the surrounding organs but showed no sign of proliferation. No haemorrhage was observed on the tumour or in the organs. The macroscopic appearance of their surface was smooth. Histopathologically, the tumour showed malpighian cells, atrophied cells, hyperplasia and fibrosis with eosinophilia and inflammatory cells infiltration.

KEY WORDS: Histology, Neoplastic growth, Fish, Unknown etiology, Malpighian cells, Hyperplasia.

INTRODUCTION

Fishes have economic value all over the world. Marine fishes are important source of protein and organic products without deposition of cholesterol. Fishes are highly valueable because of their delicious taste. Doctors suggest fish meat to the patients suffering from hypertension and heart disease. Fish meat may become affected by various pathogens like viruses, bacteria, parasites and also by neoplastic growth. In recent medical terminology, a tumour is defined as neoplasm and cancer and is often used in an alternative way. Generally, the term cancer refers as a malignant disease in which the cancer, unless safe by medical treatment, has the capacity to infiltrate and disseminate throughout the body (metastasize), finally killing the host. The neoplasia defined (the disease process) and neoplasm (a tumour), include both the malignant and non-malignant (benign) forms of the disease. The term neoplasia are defined by their "an abnormal growth of cells, which by proliferation, press upon, infiltrate, healthy tissues, thereby damaging of cells and organs and affecting the physiological functions, resulting ultimately in the death of an animal". In fish, as in mammals, neoplasm is recognized as a particular range of growth potentials from those that seems to be very-slow growing and localized, to that part and those are obviously infiltrate the host's tissues and are eventually recognized to be a cancerous (Black, 1984).

According to Robert (1978) known and suspected factors studied to tumour formation in fish include viruses, chemical or biological toxins, physical agents and immunological competence of the host.

Various fishes of Karachi coast have tumorous growth. Most of the general disease conditions that are reported in mammals, e.g. inflammation, wound repair, hemorrhage, necrosis, septicemia, atrophy, metaplasia, hyperplasia, and neoplasia, (Pathologically neoplasia is called tumour) are also present in fishes.

MATERIALS AND METHODS

Live as well as freshly killed specimens of *Johnius. dussumieri* were collected from various markets like Fisheries, West Wharf, Empress Market and other local Markets. Selection criterion of a specimen was to select older fish to optimize the possibility of finding neoplasms. A total of 538 fishes were dissected out of which 50were found to be suffering from neoplastic growth.

The selected tissues with neoplastic growth were fixed in 10% formalin for 24 hours, and then washed with graded series of alcohols. Tissues were then cleared by cedar wood oil by placing them for 6-12 hours, and then bath in xylene followed to remove excess oil.

After the removal of excess oil the tissue were embedded in paraffin wax (melting point 60%) for 24 hours, wax block were made and the sections were cut (6–8 microns thick) were stained to bring difference among the tissue components by staining later counter staining using haemotoxylin and eosin and mounting permanently in Canada balsam.

Photographs were taken with Nikon (Optiphot–2) photomicroscope and Fuji colour film was used. Selected photographs are presented here in support of observations.

OBSERVATIONS

Fish like other vertebrates are frequently affected by neoplastic proliferations. These are classified according to mammalian tumour classifications. Most commonly the skin neoplasia as papillomas, fibromas and fibrosarcomas are diagnosed. Few published cases of neoplasm include papillomas, squamous cells carcinomas, fibromas, chondromas and branchiocarcinomas. (Martineau and Ferguson, 2006, Thatcher and Varella 1980, Wildgoose, 1992, Wildgoose and Bucke, 1995).

Specimen of *J. dussumieri* (Valenciennes, 1833) brought to the Parasitology Laboratory, Department of Zoology University of Karachi with obvious enlarged abdomen (Fig. 1). Autopsy revealed a large rounded and greyish tumour growing from visceral mesentries (Figs. 2-3). They occur in the lower edge of the operculum and the ventral edge of the body near the anus, this kind of tumour has not been observed in any other part of the body. Tumour region is rich in connective tissue and the tumour considerably deformed and compressed the viscera due to the extensive growth of tumour. The tumour was well demonstrated, separated from the surrounding organs and showed no sign of proliferation. No haemorrhage was observed on the tumour or on the organs.

There were two basic component of the tumour structure: epithelial and mesenchymal. The prevailing epithelial components were at different stages of development. Besides the comparatively well developed and regular structure of tubules, glandular formations at a lower degree of differentiation were seen with the development of small cyst and adenopapillary formations passing into mesenchymal formations.

The macroscopic appearances of their surface were smooth. The larger tumours were folded at the surface which corresponded, to their papillomatous characteristics a lobed branching stroma supported by collagen covered by hyperplastic epidermal tissue (Fig. 3).

In the epidermal parts high prismatic basal cells prevailed (Fig. 4). All the three layers were packed close together with the intermediate layer showing significant loss of intarcellular contact (Fig. 5). In the later situation the formation of numerous intercellular spaces gives the tissue a spongy appearance (Figs. 6-7). While the tumour cells in close contact with each other resemble the malpighian cells of normal epidermis (Fig. 8). The cells of spongy regions are greatly altered (Figs. 9-10).

As tumour development progresses some of the surrounding cells show absolutely no division activity from the greatest part of the epidermal tumour tissue, but they remain separated from each other from the basal lamina and from the external tumour surface by filament containing the tumour cells of malpighian character (envelope cells) (Fig. 11). As tumour increases in size, increasing numbers of the epidermal tumour cells of malpighian character change into rounded to oval voluminous cells as observed earlier. (Brook *et al*., 1969) (Fig. 12).

Numerous strongly contrasting particles of various shapes and sizes are conspicuous. Inflammatory cells also appeared in the connective tissue of nodules along with undifferentiated mesenchymal cells and fibrosis other than fibroblasts (Fig. 13) are prevalent similar to the finding of (Peters *et al*., 1978) cells containing eosinophilic granules were also a component tumours (Vicha and Schmale, 1994) (Fig. 14)

DISCUSSION

To date three kinds of skin papillomatic growth have been observed. These can clearly be distinguished structurally as:

1. Flat (Fish pox) like growth with low connective tissue content.
2. Prominent growths with distinct collagen rich stroma and
3. Complex papillomas, the epidermal portion of which is composed of a characteristic arrangement of a rounded cells and smaller cells of malpighian character (envelope cells) in between.

The first two types correspond to the widely distributed kinds of simple fish papilloma are composed purely of cells of Malpighian character.

Substantial evidence indicates that the structural differences of the three types depend much less on the difference in the reaction patterns of the species involved than on the kind and method in which the tumours causing stimuli operates. The first type of tumour is found both in the dab and in the plaice. The second type appears in various Atlantic and pacific species, forming in the same manner. The complex type-3 seems to be limited to pacific specices although a series of genera with closely related species occurs in the both oceans (Peters and Watermann, 1979).

Type-1 and type-2 tumours are most of the time observed in flat fishes of both Atlantic and Pacific oceans. But in Arabian ocean type-3 tumour was observed in *J. dussumeri*.

It is of concerns regarding the reason for the cause of the tumour in this fish, and one of the reasons could be tumour in the prevalence of trematode infection which leads to the biochemical change which in turn originate the tumour or the other possibility could be the pollutants in water responsible for such type of growth in water as reported earlier by Dethlefsen (1978) for fish pox growth in most of fishes.

In Arabian Sea this type of growth have been observed in *J. dussumeri* while this type of growth was also observed in fishes of Japanese coastal water, in Pacific and Atlantic coast.

It can thus be concluded that the trematodes along with the pollutants in the water were responsible for promoting tumours. It is difficult to suggest that either of the two were solely responsible for promoting tumour development in *J. dussumieri*.

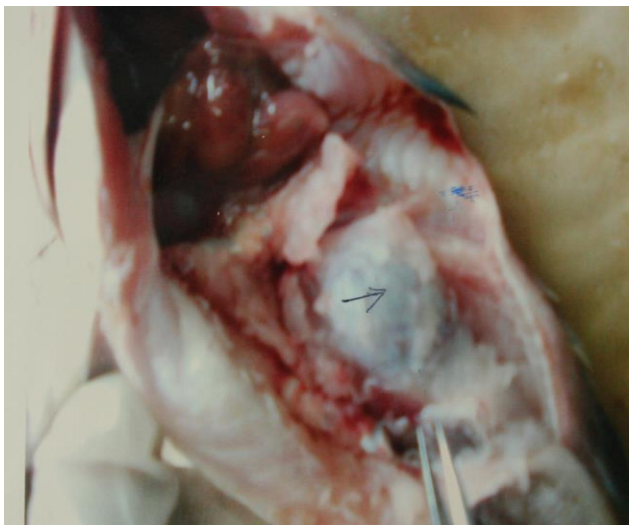

Fig. 1. Specimen of *Johnius dussumieri* (Valenciennes, 1833) with enlarged abdominal region, inflammated fins and one of the specimens with prominent tumourous growth.

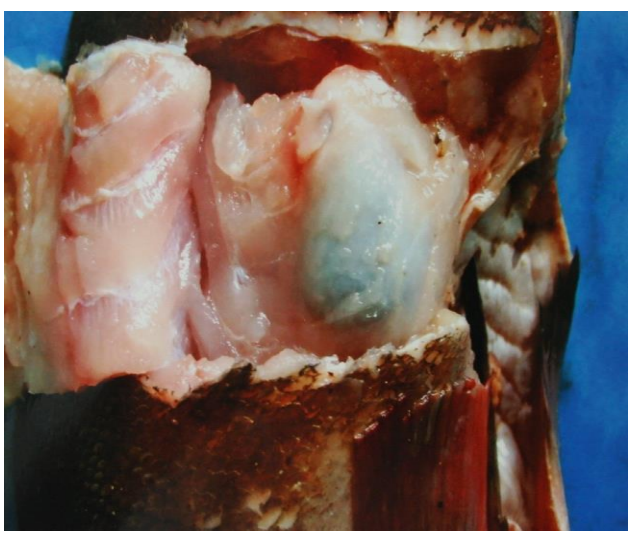

Fig. 2. Autopsied specimen showing rounded, enlarged and greyish tumour.

Fig. 3. One of the specimens with tumour growing near pelvic region.

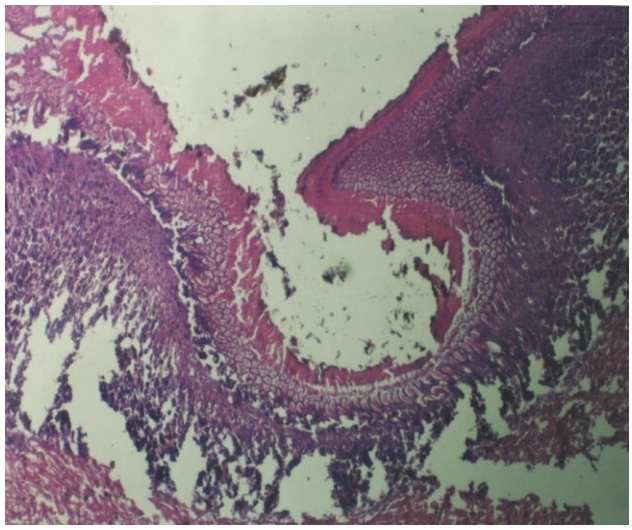

Fig. 4. Photomicrograph of tumour section showing stroma on outer surface and under layers showing neoplastic cells along with inflammatory cells; X20.

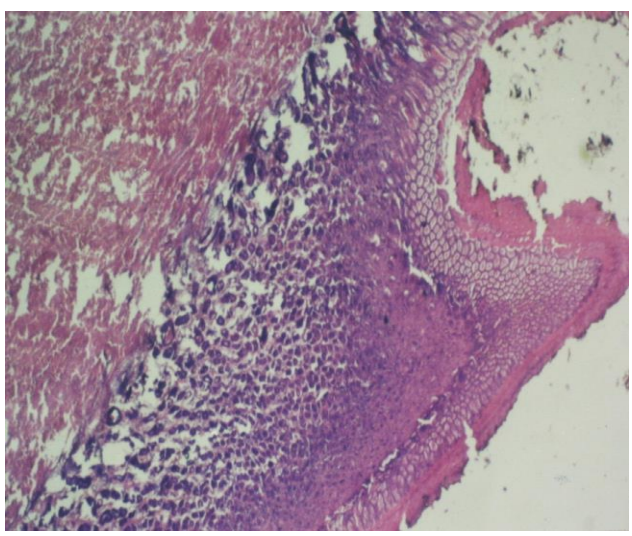

Fig. 5. Photomicrograph shows atrophied under layers of a portion of tumour; X50.

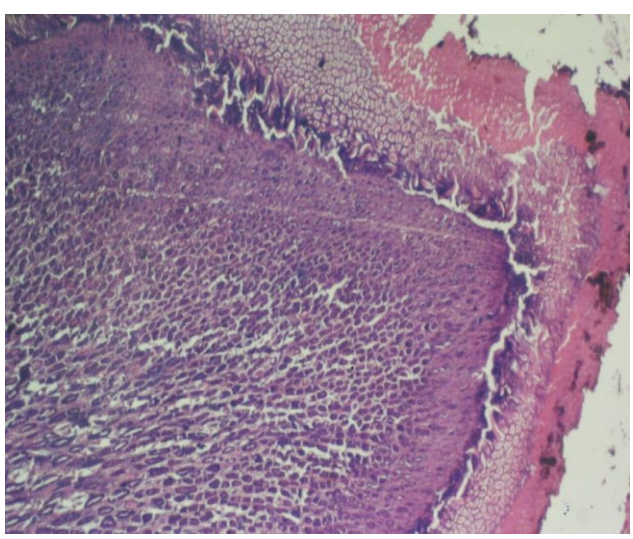

Fig. 6. Photomicrographs shows the under layers with spongy appearance; X100.

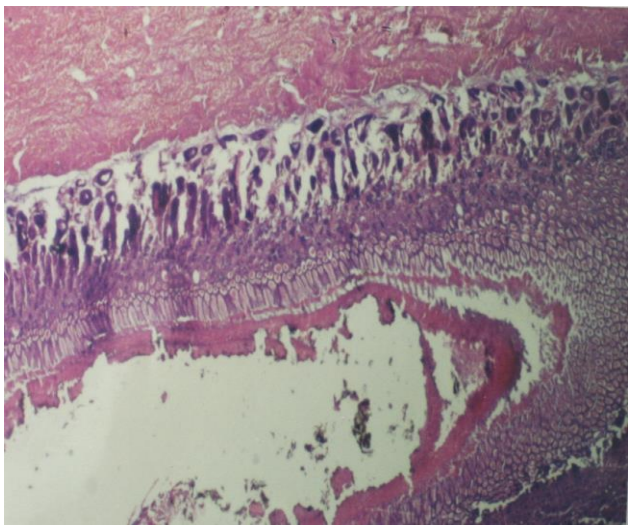

Fig. 7. The under layers of tumour collar region shows inter spaces between the cells; X100.

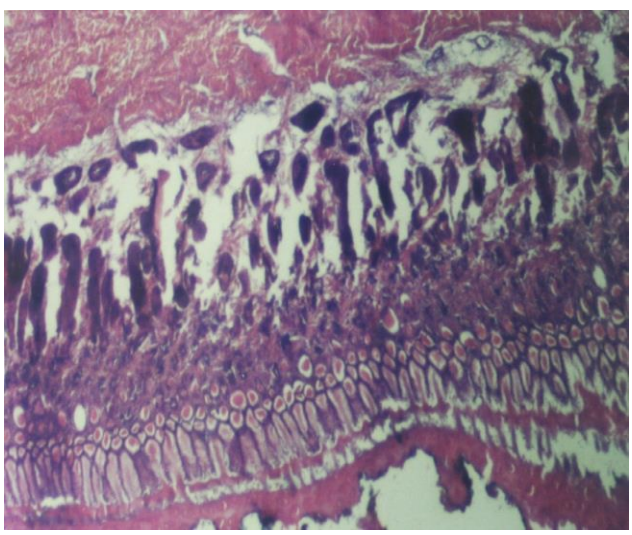

Fig. 8. Photomicrograph shows malpighian cells; X200.

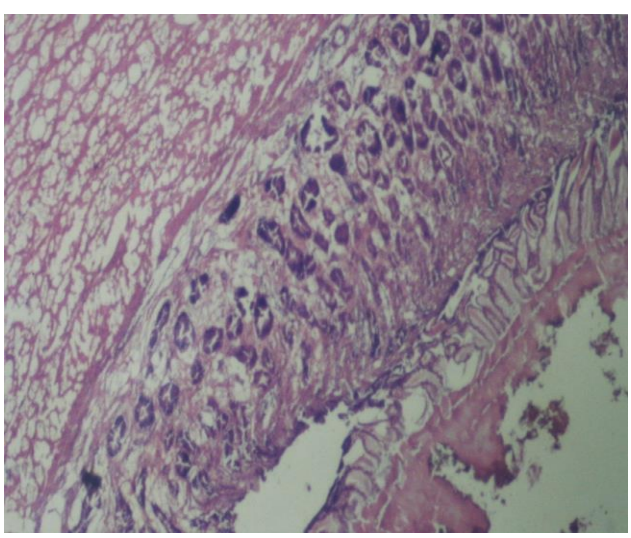

Fig. 9. Photomicrographs shows cells deviated in shape, size, structure and organization from the normal epithelial and mesenchymal cells; X200.

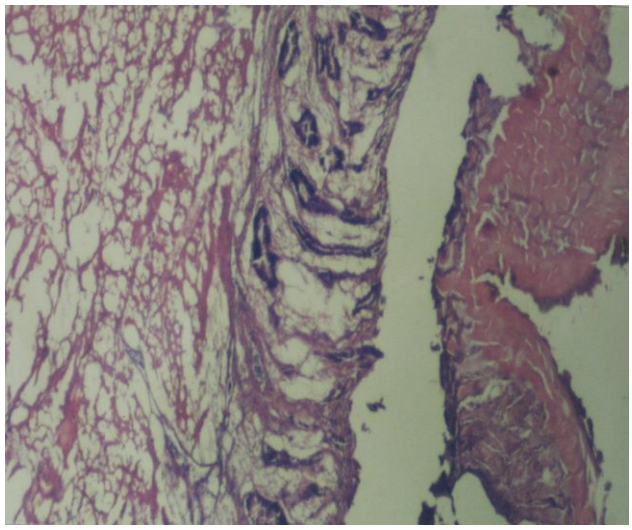

Fig. 10. Photomicrograph shows the portion of tumour section with cell converted into unidentifiable cells; X200.

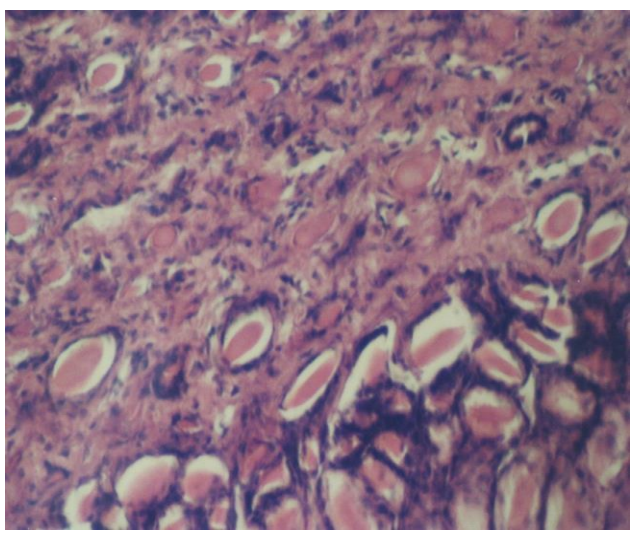

Fig. 11. Portion of tumour section showing malpighian cell and inflammatory cells; X200.

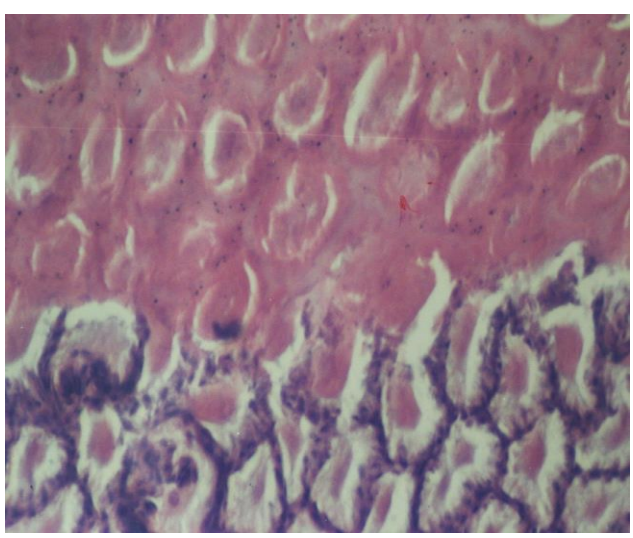

Fig. 12. Photomicrographs shows malpighian cells converted into rounded oval enlarged cells (arrow); X200.

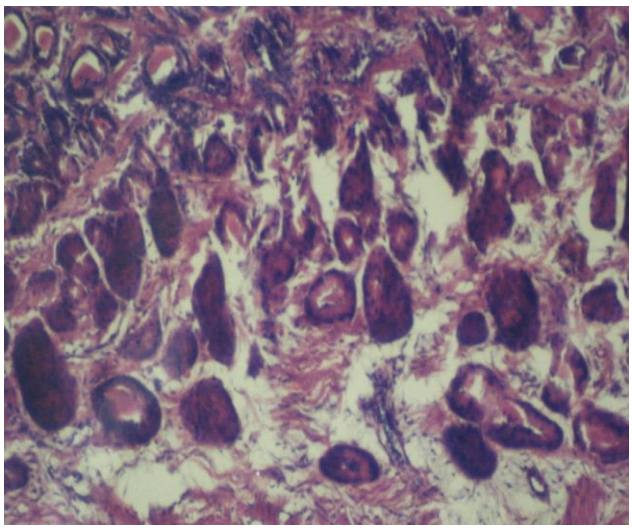

Fig. 13. Section of tumour portion showing cells of various shape along with fibrosis; X200.

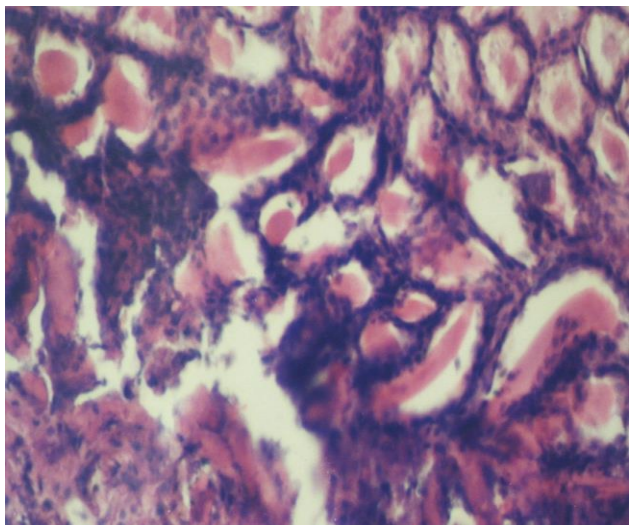

Fig. 14. Section of micrograph shows eosinophills, altered malpighian cells and atrophied cells of connective tissue; X200.

References

Black, J.J. (1984). Aquatic animal neoplasia as an indicator for carcinogenic hazards to man. In: Hazard assessment of chemicals-current developments. (Ed.): J. Saxena. Academic Press Inc. New York. pp. 181-232.

Brooks, R.E., G.E. McAm and S.R. Wellings. (1969). Ultra- structural observations on an unidentified cell type found in epidermal tumours of flounders. *J. Natn. Cancer Inst*., 43: 97-109.

Dethlefsen, V. (1978). Occurrence and abundance of some skeletal deformities, diseases and parasites of major fish species in dumping areas off the German Coast. Coun. Meet. int. Coun. Explor. Sea (= C.M. - I.C.E.S.), E: 8

Martineau, D. and H.W. Ferguson. (2006). Neoplasia. In: Systemic Pathology of Fish, ed. Ferguson, H.W. 2nd ed., pp. 313-335. Scotian Press, London, UK.

Peters, N. and B. Watermann. (1979). Three Types of Skin Papillomas of Flatfishes and Their Causes. Mar. Ecol. Prog. Ser., 1: 269-276.

Peters, N., G. Peters, H.F. Stich, A.B. Acton and G. Bresching. (1978). On differences in skin tumours of Pacific and Atlantic flatfish. *J. Fish Diseases*, 1: 3-25.

Robert, R.J. (1978). Fish pathology. Balliere Tindall London.

Thatcher, V.E. and A.B. Varella. (1980). Fish pathology of the Brazilian Amazon. *Acta Amazonica*, 10: 651-656.

Valenciennes, A., G.L. in Cuvier and A. Valenciennes. (1833). *Histarie Naturelle des poissons*. Paris: Levrault. Vol. 9512 pp. pls 246-279.

Vicha, D.L. and M.C. Schmale. (1994). Morphology and distribution of eoslnophilic granulocytes in damselfish neuroflbromatosis, a model of mast cell distribution in neurofibromatosis type 1. *Anticancer Res*., 14: 947.

Wildgoose, W.H. (1992). Papilloma and squamous cell carcinoma in koi carp (*Cyprinus carpio*). *Vet. Rec*., 130: 153-157.

Wildgoose, W.H. and D. Buckes. (1995). Spontaneous branchioblastoma in a koi carp (*Cyprinus carpio*). *Vet. Rec*., 136: 418-419.

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