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Variably Differentiating Oral Neoplasms, Ranging from Epidermal Papilloma to Odontogenic Ameloblastoma, in Cunners [*(Tautogolabrus adspersus)* Osteichthyes; Perciformes: Labridae]

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Five hundred cunners, *Tautogolabrus adspersus*, an omnivorous coastal fish ranging from Newfoundland to Virginia, were collected with rod and reel from the Sakonnet River at Portsmouth, Rhode Island, for a survey of their biology and food habits [22]. Nine (1.8%) of the specimens had abnormal growths protruding from the mouth. Four of the nine growths were examined histologically and all four were found to be neoplasms. Subsequently, three more cunners with oral protrusions were collected from the same area and histologically examined: two of the lesions were neoplastic and one was parasitic. The material from these seven cases has been accessioned into the permanent collection of the Registry of Tumors in Lower Animals (RTLA), The Smithsonian Institution, Washington, D.C.

Oral neoplasms have been recorded in 26 species of bony fish, usually manifested as papillomas and carcinomas of the lip epidermis and oral mucosa, as shown in table I, or as ameloblastomas and odontomas from the dental plates, as shown in table II. Neoplasms in close proximity to the mouth, but apparently arising from the skin of the upper or lower jaws, were excluded from the tabulation.

Normally, bony fish have conical, recurved, ankylosed teeth which fall out and are regenerated regularly. Normal tooth formation has not been studied in cunners, but in most respects tooth development in bony fish conforms to the generalized pattern for mammals. Initially in the formation of a fish tooth, a peg of oral epithelium, consisting of a basal layer (dental

Table I. Nondental neoplasms of lips and oral mucosa of bony fish

Species	Number	Diagnosis	First report	Selected other reports	RTLA No.	Contributor
Acanthogobius flavimanus	–	epidermal papilloma	[13]	[6, 7]	58	ITO
Ambloplites rupestris	1	epidermal papilloma	[18]			
Anguilla anguilla	3	epidermal papilloma	[25]	[3, 21]		
Anabas scandens	several	epidermal papilloma	[12]			
Barbus fluviatialis	several	papillary epithelioma	[8]			
Barbus vulgaris	1	epidermoid carcinoma	[26]			
Carassius auratus	–	epidermal papilloma	[18]			
Colisa lalio	several	epidermal papilloma	[12]			
Genyonemus lineatus	many	epidermal papilloma	[17]	[5, 6, 14, 27]	62	HARSHBARGER
Ictalurus catus	1	papillary epithelioma	[11]			
Ictalurus melas	1	neurofibroma	[5]	[6]	682	GAINES
Ictalurus natalis	1	epidermal papilloma	[6]		469	COMBS
Ictalurus nebulosus	266	epidermal papilloma and carcinoma	[10, 20]	[5, 6]	288, 328	COMBS
Macrozoarces americanus	1	epidermal papilloma	[6]		922	WOLKE
Malapterurus electricus	1	epithelioma	[6]		760	PAPERNA
Osmerus eperlanus	37	papillary epithelioma	[2]			
Pogonias cromis	2	papillary epithelioma	[1]			
Pterophyllum scalare	1	fibropapillomatous polyp	[6]		972	HINE
Tautogolabrus adspersus	2	epidermal papilloma	[6]		553	SHUMWAY
Tinca tinca	2	papillary epithelioma	[4]			

lamina) enclosing epithelium modified to form the stellate reticulum, grows into the underlying connective tissue. The terminal apex enlarges into a fungiform tooth bud and invaginates through a succession of stages (cap, bell and appositional) to form the enamel organ. Ameloblasts at the lip of the enamel organ induce connective tissue cells inside the 'bell' to differentiate into an odontogenic pulp bounded by a layer of dentin-secreting odontoblasts (fig. 1). Finally, the crown of the new tooth erupts through the surface.

Table II. Dental neoplasms in bony fish

Species	Number	Diagnosis	First report	Selected other reports	RTLA No.	Contributor
Cyprinodon variegatus	1	ameloblastoma	[23]			
Melanogrammus aeglefinus	1	ameloblastoma	[24]			
Micropogon opercularis	1	odontoma	[16]			
Oncorhynchus tshawytscha	2	fibroameloblastoma	[19]	[6]	248	WALES
Salvelinus fontinalis	2	odontoma	[15]			
Sparus auratus	4	odontoblastic papillomatosis	[6]		1000, 1059–61	PAPERNA
Tautogolabrus adspersus	5	ameloblastomas and ameloblastic odontomas	[6]		550–2, 675, 923	SHUMWAY and BANE

Case Reports

Case I (RTLA 553): The gross specimen was a 3-year-old adult of undetermined sex, 10.5 cm in total length. It had a firm, white growth attached to the left side of the palate. The growth extended outwardly, involving the dorsal lip, which was forced to curl upward (fig. 2). Dimensions of the growth were: lateral and longitudinal, 6 mm; vertical, 4 mm. Microscopically, the lesion was composed of pegs of dense, squamous epithelium interspersed with well vascularized connective tissue papillae. One to several rows of columnar cells clearly marked the margins of the pegs and there was no evidence of invasion. The atypical proliferating epithelial cells were smaller, more basophilic, and exhibited more mitoses than cells of nearby normal skin, and in contrast to the normal skin, mucus cells were not present. No differentiation toward dental tissue was observed and the lesion was interpreted as an epidermal papilloma.

Case II (RTLA 550): The gross specimen was a 3-year-old adult male approximately 8 cm in total length. It had a soft, white, slightly oval growth inside the mouth attached to the roof (fig. 3). Dimensions of the growth were: lateral, 4 mm; longitudinal, 3 mm; vertical, 2 mm. Microscopically, the growth contained medium-to-long pegs of squamous epithelium separated by connective tissue papillae which in some cases extended to the surface. The growth was underlain with collagenous connective tissue and bone. There was no distinct basal layer boundary along most of the epithelial pegs and connective tissue fibers intermingled with the deeper epithelial cells. A few pegs presented the spiked appearance of dental lamina. Columnar epithelial cells along the apical margin of some of these pegs had nuclei polarized away from the surface and had cytoplasmic stalks, 'Tomes' processes', separating them from the stroma (fig. 4). Both of these characteristics typify ameloblasts. One structure comparable to an enamel organ was observed. The pegs extended deeply to the bone, suggesting local invasion. Due to the fact that ameloblastic

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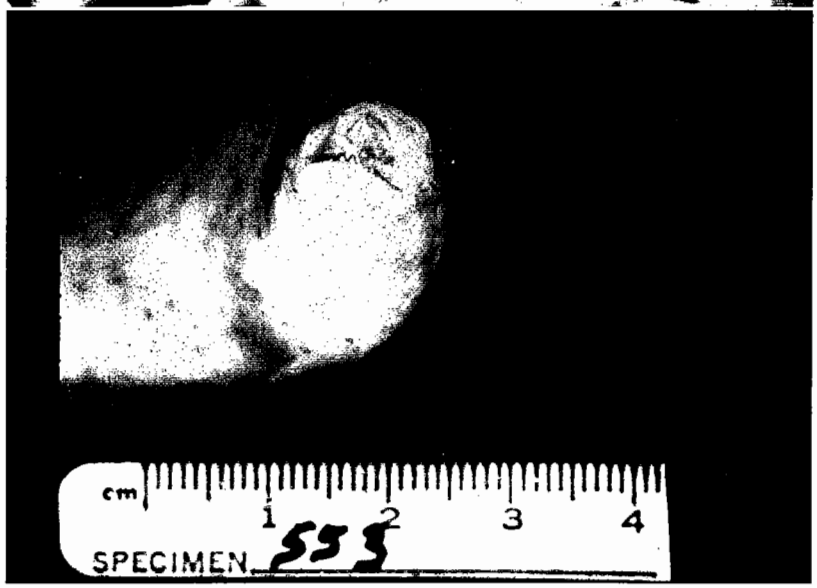

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Fig. 1. Appositional stage of normal developing tooth in a bony fish. a = Ameloblasts; p = pulp; o = odontoblasts; d = dentin.

Fig. 2. Case I: Epidermal papilloma in the open mouth.

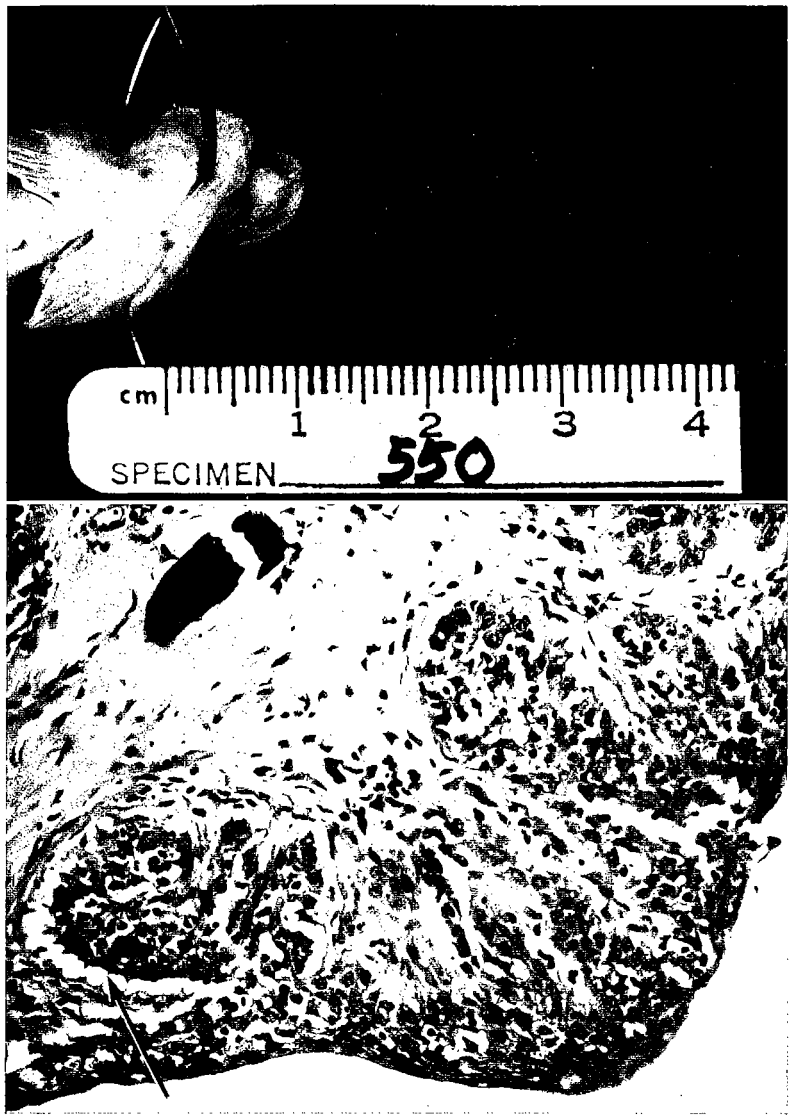

Fig. 3. Case II: Early ameloblastoma in roof of mouth.
Fig. 4. Case II: Tomes' processes (arrow) at the edge of a dental lamina. ×370.

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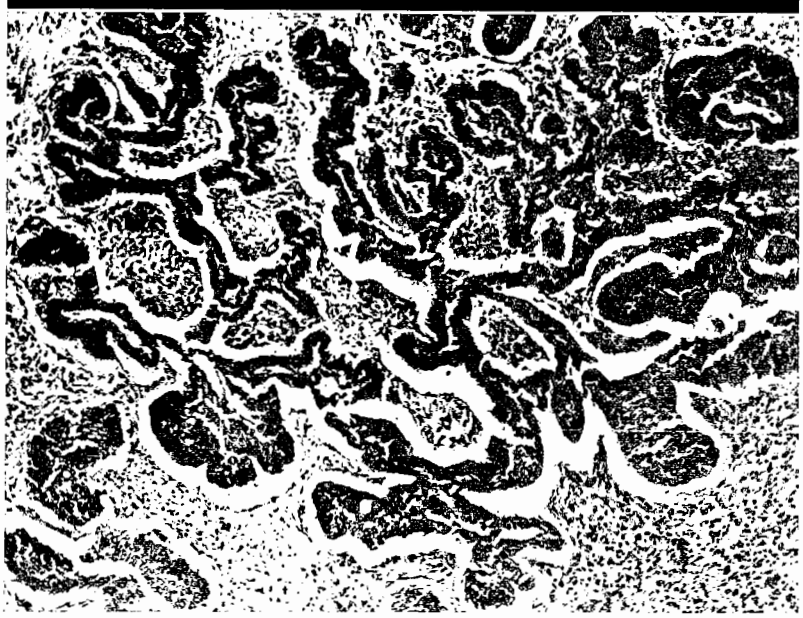

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Fig. 5. Case III: Ameloblastoma in left lower jaw.
Fig. 6. Case III: Plexiform pattern. ×150.

differentiation was occurring in multiple areas, the growth was interpreted as showing ameloblastic change within a plaque of epidermal papillomatosis.

Case III (RTLA 552): The gross specimen was a 3-year-old, adult female, 12 cm in total length. It had a white, papillary growth 1 cm in diameter involving the left inside of the lower jaw and the lower left lip (fig. 5). Dimensions of the growth were: lateral, 7 mm; longitudinal, 10 mm; vertical, 5 mm. Microscopically, the growth was composed of long, double strands of ameloblastic epithelium in a branching arboreal pattern embedded in a spongy, well vascularized, fibrous stroma (fig. 6). Cells of the stellate reticulum were enclosed within the double cords of some of the strands. Stromal changes suggested that odontogenic tissue was beginning to differentiate in several localized areas, but most of the connective tissue had the normal spindle cell pattern. The lesion is interpreted as an ameloblastoma having a plexiform pattern.

Case IV (RTLA 551): The gross specimen was a 3-year-old, adult male, 11.5 cm in total length. It had a firm, white growth attached to the roof of the mouth causing the upper lip to curl upward (fig. 7). Dimensions of the growth were: lateral, 8 mm; longitudinal, 6 mm; vertical, 6 mm. Microscopically, the growth was characterized by long, finger-like pegs of both epidermal and ameloblastic epithelium radiating 180 degrees from the point of attachment and interspersed with well vascularized fibrous papillae that extended to the surface (fig. 8). The ameloblastic cells were tall columnar cells with nuclei polarized away from the basement membrane. Some fibrous cells in close proximity to the ameloblasts had taken on the shortened basophilic appearance of odontogenic pulp cells (fig. 9). However, well differentiated odontoblasts were not present and dentin had not been produced. Some areas of the tumor exhibited a follicular pattern and a few of the follicles contained bone. The epithelial pegs appeared locally invasive as they extended through the fibrous stroma to the maxillar bone. The growth was interpreted as an ameloblastic odontoma with both papillary and follicular patterns.

Case V (RTLA 675): The gross specimen was an adult of undetermined sex, 12 cm in total length. It had a firm, yellowish-white growth arising in the maxillodental area which extended caudally into the oral chamber and cephalad through the mouth opening, causing the dorsal lip to curl upward (fig. 10). Dimensions of the growth were: lateral, 10 mm; longitudinal, 9 mm; vertical, 4 mm. Microscopically, the bulk of the growth was composed of large, irregularly shaped, epithelial cysts separated from each other by a thin, fibrous stroma (fig. 11). The cysts had multiple finger-like infoldings, each with a median rib of connective tissue continuous with the stroma. The epithelial cells adjacent to this rib were ameloblastic in appearance and those farther away resembled stellate reticulum cells. The connective tissue rib had differentiated into odontogenic pulp tissue bordered by a single row of dentin-producing odontoblasts (fig. 12). A smaller area of the tumor, somewhat similar to case III, was composed of interdigitating double cords of ameloblastic epithelium interspersed with a thin, but highly vascularized, fibrous stroma. 'Tomes' processes' were conspicuous on the outer layer of cells lining the cords, and stellate reticulum cells occupied the interior of the cords. Some odontogenic differentiation had occurred and one incomplete and malformed tooth was present (fig. 13). The growth was interpreted as an ameloblastic compound odontoma.

Case VI (RTLA 923): The gross specimen was a 3-year-old adult of undetermined sex, 7.5 cm in total length. It had a firm, creamy-white, slightly granular growth attached to the upper jaw (fig. 14). Dimensions of the growth were: lateral, longitudinal and vertical,

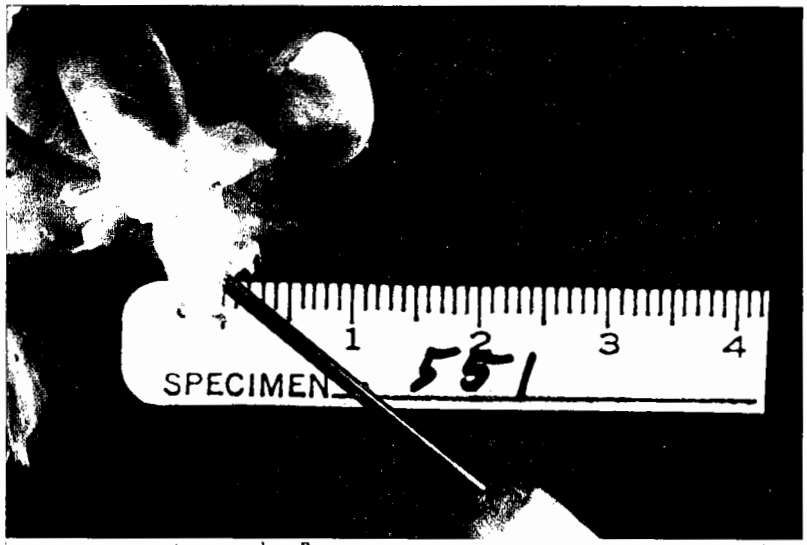

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Fig. 7. Case IV: Ameloblastic odontoma attached to roof of mouth, deflecting upper lip.
Fig. 8. Case IV: Histologic overview. ×24.

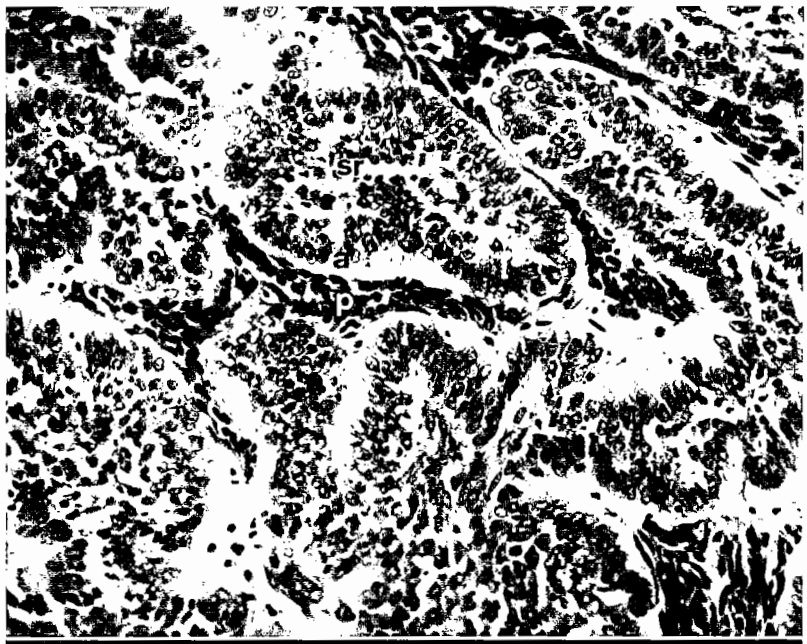

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Fig. 9. Case IV: Odontogenic pulp (p) between dental lamina composed of ameloblasts (a) enclosing stellate reticulum (sr). ×370.

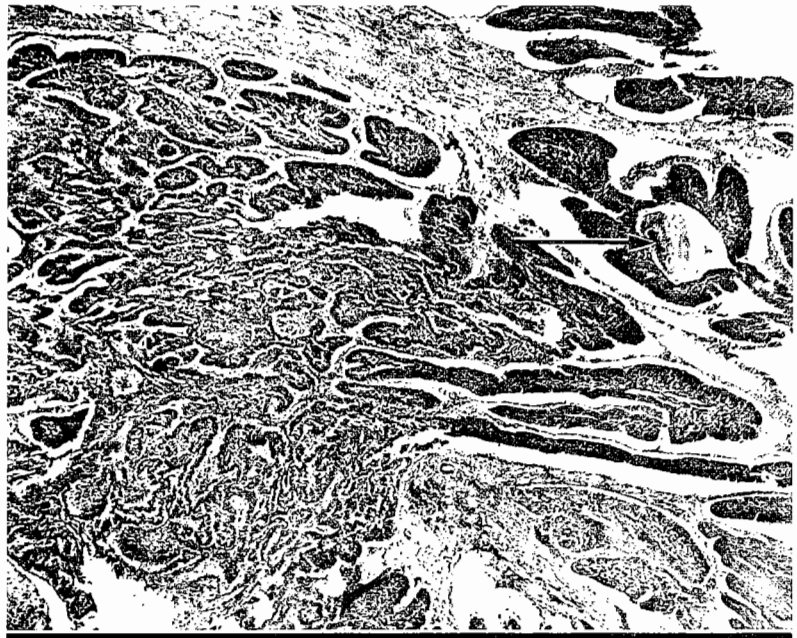
Fig. 10. Case V: Ameloblastic compound odontoma attached to dorsal dental surface of mouth. Cut-away view.

11

12

Fig. 11. Case V: Irregular epithelial cysts separated by thin fibrous stroma. Finger-like ingrowths having ribs (arrow) of pulp-like connective tissue are continuous with the thin fibrous stroma. × 60.

Fig. 12. Case V: Higher magnification of a dental element from figure 11. p = pulp; o = odontoblasts; d = dentin; a = ameloblasts. × 140.



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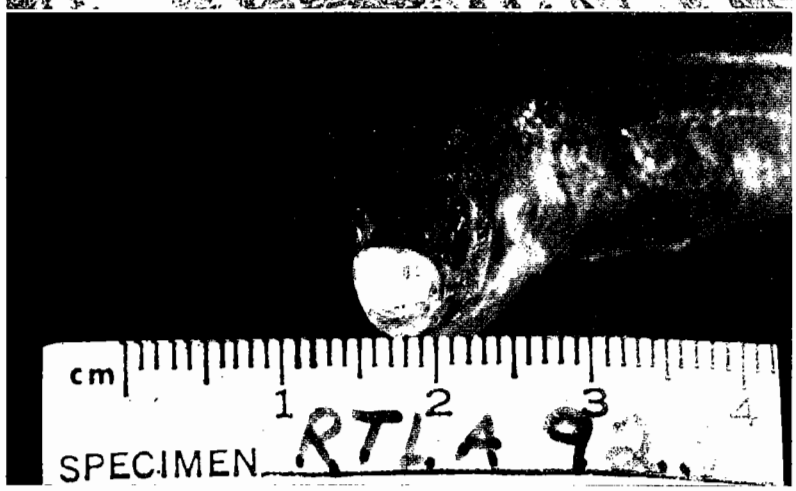

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Fig. 13. Case V: Plexiform area to the left; Malformed denticle to the right (arrow). × 60.

Fig. 14. Case VI: Well differentiated compound odontoma deflecting upper lip.

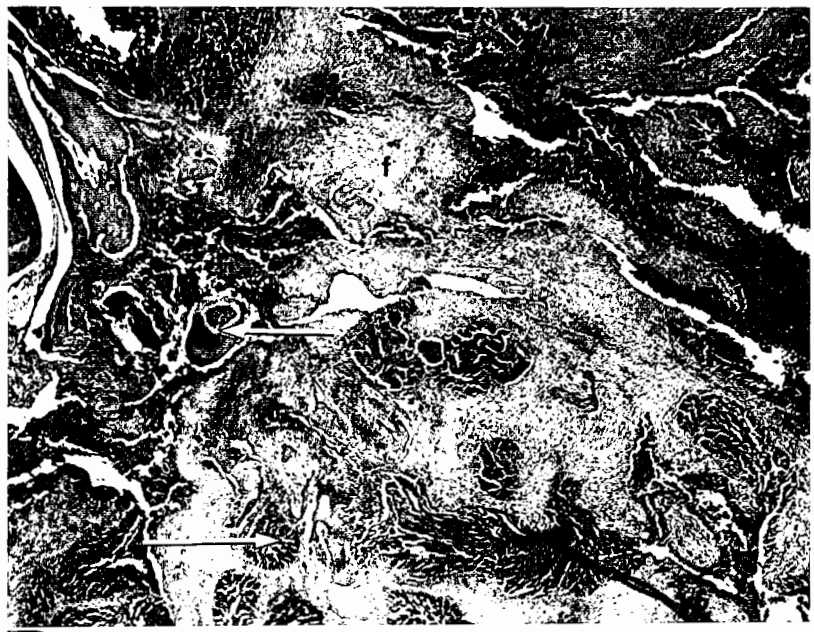

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Fig. 15. Case VI: Large fibrous component (f), patches of dentin (d), dental papillae (right arrow), and malformed denticle (left arrow). × 60.

Fig. 16. Case VI: Cleft in bone (b) cut by invading neoplasm. Two malformed denticles (arrows). × 60.

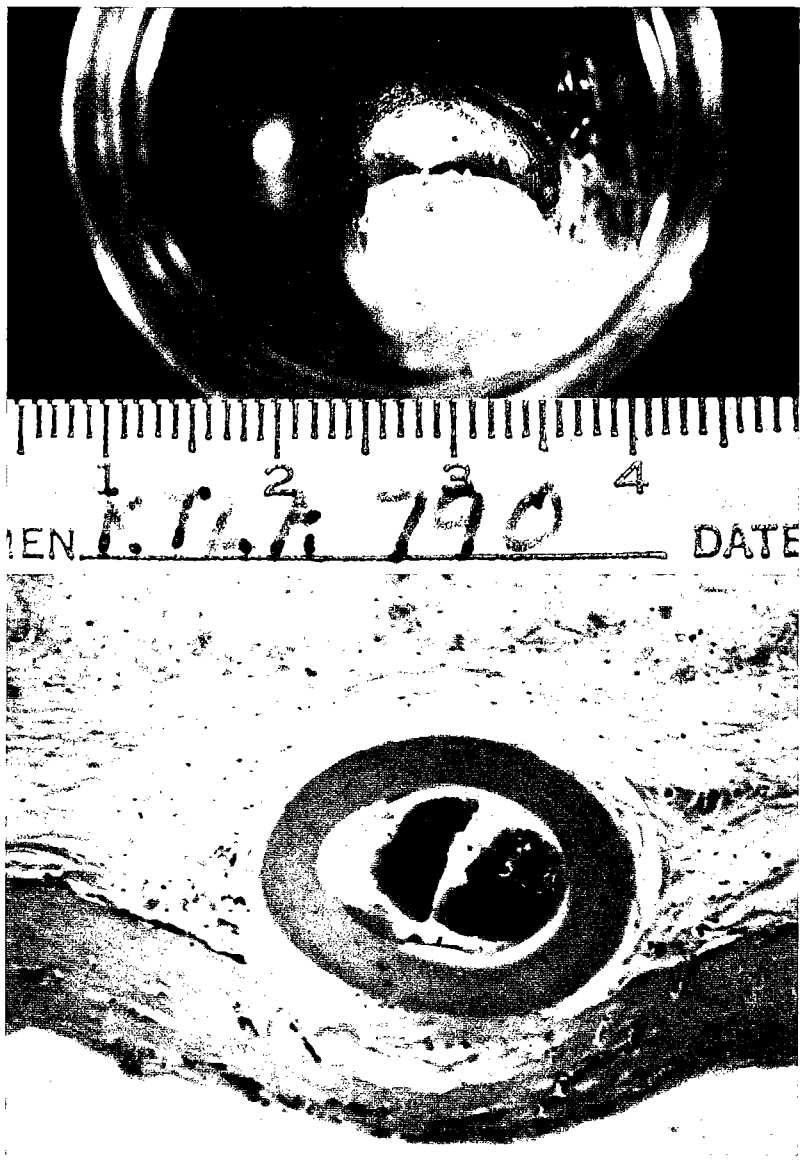

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Fig. 17. Case VII: Parasitic granuloma inside mouth.
Fig. 18. Case VII: Trematode metacercaria in a dense fibrous capsule. ×190.

3–4 mm. Microscopically, the tumor was composed of randomly distributed islands and papillae of various dental elements within a large, dense, fibrous stroma (fig. 15). The dental elements included areas of ameloblastic and/or odontogenic tissues. In several areas, apparently isolated odontoblasts produced patches of dentin. Five poorly formed replicas (denticles) of complete teeth were present at the level studied. Mitoses were easily found, but not abundant. A large cleft had been produced in the mandibular bone by invading tumor cells (fig. 16). The tumor was interpreted as a well differentiated compound odontoma.

Case VII (RTLA 790): The gross specimen was an adult of undetermined sex, 13.5 cm in total length. It had a small, firm, white growth in the maxillodental area (fig. 17). Dimensions of the growth were: lateral and longitudinal, 5 mm; vertical, 2 mm. Microscopically, dense fibrous capsules containing trematode metacercariae distended the overlying skin (fig. 18). The lesion was interpreted as a multifocal parasitic granuloma.

Discussion

This report describes the largest collection of odontogenic neoplasms known from a particular species of fish or from a single geographic location. Each case shows a limited range of morphologic variation and, as a group, the six cases illustrate a spectrum of differentiation in oral neoplasms ranging from no differentiation of tooth tissues to differentiation of all tooth elements, as follows: case I – no recognizable tooth elements; case II – early ameloblastic differentiation; case III – characteristic ameloblastic and very early odontogenic differentiation; case IV – ameloblasts and significant odontogenic pulp; case V – ameloblasts and odontoblasts with dentin production; case VI – all tooth elements, including numerous incomplete and malformed teeth.

The cause of these tumors is unknown, but a combination of factors is probably involved. Cunners feed on the bottom where one would expect chemical and viral carcinogens to accumulate. Their diet is mostly composed of abrasive types of food such as barnacles and clams, which could injure the mouth area and allow intimate contact with carcinogenic agents that might be present. Data from other fish tumor studies also indicate that abrasion can be a factor [9, 14]. The point of the hypothesized abrasion would be the site for tumor development, which would explain why the growths just described occurred on either jaw and arose from both lips and oral mucosa.

Trematode parasites, similar to the ones causing the pseudotumor in case VII, were seen in slides from the jaws in two of the specimens with neoplasms. In addition, randomly distributed integumentary black spots, presumed to be the well known black-spot disease of trematode etiology, were

seen in several of the cases. However, the presence of these parasites is considered incidental to the neoplasms.

The fact that cunners seem to be quite sensitive to some agent(s) that can induce tumors suggests that these fish may be useful in developing a model for studying neoplasms of dental origin.

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