cause of the presence of spruce cones, it is believed that the beaver wood probably is from 10,000 to 12,000 years old.

Two adjoining but apparently completely separate peat deposits were exposed in the summer of 1960 during the excavation of a large underground garage in the lower end of the Boston Common (*6*). One deposit, North peat, appeared to have been a freshwater body during the entire course of its existence (it was covered by fill in the 19th century). The South peat, though separated from the North peat by only 100 feet of gravel and till, began as a freshwater bog, but as sea level rose the bog was succeeded by a salt marsh, about 3800 years ago. This is clearly shown by an abrupt change from a deep red-brown leaf-bearing sedge peat to a light yellow-brown peat made up of *Spartina* debris. Both the North and the South peat bodies contain abundant beaver-cut wood in their freshwater section.

The North peat occupies a kettle and in the beginning was a pond about 20 feet deep. It appears that the small pond gradually filled with laminated clayey gyttja until it was sufficiently shallow to support a beaver colony. From the distribution of beaver wood throughout the peat it appears that beavers occupied the site more or less continuously until colonial times.

The South peat lacks the thick basal section of laminated lake clays of the North peat. Thin gyttja with a large amount of beaver wood, some partly charred, occurs at the base. An age determination of 11,000 ± 240 years for beaver wood and spruce cones from the layer has been made (*7*). This deposit may well be the result of construction of a beaver dam, perhaps built by the same beaver colony that occupied the kettle of the North peat. The original beaver dam probably lies to the west of the excavation, somewhere under the Boston Public Garden. Beaver-cut wood of the following types has been found in both peat deposits of the Boston Common: white pine, red pine, spruce, balsam fir, hemlock, red cedar, black birch, and oak.

Teeth marks on all the wood examined were of the size of teeth marks of *Castor canadensis,* our existing Canadian beaver. No teeth marks of *Castoroides,* the giant Pleistocene beaver, have been seen, nor have any bones yet been found. The cutting of conifer trees by beavers, though surprising at first sight, is not unknown among beavers today. Warren (*8*) noted that conifers are preferred by some present-day beavers even when aspen and other trees that are more common in beaver diet are handy.

The finding of beaver-cut wood at, or close to, the base of four of these peat deposits points to the possibility that beaver dams were responsible for the bodies of water in which the organic sediments were deposited. That is, there is presumptive evidence that beaver dams, built across shallow valleys, created beaver ponds which then persisted through thousands of years, slowly accumulating vegetational debris. The original beaver dams have been obliterated with time, perhaps in part engulfed by the peat fill of the ponds in back of them. Where the dams had been built in series up and down valleys, the positions of the dams are additionally obscured by the continuous chain of peat-filled beaver ponds. The small sample of this study therefore suggests that in early postglacial time the landscape of southern New England may have been much less swampy and poorly drained than it is today.

Castor canadensis, or a very close precursor, must have entered southeastern New England about 12,000 years ago, soon after the retreat of the last ice sheet. The beavers rapidly multiplied and, if this small sample is typical, colonized almost all small valleys, ponds, and poorly drained depressions.

For the student of the late Pleistocene the facts cited in this report (*9*) raise two important questions. (i) What has been the effect of beavers on pollen stratigraphy? Considerable stirring up of bottom sediments in the shallow ponds in which these animals lived must have occurred. This may account for the fact that the early postglacial pollen stratigraphy of eastern North America is somewhat less regular than that of Europe. (ii) What is the significance of the charred wood? The charring in all likelihood is the product of naturally set forest fires—that is, we must assume this until such time as the presence of early postglacial man in the region has been demonstrated. Lightning-set forest fires are very rare in the present humid climate of New England. Is it not possible, then, that the charred wood is an indication of a drier climate in early postglacial time?

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18 September 1962

High-Energy Sound Associated with Fright in the Dolphin

Abstract. A sound produced by the Atlantic bottlenose dolphin (*Tursiops truncatus*) under conditions of fright is described and illustrated. It is suggested that a similar sound may be the basis of the long-distance alarm signal reported in other cetaceans.

During recent behavioral studies of captive *Tursiops truncatus* (Montagu), in which behavior and concurrent sound production (especially whistles) were being investigated, an apparently context-specific sound produced under fright conditions has been discovered. The sound is apparently inaudible out of water, but it was heard clearly on underwater listening equipment. The equipment used was a Clevite (oyster type O modified) hydrophone and a Tandberg (model 6) tape recorder. The frequency response of such a system is flat from 50 cy to 10 kcy/sec, which is not adequate for studying the full range of broad-band pulses such as echolocation clicks. The sound we report on here was recorded several times, and a sonagram of one of these recordings was prepared (Fig. 1). The sound consists of a loud, sharp "crack" with a jarring impact on the listener's ear. Recent reviews of the sound production of cetaceans make no reference to it (*1*).

The sound was elicited several times from either one or both of two tame adult female *T. truncatus* on an occasion in daylight when a life-size plastic model of a young dolphin was dragged toward them. Their behavior at this

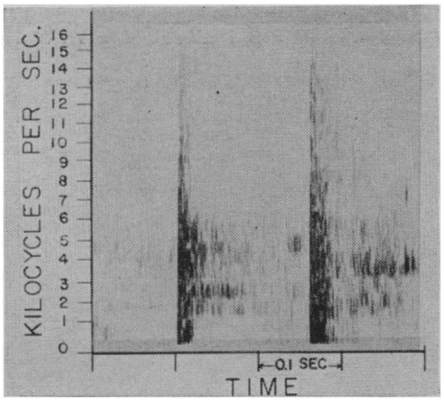

Fig. 1. Sound spectogram (sonagram) of a pair of high-energy "cracks" produced by a captive *T. truncatus* shortly after a model dolphin was introduced into the water with it. The "crack" is a rapid-onset, broad-band pulse with the bulk of the energy contained below 8000 cy/sec.

time was typified by flight, tight schooling, and hyperexcitability. Sometimes two or more of the "cracks" followed closely upon the first. We do not know whether one or both of the dolphins produced the sound.

The same sound was heard and recorded on another occasion in a tank containing three large *T. truncatus* juveniles: two females and one male, all recently captured. At night we abruptly shined a light into the eyes of a swimming dolphin just as it raised its head to breathe. It started, swam violently away, and the "crack" was heard concurrently through the underwater listening equipment. We repeated this test and the same physical reaction and sound were elicited.

In personal conversation, W. E. Evans, J. H. Prescott, and W. W. Sutherland told us that they once noted and recorded a similar sound. During the daytime, these workers projected sounds from a tank of five *T. truncatus* into a tank containing a single adult female of the same species. Picking up her sound emissions, they obtained whistles, echolocation clicks, barks, and, infrequently, "a single blast much louder than any of the other sounds." Tape recordings made during this experiment were made available to us. The infrequent blasts appear to be the same as the sound we obtained in our studies. Since the animal was alone in a small tank, observation opportunities were good and no jaw-clapping (*2*, *3*) was observed. A tail-slap against another dolphin obviously was not possible. The animal showed avoidance behavior toward the underwater speaker throughout the rest of the experiment.

The mechanism by which the sound is produced is not known, but apparently it is internal. Sonagrams of this sound and of a tail-slap, which conceivably could have produced the abrupt sound we heard, were compared and found to be different. We could not detect any evidence of jaw-clapping in our observations. However, as the animals were swimming violently at the time of the sound production and sonagrams of a jaw-clap (also an abrupt sound) were not available for comparison, we cannot completely rule out the possibility that this method may have been involved, although the evidence given us by Evans and his associates makes this seem unlikely.

Since the sound monitoring and recording equipment was set up primarily to study whistles, and to some extent, barks and echolocation clicks, the single extraordinarily loud and high-energy "cracks" easily overloaded the recording equipment. Consequently, it is impossible at present to make an accurate acoustical analysis of the sound. Plans are being made to investigate this sound with equipment better suited to the analysis of pulse-type sounds. However, preliminary examination of the sound revealed it to carry considerable energy in a lower frequency band (0.1 to 8.0 kcy/sec) than the echolocation click which, according to Evans and Prescott (*3*), has its bulk intensity at 20 to 35 kcy/sec.

Absorption of sound in sea water increases rapidly with increasing frequency (*4*). Conversely, sound of low frequency would be absorbed less and could be expected to carry for a greater distance. It has been known to both whalemen and biologists for a century or more that the sperm whale (*Physeter catodon* L.), and possibly other cetaceans, has a means of communicating alarm. The great distance of the communication is often noted (*5*). The sound we describe above thus would be very well suited to such communication of alarm, both because of its great energy (volume) at a low frequency and because of the startling impact of such a high-energy sound with its abrupt onset (*6*).

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20 September 1962

Neurosecretion in the Ophiuroid Ophiopholis aculeata

Abstract. Neurocrine activity has been demonstrated for the first time in the Ophiuroidea and for only the second time in the phylum Echinodermata. Three types of neurosecretory cells have been shown, by means of histological staining techniques, to occur in the principal motor ganglia. The secretory products are carried away from the cell bodies by axon transport but cannot be traced to special terminal reservoirs. It is possible that the neurosecretory products diffuse into adjacent coelomic spaces for further transport. It is suggested that in the echinoderms neurocrine secretions may be associated with control functions which in other phyla are regulated by endocrine products.

Although neurosecretory cells have been demonstrated to occur in a wide range of invertebrate phyla, the echinoderms have been investigated scarcely at all in this respect. This report presents evidence for the occurrence of such cells in the Ophiuroidea, a class in which their presence had not previously been established. Neurosecretory cells have been shown to occur in the so-called motor ganglia (Fig. 1, bottom) of *Ophiopholis aculeata* (Retzius) var. kennerlyi, by means of the chrome hematoxylin-phloxin and paraldehyde fuchsin techniques (*1*). All of the