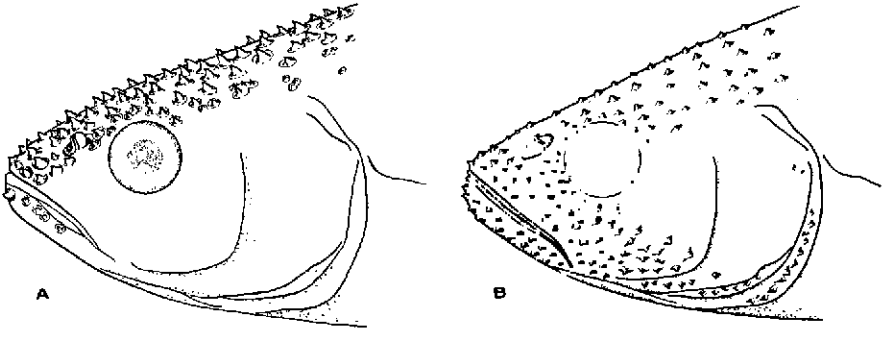

FIGURE 1.—Patterns of head tuberculation in the subgenus *Lythrurus*. Both drawings are composites from several adult breeding males. A.—*N. ardens*. CU 22997; Cumberland dr., Tennessee. 2 June 1953. This pattern is typical of all forms of the *ardens* species complex, except that *N. lirus* has fewer, more-prominent mandibular tubercles. B.—*N. umbratilis cyanocephalus*. INHS uncat.; Wabash dr., Illinois. 21 June 1961. This pattern is typical of all forms of the *roseipinnis* species complex. Gulf Coast populations of *N. fumeus* exhibit a similar pattern but have snout tubercles more reduced.

readiness. Finally Branson (1962) and Snelson (1968:784) have pointed out the difficulty of differentiating very small tubercles from sensory structures. Despite these complications, tuberculation has proved highly significant in establishing the taxonomic status of many closely related or otherwise very similar species (e.g., Gibbs, 1957b; Huntsman, 1967; Lachner and Jenkins, 1967, 1971; Snelson, 1968; Howell and Williams, 1971).

Two major patterns of head tuberculation occur in the subgenus *Lythrurus*. The *N. ardens* and *N. lirus* pattern (Fig. 1A) is characterized by (1) large, close-set, antrorse tubercles on the head dorsum; (2) a variable complement of mandible tubercles, either a few scattered at the chin tip (*lirus*) or several tubercles in a single row (*ardens*); and (3) the usual absence of tubercles elsewhere laterally and ventrally on the head. The other pattern of head tuberculation (Fig. 1B) is typical of the remainder of the subgenus except for Mississippi Valley populations of *N. fumeus*. This pattern is characterized by (1) moderate-sized, scattered, erect tubercles on the head dorsum; (2) tubercles arranged in two rows along each mandible; and (3) a general profusion of tubercles on lateral and ventral areas of the head.

In pectoral fin tuberculation, *N. fumeus* is distinguished from other members of the subgenus by its small, dense tubercles that form a fine shagreen over the rays. Other forms in the subgenus have larger, coarser