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## Total Length Estimation of Red Drum from Head Dimensions

J. E. SERAFY, C. M. SCHMITZ, T. R. CAPO, M. E. CLARKE, AND J. S. AULT

Rosenstiel School of Marine and Atmospheric Science  
Division of Marine Biology and Fisheries, University of Miami  
4600 Rickenbacker Causeway, Miami, Florida 33149, USA

**Abstract.**—Four head dimensions of red drum *Sciaenops ocellatus* were individually regressed against total length (TL) to facilitate estimation of the size of hatchery-reared fish recaptured by sport anglers. Head length, postorbital head length, snout length, and eye diameter measurements were obtained from 58 individuals ranging from 130 to 639 mm TL. Each of the head dimensions was correlated with TL, and  $r^2$  coefficients ranged from 0.963 for eye diameter to 0.995 for head length. All of the head dimensions examined appear to be good predictors of red drum TL.

The Florida Department of Environmental Protection (FDEP) has released approximately 1.3 million hatchery-reared, juvenile red drum *Sciaenops ocellatus* into Biscayne Bay, Dade County, Florida, since 1988 (W. Halstead, Florida Marine Research Institute, personal communication). About 25% of the stocked fish were marked with coded wire tags (CWTs) that were implanted in the opercular musculature. Unlike internal anchor tags, CWTs have minimal effects on growth or swimming performance of juvenile red drum (Serafy et al. 1995). A major disadvantage of CWTs, however, is that they are not easily seen by fishermen.

To assist in the scientific assessment of their red drum stock enhancement program, FDEP encourages anglers to deposit the heads of any captured red drum in freezers placed in bait-and-tackle shops throughout Dade County. This approach has increased the recovery of fish bearing CWTs in salmonid fisheries (Unwin 1982; Lirette and Hooten 1988) and has provided data for population size, movement, and growth estimation. Although age-length, weight-length, and length-length (total, standard, and fork length) conversions have been published for red drum (Peters and McMichael 1987; Murphy and Taylor 1990; Ross et al. 1995), they are of little use when only the head is available. Previous studies have used eye diameter to estimate fork length in other fish (Crane et al. 1987); however, there are no reported models to assess the relationship between specific head measurements and expected size for red drum.

Anticipating the need for accurate estimates of total length (TL) from the dimensions of frozen

heads, we used standard linear regression methods (Neter et al. 1985) to develop several single-independent-variable models with Statistical Analysis System software (SAS Institute 1990). Fifty-eight red drum, ranging from 130 to 639 mm TL, were randomly selected from the University of Miami's Experimental Hatchery, anaesthetized, and measured for TL. The heads were then removed by cutting just behind the terminus of the opercle. After the heads were placed in individual plastic bags, they were frozen for 72 h at  $-20^{\circ}\text{C}$  in a conventional freezer to simulate field conditions. While frozen, four head dimensions (head length, postorbital head length, snout length, and eye diameter), as defined by Robins and Ray (1986), were measured with vernier calipers to the nearest millimeter (Figure 1).

Pertinent model coefficients and associated goodness-of-fit statistics describing the relationship between the individual head dimensions and TL are presented in Table 1. The coefficient of determination ( $r^2$ ) ranged between 0.963 and 0.995. Results indicated that predictions of TL

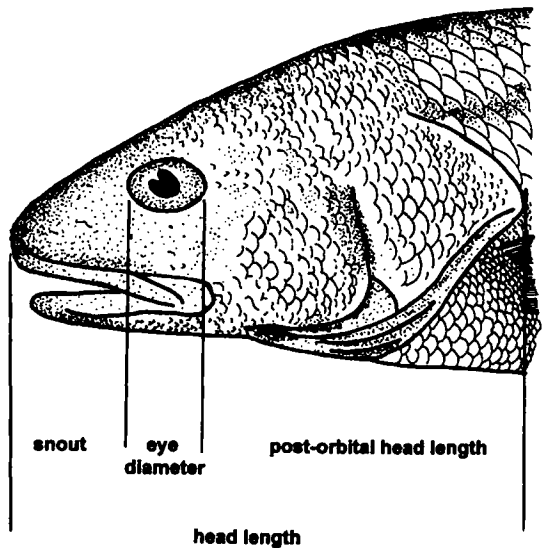


FIGURE 1.—Definitions of the four red drum head dimensions regressed against total length: head length, postorbital head length, snout length, and eye diameter.

TABLE 1.—Regression coefficients and goodness-of-fit statistics for the estimation of total length from four red drum head dimensions. Coefficients  $b_0$  and  $b_1$  refer to intercept and slope values, respectively; standard errors are in parentheses. All relationships were highly significant (for 1 and 56 df,  $F = 12.3$  at  $P = 0.001$ ). Sample size was 58 fish.

| Dimension          | $b_0$             | $b_1$          | $r^2$ | $F$      |
|--------------------|-------------------|----------------|-------|----------|
| Head length        | 6.093 (3.236)     | 3.547 (0.035)  | 0.995 | 10,068.3 |
| Postorbital length | 31.056 (3.081)    | 5.422 (0.055)  | 0.994 | 9,647.8  |
| Snout length       | 34.478 (4.635)    | 12.979 (0.201) | 0.987 | 4,172.0  |
| Eye diameter       | -288.861 (15.714) | 46.032 (1.201) | 0.963 | 1,469.3  |

from head dimensions became increasingly accurate as a larger portion of the head was measured. All of the head dimensions examined in this study appear to be good predictors of red drum TL. Because misreporting of lengths by anglers is common (Pollock et al. 1994), knowledge of these relationships will be useful for the determination of postrelease growth of stocked fish.

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