Morphological Divergence Between Western Grebe Color Morphs.—The two phenotypes of Western Grebe are classified as a single species (*Aechmophorus occidentalis*) and were assumed to represent "scattered polymorphism" (Mayr and Short 1970:88). George N. Lawrence (*in* Baird 1858:894–895) originally described the two grebe forms as separate species, calling the dark form the Western Grebe (*Podiceps occidentalis*) and the light form Clark's Grebe (*Podiceps clarkii*). However, Coues (1874) and Henshaw (1881) suggested that the forms were color phases of the same species, and the American Ornithologists' Union Check-list Committee (1931, 1957) classified the forms as a single species. Plumage differences between the morphs are described and illustrated in detail by Storer (1965) and Ratti (1982).

Both Storer (1965) and Lindvall (1976) reported assortative mating by Western Grebes from brief observations at Bear River Refuge in Utah. Subsequent research by Ratti (1979) and Nuechterlein (1981) revealed the 2 forms were reproductively isolated and identified isolating mechanisms. Ratti (1979:582) concluded that Western Grebe color morphs "biologically function as separate species."

Morphological analysis by Ratti (1977) indicated a trend of smaller size in light-phase birds. However, these data were of questionable value due to drastic variation in the condition of specimens (i.e., many specimens were badly decayed, many were frozen for an uncertain number of years, and some were measured immediately after collection without exposure to decay, freezing, drying, etc.). Therefore, we tested the hypothesis that light-phase birds were smaller than dark-phase birds. Dickerman (1963, 1973), Selander (1966), and Lindvall (1976) reported *A. occidentalis* measurements. Selander (1966) dealt primarily with sexual dimorphism, while Dickerman's (1963, 1973) and Lindvall's (1976) data include both color morphs in each male and female sample.

To determine if light-phase birds were morphologically smaller than dark-phase birds, 40 specimens, divided equally by color morph and sex, were collected during a 6-day period. All birds appeared healthy and normal at the time of collection, and all measurements were taken immediately after death by JTR and TRM. The specimens were collected (shot) on the Bear River Migratory Bird Refuge, 24 km west of Brigham City, Utah, between 28 May and 2 June 1979. Descriptions of the study area were presented by Williams and Marshall (1937) and Ratti (1977). All measurements were standard according to Baldwin et al. (1931) except that (1) height of bill at nostrils (culmen depth) was measured immediately posterior to the nostrils, and (2) length of closed wing flattened was measured with the primary feathers flattened against the measuring board. Tarsus and mandible measurements were taken to 0.1 mm with Vernier calipers and wing measurements were taken to the nearest even mm on a graduated measuring board. Specimens (heads only) were deposited in the Conner Museum (CRCM) at Washington State University, catalogue numbers 83-102 through 83-141, inclusive. Data were analyzed on an IBM 370-148 Computer using SPSS programming (Nie et al. 1975), and tested with Student's *t*-tests and discriminant analysis. Discriminant function analysis has "been applied in various biological fields, especially systematics" (Sokal and Rohlf 1969:488).

Analysis of male measurements revealed one variable—length of bill from nostril—was significantly different (Table 1). The mean values for 4 of 5 measurements were smaller for light-phase birds. Discriminant analysis correctly classified 75% of cases ($P = .1255$).

The measurements differed more between female samples. All measurements were smaller for light-phase birds, especially culmen depth, length of the bill from nostril, and total culmen length (Table 2). Stepwise discriminant analysis clearly separated female dark- and light-phase birds into two groups, with 95% of 20 cases correctly classified ($P = .0025$).

Both statistical procedures suggest that divergence is most significant in mandible structure, which may indicate competition for food items and selection of smaller prey by light-phase birds. Nuechterlein has also hypothesized that "the two color phases may be segregating behaviorally into two subtly different ecological forms specialized for feeding at different depths." An alternate hypothesis is random or environmentally induced divergence during geographic isolation. These data should be considered with caution, however, and statistical significance should not be automatically assumed to represent biological significance (Tacha et al. 1982). These data are not sufficient to *conclude* dif-

TABLE 1. Morphological analysis of male dark-phase (n = 10) and light-phase (n = 10) Western Grebes collected on Bear River Migratory Bird Refuge, 1979.

Measurement	Color phase	Mean (mm)	Standard error	t-value	Significance
Total culmen length	Dark	83.7	0.8	0.88	0.20
	Light	82.5	1.1		
Length of bill from nostril	Dark	61.0	0.6	1.71	0.05
	Light	59.1	0.9		
Culmen depth	Dark	14.1	0.6	0.85	0.21
	Light	13.5	0.2		
CD:TC[1] ratio	Dark	0.17	0.007	0.60	0.28
	Light	0.16	0.002		
Tarsus length	Dark	77.8	0.9	0.35	0.37
	Light	78.2	0.9		
Length of closed wing flattened	Dark	204.4	1.9	0.65	0.26
	Light	202.7	1.8		

[1] CD = Culmen depth, TC = Total culmen length.

TABLE 2. Morphological analysis of female dark-phase (n = 10) and light-phase (n = 10) Western Grebes collected on Bear River Migratory Bird Refuge, 1979.

Measurement	Color phase	Mean (mm)	Standard error	t-value	Significance
Total culmen length	Dark	71.5	0.46	1.98	0.03
	Light	69.6	0.83		
Length of bill from nostril	Dark	52.3	0.44	2.04	0.03
	Light	50.6	0.70		
Culmen depth	Dark	10.8	0.09	2.81	0.01
	Light	10.4	0.12		
CD:TC ratio	Dark	0.15	0.001	0.48	0.32
	Light	0.15	0.003		
Tarsus length	Dark	71.4	0.57	0.44	0.33
	Light	71.1	0.52		
Length of closed wing flattened	Dark	189.8	1.35	1.50	0.08
	Light	186.9	1.39		

ferences in food size selection between the morphs, but indicate a need for additional research.

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JOHN T. RATTI, *Wildlife Biology, Washington State University, Pullman, Washington 99164-4220;* THOMAS R. MCCABE, *Department of Fisheries and Wildlife Sciences, South Dakota State University, Brookings, South Dakota 57007; and* LOREN M. SMITH, *Department of Fisheries and Wildlife, Utah State University, Logan, Utah 84322.* Received 10 Aug. 1982; accepted 20 Apr. 1983.