upward at the carpal joint) to a raised angle of about 40° with respect to the water (Fig. 1). The distance between bill immersions within a bout varied from about 2–20 m. After skimming birds typically flew up and circled widely to make another pass on the windward (south) side of the pond, performing this behavior over and over again. The sky was clear, the temperature was 29°C, and the wind 8–13 km/h (measured by a Dwyer wind meter); the wind caused ripples on the surface of the turbid water. All birds on all passes flew directly into the wind while skimming. On the following day, when the air was nearly calm, no gulls were skimming on the pond during the two check periods although many individuals were flying about the area.

As is often the case with the evolution of unusual behavior patterns, the specialized skimming of the Rynchopidae appears to have recognizable phylogenetic precursors in the simpler skimming of related species in other charadriiform families. One other gull is known to skim: a single Black-headed Gull (*Larus ridibundus*) was observed by J. P. H. (*in* Buckley and Hailman, Br. Birds 63:210–212, 1970) to rotate its head ventro-posteriorly and snap its bill together during 1 of 11 skimming bouts. Skimming-like behavior in terns has been interpreted by P. A. Buckley (Buckley and Hailman 1970) and F. G. Buckley and P. A. Buckley (Ibis 114:344–359, 1972) as drinking when they skimmed after being flushed from the nest during the heat of the day or bill-cleaning following prey capture. None of these observations report wind conditions at the time of skimming or skimming-like behavior.

Skimming in Laughing Gulls thus shows little similarity to skimming-like behavior of terns, in that the gulls were neither cleaning their bills after capture of prey nor drinking when flushed from the nest at mid-day. Rather, skimming by gulls resembles foraging by skimmers, with an important proviso: Black Skimmers can skim in calm air whereas the strong head wind appeared to provide the necessary lift allowing skimming by Laughing Gulls.

We thank Robert Howe and Richard Zusi for valuable comments on the manuscript.—JACK P. HAILMAN AND JONATHAN R. REED, *Dept. Zoology, Univ. Wisconsin, Madison, Wisconsin 53706.* *Accepted 31 Mar. 1981.*

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A lamp-booth for laboratory use.—The importance of using a reliable color standard for color evaluation is well known. Equally important is the quality of the light source under which it is used. Most artificial light sources, such as ordinary incandescent and typical daylight fluorescent lamps, are unsatisfactory for accurate color evaluation; some phase of natural daylight is usually preferred by people who work with color. Excellent simulated daylight enclosures and fixtures are available commercially, but often prove too costly for low-budget research projects.

Faced with unsuitable laboratory illumination as well as a restricted budget, I decided to devise a lamp-booth for use in my research on downy waterfowl. Two booths were built, using as a guide certain apparatus specifications in American Society for Testing and Materials pamphlet D 1729–69 (1974), "Standard method for visual evaluation of color differences of opaque materials." The larger booth (Fig. 1) has one pair of 48" (1219 mm) 40w 7400 K or 7500 K lamps, approximating north daylight, as well as an optional alternate pair of 48" 40w 5000 K lamps, approximating noon daylight (K = kelvin: unit of absolute temperature); the smaller booth, not shown, has two pairs of 24" (610 mm) 20w 5000 K lamps. Both booths have an optional, three-part curtain with head-sized viewing aperture (an accessory 45° viewing stage with styrofoam pinning surface for evaluating insect specimens is shown in a photograph of the larger booth by McKillop and Preston [Can.Entomol. 113:256,

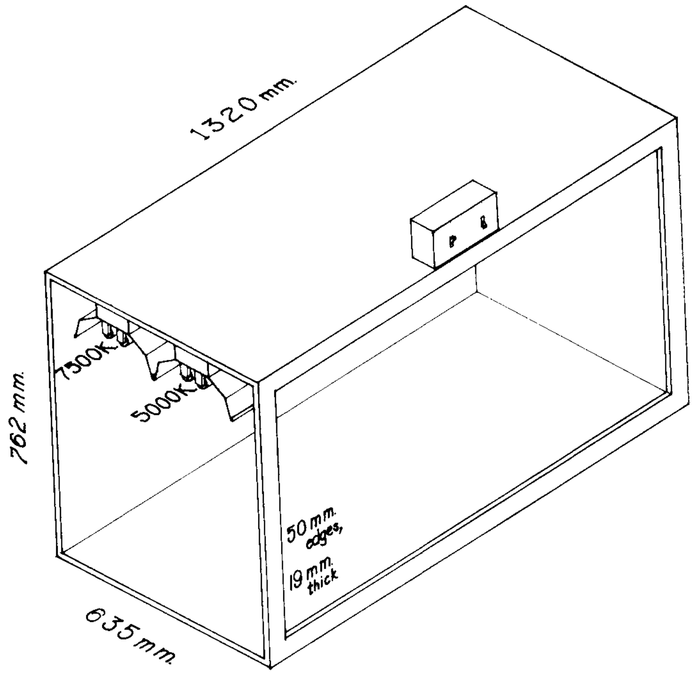

FIG. 1. Isometric drawing of larger booth, with side removed to show lamp placement. Curtain and 3.5 m electrical cord not shown.

1981]). All surfaces of the booths, including reflectors and viewing stand, were painted with Pratt and Lambert Vapex flat wall finish, color no. 2507, Crane Gray (Calibrated II Series), which has the Munsell value N 6.05/, with chroma less than /0.2 (Pratt and Lambert, F. J. Abel, in litt.). Color of the gray curtains was estimated visually as 5R 6.8/0.4.

Illumination of the booths was tested initially and at intervals thereafter with a Gossen model D P MT–2CC Photometer, Serial 310, manufactured by the Holophane Company, Ltd. In addition, illumination levels were checked at least once every 100 h with a Gossen "Lunasix 3" Exposure Meter. After the first 100 h of operation, the illumination level of the lamps decreased from approximately 200 foot-candles (2150 lumens/m^2) when the lamps were new to approximately 125 foot-candles (1340 lumens/m^2) at the time they were discarded. Note that this range of illumination is permissible for color evaluation, but not always for color matching, which involves additional criteria.

The selection of the lamps themselves is the first consideration in setting up an effective lamp-booth. The lamps should be cool, reasonably efficient and available; they should provide even illumination of an area large enough to contain and to manipulate specimens (including live material) and color standards. Most important, the spectral energy of the lamps should approximate that of a daylight phase or reference illuminant (e.g., a CIE [International Commission on Illumination] standard illuminant) of the same correlated color temperature (K) as closely as possible throughout the spectral range, so that colors evaluated under the lamps will appear much as they would under the daylight or reference illuminant. This

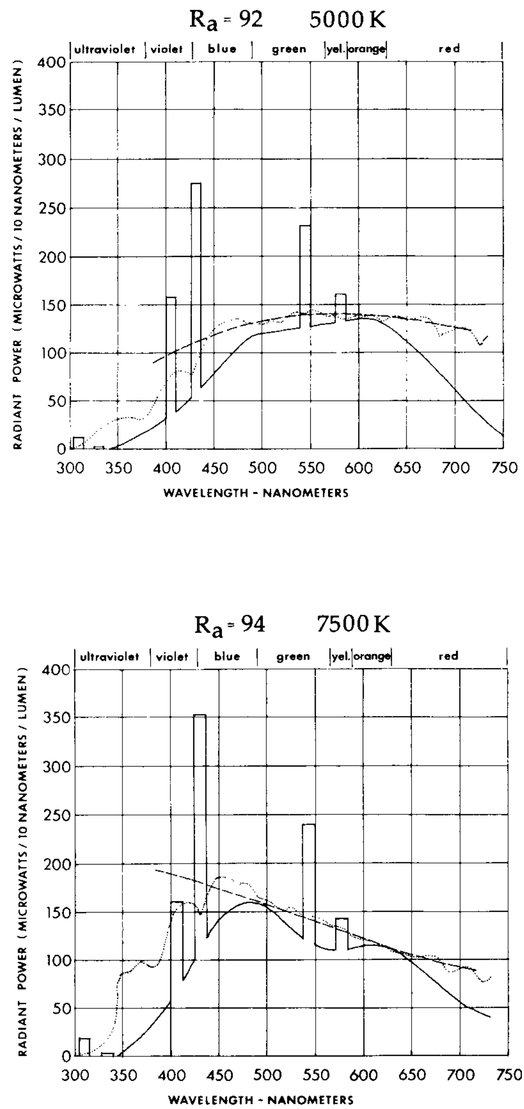

FIG. 2. Spectral energy distribution of 5000 K and 7500 K lamps, used in smaller and larger booths, respectively. Reference illuminants (......): typical daylight at 5000 K and 7500 K (*from* CGE Lamp Letter LL4–72, Dec. 1972). Note: The abrupt bursts of energy at the wavelengths of the mercury emission lines are characteristic of all fluorescent lamps.

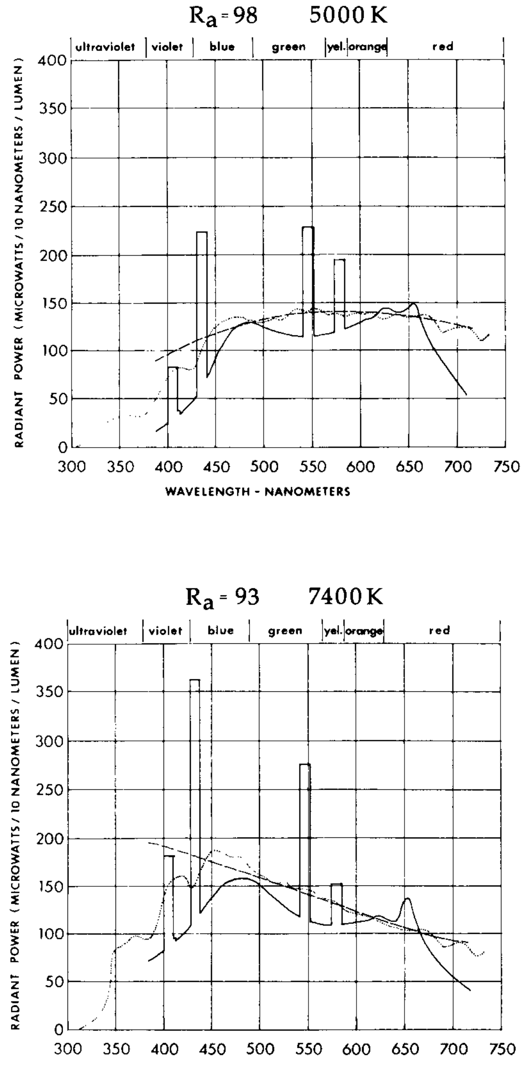

FIG. 3. Spectral energy distribution of 5000 K lamp used in larger booth (*from* Philips "Fluorescent Lamps" brochure). Spectral energy distribution of 7400 K lamp used alternatively in larger booth (*from* Philips Engin. Rept. 9, Lighting, 1968:23). Respective reference illuminants (dashes = optimized curve): black body (Planckian) radiator at 5000 K; reconstituted daylight at 7500 K (Philips Electronics, Lighting and Transformer Division, George Szeker, in litt.). Both drawings enlarged or altered to same scale as Fig. 2. See Fig. 2 Note.

correlation, called the color rendering index (R_a), should be close to 100 for accurate color evaluation. (See Appendix for more detailed discussion of color rendering and colorimetry.)

While the spectral energy distributions of the lamps selected (Figs. 2 and 3) suggest very good color rendering throughout the visible spectral range, the correlation with their respective reference illuminants is closest in the yellow and red wavelengths (ca. 575–650 nanometers), where most avian colors are found, e.g., 18 of the 21 most frequently used colors analyzed by Palmer and Reilly (A Concise Color Standard, A.O.U. Handbook Fund, 1956:5) and 55 of the 86 listed by Smithe (Naturalist's Color Guide, Pt. 1, Am. Mus. Nat. Hist., New York, New York, 1975:Intro.). Readers who wish to construct a lamp-booth and whose work involves evaluation of a particular range of colors should seek lamps that render these colors most accurately. All major lamp companies (General Electric, Philips, Sylvania, Westinghouse, etc.) manufacture deluxe or special daylight lamps and will provide technical data about them on request. These should include at least spectral energy distribution, both general (R_a) and individual (R_i) color rendering indices, color temperature and approximate initial lumens, so that the lamps chosen will be those best suited for the research intended.

I thank H. MacDiarmid for advice about and testing of the illumination of both lamp-booths, Carl and J. Nelson for building the smaller booth and G. Lammers for authorizing the construction of the larger booth by the museum workshop staff. I am grateful to H. MacDiarmid, R. Wrigley and B. McKillop for reading early drafts of the manuscript, to G. Wyszecki for reading critically a later draft and to G. Szeker for checking the drawings for Fig. 3. A. Einerson helped prepare Fig. 1 and Carl Nelson did the final drawings for Figs. 1, 2 and 3. Fig. 2 was redrawn with permission of Canadian General Electric Lamp Department and Fig. 3 with permission of Philips Electronics, Ltd., Lighting and Transformer Division.—COLLEEN NELSON, *Manitoba Museum of Man and Nature, Winnipeg, Manitoba R3B 0N2 Canada.* *Accepted 11 May 1981.*

APPENDIX

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