

June), we saw but one female (in adult plumage) present and defending. In addition, we noted no obvious size or color differences in the eggs (at the nest or in photographs) to suggest that two females were responsible for the clutch. Unfortunately, the eggs were not measured. An alternate hypothesis, implied by Snyder and Wiley (Ornithol. Monogr., No. 20, 1976), is that the unusual clutch could have been produced by an extremely well-fed female who was also genetically disposed to lay large clutches. On our

final visit (9 July), no adults were present and we found the nest broken up.

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### SUGGESTIONS FOR PREPARING AUDIOSPECTROGRAMS FOR PUBLICATION

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Audiospectrograms ("sonagrams") are subject to the same general rules for publication as other illustrative material, but they do present a few special problems. My intent here is to present some procedures, and to discuss the special problems.

First, decide to what journal the paper will be sent. In *The Condor*, the type bed is 14.7 × 23 cm. This is the maximum permissible space per page for an illustration, including the legend. The page has two columns, each 7.1 cm wide. The illustrations may be reduced to the width of one column, or, if this reduces them too much, they may occupy the double-column space. It is important to plan which reduction will be necessary, so that appropriately sized lettering can be used in the original artwork: when reduced, letters and numbers should be approximately the same size as capital letters in the text.

Next, there is a choice of modes of presentation. If the space is available, and the spectrogram is sharp, clear, and relatively short, it is preferable to use the actual sonagram for the figure. Intensity of sound is indicated by the darkness of the marking, and the details of sound are more complete and more exact on the actual sonagram. If sound intensity differences are important, and need to be shown, the illustration should be printed in halftone (e.g., Martin, *Condor* 79:209-221, 1977; Morton and Shalter, *Condor* 79:222-227, 1977). Often, however, the intensity is not important and the original artwork, including

the sonagram, can be photographed with high contrast film and paper to produce a strictly black-and-white print (e.g., Thompson, Fig. 3, *Condor* 78:200, 1976). This procedure sometimes results in a loss of structural detail in the printed figure, as seems to be the case in Figure 5 of Orians et al. (*Condor* 79:250-256, 1977). Nevertheless, depending on the characteristics of the sonagram, this process can be useful, and is much less expensive to print than the halftone. With this method, the markings of extraneous sounds may be opaqued out with paint or white correction fluid.

[In photographing any artwork, care should be taken so that the negatives and prints are perfectly sharp. Overlaying sonagrams with a glass plate during copying will prevent them from curling and ensure exact focus overall. Prints from high-contrast negatives should be exposed just enough so that the markings and lettering are black, not grey. These will become blurred if overexposed and consequently will block up when reduced.—Ed.]

If the illustration must be greatly reduced, many details will be lost. Therefore, for long sonagrams or groups of sonagrams it is often preferable to trace them onto tracing paper, and then transfer the tracing to drawing paper. An alternative is to trace the spectrograms onto vellum graph paper; the blue graph lines do not register when photographed on high contrast film, so the transfer to drawing paper can be omitted. The sharp contrast of the inked sound figures with the white background allows for considerable reduction with less loss of detail (e.g., Thompson 1976: 195-207). There is a trade-off of information in such illustrations, of course, because the intensity of sound, as indicated by the darkness of the marks, is lost. For complex sounds

(e.g., Thompson, Fig. 2k, 1976:198), it is best to use an actual sonagram, with or without high contrast, because of the difficulty of tracing accurately. For relatively simple sounds (e.g., Thompson, Figs. 4 and 5, 1976: 200–201), the tracings provide the clearest representation with the necessarily great reduction in size. Tracings are also useful for describing duet or chorus singing, when it is necessary to identify different individuals. Stippling or press-on overlays can be used to identify each singing bird (e.g., Payne, Ostrich Suppl. 9, 1971).

A time scale in seconds and a frequency scale in Kilohertz (kHz) should be included

with the sonagram, either actual or traced, because different machines are set at different speeds and frequency scales. When possible, it is best to use the 2.4 s and 80 to 8000 Hertz setting because these are the ones most commonly used and therefore make comparison easier. For reduced speed sounds, the half-speed settings of 1.2 s and 160–16000 Hertz should be used.

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