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SUMMARY OF THE SYMPOSIUM

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In bringing together a balanced mix of field biologists, statisticians, practitioners and theorists, the organizers of this symposium have been remarkably successful in achieving a unity of interest and purpose that has led to an outstandingly productive conference. The symposium was orchestrated around a central theme: how can we most effectively and efficiently obtain those elusive data we need for monitoring wild bird populations and for analysing the underlying mechanisms of population regulation? No definitive solutions were reached, but notable progress was made in defining problems and approaches. Conferees were repeatedly and forcefully reminded of the tremendous difficulties involved in obtaining accurate data in the field, and sternly admonished to adhere to appropriate statistical procedures in both the planning and analysis stages of their studies. Their response reveals a broad determination to meet these challenges vigorously and intelligently, and promises a surge of interest to develop effective solutions.

While the central emphasis of the conference was on methods, two full sessions and many poster displays were devoted to illustrating and evaluating recent progress in monitoring and mapping population trends and patterns. Studies of species and community densities on small plots using the now well-established mapping method were presented and critically examined for a variety of avian habitats. Population trends and range-boundary fluctuations were graphically displayed from data obtained in long-term monitoring programs using a variety of station count procedures, while patterns of density distribution were revealed in studies employing recently developed methods of counting detections within fixed or variable-width strips and point-centered circles along transects through large tracts of avian habitat. Other censusing techniques were discussed and illustrated including mist-netting, mark-recapture, and calling secretive birds to the observer with playbacks of recorded vocalizations.

Three sessions and a number of poster displays then focused on the evaluation of methods in common use, criticisms of traditional procedures, and suggetions for modifications and innovations. Results obtained by mapping, station counts and several types of transect surveys were compared and evaluated by field investigators and statisticians in a wide variety of situations including areas where the local populations had been marked and intensively studied.

Three more sessions and a large number of poster exhibits were devoted to the numerous and difficult problems encountered in obtaining reliable census data in the field, and principles to be followed in organizing field projects and analysing data sets. The field problems considered included aspects of species and individual variability, unpredictability of bird responses, interactions between birds and observers, seasonal and hourly changes in bird abundance, activity, and detectability, vegetation structure and terrain, sound attenuation with distance in various vegetation types, and variations in the experience, skill, hearing acuity, and attentiveness of observers. Programs for training field workers in identification and distance estimation were described and the possibility of replacing distance estimations with predetermined detection threshold distance values was considered. Several papers considered problems of designing projects and analysing census data.

In the final session attention was turned to applications of bird censusing in studies of habitat distribution, habitat responses, and community dynamics in situations ranging from scrub deserts to intensely cultivated farm lands, and from tropical forests to island archipelagos. Adaptation of procedure to the specifics of research objectives was discussed, and the potential of emerging quantitative techniques for analysing community structure and dynamics was explored.

An accomplishment of the symposium that will persist beyond the conference itself in the published proceedings is the guidance it will provide for investigators undertaking projects or organizing programs involving bird censuses. Stressing the importance of selecting the procedure most appropriate to the specific objectives of a project I have prepared a table summarizing my views on census problems and census methods as developed and discussed during the conference (Table 1).

Most projects will, I believe, fall into one of two problem areas identified in the first column of the table as population responses and population dynamics. These can then be assigned to one of a limited number of categories listed as project objectives in the second column. The third column, headed units of measurement, suggests that indices of relative abundance are

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TABLE 1
BIRD CENSUS PROBLEMS AND METHODS

Problem areas	Project objectives	Units of measurement	Methods available and examples
Population behavior and responses — Comparisons	Temporal changes Year to year Season to season Before-after Site differences Different habitats Different sites Experimental-control	Detections per unit of effort — Indices of relative abundance	Mist net sampling Line counts No boundary (Aud. Xmas B.C.) (Fixed strip) (Variable strip) Point or station counts No boundary (IPA, NABBS) (Fixed radius) (Variable radius)
Population regulation and dynamics — Analyses	Density structure Species rank Equitability and diversity Subcommunity structure Density dynamics Biomass structure Trophic balance Energy flow	Birds per unit of area — Measures (Indices) of density — Instantaneous or cumulative	Mark-recapture (single species) Mapping (CBC, Aud. BBC) Line counts Fixed strip (Finn) Variable strip (USBLM-Ariz.) Point counts Fixed radius Variable radius (USFWS-Haw.)

adequate and preferable to density estimates for most if not all projects concerned with population responses (first problem area). In station counts, point counts or line counts (column 4) the units of observer effort could be units of time, distance, or area. Where properly standardized for speed of walking or duration of observation stops, time and distance will be equivalent and equally acceptable; area calculated from estimated detection distances could provide additional information on the relative abundance of species in the community, but because of the unsubstantial nature of most distance estimations should be avoided unless the additional information is clearly needed.

Absolute density values (birds per unit of area) may be necessary where species with differing detectabilities are to be compared as in studies dealing with numerical diversity, or combined as in studies involving consumer-resource, or predator-prey ratios. The methods currently available for density measurements are laborious, costly and limited in applicability (mark-recapture and territory mapping on small plots), or dependent on subjectively determined areal denominators (detection counts within estimated strip or circle boundaries). They are producing much valuable information, however, and must be promoted for the present as the best we have been able to devise.