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Response = Signal + Noise; 3.2.1 The Noise Component; 3.2.2 The Signal Component

3.2.3 Bringing the Noise and the Signal Components Together: The Link Function 3.3 Poisson GLM in R and WinBUGS for Modeling Time Series of Counts; 3.3.1 Generation and Analysis of Simulated Data; 3.3.2 Analysis of Real Data Set; 3.4 Poisson GLM for Modeling Fecundity; 3.5 Binomial GLM for Modeling Bounded Counts or Proportions; 3.5.1 Generation and Analysis of Simulated Data; 3.5.2 Analysis of Real Data Set; 3.6 Summary and Outlook; 3.7 Exercises; 4 Introduction to Random Effects: Conventional Poisson GLMM for Count Data; 4.1 Introduction; 4.1.1 An Example; 4.1.2 What Are Random Effects? 4.1.3 Why Do We Treat Batches of Effects as Random? Scope of Inference; Assessment of Variability; Partitioning of Variability; Modeling of Correlations among Parameters; Accounting for All Random Processes in a Modeled System; Avoiding Pseudoreplication; Borrowing Strength; Random Effects as a Compromise between Pooling and No Pooling of Batched Effects; Combining Information; 4.1.4 Why Should We Ever Treat a Factor as Fixed?; 4.2 Accounting for Overdispersion by Random Effects-Modeling in R and WinBUGS; 4.2.1 Generation and Analysis of Simulated Data; 4.2.2 Analysis of Real Data 4.3 Mixed Models with Random Effects for Variability among Groups (Site and Year Effects) 4.3.1 Generation and Analysis of Simulated Data; 4.3.2 Analysis of Real Data Set; Null or Intercept-Only Model; Fixed Site Effects; Fixed Site and Fixed Year Effects; Random Site Effects (No Year Effects); Random Site and Random Year Effects; Random Site and Random Year Effects and First-Year Fixed Observer Effect; Random Site and Random Year Effects, First-Year Fixed Observer Effect, and Overall Linear Time Trend; The Full Model; 4.4 Summary and Outlook; 4.5 Exercises

## 5 State-Space Models for Population Counts

### Sommario/riassunto

Bayesian statistics has exploded into biology and its sub-disciplines, such as ecology, over the past decade. The free software program WinBUGS, and its open-source sister OpenBUGS, is currently the only flexible and general-purpose program available with which the average ecologist can conduct standard and non-standard Bayesian statistics. Comprehensive and richly commented examples illustrate a wide range of models that are most relevant to the research of a modern population ecologist. All WinBUGS/OpenBUGS analyses are completely integrated in software R.