munittiin 21. toukokuuta. Kaikki munat kuoriutuivat ja seitsemän poikasta lähti pöntöstä lentoon. Kaikki emot ruokkivat innokkaasti poikasia, joista kuusi oli ruskeapäisiä lapintiaistyyppisiä ja yksi mustapäinen hömötiaistyyppinen.

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Author's address: Kilpisjärvi Biological Station, University of Helsinki, Arkadiankatu 7, SF-00100 Helsinki, Finland

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Statistical methods used in Ornis Fennica

Antero Järvinen

Statistics is an essential part of today's ornithological literature. Investigations have become increasingly quantitative. Objective analysis and interpretation of data and evaluation of the reliability of conclusions is difficult or impossible without adequate statistics. Statistics can also help in the planning of experiments and in the testing of hypotheses.

To gain insight into the most common statistical methods used by ornithologists writing articles for Ornis Fennica, I analysed the contents of Ornis Fennica from 1980—83 (n=55 articles) and from 1984—86 (n=43). I compared the data with the statistics used in Ornis Scandinavica from 1984—86 (n=114; Table 1). I do not, however, discuss whether the authors have used suitable or unsuitable methods.

In Ornis Fennica statistics has become more popular during the 1980s. In 1980—83 the median number of different statistical methods per article was one, but in 1984—86, three. In the same period the percentage of articles without statistics ("none" in Table 1) decreased from 31% to 9%. Nonparametric methods seem to have become relatively more common than parametric methods.

In 1984-86 the statistical repertoire of Ornis Fennica has been similar to that of Ornis Scandinavica. For instance, in both journals the relative frequencies of the five most common methods are nearly equal. However, there are also some relevant differences between the journals. Nonparametric, matched pairs tests (Wilcoxon signed rank test and sign test), Fisher's exact test, rank correlations (Spearman and Kendall) and multivariate methods are relatively rare in Ornis Fennica. Ornis Fennica also contained more articles where the methods are not described (only the probability has been given; "unknown method" in Table 1).

Since the sample size of Ornis Scandinavica is clearly larger than that of Ornis Fennica in 1984—86, Ornis Scandinavica naturally contained more methods. According to a rarefaction analysis based on the distribution of methods used in Ornis Scandinavica, the expected number of methods in Ornis Fennica, in 1984—86, was 27±4 (95% limits), when 24 methods were actually used (including "none").

For those who dislike statistics, Table 1 carries a delightful message: no more than 10 methods are needed to understand all, or nearly all, statistics in most articles. Sophisticated methods occur in less than 10% of the articles. Both in Ornis Fennica and in Ornis Scandinavica the analysis of variance is surprisingly rarely used, and even rarer are multiple comparison tests as a constituent of ANOVA.

Analysis of covariance and the nonparametric alternatives of ANOVA (Kruskal-Wallis and Friedman) are also rare. Explorative data analysis (EDA) was not used.

Selostus: **Ornitologin tilastolliset työkalut**

Kirjoituksessa verrataan tilastollisten menetelmien käyttöä Ornis Fennicassa (1980—86) ja Ornis Scandinavicassa (1984—86) julkaistuissa artikkeleissa (taulukko 1). Ornis Fennicassa tilastotieteen käyttö on nopeasti yleistynyt: 1980—83 eri menetelmiä oli keskimäärin 1/artikkeli (mediaani), 1984—86 3/artikkeli. Samanaikaisesti sellaisten artikkeleiden osuus, joissa ei ole käytetty lainkaan tilastollisia menetelmiä on pudonnut 31%:sta 9%:iin. Vuosina 1984—86 Ornis Fennican kirjoittajien tilastollinen repertoaari on kutakuinkin vastannut Ornis Scandinavicassa käytettyjen tilastomenetelmien valikoimaa. Esim. molemmissa lehdissä viiden yleisimmin käytetyn menetelmän prosenttiosuudet ovat miltei samat.

Tilastollisia menetelmiä vieroksuville taulukosta 1 välittyy ilahduttava tosiasia: opettelemalla 10 menetelmää ymmärtää jo melkein kaiken tilastollisen analyysin useimmista artikkeleista.

Authors's address: Antero Järvinen, Kilpisjärvi Biological Station, Arkadiankatu 7, SF-00100 Helsinki, Finland.

Table 1. Statistical methods used in articles published in Ornis Fennica (OF) from 1980–86 and in Ornis Scandinavica (OS) from 1984–86. The numbers present the numbers of articles in which different methods were used (% in parentheses). "Descriptive statistics" = at least standard deviations or standard errors for the mean and/or percentages are given, "unknown method" = only the probability is given, "none" = percentages and means without standard errors, medians and ranges or merely prose.

Method	OF 1980–83 n (%)	OF 1984–86 n (%)	OS 1984–86 n (%)
Parametric methods			
Descriptive statistics	28 (50.9)	31 (72.1)	81 (71.1)
Unpaired t-test	9 (16.4)	14 (32.6)	41 (36.0)
Paired t-test	1 (1.8)	0 (0.0)	2 (1.8)
z-test	0 (0.0)	1 (2.3)	2 (1.8)
1-way analysis of variance	5 (9.1)	6 (14.0)	12 (10.5)
2-way analysis of variance	1 (1.8)	2 (4.7)	4 (3.5)
Nested analysis of variance	0 (0.0)	0 (0.0)	3 (2.6)
Multiple comparisons	0 (0.0)	2 (4.7)	2 (1.8)
Pearson's correlation	11 (20.0)	18 (41.9)	50 (43.9)
Simple linear regression	7 (12.7)	10 (23.3)	36 (31.6)
Multiple regr. and correlation	2 (3.6)	3 (7.0)	6 (5.3)
Polynomial regression	2 (3.6)	1 (2.3)	3 (2.6)
Analysis of covariance	0 (0.0)	0 (0.0)	1 (0.9)
Nonparametric methods			
Mann-Whitney test	4 (7.3)	7 (16.3)	22 (19.3)
Kruskal-Wallis test	1 (1.8)	2 (4.7)	4 (3.5)
Friedman test	0 (0.0)	1 (2.3)	2 (1.8)
Median test	0 (0.0)	2 (4.7)	2 (1.8)
Randomization test	0 (0.0)	1 (2.3)	1 (0.9)
Wilcoxon signed rank test	0 (0.0)	0 (0.0)	5 (4.4)
Sign test	0 (0.0)	0 (0.0)	4 (3.5)
Chi-squared test	10 (18.2)	17 (39.5)	44 (38.6)
G-test	0 (0.0)	4 (9.3)	5 (4.4)
Fisher's exact test	1 (1.8)	2 (4.7)	16 (14.0)
Binomial test	1 (1.8)	2 (4.7)	5 (4.4)
Runs test	1 (1.8)	0 (0.0)	1 (0.9)
Spearman's rank correlation	4 (7.3)	6 (14.0)	20 (17.5)
Kendall's rank correlation	0 (0.0)	0 (0.0)	3 (2.6)
Kendall's coeff. of concord.	0 (0.0)	0 (0.0)	1 (0.9)
Circular statistics			
Rayleigh test	0 (0.0)	0 (0.0)	1 (0.9)
V-test	0 (0.0)	0 (0.0)	1 (0.9)
Watson U^2-test	0 (0.0)	0 (0.0)	1 (0.9)
Multivariate methods			
Factor analysis	0 (0.0)	1 (2.3)	0 (0.0)
Principal comp. analysis	0 (0.0)	0 (0.0)	3 (2.6)
Discriminant analysis	0 (0.0)	0 (0.0)	5 (4.4)
Cluster analysis	0 (0.0)	0 (0.0)	2 (1.8)
Canonical correlation	0 (0.0)	0 (0.0)	1 (0.9)
Detrended correspond. anal.	0 (0.0)	0 (0.0)	1 (0.9)
Other			
Rarefaction	0 (0.0)	1 (2.3)	0 (0.0)
Unknown method	6 (10.9)	3 (7.0)	1 (0.9)
None	17 (30.9)	4 (9.3)	6 (5.3)
No. of articles	55	43	114
Methods/article (median)	1	3	3