

Referencias

- Alatalo, R. V., Lundberg, A. & Glynn, C, 1986. Female pied flycatchers choose territory quality and not male characteristics. *Nature*, 323: 152–153.
- Amundsen, T., 2000. Why are female birds ornamented. *Trend. Ecol. Evol.*, 15: 149–155.
- Amundsen, T., Forsgren, E. & Hansen, L. T. T., 1997. On the function of female ornaments: Male bluethroats prefer colourful females. *Proc. R. Soc. Lond. B*, 264: 1579–1586.
- Andersson, M., 1982. Female choice selects for extreme tail length in a widowbird. *Nature*, 299: 818–820.
- 1983. On the functions of conspicuous seasonal plumages in birds. *Anim. Behav.*, 31: 1262–1263.
 - 1994. *Sexual selection*, Princeton University Press, Princeton, NJ.
- Andersson, S., 1989. Sexual selection and cues for female choice in leks of Jackson's widowbird *Euplectes jacksoni*. *Behav. Ecol. Sociobiol.*, 25: 403–410.
- Andersson, S. & Amundsen, T., 1997. Ultraviolet colour vision and ornamentation in bluethroats. *Proc. R. Soc. Lond. B*, 264: 1587–1591.
- Andersson, S., Ornborg, J. & Andersson, M., 1998. Ultraviolet sexual dimorphism and assortative mating in blue tits. *Proc. R. Soc. Lond. B*, 265: 445–450.
- Aragonés, J., 1997. Influencia de la cípsis en el comportamiento del chotacabras pardo, *Caprimulgus ruficollis*. Tesis doctoral, Universidad de Córdoba, Córdoba.
- Armstrong, E. A., 1971. Social signalling and white plumage. *Ibis*, 113: 534.
- Badyaev, A. V. & Duckworth, R. A., 2003. Context-dependent sexual advertisement: plasticity in development of sexual ornamentation throughout the lifetime of a passerine bird. *J. Evol. Biol.*, 16: 1065–1076.
- Badyaev, A. V. & Hill, G. E., 1999. Variation in avian sexual dichromatism in relation to phylogeny and ecology. In: *Proc. 22 Int. Ornithol. Congr.*, Durban: 1687–1705 (N. Adams & R. Slotow, Eds.). BirdLife South Africa, Johannesburg.
- 2000. Evolution of sexual dichromatism: contribution of carotenoid–versus melanin–based coloration. *Biol. J. Linn. Soc.*, 69: 153–172.
- Badyaev, A. V., Hill, G. E., Dunn, P. O. & Glen, J. C., 2001. Plumage color as a composite trait: development and functional integration of sexual ornamentation. *Am. Nat.*, 158: 221–235.
- Badyaev, A. V. & Qvarnström, A., 2002. Putting sexual traits into the context of an organism: a life-history perspective in studies of sexual selection. *Auk*, 119: 301–310.
- Baker, R. R., 1985. Bird coloration: In defence of unprofitable prey. *Anim. Behav.*, 33: 1387–1388.
- Baker, R. R. & Hounsome, M. V., 1983. Bird coloration:unprofitable prey model supported by ringing data. *Anim. Behav.*, 31: 614–615.

- Baker, R. R. & Parker, G. A., 1979. The evolution of bird coloration. *Phil. Trans. R. Soc. Lond. B*, 287: 63–130.
- Ballentine, B. & Hill, G. E., 2003. Female mate choice in relation to structural plumage coloration in blue grosbeaks. *Condor*, 105: 593–598.
- Balph, M. H. & Balph, D. F., 1979. On the relationship between plumage variability and social behaviour in wintering Pine siskins (*Carduelis pinus*). *XVI Int. Ethol. Conf.*
- Balph, M. H., Balph, D. F., Barash, D. P., 1982. *Sociobiology and behavior*. Hodder and Stoughton, London.
- Barnard, C., Gilbert, F. & McGregor, P., 1993b. *Asking questions in biology*. Longman Scientific & Technical, Essex, UK.
- Barnard, P., 1990. Male tail length, sexual display intensity and female sexual response in a parasitic African finch. *Anim. Behav.*, 39: 652–656.
- Bart, J., Fligner, M. A. & Notz, W. I., 1998. *Sampling and statistical methods for behavioral ecologists*, Cambridge Univ. Press, Cambridge.
- Beauchamp, G., 2003. Delayed maturation in birds in relation to social foraging and breeding competition. *Evol. Ecol. Res.*, 5: 589–596.
- Beauchamp, G. & Heeb, P., 2001. Social foraging and the evolution of white plumage. *Evol. Ecol. Res.*, 3: 703–720.
- Begon, M., Harper, J. L. & Townsend, C. R., 1986. *Ecology: individuals, populations, and communities*. Sinauer, Sunderland Mass.
- Belthoff, J. R., Dufty, A. M. Jr. & Gauthreaux, S. A., 1994. Plumage variation, plasma steroids and social dominance in male House Finches. *Condor*, 96: 614–625.
- Bennett, A. T. D. & Cuthill, I. C., 1994. Ultraviolet vision in birds: what is its function? *Vision Res.*, 34: 1471–1478.
- Bennett, A. T. D., Cuthill, I. C. & Norris, K. J., 1994. Sexual selection and the mismeasure of color. *Am. Nat.*, 144: 848–860.
- Bennett, A. T. D., Cuthill, I. C., Partridge, J. C. & Lunau, K., 1997. Ultraviolet plumage colors predict mate preferences in starlings. *Proc. Natl. Acad. Sci. USA*, 94: 8618–8621.
- Bennett, A. T. D., Cuthill, I. C., Partridge, J. C. & Maler, E., 1996. Ultraviolet vision and mate choice in zebra finches. *Nature*, 380: 433–435.
- Bensch, S. & Grahn, M., 1993c. A new method for estimating individual speed of molt. *Condor*, 95: 305–315.
- Berglund, A., Bisazza, A. & Pilastro, A., 1996. Armaments and ornaments: an evolutionary explanation of traits of dual utility. *Biol. J. Linn. Soc.*, 58: 385–399.
- Birkhead, T. R. & Möller, A. P., 1992. *Sperm competition in birds*. Academic Press, London.
- 1998. *Sperm competition and sexual selection*. Academic Press, San Diego.
- Blanco, G. & Puente, J. de la, 2002. Multiple elements of the black-billed magpie's tail correlate with variable honest information on quality in different age/sex classes. *Anim. Behav.*, 63: 217–225.
- Boag, P. T. & Van Noordwijk, A. J., 1987. Quantitative genetics. In: *Avian genetics: A population and ecological approach*: 45–78 (F. Cooke & P. A. Buckley, Eds.). Academic Press, London.
- Boere, M., 1976. The significance of the Dutch Waddenze in the annual life cycle of artic, subartic and boreal waders. Part 1. The function as a moulting area. *Ardea*, 64: 210–291.

- Bogliani, G. & Brangi, A., 1990. Abrasion of the status badge in the male Italian Sparrow *Passer italiae*. *Bird Study*, 37: 195–198.
- Borras, A., Cabrera, J., Colome, X. & Senar, J. C., 1993. Sexing fledglings of cardueline finches by plumage color and morphometric variables. *J. Field Ornithol.*, 64: 199–204.
- Borras, A., Cabrera, T., Cabrera, J. & Senar, J. C., 2004. Inter-locality variation in speed of moult in the Citril Finch *Serinus citrinella*. *Ibis*, 146: 14–17.
- Bortolotti, G. R., Negro, J. J., Tella, J. L., Marchant, T. A. & Bird, D. M., 1996. Sexual dichromatism in birds independent of diet, parasites and androgens. *Proc. R. Soc. Lond. B*, 263: 1171–1176.
- Bradbury, J. W. & Davies, N. B., 1987. Relative roles of intra- and intersexual selection. In: *Sexual selection: testing the alternatives*: 143–163 (J. W. Bradbury & M. B. Andersson, Eds.). Wiley, Chichester, UK.
- Brockmann, H. & Völker, O., 1934. Der Gelbe Federfarbstoff des Kanarienvogels (*Serinus canaria canaria* (L.)) und das Vorkommen von Carotinoiden bei Vögeln. *Hoppe-Seyler's Zeitschrift für Physiologische Chemie*, 224: 193–215.
- Brodin, A., 1993d. Radio-ptilochronology –tracing radioactively labelled food in feathers. *Ornis Scand.*, 24: 167–173.
- Brooks, R. & Coulbridge, V., 1999. Multiple Sexual Ornaments Coevolve with Multiple Mating Preferences. *Am. Nat.*, 154: 37–45.
- Brotóns, L., 1998. Status signalling in the Coal tit (*Parus ater*): the role of previous knowledge of individuals. *Etología*, 6: 49–52.
- Brown, C. R., 1984. Light-breasted Purple Martins dominate dark-breasted birds in a roost: implications for female mimicry. *Auk*, 101: 162–164.
- Brown, M. B. & Brown, C. R., 1988. Access to winter food resources by bright- versus dull-colored house finches. *Condor*, 90: 729–731.
- Brown, M. E., 1996. Assessing body condition in birds. *Current Ornithology*, 13: 67–135.
- Brush, A. H., 1978. Avian pigmentation. In: *Chemical zoology*, vol. X, Aves: 141–161 (A. H. Brush, Ed.). Academic Press, New York.
- Brush, A. H. & Power, D. M., 1976. House finch pigmentation: carotenoid metabolism and the effect of diet. *Auk*, 93: 725–739.
- Buchanan, K. L., Evans, M. R. & Goldsmith, A. R., 2003. Testosterone, dominance signalling and immunosuppression in the house sparrow, *Passer domesticus*. *Behav. Ecol. Sociobiol.*, 55: 50–59.
- Burley, N., 1985. The organization of behavior and the evolution of sexually selected traits. In: *Avian monogamy. Ornithology monograph*, 38: 22–44 (P. A. Gowaty & D. W. Mock, Eds.). American Ornithologists Union, Washington DC.
- Burley, N., Krantzberg, G. & Radman, P., 1982. Influence of colour-banding on the conspecific preferences of zebra finches. *Anim. Behav.*, 30: 444–455.
- Burtt, E. H., 1979. Tips on wings and other things. In: *The behavioral significance of color*: 75–110 (E. H. Burtt, Ed.). Garland STPM Press, New York.
- 1981. The adaptiveness of animal colors. *BioScience*, 31: 723–729.
- 1984. Colour of the upper mandible: an adaptation to reduce reflectance. *Anim. Behav.*, 32: 652–658.
- 1986. An analysis of physical, and optical aspects of avian coloration with emphasis on wood-warblers. *Ornithol. Monogr.*, 38: 1–126.
- 1999. Rules to bird by Gloger's rule and Allen's rule. *Birding*, 31: 362–365.

- Burtt, E. H. & Gatz, A. J., 1982. Color convergence: is it only mimetic? *Am. Nat.*, 119: 738–740.
- Burtt, E. H. & Ichida, J. M. 1999. Occurrence of feather-degrading bacilli in the plumage of birds. *Auk*, 116: 364–372.
- Burtt, E. H., Swanson, J. A., Porter, B. A. & Waterhouse, S. M., 1994. Wing-flashing in mockingbirds of the Galápagos Islands. *Wilson Bull.*, 106: 559–562.
- Busse, P., 1984. Key to sexing and ageing of European Passerines. *Beitr. Naturk. Niedersachsens*, 37: 1–224.
- Butcher, G. S. & Rohwer, S. A., 1989. The evolution of conspicuous and distinctive coloration for communication in birds. *Current Ornithology*, 6: 51–108.
- Calkins, J. D. & Burley, N. T., 2003. Mate choice for multiple ornaments in the California quail, *Callipepla californica*. *Anim. Behav.*, 65: 69–81.
- Carranza, J., 1994b. *Etología. Introducción a la ciencia del comportamiento*. Universidad de Extremadura, Cáceres.
- 1994a. Sistemas de apareamiento y selección sexual. In: *Etología: introducción a la ciencia del comportamiento*: 363–406 (J. Carranza, Ed.). Universidad de Extremadura, Cáceres.
- Carrascal, L. M., Senar, J. C., Mozetich, I., Uribe, F. & Domènec, J., 1998. Interactions among environmental stress, body condition, nutritional status, and dominance in Great Tits. *Auk*, 115: 727–738.
- Caryl, P. G., 1982. Telling the truth about intentions. *J. theor. Biol.*, 97: 679–689.
- Charlesworth, B., 1987. The heritability of fitness. In: *Sexual selection: testing the alternatives*: 21–40 (J. W. Bradbury & M. B. Andersson, Eds.). Wiley, Chichester.
- Christe, P., Richner, H. & Oppliger, A., 1996. Begging, food provisioning, and nestling competition in great tit broods infested with ectoparasites. *Behav. Ecol.*, 7: 127–131.
- Chu, P. C., 1994. Historical examination of delayed plumage maturation in the shorebirds (Aves: Charadriiformes). *Evolution*, 48: 327–350.
- Clayton, D. H., 1990. Mate choice in experimentally parasitized Rock Doves: lousy males lose. *Amer. Zool.*, 30: 251–262.
- 1999. Feather-busting bacteria. *Auk*, 116: 302–304.
- Clayton, D. H. & Moore, J., 1997. *Host–Parasite Evolution: general principles and avian models*, Oxford University Press, Oxford.
- Collias, E. C., Collias, N. E., Jacobs, C. H., McAlary, F. & Fujimoto, J. T., 1979. Experimental evidence for facilitation of pair formation by bright color in weaverbirds. *Condor*, 81: 91–93.
- Cordero, P. J., Wetton, J. H. & Parkin, D. T., 1999. Extra-pair paternity and male badge size in the House Sparrow. *J. Avian Biol.*, 30: 97–102.
- Cott, H. B., 1947. The edibility of birds. *Proc. Zool. Soc. Lond.*, 116: 371–524.
- Craig, J. L., Stewart, A. M. & Brown, J. L., 1982. Subordinates must wait. *Z. Tierpsychol.*, 60: 275–280.
- Cronin, H., 1991. *The ant and the peacock*, Cambridge Univ. Press, New York.
- Cuadrado, M., 1995. Female-like plumage does not reduce aggression from adult male Black Redstarts *Phoenicurus ochruros* in winter. *Ardea*, 83: 431–434.
- Cuervo, J. J., Delope, F. & Möller, A. P., 1996. The function of long tails in female barn swallows (*Hirundo rustica*): An experimental study. *Behav. Ecol.*, 7: 132–136.
- Curio, E., 1976. *The ethology of predation*, Springer–Verlag, Berlin.
- Cuthill, I. C., Bennett, A. T. D., Partridge, J. C. & Maier, E. J., 1999b. Plumage

- reflectance and the objective assessment of avian sexual dichromatism. *Am. Nat.*, 153: 183–200.
- Cuthill, I. C., Partridge, J. C. & Bennett, A. T. D., 1999a. UV vision and its functions in birds. In: *Proc. 22 Int. Ornithol. Congr.* (N. Adams & R. Slotow, Eds.). BirdLife South Africa, Johannesburg.
- Dale, S. & Slagsvold, T., 1995. Female contests for nest sites and mates in the pied flycatcher *Ficedula hypoleuca*. *Ethology*, 99: 209–222.
- 1996a. Mate choice on multiple cues, decision rules and sampling strategies in female pied flycatchers. *Behaviour*, 133: 903–944.
- 1996b. Plumage coloration and conspicuousness in birds: Experiments with the pied flycatcher. *Auk*, 113: 849–857.
- Darwin, C., 1859. *On the origin of species by means of natural selection*. John Murray, London.
- 1871. *The descent of man and selection in relation to sex*. John Murray, London.
- Dawkins, R. & Krebs, J. R., 1978. Animal signals: information or manipulation? In: *Behavioural Ecology: an evolutionary approach*: 282–309 (J. R. Krebs & N. B. Davies, Eds.). Blackwell Scientific Publications, Oxford.
- 1979. Arms races between and within species. *Proc. R. Soc. Lond. B*, 205: 489–511.
- De Vries, T., 1976. Prey selection and hunting methods of the Galápagos Hawk, *Buteo galapagoensis*. *Gerfaut*, 66: 3–42.
- Desrochers, A., 1992. Age and foraging success in European blackbirds: variation between and within individuals. *Anim. Behav.*, 43: 885–894.
- Dhondt, A. A., 1979. Summer dispersal and survival of juvenile great tits in southern Sweden. *Oecologia*, 42: 139–157.
- Dhondt, A. A., Tessaglia, D. L. & Slothower, R. L., 1998. Epidemic mycoplasmal conjunctivitis in House Finches from eastern North America. *J. Wildl. Dis.*, 34: 265–280.
- Dolnik, V. R., 1982. *Population ecology of the Chaffinch* (*Fringilla coelebs*), Nauka, Leningrad.
- Domènech, J. & Senar, J. C., 1997. Medición de la condición física de las aves a través de la Ptilocronología. *EtoloGuía*, 15: 37–44.
- Dorst, J., 1976. Los colores de las aves. In: *La vida de las aves*: 75–93 (Anonymous). Ediciones Destino, Barcelona.
- Doucet, S. M. & Montgomerie, R., 2003. Structural plumage colour and parasites in satin bowerbirds *Ptilonorhynchus violaceus*: implications for sexual selection. *J. Avian Biol.*, 34: 237–242.
- Dufva, R. & Allander, K., 1995. Intraspecific variation in plumage coloration reflects immune response in Great Tit (*Parus major*) males. *Funct. Ecol.*, 9: 785–789.
- Dumbacher, J. P., Beehler, B. M., Spande, T. F., Garraffo, H. M. & Daly, J. W., 1992. Homobatrachotoxin in the genus *Pitoehui*: Chemical defense in birds? *Science*, 258: 799–801.
- Eaton, M. D. & Lanyon, S. M., 2003. The ubiquity of avian ultraviolet plumage reflectance. *Proc. R. Soc. Lond. B*, 270: 1721–1726.
- Eckert, C. G. & Weatherhead, P. J. 1987. Ideal dominance distributions: a test using red-winged blackbirds (*Agelaius phoeniceus*). *Behav. Ecol. Sociobiol.*, 20: 143–152.
- Eeva, T., Lehikoinen, E. & Pohjalainen, T., 1997. Pollution-related variation in food supply and breeding success in two hole-nesting passerines. *Ecology*, 78: 1120–1131.

- Eeva, T., Lehikoinen, E. & Rönkä, M., 1998. Air pollution fades the plumage of the Great Tit. *Funct. Ecol.*, 12: 607–612.
- Ehrlich, P. R., Dobkin, D. S. & Wheye, D., 1986. The adaptative significance of anting. *Auk*, 103: 835–835.
- Ekman, J. B., 1987. Exposure and time use in willow tit flocks: the cost of subordination. *Anim. Behav.*, 35: 445–452.
- 1989. Ecology on non-breeding social systems of Parus. *Wilson Bull.*, 101: 263–288.
- Ekman, J. B. & Askenmo, C. E. H., 1984. Social rank and habitat use in willow tit groups. *Anim. Behav.*, 32: 508–514.
- Ellegren, H. & Staav, R., 1990. Ruggningsflytning hos blåhaken *Luscinia s. svecica*. *Vår Fågelvärld*, 49: 80–86.
- Emlen, S. T., 1998. Relevance and responsibility in Behavioural Ecology. *ISBE Newsletter* 10: 8–10.
- Endler, J. A., 1990. On the measurement and classification of colour in studies of animal colour patterns. *Biol. J. Linn. Soc.*, 41: 315–352.
- 1991. Interactions between predators and prey. In: *Behavioural ecology: an evolutionary approach*: 169–196 (J. R. Krebs & N. B. Davies, Eds.). Blackwell Scientific Publications, Oxford.
- Enoksson, B., 1988. Age- and sex-related differences in dominance and foraging behaviour of nuthatches *Sitta europaea*. *Anim. Behav.*, 36: 231–238.
- Ens, B. J. & Goss-Custard, J. D., 1984. Interference among oystercatchers, *Haematopus ostralegus*, feeding on mussels, *Mytilus edulis*, on the Exe Estuary. *J. Anim. Ecol.*, 53: 217–231.
- 1986. Piping as a display of dominance by wintering Oystercatchers *Haematopus ostralegus*. *Ibis*, 128: 382–381.
- Enstrom, D. A., 1992. Breeding season communications hypotheses for delayed plumage maturation in passerines: tests in the orchard oriole, *Icterus spurius*. *Anim. Behav.*, 43: 463–472.
- Evans, M. R., Goldsmith, A. R. & Norris, R. A., 2000. The effects of testosterone on antibody production and plumage coloration in male house sparrows (*Passer domesticus*). *Behav. Ecol. Sociobiol.*, 47: 156–163.
- Evans, M. R. & Hatchwell, B. J., 1992. An experimental study of male adornment in the scarlet-tufted malachite sunbird: II: The role of the elongated tail in mate choice and experimental evidence for a handicap. *Behav. Ecol. Sociobiol.*, 29: 421–427.
- Ficken, M. S., Weise, C. M. & Popp, J. W., 1990. Dominance rank and resource access in winter flocks of Black-capped Chickadees. *Wilson Bull.*, 102: 623–633.
- Ficken, R. W., Mathiae, P. E. & Horwich, R., 1971. Eye marks in vertebrates: aids to vision. *Science*, 173: 936–939.
- Figuerola, J., 1999. A comparative study on the evolution of reversed size dimorphism in monogamous waders. *Biol. J. Linn. Soc.*, 67: 1–18.
- Figuerola, J., Domènec, J. & Senar, J. C., 2003. Plumage colour is related to ectosymbiont load during moult in the serin, *Serinus serinus*: an experimental study. *Anim. Behav.*, 65: 551–557.
- Figuerola, J., Muñoz, E., Gutiérrez, R. & Ferrer, D., 1999b. Blood parasites, leucocytes and plumage brightness in the Cirl Bunting *Emberiza cirlus*. *Funct. Ecol.*, 13: 594–601.
- Figuerola, J., Pascual, J. & Senar, J. C., 1999a. The use of a colorimeter in field

- studies of Blue Tit *Parus caeruleus* coloration. *Ardea*, 87: 269–275.
- Figueroa, J. & Senar, J. C., 2000. Measurement of plumage badges: an evaluation of methods used in the Great Tit *Parus major*. *Ibis*, 142: 482–484.
- in press. Seasonal changes in plumage coloration in the Great Tit *Parus major*. *Ibis*.
- Fischer, J. R., Stallknecht, D. E., Luttrell, M. P., Dhondt, A. A. & Converse, K. A., 1997. Mycoplasmal conjunctivitis in wild songbirds: the spread of a new contagious disease in a mobile host population. *Emerg. Infect. Dis.*, 3: 69–72.
- Fisher, R. A., 1930. *The genetical theory of natural selection*. Oxford University Press, Oxford.
- Fitze, P. S., Kölliker, M. & Richner, H., 2003. Effects of common origin and common environment on nestling plumage coloration in the great tit (*Parus major*). *Evolution*, 57: 144–150.
- Fitze, P. S. & Richner, H., 2002. Differential effects of a parasite on ornamental structures based on melanins and carotenoids. *Behav. Ecol.*, 13: 401–407.
- Fitzpatrick, S., 1997. Magpies' tails: damage as an indicator of quality. *Behav. Ecol. Sociobiol.*, 40: 209–212.
- 1998a. Birds'tails as signaling devices: markings, shape, length, and feather quality. *Am. Nat.*, 151: 157–173.
- 1998b. Colour schemes for birds: structural coloration and signals of quality in feathers. *Ann. Zool. Fennici*, 35: 67–77.
- Flegg, J. J. M. & Cox, C. J., 1977. Morphometric studies of a population of Blue and Great Tits. *Ringing & Migration*, 1: 135–140.
- Flood, N., 1984. The adaptive significance of delayed plumage maturation in male northern orioles. *Evolution*, 32: 267–279.
- Folstad, I. & Karter, A. J., 1992. Parasites, bright males, and the immunocompetence handicap. *Am. Nat.*, 139: 603–622.
- Foster, M. S., 1987a. Delayed maturation, neoteny, and social system differences in two Manakins of the genus *Chiroxiphia*. *Evolution*, 41: 547–558.
- Fox, D. L., 1976. *Animal biochromes and structural colours*. University of California Press, Berkeley, CA.
- Francis, C. M. & Wood, D. S., 1989. Effects of age and wear on wing length of wood-warblers. *J. Field Ornithol.*, 60: 495–503.
- Freedman, B., 1989. *Environmental ecology*. Academic Press, New York.
- Fretwell, S., 1969. Dominance behavior and winter habitat distribution in Juncos (*Junco hyemalis*). *Bird banding*, 40: 1–25.
- Friend, M., 1987. Field guide to wildlife diseases. General field procedures and diseases of migratory birds. *U. S. Fish Wildl. Serv., Resour. Publ.*, 167: 1–225.
- Fugle, G. N. & Rothstein, S. I., 1987. Experiments on the control of deceptive signals of status in White-crowned Sparrows. *Auk*, 104: 188–197.
- Fugle, G. N., Rothstein, S. I., Osenberg, C. W. & McGinley, M. A., 1984. Signals of status in wintering white-crowned sparrows, *Zonotrichia leucophrys gambelii*. *Anim. Behav.*, 32: 86–93.
- Ginn, H. B. & Melville, D. S., 1983a. *Moult in birds*. BTO, Tring.
- Glick, B., 1983. Bursa of Fabricius. In: *Avian Biology*: 443–500 (D. S. Farner, J. R. King & K. C. Parkes, Eds.). Academic Press, New York.
- González, G., Sorci, G. & Lope, F. de, 1999a. Seasonal variation in the relationship between cellular immune response and badge size in male house sparrows (*Passer*

- domesticus)*. *Behav. Ecol. Sociobiol.*, 46: 117–122.
- González, G., Sorci, G., Møller, A. P., Ninni, P., Haussy, C. & De Lope, F., 1999b. Immunocompetence and condition-dependent sexual advertisement in male house sparrows (*Passer domesticus*). *J. Anim. Ecol.*, 68: 1225–1234.
- González, G., Sorci, G., Smith, L. C. & De Lope, F., 2002. Social control and physiological costs of cheating in status signalling male House Sparrows (*Passer domesticus*). *Ethology*, 108: 1–14.
- Gosler, A. G., 1993. *The Great Tit*. Hamlyn, London.
- Götmark, F., 1987. White underparts in gulls function as hunting camouflage. *Anim. Behav.*, 35: 1786–1792.
- 1992. Anti-predator effect of conspicuous plumage in a male bird. *Anim. Behav.*, 44: 51–56.
 - 1993. Conspicuous coloration in male birds is favoured by predation in some species and disfavoured in others. *Proc. R. Soc. Lond. B*, 253: 143–146.
 - 1994a. Are bright birds distasteful? A re-analysis of H. B. Cott's data on the edibility of birds. *J. Avian Biol.*, 25: 184–197.
 - 1994b. Does a novel bright colour patch increase or decrease predation? Red wings reduce predation risk in European blackbirds. *Proc. R. Soc. Lond. B*, 256: 83–87.
 - 1995. Black-and-white plumage in male pied flycatchers (*Ficedula hypoleuca*) reduces the risk of predation from sparrowhawks (*Accipiter nisus*) during the breeding season. *Behav. Ecol.*, 6: 22–26.
 - 1997. Bright plumage in the magpie: does it increase or reduce the risk of predation? *Behav. Ecol. Sociobiol.*, 40: 41–49.
 - 1999. The importance of non-reproductive functions of bird colouration, especially anti-predator adaptations. In: *Proc. 22 Int. Ornithol. Congr., Durban*: 1706–1718 (N. Adams & R. Slotow, Eds.). BirdLife South Africa, Johannesburg.
- Götmark, F. & Hohlfält, A., 1995. Bright male plumage and predation risk in passerine birds: are males easier to detect than females? *Oikos*, 74: 475–484.
- Götmark, F., Post, P., Olsson, J. & Himmelmann, D., 1997. Natural selection and sexual dimorphism: sex-biased sparrowhawk predation favours crypsis in female chaffinches. *Oikos*, 80: 540–548.
- Götmark, F. & Unger, U., 1994. Are conspicuous birds unprofitable prey? field experiments with Hawks and stuffed prey species. *Auk*, 111: 251–262.
- Grafen, A., 1990b. Biological signals as handicaps. *J. theor. Biol.*, 144: 517–546.
- 1990a. Sexual selection unhandicapped by the Fisher process. *J. theor. Biol.*, 144: 473–516.
- Grant, B. R., 1990. The significance of subadult plumage in Darwin's finches, *Geospiza fortis*. *Behav. Ecol.*, 1: 161–170.
- Grant, B. R. & Grant, P. R., 1987. Mate choice in Darwin's finches. *Biol. J. Linn. Soc.*, 32: 247–270.
- Grant, P. R., 1986. *Ecology and evolution of Darwin's Finches*. Princeton University Press, Princeton.
- Grasso, M. J., Savalli, U. M. & Mumme, R. L., 1996. Status signalling in Dark-eyed Juncos: perceived status of other birds affects dominance interactions. *Condor*, 98: 636–639.
- Gray, D. A., 1996. Carotenoids and sexual dichromatism in North American passerine birds. *Am. Nat.*, 148: 453–480.

- Grayson, J. & Edmunds, M., 1989. The causes of colour and colour change in caterpillars of the poplar and eyed hawkmoths (*Laothoe populi* and *Smerinthus ocellata*). *Biol. J. Linn. Soc.*, 37: 263–279.
- Grayson, J., Edmunds, M. & Evans, E. H., 1991. Carotenoids and colouration of poplar hawkmoth caterpillars (*Laothoe populi*). *Biol. J. Linn. Soc.*, 42: 457–465.
- Greene, E., Lyon, B. E., Muehter, V. R., Ratcliffe, L., Oliver, S. J. & Boag, P. T., 2000. Disruptive sexual selection for plumage coloration in a passerine bird. *Nature*, 407: 1000–1003.
- Griffith, S. C., Ornborg, J., Russell, A. F., Andersson, S. & Sheldon, B. C., 2003. Correlations between ultraviolet coloration, overwinter survival and offspring sex ratio in the blue tit. *Journal of Evolutionary Biology*, 16: 1045–1054.
- Griffith, S. C., Owens, I. P. F. & Burke, T., 1999. Environmental determination of a sexually selected trait. *Nature*, 400: 358–360.
- Griffith, S. C. & Sheldon, B. C., 2001. Phenotypic plasticity in the expression of sexually selected traits: neglected components of variation. *Anim. Behav.*, 61: 987–993.
- Grill, C. P. & Rush, V. N., 2000. Analysing spectral data: comparison and application of two techniques. *Biol. J. Linn. Soc.*, 69: 121–138.
- Gross, M. R., 1994. The evolution of behavioural ecology. *Trend. Ecol. Evol.*, 9: 358–360.
- Grubb, T. C., 1989b. Ptilochronology: feather growth bars as indicators of nutritional status. *Auk*, 106: 314–320.
– 1991. A deficient diet narrows growth bars on induced feathers. *Auk*, 108: 725–727.
– 1995. Ptilochronology. A review and prospectus. *Current Ornithology*, 12: 89–114.
- Grubb, T. C. & Cimprich, D. A., 1990. Supplementary food improves the nutritional condition of wintering woodland birds: evidence from ptilochronology. *Ornis Scand.*, 21: 277–281.
- Grubb, T. C. & Yosef, R., 1994. Habitat-specific nutritional condition in Loggerhead Shrikes (*Lanius ludovicianus*): evidence from ptilochronology. *Auk*, 111: 756–759.
- Gustafsson, L., Qvarnström, A. & Sheldon, B. C., 1995. Trade-offs between life-history traits and a secondary sexual character in male collared flycatchers. *Nature*, 375: 311–313.
- Hailman, J. P., 1960. A field study of the mockingbird's wing-flashing behavior and its association with foraging. *Wilson Bull.*, 72: 346–357.
- Hairston, N. G., 1989. *Ecological experiments. Purpose, design and execution*. Cambridge Univ. Press, Cambridge.
- Hakkainen, H., Korpimäki, E., Huhta, E. & Palokangas, P., 1993. Delayed maturation in plumage colour: evidence for the female-mimicry hypothesis in the kestrel. *Behav. Ecol. Sociobiol.*, 33: 247–251.
- Hall, D. O. & Rao, K. K., 1977. *Fotosíntesis*. Ediciones Omega, Barcelona.
- Hamilton, W. D. & Zuk, M., 1982. Heritable true fitness and bright birds: a role for parasites. *Science*, 218: 384–387.
- Harder, J. D. & Kirkpatrick, R. L., 1994. Physiological methods in wildlife research. In: *Research and management techniques for wildlife and habitats*: 275–306 (T. A. Bookhout, Ed.). The Wildlife Society, Bethesda, Md.
- Harper, D. G. C., 1999. Feather mites, pectoral muscle condition, wing length and plumage coloration of passerines. *Anim. Behav.*, 58: 553–562.
- Hartup, B. K., Bickal, J. M., Dhondt, A. A., Ley, D. H. & Kollias, G. V., 2001. Dynamics of conjunctivitis and *Mycoplasma Gallisepticum* infections house finches. *Auk*,

- 118: 327–333.
- Hasselquist, D., Marsh, J. A., Sherman, P. W. & Wingfield, J. C., 1999. Is avian humoral immunocompetence suppressed by testosterone? *Behav. Ecol. Sociobiol.*, 45: 167–175.
- Hasson, O., 1990. The role of amplifiers in sexual selection: an integration of the amplifying and the Fisherian mechanisms. *Evol. Ecol.*, 4: 277–289.
- 1991. Sexual displays as amplifiers: practical examples with an emphasis on feather decorations. *Behav. Ecol.*, 2: 189–197.
- Hasson, O., Cohen, D. & Shmida, A., 1992. Providing or hiding information: on the evolution of amplifiers and attenuators of perceived quality differences. *Acta Biother.*, 40: 269–283.
- Hauser, M. D. & Nelson, D. A., 1991. "Intentional" signalling in animal communication. *Trend. Ecol. Evol.*, 6: 186–189.
- Hausmann, F., Arnold, K. E., Marshall, N. J. & Owens, I. P. F., 2003. Ultraviolet signals in birds are special. *Proc. R. Soc. Lond. B*, 270: 61–67.
- Hawsey, R. A. & Peterson, D. E., 2002. Flourescence of yellow budgerigars. *Science*, 296: 655–655.
- Hästad, O., 2003. Plumage colours and the eye of the beholder: the ecology of colour and its perception in birds. PhD Thesis, Uppsala University.
- Hegner, R. E., 1985. Dominance and anti-predator behaviour in blue tits (*Parus caeruleus*). *Anim. Behav.*, 33: 762–768.
- Heindl, M., 2002. Ambient light and the signaling function of bird plumage colors. Ph. D. Thesis, Universität Wien.
- Heinroth, O., 1979. *El estudio de las aves*. Ed. Labor, Barcelona.
- Heywood, J. S., 1989. Sexual selection by the handicap mechanism. *Evolution*, 43: 1387–1397.
- Hill, G. E., 1988. The function of delayed plumage maturation in male Black-headed Grosbeaks. *Auk*, 105: 1–10.
- 1989. Late spring arrival and dull plumage: aggression avoidance by yearling males? *Anim. Behav.*, 37: 665–673.
- 1990. Female house finches prefer colourful males: sexual selection for a condition-dependent trait. *Anim. Behav.*, 40: 563–572.
- 1991. Plumage coloration is a sexually selected indicator of male quality. *Nature*, 350: 337–339.
- 1992. Proximate basis of variation in carotenoid pigmentation in male House Finches. *Auk*, 109: 1–12.
- 1993a. Geographic variation in the carotenoid plumage pigmentation of male house finches (*Carpodacus mexicanus*). *Biol. J. Linn. Soc.*, 49: 63–86.
- 1993b. Male mate choice and the evolution of female plumage coloration in the house finch. *Evolution*, 47: 1515–1525.
- 1994a. House finches are what they eat: a reply to Hudon. *Auk*, 111: 221–225.
- 1994b. Testis mass and subadult plumage in Black-Headed Grosbeaks. *Condor*, 96: 626–630.
- 1995. Ornamental traits as indicators of environmental health. *BioScience*, 45: 25–31.
- 1996a. Redness as a measure of the production cost of ornamental coloration. *Ethol. Ecol. & Evol.*, 8: 157–175.
- 1996b. Subadult plumage in the House Finch and tests of models for the evolution

- of delayed plumage maturation. *Auk*, 113: 858–874.
- 1998a. An easy, inexpensive means to quantify plumage coloration. *J. Field Ornithol.*, 69: 353–363.
 - 1998b. Plumage redness and pigment symmetry in the House Finch. *J. Avian Biol.*, 29: 86–92.
 - 1999. Mate choice, male quality, and carotenoid-based plumage coloration. In: *Proc. 22 Int. Ornithol. Congr., Durban*: 1654–1668 (N. Adams & R. Slotow, Eds.). BirdLife South Africa, Johannesburg.
 - 2002. *A red Bird in a Brown Bag*. Oxford University Press, Oxford.
- Hill, G. E. & Brawner, W. R., 1998. Melanin-based plumage coloration in the house finch in unaffected by coccidial infection. *Proc. R. Soc. Lond. B*, 265: 1105–1109.
- Hill, G. E. & Montgomerie, R., 1994. Plumage colour signals nutritional condition in the house finch. *Proc. R. Soc. Lond. B*, 258: 47–52.
- Hill, G. E., Montgomerie, R., Roeder, C. & Boag, P., 1994. Sexual selection and cuckoldry in a monogamous songbird: implications for sexual selection theory. *Behav. Ecol. Sociobiol.*, 35: 193–199.
- Hillgarth, N. & Wingfield, J. C., 1997. Parasite-mediated sexual selection: endocrine aspects. In: *Host-parasite evolution: General principles and Avian models*: 78–103 (D. H. Clayton & J. Moore, Eds.). Oxford University Press, Oxford.
- Hinde, R. A., 1961. Behaviour. In: *Biology and comparative physiology of birds*: 373–411 (A. J. Marshall, Ed.). Academic Press, London.
- Hochachka, W. M. & Dhondt, A. A., 2000. Density-dependent decline of host abundance resulting from a new infectious disease. *Proceedings of the National Academy of Sciences*, 97: 5303–5306.
- Hoelzer, G. A., 1989. The good parent process of sexual selection. *Anim. Behav.*, 38: 1067–1078.
- Hogstad, O., 1992. Mate protection in alpha pairs of wintering willow tits, *Parus montanus*. *Anim. Behav.*, 43: 323–328.
- Hogstad, O. & Kroglund, R. T., 1993. The throat badge as a status signal in juvenile male Willow tits *Parus montanus*. *J. Orn.*, 134: 413–423.
- Hoi, H., Schleicher, B. & Valera, F., 1994. Female mate choice and nest desertion in penduline tits, *Remiz pendulinus*: the importance of nest quality. *Anim. Behav.*, 48: 743–746.
- 1996. Nest size variation and its importance for mate choice in penduline tits, *Remit pendulinus*. *Anim. Behav.*, 51: 464–466.
- Holberton, R. L., Able, K. P. & Wingfield, J. C., 1989. Status signalling in dark-eyed juncos, *Junco hyemalis*: plumage manipulations and hormonal correlates of dominance. *Anim. Behav.*, 37: 681–689.
- Hörak, P., 1993. Low fledging success of urban Great Tits. *Ornis Fennica*, 70: 168–172.
- Hörak, P., Ots, I., Vellau, H., Spottiswoode, C. & Möller, A. P., 2001. Carotenoid-based plumage coloration reflects hemoparasite infection and local survival in breeding great tits. *Oecologia*, 126: 166–173.
- Hörak, P., Vellau, H., Ots, I. & Möller, A. P., 2000. Growth conditions affect carotenoid-based plumage coloration of great tit nestlings. *Naturwissenschaften*, 87: 460–464.
- Hunt, S., Bennett, A. T. D., Cuthill, I. C. & Griffiths, R., 1998. Blue tits are ultraviolet tits. *Proc. R. Soc. Lond. B*, 265: 451–455.

- Hunt, S., Cuthill, I. C., Bennett, A. T. D. & Griffiths, R., 1999. Preferences for ultraviolet partners in the blue tit. *Anim. Behav.*, 58: 809–815.
- Hurlbert, S. H., 1984. Pseudoreplication and the design of ecological field experiments. *Ecological monographs*, 54: 187–211.
- Inouye, C. Y., Hill, G. E., Stradi, R. & Montgomerie, R., 2001. Carotenoid pigments in male house finch plumage in relation to age, subspecies, and ornamental coloration. *Auk*, 118: 900–915.
- Jablonski, P., 1996. Dark habitats and bright birds: warblers may use wing patches to flush prey. *Oikos*, 75: 350–352.
- Jablonski, P. G. & Matyjasik, P., 2002. Male wing-patch asymmetry and aggressive response to intruders in the common chaffinch (*Fringilla coelebs*). *Auk*, 119: 566–572.
- Jackson, W. M., Rohwer, S. A. & Winnegrad, R. L., 1988. Status signaling is absent within age-and-sex classes of Harris' sparrows. *Auk*, 105: 424–427.
- James, F. C. & McCulloch, C. E., 1985. Data analysis and the design of experiments in ornithology. *Current Ornithology*, 2: 1–63.
- Jawor, J. M., 2003. Multiple ornaments and sexual selection in a socially monogamous passerine, the Northern Cardinal (*Cardinalis cardinalis*). Ph. D. dissertation, Univ. of Dayton, Ohio.
- Jawor, J. M. & Breitwisch, R., 2003. Melanin ornaments, honesty, and sexual selection. *Auk*, 120: 249–265.
- Jawor, J. M., Linville, S. U., Beall, S. M. & Breitwisch, R., 2003. Assortative mating by multiple ornaments in northern cardinals (*Cardinalis cardinalis*). *Behav. Ecol.*, 14: 515–520.
- Järvi, T. & Bakken, M., 1984. The function of the variation in the breast stripe of the Great tit (*Parus major*). *Anim. Behav.*, 32: 590–596.
- Järvi, T., Walso, O. & Bakken, M., 1987. Status signalling by *Parus major*: an experiment in deception. *Ethology*, 76: 334–342.
- Jehl, J. R., 1990. Aspects of the molt migration. In: *Bird migration*: 102–115 (E. Gwinner, Ed.). Springer Verlag, Berlin.
- Jenkins, K. D., Hawley, D. M., Farabaugh, C. S. & Cristol, D. A., 2001. Ptilochronology reveals differences in condition of captive white-throated sparrows. *Condor*, 103: 579–586.
- Jenni, L. & Winkler, R., 1994a. *Moult and ageing of European Passerines*. Academic Press, London.
- Johnson, K., Dalton, R. & Burley, N., 1993. Preferences of female American goldfinches (*Carduelis tristis*) for natural and artificial male traits. *Behav. Ecol.*, 4: 138–143.
- Johnstone, R. A., 1995. Sexual selection, honest advertisement and the handicap principle: reviewing the evidence. *Biol. Rev.*, 70: 1–65.
- Johnstone, R. A. & Grafen, A., 1993. Dishonesty and the handicap principle. *Anim. Behav.*, 46: 759–764.
- Johnstone, R. A. & Norris, K. J., 1993. Badges of status and the cost of aggression. *Behav. Ecol. Sociobiol.*, 32, 127–134.
- Jones, I. L., 1990. Plumage variability functions for status signalling in least auklets. *Anim. Behav.*, 39: 967–975.
- Jones, I. L. & Hunter, F. M., 1993. Mutual sexual selection in a monogamous seabird. *Nature*, 362: 238–239.

- Kamil, A. C., 1988. Experimental design in ornithology. *Current Ornithology*, 5: 313–346.
- Karlsen, R. & Slagsvold, T., 1997. Aggression of female Pied Flycatchers *Ficedula hypoleuca* towards caged conspecific female intruders. *Fauna norv. Ser. C, Cinclus*, 20: 39–47.
- Kepler, G., 1990. *Design and analysis. A researcher's handbook*. Prentice Hall, Englewood Cliffs, New Jersey.
- Ketterson, E. D., 1979. Status signaling in Dark-eyed juncos. *Auk*, 96: 94–99.
- Keys, G. C. & Rothstein, S. I., 1991. Benefits and costs of dominance and subordination in white-crowned sparrows and the paradox of status signalling. *Anim. Behav.*, 42: 899–912.
- Keyser, A. J. & Hill, G. E., 1999. Condition-dependent variation in the blue-ultraviolet coloration of a structurally based plumage ornament. *Proc. R. Soc. Lond. B*, 266: 771–777.
- 2000. Structurally based plumage coloration is an honest signal of quality in male blue grosbeaks. *Behav. Ecol.*, 10: 202–209.
- Kirkpatrick, C. E., Robinson, S. K. & Kitron, U. D., 1991. Phenotypic correlates of blood parasitism in the common grackle. In: *Bird-parasite interactions. Ecology, evolution and behaviour*: 344–358 (J. E. Loye & M. Zuk, Eds.). Oxford University Press, Oxford.
- Kirkpatrick, M., 1987. Sexual selection by female choice in polygynous animals. *Annu. Rev. Ecol. Syst.*, 18: 43–70.
- Kirkpatrick, M., Price, T. & Arnold, S. J., 1990. The Darwin–Fisher theory of sexual selection in monogamous birds. *Evolution*, 44: 180–193.
- Kirkpatrick, M. & Ryan, M. J., 1991. The evolution of mating preferences and the paradox of the lek. *Nature*, 350: 33–38.
- Kodric-Brown, A. & Brown, J. H., 1984. Truth in advertising: the kinds of traits favored by sexual selection. *Am. Nat.*, 124: 309–323.
- Kose, M. & Möller, A. P., 1999. Sexual selection, feather breakage and parasites: the importance of white spots in the tail of the barn swallow (*Hirundo rustica*). *Behav. Ecol. Sociobiol.*, 45: 430–436.
- Krebs, C. J., 1989a. *Ecological methodology*. Harper Collins, New York.
- Krebs, J. R. & Davies, N. B., 1993. *An introduction to behavioural ecology*. Blackwell Scientific Publications, Oxford.
- Kushlan, J. A., 1977. The significance of plumage colour in the formation of feeding aggregations of ciconiiforms. *Ibis*, 119: 361–364.
- Lack, D., 1954. *The natural regulation of animal numbers*. Clarendon, Oxford.
- 1968. *Ecological adaptations for breeding in birds*. Methuen, London.
- Landmann, A. & Kollinsky, C., 1995a. Age and plumage related territory differences in male black redstarts: The (non)-adaptive significance of delayed plumage maturation. *Ethol. Ecol. & Evol.*, 7: 147–167.
- 1995b. Territory defence in black redstarts, *Phoenicurus ochruros*: Effects of intruder and owner age? *Ethology*, 101: 121–129.
- Lawton, M. F. & Lawton, R. O., 1986. Heterochrony, deferred breeding, and avian sociality. *Current Ornithology*, 3: 187–222.
- Lehner, P. N., 1979. *Handbook of ethological methods*. Garland STPM Press, NY.
- Lemel, J. & Wallin, K., 1993. Status signalling, motivational condition and dominance: an experimental study in the great tit, *Parus major* L. *Anim. Behav.*, 45: 549–558.

- Lifjeld, J. T. & Slagsvold, T., 1988. Female pied flycatchers *Ficedula hypoleuca* choose male characteristics in homogeneous habitats. *Behav. Ecol. Sociobiol.*, 22: 27–36.
- Linville, S. U., Breitwisch, R. & Schilling, A. J., 1998. Plumage brightness as an indicator of parental care in northern cardinals. *Anim. Behav.*, 55: 119–127.
- Lochmiller, R. L., 1995. Testing the immunocompetence handicap theory. *Trend. Ecol. Evol.*, 10: 372–373.
- Loehle, C., 1987. Hypothesis testing in ecology: psychological aspects and the importance of theory maturation. *Quart. Rev. Biol.*, 62: 397–409.
- Lott, D. F., 1991. *Intraspecific variation in the social systems of wild vertebrates*. Cambridge Univ. Press, Cambridge.
- Loye, J. E. & Zuk, M., 1991. *Bird-Parasite Interactions: ecology, evolution and behaviour*. Oxford University Press, Oxford.
- Lozano, G. A. & Handford, P. T., 1995. A test of an assumption of delayed plumage maturation hypothesis using female Tree Swallows. *Wilson Bull.*, 107: 153–164.
- Lundberg, A. & Alatalo, R. V., 1992. *The Pied Flycatcher*. T. & A. D. Poyser, London.
- Lyon, B. E. & Montgomerie, R. D., 1985. Conspicuous plumage in birds: sexual selection or unprofitable prey? *Anim. Behav.*, 33: 1038–1040.
- 1986. Delayed plumage maturation in passerine birds: reliable signaling by subordinate males? *Evolution*, 40: 605–615.
- Maccarone, A. D., 1987. Age-class differences in the use of food sources by European Starlings. *Wilson Bull.*, 99: 699–704.
- MacDougall, A. K. & Montgomerie, R., 2003. Assortative mating by carotenoid-based plumage colour: a quality indicator in American goldfinches, *Carduelis tristis*. *Naturwissenschaften*, 90: 464–467.
- Magnhagen, C., 1991. Predation risk as a cost of reproduction. *Trend. Ecol. Evol.*, 6: 183–185.
- Marchetti, K., 1997. The adaptive significance of colour patterns in the Old World leaf warblers, genus *Phylloscopus*. *Oikos*, 79: 410–412.
- Marler, P., 1956. Studies of fighting in Chaffinches. (3) Proximity as a cause of aggression. *Brit. J. Anim. Behaviour*, 4: 23–30.
- Martin, P. & Bateson, P., 1993. *Measuring behaviour; an introductory guide*. Cambridge Univ. Press, Cambridge.
- Martin, T. E. & Badyaev, A. V., 1996. Sexual dichromatism in birds: importance of nest predation and nest location for females versus males. *Evolution*, 50: 2454–2460.
- Martínez, J. G., 1998. El Fingerprinting: un método molecular aplicado al estudio de las estrategias reproductoras. *EtoLoGuía*, 16: 37–46.
- Maxwell, S. E. & Delany, H. D., 1990. *Designing experiments and analysing data*. Wadsworth Publishing Co., Belmont, California.
- Maynard Smith, J., 1976. Sexual selection and the handicap principle. *J. Theor. Biol.*, 57: 239–242.
- 1978. The handicap principle: A comment. *J. theor. Biol.*, 70: 251–252.
- 1982. *Evolution and the theory of games*. Cambridge Univ. Press, Cambridge.
- Maynard Smith, J. & Harper, D., 2003. *Animal signals*. Oxford Univ. Press, Oxford.
- 1988. The evolution of aggression: can selection generate variability? *Phil. Trans. R. Soc. Lond. B*, 319: 557–570.
- McCLEERY, R. H. & PERRINS, C. M., 1991. The effects of predation on the numbers of

- Great Tits *Parus major*. In: *Bird population studies: Relevance to conservation and management*: 129–147 (C. M. Perrins, J. D. Lebreton & G. J. M. Hirons, Eds.). Oxford Univ. Press, Oxford.
- McClure, H. E., 1984. *Bird Banding*. Boxwood Press, Pacific Grove.
- 1989. Epizootic lesions of House Finches in Ventura county, California. *J. Field Ornithol.*, 60: 421–430.
- McDonald, D. B., 1993. Delayed plumage maturation and orderly queues for status: a manakin mannequin experiment. *Ethology*, 94: 31–45.
- McGraw, K. J., Dale, J. & Mackillop, E. A., 2003. Social environment during molt and the expression of melanin-based plumage pigmentation in male house sparrows (*Passer domesticus*). *Behav. Ecol. Sociobiol.*, 53: 116–122.
- McGraw, K. J. & Hill, G. E., 2000. Differential effects of endoparasitism on the expression of carotenoid- and melanin-based ornamental coloration. *Proc. R. Soc. Lond. B*, 267: 1525–1531.
- 2001. Carotenoid access and intraspecific variation in plumage pigmentation in male American Goldfinches (*Carduelis tristis*) and Northern Cardinals (*Cardinalis cardinalis*). *Funct. Ecol.*, 15: 732–739.
- Mentis, M. T. 1988. Hypothetico-deductive and inductive approaches in ecology. *Funct. Ecol.*, 2: 5–14.
- Merila, J., Sheldon, B. C. & Lindström, K., 1999. Plumage brightness in relation to haematozoan infections in the greenfinch *Carduelis chloris*: Bright males are a good bet. *Ecoscience*, 6: 12–18.
- Mester, H. & Prünte, W., 1982. Die "sektorale" postjuvenile handschwingenmauser der carduelinen in südeuropa. *J. Orn.*, 123: 381–399.
- Metcalfe, N. B. & Ure, S. E., 1995. Diurnal variation in flight performance and hence potential predation risk in small birds. *Proc. R. Soc. Lond. B*, 261: 395–400.
- Millikan, G. C., Gaddis, P. & Pulliam, H. R., 1985. Interspecific dominance and the foraging behaviour of juncos. *Anim. Behav.*, 33: 428–435.
- Minolta Corporation, L., 1994. *Precise color communication: color control from feeling to instrumentation*. Minolta Corporation Ltd., Osaka.
- Møller, A. P., 1987a. Variation in badge size in male house sparrows *Passer domesticus*: evidence for status signalling. *Anim. Behav.*, 35: 1637–1644.
- 1987b. Social control of deception among status signalling House sparrows *Passer domesticus*. *Behav. Ecol. Sociobiol.*, 20: 307–311.
 - 1988. Female choice selects for male sexual tail ornaments in the monogamous swallow. *Nature*, 332: 640–642.
 - 1989. Natural and sexual selection on a plumage signal of status and on morphology in house sparrows, *Passer domesticus*. *J. Evol. Biol.*, 2: 125–140.
 - 1990a. Effects of a haematophagous mite on the barn swallow (*Hirundo rustica*): a test of the Hamilton and Zuk hypothesis. *Evolution*, 44: 771–784.
 - 1990b. Male tail length and female mate choice in the monogamous swallow *Hirundo rustica*. *Anim. Behav.*, 39: 458–465.
 - 1990c. Sexual behaviour is related to badge size in the house sparrow *Passer domesticus*. *Behav. Ecol. Sociobiol.*, 27: 23–29.
 - 1991a. Sexual ornament size and the cost of fluctuating asymmetry. *Proc. R. Soc. Lond. B*, 243: 59–62.
 - 1991b. Parasites, sexual ornaments, and mate choice in the barn swallow. In:

- Bird-parasite interactions. Ecology, evolution and behaviour:* 328–343 (J. E. Loye & M. Zuk, Eds.). Oxford University Press, Oxford.
- 1991c. Sexual selection in monogamous barn swallow (*Hirundo rustica*). I. Determinants of tail ornament size. *Evolution*, 45: 1823–1836.
 - 1992a. Sexual selection in the monogamous barn swallow (*Hirundo rustica*). II. Mechanisms of sexual selection. *J. Evol. Biol.*, 5: 603–624.
 - 1992b. Female swallow preference for symmetrical male sexual ornaments. *Nature*, 357: 238–240.
 - 1992c. Frequency of female copulations with multiple males and sexual selection. *Am. Nat.*, 139: 1089–1101.
 - 1993. Morphology and sexual selection in the barn swallow *Hirundo rustica* in Chernobyl, Ukraine. *Proc. R. Soc. Lond. B*, 252: 51–57.
 - 1994. *Sexual selection and the Barn Swallow*. Oxford Univ. Press, Oxford.
 - 1995. Hormones, handicaps and bright birds. *Trend. Ecol. Evol.*, 10: 121.
- Møller, A. P., Allander, K. & Dufva, R., 1990. Fitness effects of parasites on Passerine birds: a review. In: *Population biology of Passerine birds: an integrated approach*: 1–269 (J. Blondel, A. Gosler, J. D. Lebreton & R. McCleery, Eds.). Springer-Verlag, Berlin Heidelberg.
- Møller, A. P., Biard, C., Blount, J. D., Houston, D. C., Ninni, P., Saino, N. & Surai, P. F., 2000. Carotenoid-dependent signals: indicators of foraging efficiency, immunocompetence or detoxification ability? *Avian & Poult. Biol. Rev.*, 11: 137–159.
- Møller, A. P., Kimball, R. T. & Erritzoe, J., 1996. Sexual ornamentation, condition, and immune defence in the house sparrow *Passer domesticus*. *Behav. Ecol. Sociobiol.*, 39: 317–322.
- Møller, A. P., Magnhagen, C., Ulfstrand, A. & Ulfstrand, S., 1995. Phenotypic quality and molt in the barn swallow, *Hirundo rustica*. *Behav. Ecol.*, 6: 242–249.
- Møller, A. P. & Swaddle, J. P., 1997. *Asymmetry, developmental stability, and evolution*. Oxford Univ. Press, Oxford.
- Møller, A. P. & Thornhill, R., 1998. Male parental care, differential parental investment by females and sexual selection. *Anim. Behav.*, 55: 1507–1515.
- Montgomerie, R. D. & Lyon, B. E., 1986. Does longevity influence the evolution of delayed plumage maturation in passerine birds? *Am. Nat.*, 128: 930–936.
- Montgomerie, R., Lyon, B. & Holder, K., 2001. Dirty ptarmigan: behavioral modification of conspicuous male plumage. *Behav. Ecol.*, 12: 429–438.
- Mountjoy, D. J. & Robertson, R. J., 1988. Why are Waxwings "waxy"? Delayed plumage maturation in the Cedar Waxwing. *Auk*, 105: 61–69.
- Muehter, V. R., Greene, E. & Ratcliffe, L., 1997. Delayed plumage maturation in Lazuli buntings: tests of the female mimicry and status signalling hypotheses. *Behav. Ecol. Sociobiol.*, 41: 281–290.
- Mulvihill, R. S., 1993. Using wing molt to age Passerines. *N. Am. Bird Bander*, 18: 1–10.
- Muma, K. E. & Weatherhead, P. J., 1989. Male traits expressed in females: direct or indirect sexual selection? *Behav. Ecol. Sociobiol.*, 25: 23–31.
- Nakamura, H., 1979. Summer concentrations and moult in the oriental Greenfinch *Carduelis sinica*. *Tori*, 28: 1–28.
- Negro, J. J., Margalida, A., Hiraldo, F. & Heredia, R., 1999. The function of the cosmetic coloration of bearded vultures: when art imitates life. *Anim. Behav.*, 58: F14–F17.

- Negro, J. J., Margalida, A., Torres, M. J., Grande, J. M., Hiraldo, F. & Heredia, R., 2002. Iron oxides in the plumage of bearded vultures. Medicine or cosmetics? *Anim. Behav.*, 64: F5–F7.
- Newton, I., 1972. *Finches*. Collins, London.
- 1998. *Population limitation in birds*. Academic Press, San Diego.
- Ninni, P., 2003. La fonction des caroténoïdes chez les hirondelles de cheminée (*Hirundo rustica*). These de Doctorat, Université Paris 6.
- Nolan, P. M., Hill, G. E. & Stoehr, A. M., 1998. Sex, size, and plumage redness predict house finch survival in an epidemic. *Proc. R. Soc. Lond. B*, 265: 961–965.
- Norris, K. J., 1990b. Female choice and the evolution of the conspicuous plumage coloration of monogamous male great tits. *Behav. Ecol. Sociobiol.*, 26: 129–138.
- 1990a. Female choice and the quality of parental care in the great tit *Parus major*. *Behav. Ecol. Sociobiol.*, 27: 275–281.
- 1993. Heritable variation in a plumage indicator of viability in male great tits *Parus major*. *Nature*, 362: 537–539.
- Olson, V. A., 1996. Coccidia and sexual selection in the American Goldfinch (*Carduelis tristis*): a test of the Hamilton–Zuk Hypothesis. Master of Science Thesis, University of Guelph.
- Olson, V. A. & Owens, I. P. F., 1998. Costly sexual signals: are carotenoids rare, risky or required? *Trend. Ecol. Evol.*, 13: 510–514.
- Osorio, D. & Ham, A. D., 2002. Spectral reflectance and directional properties of structural coloration in bird plumage. *J. Evol. Biol.*, 205: 2017–2027.
- Owens, I. P. F. & Hartley, I. R., 1991. "Trojan sparrows": evolutionary consequences of dishonest invasion for the badges-of-status model. *Am. Nat.*, 138: 1187–1205.
- Owens, I. P. F. & Short, R. V., 1995. Reply from I. P. F. Owens and R. V. Short. *Trend. Ecol. Evol.*, 10: 121–122.
- Örnborg, J., 2002. Ultraviolet coloration and colour communication in blue tits *Parus caeruleus*. Ph. D. Thesis, Göteborg University.
- Palokangas, P., Korpimäki, E., Hakkarainen, H., Huhta, A., Tolonen, P. & Alatalo, R. V., 1994. Female kestrels gain reproductive success by choosing brightly ornamented males. *Anim. Behav.*, 47: 443–448.
- Parker, T. H., Stansberry, B. M., Becker, C. D. & Gipson, P. S., 2003. Do melanin- or carotenoid-pigmented plumage ornaments signal condition and predict pairing success in the kentucky warbler? *Condor*, 105: 663–671.
- Parrish, J. D., Whitman, M. L. & Comings, S. B., 1994. A Facilitated Method for Collection of Fecal Samples from Mist-netted Birds. *N. Am. Bird Bander*, 19: 49–51.
- Parsons, J. & Baptista, L. F., 1980. Crown coloration and dominance in the White-crowned Sparrow. *Auk*, 97: 807–815.
- Pärt, T. & Qvarnström, A., 1997. Badge size in collared flycatchers predicts outcome of male competition over territories. *Anim. Behav.*, 54: 893–899.
- Partali, V., Liaaen-Jensen, S., Slagsvold, T. & Lifjeld, J. T., 1987. Carotenoids in food chain studies –II. The food chain of *Parus* spp. monitored by carotenoid analysis. *Comp. Biochem. Physiol.*, 87B: 885–888.
- Payne, R. B., 1982. Ecological consequences of song matching: breeding success and intraspecific song mimicry in Indigo Buntings. *Ecology*, 63: 401–411.
- Pearn, S. M., Bennett, A. T. D. & Cuthill, I. C., 2001. Ultraviolet vision, fluorescence and mate choice in a parrot, the budgerigar *Melopsittacus undulatus*. *Proc. R. Soc.*

- Lond. B*, 268: 2273–2279.
- Perrins, C. M., Lebreton, J. D. & Hirons, G. J. M., 1991. *Bird population studies: relevance to conservation and management*, Oxford Univ. Press, Oxford.
- Petrie, M., 1993. Do peacock's trains advertise age? *J. Evol. Biol.*, 6: 443–448.
- Petrie, M., Hall, M., Halliday, T., Budgey, H. & Pierpoint, C., 1992. Multiple mating in a lekking bird: Why do peahens mate with more than one male and with the same male more than once? *Behav. Ecol. Sociobiol.*, 31: 349–358.
- Petrie, M., Halliday, T. & Sanders, C., 1991. Peahens prefer peacocks with elaborate trains. *Anim. Behav.*, 41: 323–331.
- Petrie, M. & Kempenaers, B., 1998. Extra-pair paternity in birds: explaining variation between species and populations. *Trend. Ecol. Evol.*, 13: 52–58.
- Petrie, M. & Williams, A., 1993. Peahens lay more eggs for peacocks with larger trains. *Proc. R. Soc. Lond. B*, 251: 127–131.
- Piersma, T., Dekker, M. & Damste, J. S. S., 1999. An avian equivalent of make-up? *Ecol. Letters*, 2: 201–203.
- Poiani, A., Goldsmith, A. R. & Evans, M. R., 2000. Ectoparasites of house sparrows (*Passer domesticus*): an experimental test of the immunocompetence handicap hypothesis and a new model. *Behav. Ecol. Sociobiol.*, 47: 230–242.
- Polo, V. & Carrascal, L. M., 1998. Relación entre la condición invernal y la capacidad de regenerar plumas en el Carbonero Garrapinos *Parus ater*. *Ardeola*, 45: 201–211.
- Popper, K. R., 1959. *The logic of scientific discovery*. Basic Books, New York.
— 1968. *Conjectures and refutations: The growth of scientific knowledge*. Harper, New York.
- Potter, E. F., 1985. Anting antics. *The Living Bird Quarterly*, 4: 12–15.
- Potter, E. F. & Hauser, D. C., 1974. Relationship of anting and sunbathing to molting in wild birds. *Auk*, 91: 537–563.
- Potti, J., 1993. A male trait expressed in female pied flycatchers, *Ficedula hypoleuca*: the white forehead patch. *Anim. Behav.*, 45: 1245–1247.
- Potti, J. & Merino, S., 1996. Decreased levels of blood trypanosome infection correlate with female expression of a male secondary sexual trait: implications for sexual selection. *Proc. R. Soc. Lond. B*, 263: 1199–1204.
- Potti, J. & Montalvo, S., 1991. Male colour variation in Spanish Pied Flycatchers *Ficedula hypoleuca*. *Ibis*, 133: 293–299.
- Poulton, E. H., 890. *The colours of animals*. Kegan Paul, Trench, Trübner, & Co, London.
- Pöysä, H., 1988. Feeding consequences of the dominance status in Great Tit *Parus major* groups. *Ornis Fennica*, 65: 69–75.
- Price, T. D., 1984. Sexual selection on body size, territory and plumage variables in a population of Darwin's finches. *Evolution*, 38: 327–341.
- Price, T. D., Schlüter, D. & Heckman, N. E. 1993. Sexual selection when the female directly benefits. *Biol. J. Linn. Soc.*, 48: 187–211.
- Procter-Gray, E., 1991. Female-like plumage of subadult male American Redstarts does not reduce aggression from other males. *Auk*, 108: 872–879.
- Procter-Gray, E. & Holmes, R. T., 1981. Adaptive significance of delayed attainment of plumage in male american redstarts: tests of two hypotheses. *Evolution*, 35: 742–751.
- Promislow, D. E. L., Montgomerie, R. D. & Martin, T. E., 1994. Sexual selection and

- survival in north american waterfowl. *Evolution*, 48: 2045–2050.
- 1992. Mortality costs of sexual dimorphism in birds. *Proc. R. Soc. Lond. B*, 250: 143–150.
- Prum, R. O., 1999. The anatomy and physics of avian structural colours. In: *Proc. 22 Int. Ornithol. Congr., Durban*: 1633–1653 (N. Adams & R. Slotow, Eds.). BirdLife South Africa, Johannesburg.
- Pryke, S. R., 2003. Sexual selection and plumage ornamentation in Widowbirds. Ph. D. Thesis, Göteborg Univ.
- Pryke, S. R., Andersson, S. & Lawes, M., 2001. Sexual selection of multiple handicaps in the red-collared widowbird: female choice of tail length but not carotenoid display. *Evolution*, 55: 1452–1463.
- Pryke, S. R., Andersson, S., Lawes, M. J. & Piper, S. E., 2002. Carotenoid status signaling in captive and wild red-collared widowbirds: independent effects of badge size and color. *Behav. Ecol.*, 13: 622–631.
- Pyle, P., Howell, S. N. G., Yunick, R. P. & DeSante, D. F., 1987. *Identification guide to North American Passerines*. Slate Creek Press, Bolinas.
- Quinn, J. F. & Dunham, A. E., 1983. On hypothesis testing in ecology and evolution. *Am. Nat.*, 122: 602–617.
- Qvarnström, A., 1997. Experimentally increased badge size increases male competition and reduces parental care in the collared flycatcher. *Proc. R. Soc. Lond. B*, 264: 1225–1231.
- 1998. Sexual selection in the collare flycatcher (*Ficedula albicollis*). A life-history perspective. Ph. D. Thesis, Uppsala University.
 - 2000. Genotype-by-environment interactions in the determination of the size of a secondary sexual character in the collared flycatcher (*Ficedula albicollis*). *Evolution*, 53: 1564–1572.
 - 2001. Context-dependent genetic benefits from mate choice. *Trend. Ecol. Evol.*, 16: 5–7.
- Qvarnström, A. & Forsgren, E., 1998. Should females prefer dominant males? *Trend. Ecol. Evol.*, 13: 498–501.
- Ralph, C. J. & Pearson, C. A., 1971. Correlation of age, size of territory, plumage and breeding success in White-crowned Sparrows. *Condor*, 73: 77–80.
- Redondo, T., 1994. Comunicación: teoría y evolución de las señales. In: *Etología: introducción a la ciencia del comportamiento*: 255–297 (J. Carranza, Ed.). Universidad de Extremadura, Cáceres.
- Reid, J. B., 1984. Bird coloration: predation, conspicuousness and the unprofitable prey model. *Anim. Behav.*, 32: 294–295.
- Repentigny, Y., Ouellet, H. & McNeil, R., 1997. Quantifying conspicuousness and sexual dimorphism of the plumage in birds: a new approach. *Can. J. Zool.*, 75: 1972–1981.
- Ripoll, J., Saldana, J. & Senar, J. C. (2004). Evolutionary stable transition rates in a stage-structured model. An application to the analysis of size distributions of badges of social status. *Mathematical Biosciences*, 190: 145–181.
- Ritchison, G., 1985. Plumage variability and social status in captive male House sparrows. *Kentucky Warbler*, 61: 39–42.
- Rohde, P. A., Johnsen, A. & Lifjeld, J. T., 1999. Female plumage coloration in the Bluethroat: no evidence for an indicator of maternal quality. *Condor*, 101: 96–104.

- Rohwer, S., 1978. Passerine subadult plumages and the deceptive acquisition of resources: Test of a critical assumption. *Condor*, 80: 173–179.
- Rohwer, S. & Niles, D. M., 1979. The subadult plumage of Purple Martins: variability, female mimicry and recent evolution. *Z. Tierpsychol.*, 51: 282–300.
- Rohwer, S. A., 1975. The social significance of avian winter plumage variability. *Evolution*, 29: 593–610.
- 1977. Status signaling in Harris sparrows : some experiments in deception. *Behaviour*, 61: 107–129.
 - 1982. The evolution of reliable and unreliable badges of fighting ability. *Amer. Zool.*, 22: 531–546.
 - 1983. Testing the female mimicry hypothesis of delayed plumage maturation: a comment on Procter–Gray and Holmes. *Evolution*, 37: 421–423.
 - 1986. A previously unknown plumage of first-year Indigo Buntings and theories of delayed plumage maturation. *Auk*, 103: 281–292.
- Rohwer, S. A. & Butcher, G. S., 1988. Winter versus summer explanations of delayed plumage maturation in temperate passerine birds. *Am. Nat.*, 131: 556–572.
- Rohwer, S. A., Fretwell, S. D. & Niles, D. M., 1980. Delayed maturation in Passerine plumages and the deceptive acquisition of resources. *Am. Nat.*, 115: 400–437.
- Rohwer, S. A., Klein, W. P. & Herad, S., 1983. Delayed plumage maturation and the presumed prealternate molt in american redstarts. *Wilson Bull.*, 95: 199–208.
- Rohwer, S. A. & Manning, J., 1990. Differences in timing and number of molts for Baltimore and Bullock's Orioles: implications to hybrid fitness and theories of delayed plumage maturation. *Condor*, 92: 125–140.
- Rohwer, S. A. & Rohwer, F. C., 1978. Status signalling in Harris sparrows: experimental deceptions achieved. *Anim. Behav.*, 26: 1012–1022.
- Rohwer, S. A. & Roskaft, E., 1989. Results of dyeing male yellow-headed blackbirds solid black: implications for the arbitrary identity badge hypothesis. *Behav. Ecol. Sociobiol.*, 25: 39–48.
- Roper, T. J., 1986. Badges of status in avian societies. *New Scient.*, 109: 38–40.
- Rosenberg, D. M. & Resh, V. H., 1993. *Freshwater biomonitoring and benthic macroinvertebrates*, Chapman and Hall, New York.
- Rothery, P. & Newton, I., 2002. A simple method for estimating timing and duration of avian primary moult using field data. *Ibis*, 144: 526–528.
- Roulin, A., Richner, H. & Ducrest, A. L. 1998. Genetic, environmental, and condition-dependent effects on female and male ornamentation in the barn owl *Tyto alba*. *Evolution*, 52: 1451–1460.
- Ryan, M. J., 1990. Sensory systems, sexual selection, and sensory exploitation. *Oxford Surv. Evol. Biol.*, 7: 157–195.
- 1997. Sexual selection and mate choice. In: *Behavioural Ecology: an evolutionary approach*: 179–202 (J. R. Krebs & N. B. Davies, Eds.). Blackwell Science, Oxford.
- Ryttkönen, S., Kuokkanen, P., Hukkanen, M. & Huhtala, K., 1998. Prey selection by Sparrowhawks *Accipiter nisus* and characteristics of vulnerable prey. *Ornis Fennica*, 75: 77–87.
- Saetre, G. P., Dale, S. & Slagsvold, T., 1994. Female pied flycatchers prefer brightly coloured males. *Anim. Behav.*, 48: 1407–1416.
- Saetre, G. P., Fossnes, T. & Slagsvold, T., 1995. Food provisioning in the pied flycatcher: do females gain direct benefits from choosing bright-coloured males?

- J. Anim. Ecol.*, 64: 21–30.
- Saetre, G. P. & Slagsvold, T., 1996. The significance of female mimicry in male contests. *Am. Nat.*, 147: 981–995.
- Saino, N., Bolzern, A. M. & Møller, A. P., 1997. Immunocompetence, ornamentation, and viability of male barn swallows (*Hirundo rustica*). *Proc. Natl. Acad. Sci. USA*, 94: 549–552.
- Saino, N. & Møller, A. P., 1996. Sexual ornamentation and immunocompetence in the barn swallow. *Behav. Ecol.*, 7: 227–232.
- Saino, N., Møller, A. P. & Bolzern, A. M., 1995. Testosterone effects on the immune system and parasite infestations in the barn swallow (*Hirundo rustica*): An experimental test of the immunocompetence hypothesis. *Behav. Ecol.*, 6: 397–404.
- Saks, L., McGraw, K. & Hörak, P., 2003a. How feather colour reflects its carotenoid content. *Funct. Ecol.*, 17: 555–561.
- Saks, L., Ots, I. & Hörak, P., 2003b. Carotenoid-based plumage coloration of male greenfinches reflects health and immunocompetence. *Oecologia*, 134: 301–307.
- Salomonsen, F., 1968. The moult migration. *Wildfowl*, 19: 5–24.
- Savalli, U. M., 1995. The evolution of bird coloration and plumage elaboration. A review of hypotheses. *Current Ornithology*, 12: 141–190.
- Schein, M. W., 1975. *Social hierarchy and dominance*. Dowden, Hutchinson & Ross, Stroudsburg.
- Scheiner, S. M. & Gurevitch, J., 1993a. *Design and analysis of ecological experiments*. Chapman & Hall, New York.
- Schjelderup-Ebbe, T., 1922. Beiträge zur Sozialpsychologie des Haushuhns. *Z. Psychol.*, 88: 225–252.
- Schmidt, K. H. & Einloft-Achenbach, H., 1984. Können isolierte Meisenpopulationen in Städten ihren Bestand erhalten? *Vogelwelt*, 105: 97–105.
- Selander, R. K., 1965. On mating systems and sexual selection. *Am. Nat.*, 99: 129–141.
- 1972. Sexual selection and dimorphism in birds. In: *Sexual selection and the descent of man*. (B. G. Campbell, Ed.). Aldine, Chicago.
- Senar, J. C., 1994. Vivir y convivir: la vida en grupos sociales. In: *Etología: Introducción a la ciencia del comportamiento*: 205–233 (J. Carranza, Ed.). Univ. of Extremadura, Cáceres.
- 1999a. La medición de la repetibilidad y el error de medida. *EtoloGuía*, 17: 53–64.
- 1999b. Plumage coloration as a signal of social status. In: *Proc. 22 Int. Ornithol. Congr., Durban*: 1669–1686 (N. Adams & R. Slotow, Eds.). BirdLife South Africa, Johannesburg.
- Senar, J. C., Burton, P. J. K. & Metcalfe, N. B., 1992. Variation in the nomadic tendency of a wintering finch *Carduelis spinus* and its relationship with body condition. *Ornis Scand.*, 23: 63–72.
- Senar, J. C. & Camerino, M., 1998. Status signalling and the ability to recognize dominants: an experiment with siskins (*Carduelis spinus*). *Proc. R. Soc. Lond. B*, 265: 1515–1520.
- Senar, J. C., Camerino, M., Copete, J. L. & Metcalfe, N. B., 1993. Variation in black bib of the Eurasian Siskin (*Carduelis spinus*) and its role as a reliable badge of dominance. *Auk*, 110: 924–927.
- Senar, J. C., Camerino, M. & Metcalfe, N. B., 1990a. Familiarity breeds tolerance:

- the development of social stability in flocking Siskins (*Carduelis spinus*). *Ethology*, 85: 13–24.
- 1994c. Using correspondence analysis to generate cardinal dominance ranks. *Etología*, 4: 69–75.
- Senar, J. C. & Conroy, M., 2004. Multi-state analysis of the impacts of avian pox on a population of Serins (*Serinus serinus*): the importance of estimating recapture rates. *Anim. Biodiv. Conserv.*, 27.1 (in press).
- Senar, J. C., Copete, J. L. & Domènec, J., 1994. The use of decoys to trap birds and associated biases: an example in the Siskin *Carduelis spinus*. *Butll. GCA*, 11: 23–30.
- Senar, J. C., Copete, J. L. & Martin, A. J., 1998a. Behavioural and morphological correlates of variation in the extent of postjuvenile moult in the Siskin *Carduelis spinus*. *Ibis*, 140: 661–669.
- Senar, J. C., Copete, J. L. & Metcalfe, N. B., 1990b. Dominance relationships between resident and transient wintering Siskins. *Ornis Scand.*, 21: 129–132.
- Senar, J. C. & Corbera, E., 1980. Sobre la depredación de níus de *Serinus serinus* per formigues. *Acta Grup Autònom de Manresa, Inst. Cat. Hist. Nat.*, 2: 115.
- Senar, J. C. & Domènec, J. (in prep). The depressed quality of suburban habitat for the Great tit: evidence from Ptilochronology.
- Senar, J. C., Domènec, J. & Camerino, M. (in press). Female siskins choose mates by the size of the yellow wing stripe. *Behav. Ecol. Sociobiol.*
- Senar, J. C., Domènec, J., Carrascal, L. M. & Moreno, E., 1997. A funnel trap for the capture of tits. *Butll. G.C.A.*, 14: 17–24.
- Senar, J. C., Domènec, J. & Conroy, M. J., 1998b. Sexing Serin *Serinus serinus* fledglings by plumage colour and morphometric variables. *Ornis Svecica*, 8: 17–22.
- Senar, J. C. & Escobar, D., 2002. Carotenoid derived plumage coloration in the siskin *Carduelis spinus* is related to foraging ability. *Avian Science*, 2: 19–24.
- Senar, J. C., Figuerola, J. & Domènec, J., 2003. Plumage coloration and nutritional condition in the Great tit *Parus major*: the roles of carotenoids and melanins differ. *Naturwissenschaften*, 90: 234–237.
- Senar, J. C., Figuerola, J. & Pascual, J., 2002. Brighter yellow blue tits make better parents. *Proc. R. Soc. Lond. B*, 269: 257–261.
- Senar, J. C. & Metcalfe, N. B., 1988. Differential use of local enhancement for finding food by resident and transient siskins. *Anim. Behav.*, 36: 1549–1550.
- Seutin, G., 1994. Plumage redness in redpoll finches does not reflect hemoparasitic infection. *Oikos*, 70: 280–286.
- Sheldon, B. C., 1994. Male phenotype, fertility, and the pursuit of extra-pair copulations by female birds. *Proc. R. Soc. Lond. B*, 257: 25–30.
- Sheldon, B. C., Andersson, S., Griffith, S. C., Örnborg, J. & Sendecka, J., 1999. Ultraviolet colour variation influences blue tit sex ratios. *Nature*, 402: 874–877.
- Sheldon, B. C., Merilä, J., Qvarnström, A., Gustafsson, L. & Ellegren, H., 1997. Paternal genetic contribution to offspring condition predicted by size of male secondary sexual character. *Proc. R. Soc. Lond. B*, 264: 297–302.
- Sheldon, B. C. & Verhulst, S., 1997. Reply from B. C. Sheldon and V. Verhulst. *Trend. Ecol. Evol.*, 12: 68.
- Shields, W. M., 1977. The social significance of avian winter plumage variability: a comment. *Evolution*, 31: 905–907.
- Siikamäki, P., Hovi, M. & Räti, O., 1994. A trade-off between current reproduction

- and moult in the Pied Flycatcher –an experiment. *Funct. Ecol.*, 8: 587–593.
- Sitari, H., Honkavaara, J., Huhta, E. & Viitala, J., 2002. Ultraviolet reflection and female mate choice in the pied flycatcher, *Ficedula hypoleuca*. *Anim. Behav.*, 63: 97–102.
- Silver, R., Zhuang, X. X. & Silverman, A. J., 1996. Immunocompetence, mast cells and sexual behaviour. *Ibis*, 138: 101–111.
- Skarstein, F. & Folstad, I., 1996. Sexual dichromatism and the immunocompetence handicap: an observational approach using Arctic charr. *Oikos*, 76: 359–367.
- Slagsvold, T., 1986. Nest site settlement by the Pied Flycatcher: does the female choose her mate for the quality of his house or himself? *Omis Scand.*, 17: 210–220.
- 1993. Female–female aggression and monogamy in Great Tits *Parus major*. *Ornis Scand.*, 24: 155–158.
- Slagsvold, T., Amundsen, T., Dale, S. & Lampe, H., 1992. Female–female aggression explains polyterritoriality in male pied flycatchers. *Anim. Behav.*, 43: 397–408.
- Slagsvold, T. & Dale, S., 1995. Polygyny and female aggression in the pied flycatcher: A comment on Ratti et al. *Anim. Behav.*, 50: 847–849.
- Slagsvold, T., Dale, S. & Kruszewicz, A., 1995. Predation favours cryptic coloration in breeding male pied flycatchers. *Anim. Behav.*, 50: 1109–1121.
- Slagsvold, T. & Lifjeld, J. T., 1985. Variation in plumage colour of the Great Tit *Parus major* in relation to habitat, season and food. *J. Zool. Lond.*, 206: 321–328.
- 1992. Plumage color is a condition–dependent sexual trait in male Pied Flycatchers. *Evolution*, 46: 825–828.
- Slagsvold, T. & Saetre, G. P., 1991b. Evolution of plumage color in male pied flycatchers (*Ficedula hypoleuca*): evidence for female mimicry. *Evolution*, 45: 910–917.
- Slotow, R., Alcock, J. & Rothstein, S. I., 1993. Social status signalling in white-crowned sparrows: an experimental test of the social control hypothesis. *Anim. Behav.*, 46: 977–989.
- Smith, H. G. & Montgomerie, R., 1991. Sexual selection and the tail ornaments of North American barn swallows. *Behav. Ecol. Sociobiol.*, 28: 195–201.
- Stephanie, M. D., 2002. Structural plumage coloration, male body size, and condition in the Blue–black grassquit. *Condor*, 104: 30–38.
- Stradi, R., 1998. *The colour of flight: carotenoids in bird plumage*. Solei Gruppo Editoriale Informatico, Milan.
- Stradi, R., Celentano, G. & Nava, D., 1995a. Separation and identification of carotenoids in bird's plumage by high–performance liquid chromatography–diode–array detection. *J. Chromatogr. B*, 670: 337–348.
- Stradi, R., Celentano, G., Rossi, E., Rovati, G. & Pastore, M., 1995b. Carotenoids in bird plumage—I. The carotenoid pattern in a series of Palearctic Carduelinae. *Comp. Biochem. Physiol.*, 110: 131–143.
- Stradi, R., Hudon, J., Celentano, G. & Pini, E., 1998. Carotenoids in bird plumage: the complement of yellow and red pigments in true woodpeckers (Picinae). *Comp. Biochem. Physiol.*, 120: 223–230.
- Stradi, R., Pini, E. & Celetano, G., 2001. The chemical structure of the pigments in *Ara macao* plumage. *Comp. Biochem. Physiol. B*, 130: 57–63.
- Stradi, R., Rossi, E., Celentano, G. & Bellardi, B., 1996. Carotenoids in bird plumage: the pattern in three *Loxia* species and in *Pinicola enucleator*. *Comp. Biochem. Physiol.*, 113: 427–432.
- Studd, M. V. & Robertson, R. J., 1985a. Evidence for reliable badges of status in

- territorial yellow warblers (*Dendroica petechia*). *Anim. Behav.*, 33: 1102–1113.
- 1985b. Life span, competition, and delayed plumage maturation in male passerines: the breeding threshold hypothesis. *Am. Nat.*, 126: 101–115.
- Stutchbury, B. J., 1991. The adaptive significance of male subadult plumage in purple martins: plumage dyeing experiments. *Behav. Ecol. Sociobiol.*, 29: 297–306.
- Stutchbury, B. J. & Robertson, R. J., 1987. Signaling subordinate and female status: two hypothesis for the adaptive significance of subadult plumage in female Tree Swallows. *Auk*, 104: 717–723.
- Sundberg, J., 1994. Sexual selection in the yellowhammer (*Emberiza citrinella*): the advantage of being yellow. Ph. D. dissertation, Uppsala University.
- 1995b. Female yellowhammers (*Emberiza citrinella*) prefer yellower males: A laboratory experiment. *Behav. Ecol. Sociobiol.*, 37: 275–282.
- 1995a. Parasites, plumage coloration and reproductive success in the yellowhammer, *Emberiza citrinella*. *Oikos*, 74: 331–339.
- Sundberg, J. & Larsson, C., 1994. Male coloration as an indicator of parental quality in the yellowhammer, *Emberiza citrinella*. *Anim. Behav.*, 48: 885–892.
- Svensson, E. & Merilä, J., 1996. Molt and migratory condition in Blue Tits: A serological study. *Condor*, 98: 825–831.
- Svensson, L., 1992. *Identification guide to European Passerines*. L.Svensson, Stockholm.
- Swaddle, J. P., Witter, M. S., Cuthill, I. C., Budden, A. & McCowen, P., 1996. Plumage condition affects flight performance in Common Starlings: implications for developmental homeostasis, abrasion and moult. *J. Avian Biol.*, 27: 103–111.
- Számado, S., 2000. Cheating as a mixed strategy in a simple model of aggressive communication. *Anim. Behav.*, 59: 221–230.
- Tanaka, Y., 1996. Social selection and the evolution of animal signals. *Evolution*, 50: 512–523.
- Tella, J. L., Forero, M. G., Donazar, J. A. & Hiraldo, F., 1997. Is the expression of male traits female lesser kestrels related to sexual selection? *Ethology*, 103: 72–81.
- Tella, J. L., Negro, J. J., Rodríguez-Estrella, R., Blanco, G., Forero, M. G., Blázquez, M. C. & Hiraldo, F., 1998. A comparison of spectrophotometry and color charts for evaluating total plasma carotenoids in wild birds. *Physiol. Zool.*, 71: 708–711.
- Thayer, G. H., 1909. *Concealing coloration in the Animal Kingdom*. Macmillan, NY.
- Thompson, C. W., 1991. The sequence of molts and plumages in Painted Buntings and implications for theories of delayed plumage maturation. *Condor*, 93: 209–235.
- Thompson, C. W., Hillgarth, N., Leu, M. & McClure, H. E., 1997. High parasite load in house finches (*Carpodacus mexicanus*) is correlated with reduced expression of a sexually selected trait. *Am. Nat.*, 149: 270–294.
- Thompson, C. W. & Leu, M., 1995. Molts and plumages of orange-breasted buntings (*Passerina leclancherii*): Implications for theories of delayed plumage maturation. *Auk*: 112: 1–19.
- Trivers, R., 1985. *Social evolution*. Benjamin/Cummings Publ. Company, Menlo Park, CA.
- Tschirren, B., Fitze, P. S. & Richner, H., 2003. Proximate mechanisms of variation in the carotenoid-based plumage coloration of nesting great tits (*Parus major* L.). *J. Evol. Biol.*, 16: 91–100.
- VanderWerf, E. A. & Freed, L. A., 2003. Elepaio subadult plumages reduce

- aggression through graded status-signaling, not mimicry. *Journal of Field Ornithology*, 74: 406–415.
- Veiga, J. P., 1993. Badge size, phenotypic quality, and reproductive success in the House Sparrow: a study on honest advertisement. *Evolution*, 47: 1161–1170.
- 1995. Honest signalling and the survival cost of badges in the House Sparrow. *Evolution*, 49: 570–572.
- Veiga, J. P. & Puerta, M., 1996a. Nutritional constraints determine the expression of a sexual trait in the house sparrow, *Passer domesticus*. *Proc. R. Soc. Lond. B*, 263: 229–234.
- Verhulst, S., Dieleman, S. L. & Parmentier, H. K., 1999. A tradeoff between immunocompetence and sexual ornamentation in domestic fowl. *Proc. Natl. Acad. Sci. USA*, 96: 4478–4481.
- Vevers, G., 1982. *The colours of animals. Studies in Biology series nº 146*. Edward Arnold, London.
- Villafuerte, R. & Negro, J. J., 1998. Digital imaging for colour measurement in ecological research. *Ecol. Letters*, 1: 151–154.
- Völker, O., 1934. Die Abhangigkeit der lipochrombildung bei vögeln von pflanzlichen carotinoiden. *J. Orn.*, 82: 439.
- 1938. The dependence of lipochrome-formation in birds on plant carotenoids. In: *International Ornithological Congres*: 425–426 (Anonymous, Ed.). Proc. 8th Intern. Ornithol. Congr.
- Waite, T. A., 1990. Effects of caching supplemental food on induced feather regeneration in wintering Gray Jays *Perisoreus canadensis*: a ptilochronology study. *Ornis Scand.*, 21: 122–128.
- Walsberg, G. E., 1983. Avian ecological energetics. In: *Avian biology, vol. VII*: 161–220 (D. S. Farner, J. R. King & K. C. Parkes, Eds.). Academic Press, New York.
- Watt, D. J., 1986a. A comparative study of status signalling in sparrows (genus *Zonotrichia*). *Anim. Behav.*, 34: 1–15.
- 1986b. Relationship of plumage variability, size and sex to social dominance in Harris' sparrows. *Anim. Behav.*, 34: 16–27.
- Weatherhead, P. J., Bennett, G. F. & Shutler, D., 1991. Sexual selection and parasites in Wood-Warbblers. *Auk*, 108: 147–152.
- Weatherhead, P. J. & Robertson, R. J., 1979. Offspring quality and the polygyny threshold: "The sexy son hypothesis". *Am. Nat.*, 113: 201–208.
- Wedekind, C., Meyer, P., Frischknecht, M., Niggli, U. A. & Pfander, H., 2003. Different Carotenoids and Potential Information Content of Red Coloration of Male Three-Spined Stickleback. *Journal of Chemical Ecology*, 25: 787–801.
- Weggler, M. B., 1997. Age-related reproductive success and the function of delayed plumage maturation in male Black Redstarts *Phoenicurus ochruros*. Ph. D. Thesis, Universität Zürich.
- West Eberhard, M. J., 1975. The evolution of social behaviour by kin selection. *Quat. Rev. Biol.*, 50: 1–33.
- Whitfield, D. P., 1986. Plumage variability and territoriality in breeding turnstone *Arenaria interpres*: status signalling or individual recognition? *Anim. Behav.*, 34: 1471–1482.
- 1987. Plumage variability, status signalling and individual recognition in avian

- flocks. *Trend. Ecol. Evol.*, 2: 13–18.
- Wiley, R. H., 1991. Both high- and low-ranking white-throated sparrows find novel locations of food. *Auk*, 108: 8–15.
- Willoughby, E. J., Murphy, M. & Gorton, H. L., 2002. Molt, plumage abrasion, and color change in lawrence's goldfinch. *The Wilson Bulletin*, 114: 380–392.
- Wilson, E. O., 1975. *Sociobiology, the new synthesis*. Harvard Univ. Press, Cambridge.
- Wilson, J. D., 1992. A re-assessment of the significance of status signalling in populations of wild great tits, *Parus major*. *Anim. Behav.*, 43: 999–1009.
- With, T. K., 1957. Pure unequivocal uroporphyrin III. Simplified method of preparation from turaco feathers. *Scand. J. Clin. Lab. Invest.*, 9: 398–401.
- Wolf, J. B., Brodie, E. D., III & Moore, A. J., 1999. Interacting Phenotypes and the Evolutionary Process. II. Selection Resulting from Social Interactions. *Am. Nat.*, 153: 254–266.
- Wolfe, D. F. G., 1996. Opportunistic winter water acquisition by Pine Grosbeaks. *Wilson Bull.*, 108: 186–187.
- Wolfenbarger, L. L., 1999b. Female mate choice in Northern cardinals: is there a preference for redder males? *Wilson Bull.*, 111: 76–83.
- 1999a. Is red coloration of male Northern Cardinals beneficial during the nonbreeding season?: a test of status signaling. *Condor*, 101: 655–663.
- 1999c. Red coloration of male northern cardinals correlates with mate quality and territory quality. *Behav. Ecol.*, 10: 80–90.
- Wolfenden, I., 1980. The birds of the Crosby Hightown dunes. *Bird Ringing SW Lancashire*, 10: 13–41.
- Yosef, R., 1996. On habitat-specific nutritional condition in Graceful Warblers *Prinia gracilis*: evidence from ptilechronology. *J. Orn.*, 139: 309–313.
- Yosef, R. & Grubb, T. C., 1992. Territory size influences nutritional condition in nonbreeding loggerhead shrikes (*Lanius ludovicianus*): A ptilechronology approach. *Conservation Biology*, 6: 447–447.
- Young, B. E., 1991. Annual molts and interruption of the fall migration for molting in Lazuli Buntings. *Condor*, 93: 236–250.
- Zahavi, A., 1975. Mate selection – a selection for a handicap. *J. theor. Biol.*, 53: 205–214.
- Zahavi, A. & Zahavi, Av., 1997. *The handicap principle: A missing piece of Darwin's Puzzle*. Oxford Univ. Press, New York.
- Zahn, S. N. & Rothstein, S. I., 1999. Recent increase in male House Finch plumage variation and its possible relationship to avian pox disease. *Auk*, 116: 35–44.
- Zuberbier, G. M. & Grubb, T. C., 1992. Ptilechronology: wind and cold temperatures fail to slow induced feather growth in captive White-breasted Nuthatches *Sitta carolinensis* maintained on ad libitum food. *Ornis Scand.*, 23: 139–142.
- Zuk, M. & Decruyenaere, J. G., 1994. Measuring individual variation in colour: a comparison of two techniques. *Biol. J. Linn. Soc.*, 53: 165–173.