

Literature on the Effects of Waterfowl on Water Quality

Impacts of Heronries on Water Quality as Evaluated through *Escherichia coli* and Fecal Sterol Analyses.

J.M. Telesford-Checkley, M.A. Mora, T.J. Gentry, T.J. McDonald, D.E. Boellstorff. 2017.

Abstract: The authors used fecal sterol analysis to determine the potential contribution of *E. coli* from heronries to waterbodies in east-central Texas. They analyzed *E. coli* and fecal sterol concentrations in samples from four heronries during the breeding seasons in 2011–2013. The highest *E. coli* concentrations were in water samples from the two largest heronries established directly over water. The main sterols in fecal samples were cholesterol and stigmaterol, and in water, cholesterol, coprostanol, and cholestanol. Total sterols ranged 979 to 5838 ng/g dry weight in fecal samples, and 13 to 600 ng/L in water samples. There was a positive correlation between *E. coli* and the sum of bird sterols in water exposed directly to fecal deposition, but not in water surrounding the heronries. The authors found a strong association between *E. coli* and stigmaterol, suggesting that the presence of stigmaterol in water could be used for predicting *E. coli* sources from heronries nesting close to waterbodies.

Available at:

<https://www.ingentaconnect.com/contentone/wef/wer/2017/00000089/00000006/art00004?crawler=true&mimetype=application/pdf>

Nutrient Additions by Waterfowl to Lakes and Reservoirs: Predicting Their Effects on Productivity and Water Quality.

B.A. Manny, W.C. Johnson, and R.G. Wetzel. 1994.

Abstract:

Lakes and reservoirs provide water for human needs and habitat for aquatic birds. Managers of such waters may ask whether nutrients added by waterfowl degrade water quality. For lakes and reservoirs where primary productivity is limited by phosphorus (P), we developed a procedure that integrates annual P loads from waterfowl and other external sources, applies a nutrient load-response model, and determines whether waterfowl that used the lake or reservoir degraded water quality. Annual P loading by waterfowl can be derived from a figure in this report, using the days per year that each kind spent on any lake or reservoir. In our example, over 6500 Canada geese (*Branta canadensis*) and 4200 ducks (mostly mallards, *Anas platyrhynchos*) added 4462 kg of carbon (C), 280 kg of nitrogen (N), and 88 kg of P y^{-1} to Wintergreen Lake in southwestern Michigan, mostly during their migration. These amounts were 69% of all C, 27% of all N, and 70% of all P that entered the lake from external sources. Loads from all external sources totaled 840 mg P $m^{-2} y^{-1}$. Application of a nutrient load-response model to this concentration, the hydraulic load (0.25 m y^{-1}), and the water

residence time (9.7 y) of Wintergreen Lake yielded an average annual concentration of total P in the lake of 818 mg m⁻³ that classified the lake as hypertrophic. This trophic classification agreed with independent measures of primary productivity, chlorophyll-a, total P, total N, and Secchi disk transparency made in Wintergreen Lake. Our procedure showed that waterfowl caused low water quality in Wintergreen Lake.

Available at: <https://link.springer.com/article/10.1007/BF00027847>

Escherichia coli Concentrations in Feces of Geese, Coots, and Gulls Residing on Recreational Water in the Netherlands

Bastiaan G. Meerburg, Miriam G.J. Koene, and David Kleijn. 2011.

Abstract: Contamination of recreational water by bird feces is a main concern of water managers. It is important to understand the sources of Escherichia coli contamination since the organism is frequently used as a water hygiene parameter. Here, we address presence and levels of E. coli in fecal shedding from several waterfowl (25 geese, 20 coots, and 40 gulls) and demonstrate that there is a bird species variation. Results indicate that gull feces contain a greater average concentration of E. coli per gram than do geese or coot feces. However, contamination risks also depends on bird abundance. These are important aspects for effective water bird management.

Available at:

https://www.researchgate.net/publication/51104213_Escherichia_coli_Concentrations_in_Feces_of_Geese_Coots_and_Gulls_Residing_on_Recreational_Water_in_The_Netherlands?_esc=publicationCoverPdf&el=1_x_3&enrichId=rgreq-96731949217dcd0b68c8944ccbc96d0b-XXX&enrichSource=Y292ZXJQYWdIOzUxMTA0MjEzO0FTOjEwNDcyNjA0MTQ2NDgzNUAxNDaxOTgwMDQyMzEx

Just Feeding the Ducks: Quantifying a Common Wildlife-Human Interaction

R. Chapman and D.N. Jones. 2009.

Abstract: Wildlife feeding is very popular and widespread throughout the Western world. In Australia, the public is actively engaged in both private and public settings. Duck feeding in urban lakes, in particular, is a popular public activity. This preliminary study investigated the practice of duck feeding at 10 locations within south-east Queensland. The diversity of waterbird species fed was consistent with previous studies within the region. An unexpected finding was the abundance of domesticated ducks present. Dabbling duck species were seen to take advantage of feeding whereas grazing duck species did not. It was found that duck feeding was a common practice of humans and that on average people were involved for 4.5 minutes and fed an average

of 4.9 slices of bread per feeding session. This suggests a need for further study into the potential impacts.

Available at:

https://www.researchgate.net/publication/44190529_Just_feeding_the_ducks_quantifying_a_common_wildlife-human_interaction

New York City Department of Environmental Protection, Bureau of Water Supply: Waterfowl Management Program.

2016

Summary: A Waterfowl Management Program was developed to evaluate and mitigate pollutant impacts (fecal coliform bacteria) from migratory and resident waterbirds (waterfowl, gulls and cormorants). The purpose of the study reported here, for the period August 1, 2015 to July 31, 2016, is to evaluate further the trends observed in bird numbers and their effect on fecal coliform bacteria levels as a consequence of DEP's Waterfowl Management Program.

Available at:

http://www.nyc.gov/html/dep/pdf/reports/fad_4.1_waterfowl_management_program_-_annual_report_09-16.pdf

The Effect of Goose Management on Water Quality

M. Swallow, J. Huffman, K.V. Why, and G. D'Angelo. 2010.

Abstract: Canada geese are causing a growing concern regarding their impact on Public health and safety risks. In Pennsylvania the USDA's Wildlife Services division manages geese in problematic areas. The purpose of goose management is to reduce damage to agricultural, urban, and natural resources, as well as reducing threats to public health. For this study, three impoundments were monitored bi-weekly from May to September along with a single sampling date in both October and November 2009. Two of the impoundments are managed by the USDA while the third was the unmanaged control site. The objective of the study was to compare water chemistry and fecal coliform counts from the three sites. Dissolved oxygen, pH, and water temperature were measured along with fecal and total coliforms to monitor water quality from the nesting to migration seasons. Results from fecal coliform testing show strong evidence of the benefits of management with coliform levels up to three times higher in the unmanaged impoundment. Based on these findings, the USDA's methods of management are effective in reducing health threats as well as improving water quality. Key Words: *Branta canadensis*, Canada geese, fecal coliforms, management, water quality.

Available at:

https://www.aphis.usda.gov/wildlife_damage/nwdp/Publications/10pubs/Swallow%20et%20al%202010.pdf

Waterfowl Management in Stormwater Management Ponds

C.D. Smith. 2006.

Abstract: Urbanization, which is ever increasing on a global scale, can negatively affect wildlife and habitat as well as biotic realms including air, soil, and water. One of the impacts of urbanization is urban runoff. A method commonly employed to mitigate runoff is the construction of stormwater management ponds (SWMPs). These ponds have created new habitat for urban wildlife, especially waterfowl such as Canada geese and mallard ducks. In some municipalities, increased numbers and densities of waterfowl near SWMPs are considered a nuisance due to their large numbers, considerable amount of fecal matter and because they may create health hazards. This research specifically examines the influence of species composition and height of vegetation around SWMPs on waterfowl use and whether changes in *Escherichia coli* counts are attributed to waterfowl use. Ponds were visited 140 times between April 2005 and June 2006. At each site, the number of Canada geese, mallard ducks, and other waterfowl species was recorded. Geese significantly preferred ponds with short vegetation ($F = 53.45$, $p < 0.0001$) and ducks exhibited no preference ($F = 2.17$, $p = 0.347$). The time (day) that observations were made was a factor indicating that there were temporal variations among seasons; geese were slightly more affected by time ($F = 16.08$, $p < 0.0001$) than ducks ($F = 11.18$, $p < 0.001$). This was not surprising given that waterfowl generally migrate locally across seasons. This result also supported the hypothesis that geese respond to changes in vegetation height. The influence of time coincides with the development of vegetation between spring and summer. Geese moved to the ponds with short vegetation as the growing season progressed, whereas they tended to avoid ponds with more naturalized vegetation due to the increased height. From a management perspective, municipalities can discourage nuisance geese at SWMPs through the naturalization of ponds and decreasing the level of maintenance via less mowing. There was no significant correlation between waterfowl use of ponds and *E. coli* counts. The Pearson's correlation ranged from -0.152 to 0.990, associated p values ranged from 0.07 to 0.981. While further study is required, it appears that waterfowl do not offer any noticeable addition of *E. coli* to stormwater management ponds beyond what is already in the water column from other sources. Therefore, waterfowl may not present a health threat, at least within the pond itself.

Available at:

[https://uwspace.uwaterloo.ca/bitstream/handle/10012/2718/FinalThesisFinal\[1\].pd;jsessionid=5548A1159ADE8EC30E0F157B14E2BB9C?sequence=1](https://uwspace.uwaterloo.ca/bitstream/handle/10012/2718/FinalThesisFinal[1].pd;jsessionid=5548A1159ADE8EC30E0F157B14E2BB9C?sequence=1)

Bird Use of Stormwater-Management Ponds: Decreasing Avian Attractants on Airports

B.F. Blackwell, L. Schafer, D. Helon, and M. Linnell. 2008.

Abstract: Characteristics of stormwater-management ponds that contribute to avian hazards to aviation at airports have not been quantified. We selected 30 stormwater-management ponds (average 0.1 ha), approximately 50 km from Seattle-Tacoma International Airport, as surrogates to on-airport facilities. We conducted 46 weeks of avian surveys (between 14 February 2005 and 17 February 2006) and evaluated model fit of 6 a priori models relative to pond use by an avian group via Kullback–Leibler information. Our full model, composed of pond surface area (sa), ratio of area of open water to area of emergent and woody vegetation (ow:ew), perimeter irregularity, and geographic isolation, was among 3 best approximating models for pond use by 9 of 13 groups (within Anatidae, Ardeidae, Charadriidae, Columbidae, Accipitridae, Laridae, and Rallidae) considered. The full model and models lacking sa or ow:ew were indistinguishable in fit for a group composed of avian species considered hazardous to aviation. For models selected, Akaike weights (i.e., relative likelihoods) ranged from 0.869 to 0.994. In contrast, relative likelihood for a mean model (i.e., a model including only an intercept) was $<10^{-4}$ for all groups. We suggest that designs of stormwater-management ponds at airports in the Pacific Northwest should minimize the pond perimeter via circular or linear designs. Also, ponds should be located so as to reduce the number and proximity of other water resources within 1 km. For existing stormwater-management ponds at airports, we suggest reducing the availability of open water via covering or drawdown.

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