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**Annotated Bibliography for North American Colonial Waterbird Conservation**

Katharine Parsons and Corey Wisneski  
Manomet Center for the Conservation Sciences  
Manomet, Massachusetts

**WORKING ANNOTATED BIBLIOGRAPHY AS OF 12/22/1999**

**\* = particularly important source**

GENERAL INFORMATION

\*Anderson, J.M. 1978. Protection and management of wading birds. Pages 99-103. In Wading Birds (A. Sprunt et al., eds).

*This article summarizes some of the methods used in the management of wading birds, their colony sites, and their foraging grounds. Anderson recommends that human disturbance levels be more strictly controlled due to the risk of nest abandonment by sensitive species (i.e. roseate spoonbills). He also calls for the hiring of more personnel to monitor nesting sites and to protect them from disturbance. On the management side, he lauds the construction of new islands for nesting habitat, the control of pollution and predators, the provision of food sources, and the establishment of sanctuaries under governmental control. The management suggestions given in this paper are most helpful.*

Beaver, D.L., R.G. Osborn, and T.W. Custer. 1980. Nest site and colony characteristics of wading birds in selected Atlantic coast colonies. Wilson Bulletin 92: 200-220.

**Key species covered:** Great Egret, Snowy Egret, Little Blue Heron, Cattle Egret, Glossy Ibis, and Louisiana Heron (*not covered by plan*)

**Geographic areas covered:** Massachusetts, Virginia, and North Carolina

*This resource contains information about nest-site preferences among wading bird species. Some of the included colonies were found on old landfills and dredge spoil islands so this article may be useful for colony-site restoration and determining preferred habitat type for attracting nesters. Pertinent conclusions drawn were that these birds preferred to nest in vegetation areas that provided stable nest-sites and that the density and dispersion of nests within a colony was related to vegetation patterns, not necessarily social factors.*

\*Carter, H.R. and S.G. Sealy. 1986. Year-round use of coastal lakes by Marbled Murrelets. The Condor 88: 473-477.

**Key Species covered:** Marbled Murrelet

**Geographic areas covered:** British Columbia, Alaska, Washington, Oregon (freshwater lakes)

*Acknowledges that marbled murrelets feed at freshwater lakes (usually within 20 km. of ocean) during both breeding and nonbreeding seasons. This information may be valuable in knowing which habitats are crucial to protect for the marbled murrelet, an endangered species.*

Chapman, B.R. 1984. Great Egret. In Habitat Suitability Index Models.

**Key Species covered:** Great Egret

*This resource is a basic overview of great egret characteristics and does not contain much information directly relevant to management. Rather, it is a concise record of great egret distribution, life history, and suitable habitat; this information is important for management purposes, but can also likely be found in innumerable other places.*

\*Duffy, D.C. 1994. Afterwards: an agenda for managing seabirds and islands.

Birdlife Conservation Series no. 1: 311-318.

**Covers all seabird species**

*This article provides lots of great suggestions for management of seabirds on a global scale. Although the suggestions are meant for general purposes, the recommendations can be tailored for application to a specific species. Duffy writes that many conservation problems that seabirds face are*

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*universal and solutions may have wide applications. Duffy also considers the human dimensions/governmental issues involved in seabird conservation.*

Erwin, R.M., J. Galli, and J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. The Auk 98: 550-561.

**Key Species covered:** Herring Gull, Common Tern, Black Skimmer, Forster's Tern, and Laughing Gull

**Geographic areas covered:** Delmarva coastal region (undisturbed) compared with New Jersey (disturbed)

*Erwin et al. write about preferred habitat types for these five ground-nesting species along the Atlantic coast and how human development issues affect nesting and colony-site choice. This article discusses the use of dredge spoil islands by nesting colonial birds; therefore, this article may have implications for colony-site restoration, especially as it pertains to the acceptance of spoil areas by certain bird species.*

Erwin, R.M. and T.W. Custer. 1982. Estimating reproductive success in colonial waterbirds: an evaluation. Colonial Waterbirds 5: 49-56.

**Key Species covered:** Black-crowned Night Heron, Common Tern, and Herring Gull

**Geographic areas covered:** North and mid-Atlantic states coastal regions

*This resource covers how to obtain accurate nesting success information without causing excessive disturbance of the birds. The information presented here may be helpful in determining population sizes of some species, but its application for management issues is limited. Rather, field researchers studying the conservation statuses of birds may find this information useful.*

\*Everett, W.T. and R.L. Pitman. 1990. Status and conservation of shearwaters of the North Pacific. Pages 93-100. *In* The status, ecology, and conservation of marine birds in the North Pacific (Vermeer et al., eds.).

Canadian Wildlife Service Spec. Publ., Ottawa.

**Key Species covered:** Townsend's Shearwater, Black-vented Shearwater, Newell's Shearwater, Pink-footed Shearwater, Flesh-footed Shearwater, Wedge-tailed Shearwater, Buller's Shearwater, Sooty Shearwater, Short-tailed Shearwater, and Christmas Shearwater

**Geographic areas covered:** North Pacific (north of equator)

*The authors approach each of the above species separately and discuss the general biology and current status of that species. They also address the various threats faced by these shearwaters and offer recommendations for conservation efforts. The most serious threat faced by shearwaters, the authors claim, is incidental mortality in drift gillnet fisheries and the short-tailed shearwater is most affected. Other critical threats include plastic ingestion, oil contamination, direct human disturbance, and predation by introduced animals.*

Gonzalez, J.A. Breeding biology of the Jabiru in the southeast llanos of Venezuela. Wilson Bulletin 108: 524-534.

**Key Species covered:** Jabiru stork

**Geographic areas covered:** Venezuela, but Jabiru storks are also found within the regional limits of the conservation plan (i.e. S. Mexico)

*Gonzalez's article provides good information about the breeding, nesting and rearing behavior of Jabiru storks but its relevance to management is limited. It is unknown whether this information from Venezuela is applicable to Mexico. However, his bibliography did provide some useful sources of Jabiru stork conservation issues.*

Kendall, S.J. and B.A. Agler. 1998. Distribution and abundance of Kittlitz's Murrelets in south-central and southeastern Alaska. Colonial Waterbirds 21: 53-60.

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**Key Species covered:** Kittlitz's Murrelets

**Geographic areas covered:** south-central and southeastern Alaska

*Similar to the above source, this article provides general and recent population information which may be useful in determining the current status of Kittlitz's Murrelets in Alaska. However, implications for effective management are few. This article would be more useful for researchers.*

\*Kushlan, J.A. 1987. Recovery plan for the U.S. breeding population of the Wood Stork. Colonial Waterbirds 10: 259-262.

**Key Species covered:** Wood Stork

*This is a review article of the Recovery Plan for the Wood Stork as written by Michael Bentzien. Kushlan praises Bentzien for making valuable and concise management and conservation suggestions and for providing actual numerical goals for the population of Wood Storks. However, few specific management guidelines are called for, perhaps due to the limited amount of knowledge about the species. The overall positive nature of this review makes me want to locate the Recovery Plan itself.*

Kushlan, J.A. 1992. Population biology and conservation of colonial wading birds. Colonial Waterbirds 15: 1-7.

**Key species covered:** herons, storks, ibises, and relatives

*This resource examines the gaps in information about wading birds and the reasons these gaps exist. He suggests future research needs and encourages scientists to fill in the gaps of knowledge. Among the topics that the author identifies as needing further research are breeding biology, foraging ecology, population size and trends, wintering habitats, and investigator disturbance.*

Kushlan, J.A. 1997. The conservation of wading birds. Colonial Waterbirds 20: 129-137.

**Key Species covered:** herons, ibises, storks, and flamingos

*This piece covers general trends and future needs in wading bird conservation on a global scale. Not much detailed management implications but broad ideas are presented for many issues related to wading birds and their habitat. Good for general ideas.*

\*Lutnin, C.S. 1987. Status and conservation priorities for the world's stork species. Colonial Waterbirds 10: 181-202.

**Key Species covered:** Wood Stork and Jabiru Stork

*This resource outlines the status and conservation needs for each species of stork in the world. Brief information but concisely provides the basic needs for the protection of the Wood Stork and the Jabiru Stork. The author notes that a conservation plan that has been successful for one species of stork may also work for another species, regardless of their geographic proximity, due to the similar habitat and ecological needs of all stork species.*

\*Mikuska, T., J.A. Kushlan, and S. Hartley. 1998. Key areas for wintering North American herons. Colonial Waterbirds 21:125-134.

**Key Species covered:** all North American heron species

*Mikuska et al. make the observation that all too often, wintering sites for migratory herons are ignored in conservation plans; rather, most attention has been paid to breeding and feeding grounds. An excellent map and chart of 43 designated heron wintering areas (as determined from banding data) is included in this source and can certainly be helpful in identifying regions of conservation priority. The authors also identify those few areas of the 43 that are the most crucial and should receive the most immediate attention; they also propose that a network of key areas be established, akin to WHSRN.*

Miller, L.M. and J. Burger. 1978. Factors affecting nesting success of the Glossy Ibis. The Auk 95: 353-361.

**Key Species covered:** Glossy Ibis

**Geographic areas covered:** New York and New Jersey

*The authors were interested in investigating the reasons for the recent northward expansion of the Glossy Ibis. There is not too much information here that could pertain to management but an interesting observation is made: "In order for a species to expand, extrinsic factors (e.g. climate, predators, habitat),*

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*which usually work against expansion, must exert less of an effect than intrinsic factors (e.g. rate of increase, population density, age structure)."*

\*Myers, J.P. et al. 1987. Conservation strategy for migratory species. American Scientist 75: 19-26.

**Key Species covered:** mainly shorebird species

*Even though the authors of this source concentrated primarily on shorebirds and no other migratory birds, their ideas can be applied to many different waterbird issues. The authors stress the importance of forming reserve networks to protect migratory species and also describe the unique conservation issues that migratory birds necessitate, needing more than one or two protected areas.*

\*Parnell, J.F. et al. 1988. Colonial waterbird management in North America. Colonial Waterbirds 11: 129-169.

**Key species covered:** all colonial waterbird species

**Geographic areas covered:** North America north of Mexico

*This article, according to the authors, "review[s] the many problems facing colonial waterbirds, review[s] management techniques, discuss[es] implementation of management programs, and indicate[s] needs for research and education." The source does what it says and is one of the more helpful articles found. The authors not only cover colonial waterbird problems and possible solutions, but also discuss the legal aspects of management, the roles that agencies play, and how research, education, and enforcement may be improved in the future. Loads of information and a lengthy and helpful bibliography.*

Parnell, J.F. et al. 1997. Changes in nesting populations of colonial waterbirds in coastal North Carolina 1900-1995. Colonial Waterbirds 20: 458-469.

**Key species covered:** about twenty, including herons, gulls, egrets, terns, pelicans etc.

**Geographic areas covered:** coastal zone of North Carolina

*This source looks at nearly a century of census data and attempts to determine the general status of waterbirds in this area. Are populations increasing or decreasing? Is species composition relatively the same or has it become less or more diverse? How have the size of colonies changed over the years? How has recent increasing human development along the coast affected waterbird colonies? All these questions and more are discussed by the authors and this article ends up being fairly useful for determining the current status of some species of waterbirds and for predicting future trends along heavily developed Atlantic coastal regions.*

\*Wheeler, M.W. 1999. Wetland Birds. Cambridge University Press, Cambridge, UK.

*Three different chapters from this book are useful for management and research information. The first chapter summarizes habitat use patterns and how these relate to conservation and management. Wheeler discusses the "influence of bird biology on conservation approaches", "population and species influences on conservation strategies", community-level issues, and the values of wetland dynamics (water levels, vegetation etc.) to waterbirds. The second chapter covers how wetland bird species compete with human society for resources and what are the current status of wetlands around the world. The final chapter focuses on approaches to habitat management with the ultimate goal of multi-species conservation. He also covers the restoration and creation of wetlands. This source is excellent not only because it is thorough but because it is current. Excellent bibliography at end of each chapter.*

## COLONY-SITE RESTORATION

\*Blokpoel, H., G.D. Tessier, and R.A. Andress. 1997. Successful restoration of the Ice Island Common Tern colony requires on-going control of Ring-billed Gulls. Colonial Waterbirds 20: 98-101.

**Key species covered:** Common Terns and Ring-billed Gulls

**Geographic areas covered:** Great Lakes area and St. Lawrence River

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*This paper discusses the restoration of a common tern colony after it was taken over by ring-billed gulls; the gulls arrive earlier than the terns and usurp all quality nesting sites. The authors describe their use of monofilament lines to discourage the nesting of the gulls and to save the areas for the terns. The destruction of gull nests and eggs (under a permit) allowed for further assurance that the terns would have a successful season. It was determined that the monofilament line approach worked best at small colony sites that had the only nearby suitable sites. The authors also used decoys to attract the terns to the colony. This article provides good information about the restoration of colonial waterbird colonies and also shows that complete management is needed if it is desired for the gulls to stay away permanently.*

\*Brown, S.C. and C.R. Smith. 1998. Breeding season bird use of recently re-stored versus natural wetlands in New York. Journal of Wildlife Management 62: 1480-1491.

**Geographic areas covered:** northern New York

*This resource is great in that it provides a comparison between natural and restored wetlands and assesses the degree to which bird communities of restored wetlands are similar to those of relatively natural wetlands. The authors determined that bird species numbers were similar between restored and natural sites but bird species composition differed. Differences in density suggest that three-year-old restored sites were not as capable of supporting the same density of birds as natural sites; this implied that the first three years of a restored site cannot be compared to a natural site. This article had several important implications for management.*

\*Buckley, F.G. and C.A. McCaffrey. 1978. Use of dredged material islands by colonial seabirds and wading birds in New Jersey. US Army Engineer Waterways Experiment Station. Technical Report D-78-1, NTIS No. AD-A061843.

**Geographic areas covered:** New Jersey

*This study examined the vegetative preferences of many species of colonial seabirds and wading birds. The authors also recommended the research of other characteristics of dredged material islands (i.e. microtopography) and how these pertain to colonial nesters and foragers. Nineteen useful management suggestions are also given for the effective maintenance of dredge spoil islands.*

Byrd, G.V., E.P. Bailey, and W. Stahl. 1997. Restoration of island populations of black oystercatchers and pigeon guillemots by removing introduced foxes. Colonial Waterbirds 20: 253-260.

**Key Species covered:** Pigeon Guillemot

**Geographic areas covered:** southwestern Alaskan islands

*The authors were concerned with restoring populations of pigeon guillemots following the Exxon Valdez oil spill and they chose to remove predatory fox populations in order to give the birds a chance to increase their numbers. They found, however, that merely removing the foxes was not enough to ensure the birds' recovery; enough suitable habitat for nesting had to be available. The population of guillemots began to increase substantially about 3-4 years following the removal of the foxes. This article is valuable in that it shows that predator removal is not always a fool-proof way to increase the numbers of a species. The source is valuable for the "mistake" it made.*

\*Coulter, M.C., W.D. McCourt, and A.L. Bryan. 1987. Creation of artificial foraging habitat for Wood Storks. Colonial Waterbirds 10: 203-210.

**Key Species covered:** Wood Stork

**Geographic areas covered:** South Carolina and Georgia

*This source is useful in the management category not only because it proves that Wood Storks will use artificial feeding sites if they are provided, but also because it shows that many other wading species will also take advantage of man-made ponds. The authors describe their methods well, which include managing the water level and stocking the ponds with compatible species of fish; they also raise the need for further investigation into how to limit the amount of competition between the target species and any other wading birds in the area who want to feed. They also express a desire for the ponds to eventually become self-sustaining through natural fish reproduction.*

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\*Dunlop, C.L., H. Blokpoel, and S. Jarvie. 1991. Nesting rafts as a management tool for a declining Common Tern colony. Colonial Waterbirds. 14: 116-120.

**Key Species covered:** Common Tern

**Geographic areas covered:** Eastern headland spit in Lake Ontario

*This paper looks at whether or not providing nesting platforms for Common Terns is a useful management tool. Terns successfully colonized the nesting platforms; it is not known whether the use of tern decoys played a significant role in the speedy colonization. Fledging success was variable but the rafts provided a virtually predator-free, erosion-free, and human disturbance-free place for terns to nest. The authors recommend nesting rafts as useful management and restoration tools.*

\*Dusi, J.L. Attraction of herons to a colonial nesting site

**Key Species covered:** Little Blue Heron, Cattle Egret, Great Egret, Snowy Egret, Tricolored Heron, and White Ibis

**Geographic areas covered:** coastal plain of Alabama

*Dusi wanted to determine whether herons could be induced to start a colony with the use of decoys, nests, eggs, and vocalization playbacks. His results showed that the short-term use of these methods did not attract nesters but did attract post-nesting birds to feed and roost. Perhaps a long-term study would encourage nesting. This article shows that with other ample nesting sites in the area, decoys and vocalizations may not attract nesters; however, in an region with limited nest sites, the birds may be attracted to the decoyed area.*

Erwin, R.M. et al. 1998. Modeling colony-site dynamics: a case study of gull-billed terns in coastal Virginia. The Auk 115: 970-978.

**Key Species covered:** Gull-billed Terns, Black Skimmers, and Common Terns

**Geographic areas covered:** barrier islands of Virginia

*This study showed that Gull-billed Terns have low colony-site fidelity and that their nests can be frequently flooded, especially when they are found on shellpiles. The authors also recommended management strategies that may be helpful. Providing a large number of sand and/or shellpile sites for use by nesting terns would allow the birds to switch colony sites year after year, if need be. Raising the elevation by at least 20 cm. of some shellpiles may also prevent the flooding of nests. This article was not too helpful because the management strategies suggested seemed to be applicable only to their particular study site.*

Fisk, E.J. 1978. The growing use of roofs by nesting birds. Bird Banding 49: 134-141.

**Key Species covered:** many different shorebirds and waterbirds

**Geographic areas covered:** North America, England

*This source is relatively important because its findings demonstrate that many species of birds are able and willing to modify their nesting site preferences and behavior when pressured by human activities or predation. This is mainly a listing of reports from scientists on the occurrence of rooftop nesting; this article proves that many populations of waterbirds have somewhat adapted to the threat of encroaching human disturbance by nesting on roofs that are typically in urban areas and made of tar mixed with gravel or shell fragments.*

Grant, G.S. and W.W. Kirby-Smith. 1998. The effect of open-marsh water management on summer bird populations on Topsail Island, North Carolina. Estuaries 21: 361-363.

**Key Species covered:** herons, egrets, ibises, some gulls and terns, Black Skimmer

**Geographic areas covered:** Topsail Island, North Carolina

*The authors were interested in how mosquito-control measures in estuarine marshlands would affect foraging bird species. The digging of ditches that would harbor fish and invertebrate predators of*

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*mosquito larvae did not appear to have a large impact on resident bird populations. This study is interesting in that it provides an example of how human and bird interests do not have to be conflicting. However, this study was only done on a very restricted area and further research is definitely necessary if open-marsh water management procedures are to be applied to many marshlands where large populations of waterbirds forage.*

\*Kotliar, N.B. and J. Burger. 1984. The use of decoys to attract Least Terns to abandoned colony sites in New Jersey. Colonial Waterbirds 7: 134-138.

**Key Species covered:** Least Terns

**Geographic areas covered:** coastal New Jersey

*The discovery that Least Terns nesting in New Jersey tend to nest in extremely large numbers due to habitat loss prompted this study. The main goal was to provide more suitable nesting habitat in order to decrease the susceptibility of one large colony, which would mean a devastating reproductive loss. The authors found that employing decoys to attract Least Terns to a potential nesting site can be useful. This article is important because it provides further proof for the importance of social attraction in nest-site choice. The authors also make helpful suggestions about other management techniques, especially on how to prevent predation pressures at a newly restored colony-site.*

\*Kress, S.W. and D.N. Nettleship. 1988. Re-establishment of Atlantic Puffins at a former breeding site in the Gulf of Maine. Journal of Field Ornithology. 59: 161-170.

**Key Species covered:** Atlantic Puffin

**Geographic areas covered:** Gulf of Maine

*This source examines natal site fidelity among chicks who were taken from their natal site at a very young age. The results showed that puffin chicks learn the location of their natal island sometime after two weeks of age. This article is very useful on a management level because the results show that if a colony needs to be moved for any number of reasons, the move will be more likely to be successful if it is done before the chicks are two weeks old. In this way, the chicks won't return to the undesirable locale upon fledging. There are also implications for the re-establishment of historic nesting habitat because bringing eggs of newly hatched chicks to another island would "imprint" that location in their permanent memories.*

\*Kress, S.W. 1983. The use of decoys, sound recordings, and gull control for re-establishing a tern colony in Maine. Colonial Waterbirds 6: 185-196.

**Key Species covered:** Arctic Terns, Common Terns

**Geographic areas covered:** Eastern Egg Rock, Maine

*Similar to the Kotliar and Burger study above, this resource differs slightly in that it uses gull control measures combined with various social attractants. It shows that tern populations can be re-established through the use of decoys, sound recordings, and gull control. The social attractant measures were shown to increase the potential number of tern landings and the social stimulation of the colony may have initiated courtship behavior. This study is helpful because, combined with the Kotliar and Burger study, it shows that many tern species are flexible in colony-site preference and that gull predation can be a major factor in determining tern reproductive success.*

\*Lewis, R.R. and C.S. Lewis. 1978. Colonial bird use and plant succession on dredged material islands in Florida. Volume II: Patterns of Plant succession. US Army Engineer Waterways Experiment Station. Technical Report D-78-14, NTIS No. AD-A056 803.

**Geographic areas covered:** Florida

*This article is similar in usefulness to the Scharf article in this section. It examines the relationship of plant succession on dredged material islands to bird colonization and nesting. Different species preferred different stages of plant succession. The study also addresses the role birds play in seed colonization and fecal fertilization. The authors make many useful recommendations for effective management of dredged material islands, such as vegetation removal and the constant replenishing of islands to counteract erosion. The information found in this resource is extremely helpful for colony-site restoration and management.*

Malakoff, D. 1998. Restored wetlands flunk real-world test. Science 280: 371-372.

*This short article addresses the differences between natural and man-made wetlands and how their differences affect the various wildlife species that live and forage there. Studies referred to in the article claim that the accumulation of nitrogen and organic matter were typically less in created wetlands than in natural (reference) wetlands. However, these results may be due to the short time period between wetland creation and assessment; restored or created wetlands may take much more time to establish themselves enough to be compared with the real thing. This article is useful in that it shows that the re-creation of waterbird habitat may not be as easy as 1-2-3 and useful wetlands are few and far between.*

\*Maxson, S.J. et al. 1996. Success and failure of Ring-billed Gull deterrents at Common Tern and Piping Plover colonies in Minnesota. Colonial Waterbirds 19: 242-247.

**Key Species covered:** Ring-billed Gulls, Common Terns

**Geographic areas covered:** Great Lakes region (Minnesota)

*The authors wanted to determine whether the landing and nesting of Ring-billed Gulls could be prevented at some sites in order to provide more space for Common Terns. The results showed that elevated lines of brightly colored nylon string were successful in deterring gull nesting but only at small or new colonies; well-established traditional colony-sites that harbored large numbers of gulls remained relatively unaffected by the string measures. This study is useful in that it evaluates the effectiveness of various gull deterrent measures and recommends exact procedures for the establishment of these measures.*

\*Parnell, J.F. and R.F. Soots, Jr. 1978. The use of dredge islands by wading birds. Page 105-111. In Wading Birds (A. Sprunt et al., eds.).

**Key Species covered:** Herons

**Geographic areas covered:** Atlantic Coast

*This article approaches the question of why wading birds seem to prefer man-made dredge spoil islands over natural islands. The authors credit the stability and widespread availability of dredge spoil islands for their popularity. Also, these islands are often found in strategic locations with regards to food sources and dredge spoil islands are generally inaccessible to mammalian predators. Management guidelines for dredge spoil islands are also offered. New spoil should not be deposited on already existing islands, for example, because it may destroy any colonies present. Cooperation between state wildlife agencies and the Army Corps of Engineers is also called for.*

\*Quinn, J.S. et al. 1996. Design and management of bird nesting habitat: tactics for conserving colonial waterbird biodiversity on artificial islands in Hamilton Harbor, Ontario. Canadian Journal of Aquatic Sciences (Suppl. 1): 45-57.

**Key Species covered:** double-crested cormorant, black-crowned night heron, herring gull, ring-billed gull, common tern, and Caspian tern

**Geographic areas covered:** west end of Lake Ontario

*This source is helpful in that it provides information on how certain species of birds respond to man-made nesting sites and what characteristics of these sites they prefer; the authors also include recommendations for how to prevent displacement of both tern species by ring-billed gulls and of night-herons by cormorants. This is certainly one of the more useful articles also for its inclusion of long-term management procedures.*

Scharf, W.C., G.W. Shugart, and M.L. Chamberlin. (1978). Colonial birds nesting on man-made and natural sites in the U.S. Great Lakes. US Army Engineer Experiment Station. Technical Report D-78-10, NTIS No. AD-A061 818.

**Key Species covered:** Double-crested Cormorant, Great Blue Heron, Cattle Egret, Great Egret, Snowy Egret, Black-Crowned Night Heron, Herring Gull, Ring-billed Gull, Forster's Tern, Common Tern, Caspian

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Tern, and Black Tern

**Geographic areas covered:** Great Lakes region

*This study provides information on the vegetative preferences of many types of waterbirds which is undoubtedly important for the successful restoration or creation of nesting sites. The authors also take into account other management considerations, like human disturbance, predator pressure, and proximity to an aircraft hazard zone. All these factors can, perhaps, be combined to develop an effective and universal method for establishing secure and attractive nesting sites for bird species affected by human development and/or disturbance.*

## FISHERIES AND AQUACULTURE COMPETITION

Assisting American aquaculture. 1997. Wildlife Services

<http://www.aphis.usda.gov/oa/pubs/aqua.html>

\*Cezilly, F. 1992. Turbidity as an ecological solution to reduce the impact of fish-eating colonial waterbirds on fish farms. Colonial Waterbirds 15: 249-252.

**Key Species covered:** fish-eating colonial waterbirds

*This article reviews the various methods that have been tried in order to control the predation of commercially important fish species by piscivorous birds. The author compares these other methods to the turbidity method (increasing the muddiness of the water using motion). This method was believed to block any prey from the sight of predators, thereby making the site less desirable to the birds. Although preliminary studies have shown turbidity increase to affect prey capture, several issues still need to be addressed before this method can be applied to fish farms. This source is useful in that it provides a concise summary of the pros and cons of other control methods.*

\*Cormorant Management in the Northeast Workshop Report, Appendices C-F.

<http://www.fws.gov/r9mbmo/issues/cormorant/appndxc.html>

**Key Species covered:** Double-crested Cormorant

**Geographic areas covered:** northeast United States

*Appendix C: This appendix merely lists the strategic priorities of cormorant management as determined by the workshop attendants*

*Appendix D: This appendix addressed four main fisheries issues and recommended seven strategies: 1) impacts on fish populations are poorly understood; 2) water quality issues and impacts to fish related to cormorants; 3) human dimensions related to fisheries management and cormorants; and 4) aquaculture may be impacted by cormorants*

*Appendix E: This appendix identifies four categories of concern and recommended five strategies: 1) impacts on habitat on other species; 2) inter-species interactions; 3) cormorant population issues; 4) health and safety issues*

*Appendix F: This appendix summarized 12 categories of human dimension concerns associated with cormorants, with the lack of a coordinated and effective communications plan about cormorants identified as the most important issue.*

Cormorants and their impacts on fish.

[http://www.fws.gov/r9mbmo/issues/cormorant/fish\\_impacts.html](http://www.fws.gov/r9mbmo/issues/cormorant/fish_impacts.html)

*This is a short fact sheet distributed by Fish and Wildlife that summarizes the cormorant/fisheries issue and uses case examples to assert that commercially valuable species actually make up very little of the cormorant diet.*

Depredation order issued for killing cormorants in aquaculture. Bird Calls: the newsletter of the policy council of American Bird Conservancy.

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<http://www.abcbirds.org/cormorants.htm>

*This is a news brief outlining the issuance of a depredation order by the USFWS for cormorants.*

Double-crested Cormorants and fisheries in the Great Lakes basin: Fact sheet.

[http://www.fws.gov/r9mbmo/issues/cormorant/greatlakes\\_facts.htm](http://www.fws.gov/r9mbmo/issues/cormorant/greatlakes_facts.htm)

*This fact sheet concisely summarizes the natural history, controversies, and management strategies associated with cormorant populations.*

Draulans, D. 1988. Effects of fish-eating birds on freshwater fish stocks: an evaluation. *Biological Conservation* 44: 251-263.

*This article reviews the available studies on the effects of piscivorous birds on commercially valuable fish stocks. A lengthy bibliography provides the sources cited in the text. The author identifies conflicting findings and makes recommendations for an objective assessment of the data.*

\*Duffy, D.C. and D.C.Schneider. 1994. Seabird-fishery interactions: a manager's guide. *BirdLife Conservation Series* no.1: 26-38.

*This paper focuses on those interactions between seabirds and fisheries that are likely to produce serious negative consequences for either seabirds or the fishery. The authors discuss several different ratios that can be used to measure the potential for competitive interaction between seabirds and fishery vessels. Finally, management options are outlined and further research needs are identified. This resource is valuable because it succinctly discusses the issues and makes recommendations.*

Fleury, B.E. and T.W. Sherry. 1995. Long-term population trends of colonial wading birds in the southern United States: the impact of crayfish aquaculture on Louisiana populations. *The Auk* 112: 613-632.

**Key Species covered:** 15 species of colonial wading birds

**Geographic areas covered:** Louisiana

*This source examines the possible causes behind the recent increase in some wading bird species populations and the concurrent decrease in other wading bird species populations. Particularly, the authors were interested in whether the increase in wading birds in the state of Louisiana was due to the increasing number of crayfish farms, which may provide more foraging habitat for the birds. They conclude that the two are probably related and that other explanations for the recent increase in wading birds are unconvincing. Finally, the authors make an interesting suggestion that limited predation by birds on crayfish may actually be beneficial to farmers by reducing intraspecific competition and increasing the average size of each crayfish.*

Furness, R.W. ?. Competition between fisheries and seabird communities.

*Advances in Marine Biology* 20: 225-307.

*This lengthy chapter addresses how changing fishing practices are affecting seabird populations and whether seabird populations compete with commercial fisheries. This article evaluates several different methods of estimating food consumption levels of seabirds, examines the relationship between marine ecosystem changes and seabird population fluctuations in five different global regions, and investigates the influences that food have on seabird population ecology. Also included is a long, useful bibliography.*

Lantry, B.F., T.H. Eckert, and C.P. Schneider. 1999. The relationship between the abundance of Smallmouth Bass and Double-crested Cormorants in the eastern basin of Lake Ontario. NYSDEC Special Report: Section 12: 1-10.

<http://www.dec.state.ny.us/website/dfwmr/sect12.pdf>

**Key Species covered:** Double-crested Cormorant

**Geographic areas covered:** Lake Ontario

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*This article examines the relationship between double-crested cormorant predation and the decrease in smallmouth bass populations in Lake Ontario. It concludes that cormorant predation does, in fact, have an effect on certain age classes of smallmouth bass, namely the age class immediately prior to the legal minimum for catching. Therefore, hunting by cormorants decreases substantially the numbers of smallmouth bass that are able to be caught by fishermen. This resource is helpful because it provided conclusive evidence that cormorants are a management concern in some areas and that their competition with fisheries may not be an imagined one.*

Mott, D.F. 1978. Control of wading bird predation at fish-rearing facilities. Pages 131-132. In Wading Birds (A. Sprunt et al., eds.)

**Key Species covered:** various wading birds

**Geographic areas covered:** United States

This is a short review article that covers various methods for protecting aquaculture areas from wading bird predation. The prevention of both fish loss and bird loss are approached in this source. Mott discusses physical barriers, frightening devices, trapping and transporting, and environmental control in this paper. Despite its length, this paper was helpful in summarizing the methods that work and those that don't.

Schneider, C.P. et al. 1999. Double-crested Cormorant predation on Smallmouth Bass and other fishes of the eastern basin of Lake Ontario: overview and summary. NYSDEC Special Report Section 1: 1-6.

<http://www.dec.state.ny.us/website/dfwmr/tablec.html>

*This source is merely a summary of all the studies compiled on the Double-crested Cormorant and fisheries.*

#### PREDATOR CONTROL

Baker, R.H. 1940. Crow depredation on heron nesting colonies. Wilson Bulletin 52: 124-125.

**Key Species covered:** Little Blue Herons, Snowy Egrets, Black-crowned Night Herons

**Geographic areas covered:** coastal Texas

*This short article reviews a single study of crow predation on the nests of three heron species. Its usefulness lays in the proof it provides that crows can substantially affect a colony and that crows appear to prefer little blue heron and snowy egret eggs to black-crowned night heron eggs.. This is perhaps due to the former species preferring concentrated nesting sites while the latter species is not so restricted in its spatial breeding behavior.*

\*Drever, M.C. and A.S. Harestad. 1998. Diets of Norway Rats on Langara Island, Queen Charlotte Islands, British Columbia: Implications for conservation of breeding seabirds. The Canadian Field-Naturalist 112: 676-683.

**Key Species covered:** Ancient Murrelets

**Geographic areas covered:** Queen Charlotte Islands, British Columbia

*This study implicates introduced Norway Rats as important predators of Ancient Murrelets and attempts to identify the diet of the rats in order to develop a poison control system to decrease the number of the predators. The authors also wanted to determine whether the Norway Rat preyed substantially on Ancient Murrelets and, therefore, if the bird populations would benefit at all from removal of the predators. The conclusion of this article is that steps should be taken to remove the rats from the study island because they cause significant declines in Ancient Murrelet population numbers. This piece is important because it establishes rodents as a predator of nesting birds.*

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\*Hatch, J.J. 1970. Predation and piracy by gulls at a ternery in Maine. The Auk 87: 244-254.

**Key Species covered:** Herring Gull, Black-backed Gull, Common Tern, Arctic Tern

**Geographic areas covered:** northeastern coastal Maine

*The author was interested in the predatory behavior of some gull species on tern nestlings.*

*Results of the study showed that gulls prefer to prey on live chicks and do not eat dead chicks nor go after eggs. The results of this study can have implications for how tern colonies are managed in the future and also for determining the extent and long-term effects of gull predation (i.e. colony-site abandonment by the terns or synchronization of nesting).*

Jones, R.D. and G.V.Byrd. 1979. Interrelations between seabirds and introduced animals. Pages 221-226. *In Conservation of Marine Birds of Northern North America* (J.C. Bartonek and D.N. Nettleship, eds.) USFWS Wildlife Research Report 11: Washington D.C.

**Key Species covered:** various seabirds

**Geographic areas covered:** coastal Washington, British Columbia, and Alaska

*This resource is important because it addresses nonpredatory effects that introduced animals can have on seabirds. The literature concentrates so much on carnivorous species that it tends to neglect the effects that herbivores can have. Ungulates, rabbits and invertebrates can have severe effects on seabirds by destroying habitat, trampling nests, or spreading disease and parasites. The authors also cover predatory animals such as Arctic foxes and feral cats. Unfortunately, virtually no management suggestions are offered by the authors aside from preventing altogether the introductions of exotic species.*

Nisbet, I.C.T. 1974. Selective effects of predation in a tern colony. Condor 77: 221-226.

**Key species covered:** Common Tern

**Geographic areas covered:** coastal Massachusetts

*This paper demonstrates the effects of higher predation rates early in the season on predation on chicks in a colony of Common Terns. The primary predator of Common Tern chicks in this study was the Great Horned Owl. It was determined that predation was most intense on the earliest-hatched chicks because of their small size and small numbers. Unfortunately, the author does not suggest any management strategies for preventing the predation of chicks by owls; therefore, the usefulness of this article is fairly limited.*

Schauer, J.H. and E.C. Murphy. 1996. Predation on eggs and nestlings of Common Murres at Bluff, Alaska. Colonial Waterbirds 19: 186-198.

**Key Species covered:** Common Murres, Glaucous Gulls

**Geographic areas covered:** Alaska

*This study concentrated on the predation of Common Murre eggs by Glaucous Gulls and Common Ravens. The results support the idea that predation is typically higher nearer the beginning of the nesting season, thus identifying that time of year when predator preventative management may be most needed. However, this article, like the previous one, offered no specific management suggestions, making this article also of limited worth.*

\*Seto, N.W. and S. Conant. 1996. The effects of rat predation on the reproductive success of the Bonin Petrel on Midway Atoll. Colonial Waterbirds 19: 171-185.

**Key Species covered:** Bonin Petrel

**Geographic areas covered:** Midway Atoll

*This study focuses on rat predation on Bonin Petrels and methods of controlling it. Results showed that rat predation was more intense during the incubation period and more likely in areas of low nest density. A rodenticide was used around some nests and was found to be effective for controlling the amount of predation on petrel nests. This study is useful because it demonstrates the vulnerability of island ground-nesting bird populations to introduced predators and because it shows that predator removal or*

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*culling is effective in reviving reproductive success of the Bonin Petrel populations. Management recommendations are given at the end of the article.*

Shields, M.A. and J.F. Parnell. 1986. Fish crow predation on eggs of the White Ibis at Battery Island, North Carolina. The Auk 103: 531-539.

**Key Species covered:** White Ibis

**Geographic areas covered:** North Carolina

*This article examined fish crow predation on white ibis eggs, how it varies temporally and spatially, and how this predation affects ibis reproductive levels. The authors determined that even though a crow would usually take every egg in a given clutch, the post-predation level of reproduction appeared sufficient for the maintenance of the population. No management strategies were described, although findings about the time of year and the typical location of crow predation occurrences will help wildlife managers better address the design and monitoring of white ibis colonies.*

\*Southern, L.K. and W.E. Southern. 1978. Absence of nocturnal predator defense mechanisms in breeding gulls. Proceedings of the Colonial Waterbird Group: 157-162.

**Key Species covered:** Ring-billed Gulls, Herring Gulls

*This resource addresses the predator defense mechanisms found in some species of gulls. This mechanism seems to be intact during the day, but during night predation, the gulls often fail to defend their nests, resulting in the loss of many eggs. It was discovered that the gull's primary line of defense against predators is to nest in an area that is inaccessible to predators. This article may be helpful in determining when predation takes place in a colony and when monitoring of nesting colonies should occur. The predators covered in this piece include the Great Horned Owl, a striped skunk, and red foxes.*

## HUMAN DISTURBANCE

\*Blanco, G. and R. Rodriguez-Estrella. 1998. Human activity may benefit White-Faced Ibises overwintering in Baja California Sur, Mexico. Colonial Waterbirds 21: 274-276.

**Key Species covered:** White-faced Ibis

**Geographic areas covered:** Baja CA, Mexico

*This rather short article is unique in that it concerns how human disturbance and activities can **benefit** one species of colonial waterbird. The authors claim that the numerous poultry farms in the study area provide large amounts of guano which attracted beetles. Ibises were regularly witnessed feeding on the beetles and larvae, thus allowing the authors to conclude that the byproducts of poultry farms are important food sources. This article is valuable because it shows that some human activity can be beneficial to birds; however, this human activity may be detrimental to various other species.*

\*Buckley, P.A. and F.G. Buckley. 1977. Human encroachment on barrier beaches of the Northeastern U.S. and its impact on coastal birds. In Coastal Recreation Resources in an Urbanizing Environment.

**Geographic areas covered:** Long Island beaches (as an example)

*The Buckleys use this article as a forum for outlining the various ways that humans have negatively affected the coastal areas, and in turn, affected the behavior of the coastal birds who depend on these beaches for nesting and feeding. They address such issues as bird use of dredge spoil islands and salt marsh and conclude by recommending ten strategies that could improve the status of our coastal natural resources. They, too, comment on the fact that some human activity can be beneficial for certain species of birds; however, in general, human disturbance has a negative effect on breeding and foraging populations of birds.*

\*Bunnell, F.L. et al. 1981. Effects of disturbance on the productivity and numbers of White Pelicans in British Columbia: observations and models. Colonial

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Waterbirds 4: 2-11.

**Key Species covered:** American White Pelican

**Geographic areas covered:** British Columbia

*This article evaluates the effects of human and predator disturbance on the productivity of White Pelican colonies. Low-flying aircraft and coyote predation appeared to be the two main threats to the study population. It was discovered that both these factors, gone unchecked, can have a significant impact on the survivorship of young and the reproductivity of the colony. The authors recommend a few basic strategies, mainly involving enforcement, for dealing with these threats. A model was used in this research to attempt to reveal what could happen if these disturbances continued at various levels of frequency. This article shows that White Pelicans are particularly susceptible to human disturbance.*

Burger, J. 1981. Effects of human disturbance on colonial species, particularly Gulls. Colonial Waterbirds 4: 28-36.

**Key Species covered:** Larids

**Geographic areas covered:** various in N. America

*Burger examines the sub-lethal effects of human disturbance on Larid species including behaviors that could lead to reduced reproductive success. She looks at disrupted incubation, aggressive behavior and its association with nest mortality, and chick mobility as it relates to predation and vulnerability. Among the effects she found significant were decreased incubation and chick attendance, shifts in the mate incubating, earlier and distant movements of chicks, entanglement of chicks in vegetation, increased brood sizes, more frequent aggressive encounters, greater energy expenditure for territorial defense, and attraction of predators to nest sites.*

\*Burger, J. 1982. An overview of proximate factors affecting reproductive success in colonial birds: concluding remarks and summary of panel discussion. Colonial Waterbirds 5: 58-65.

**Key Species covered:** various

*This is an extremely helpful resource because it concisely outlines the main threats to reproductive success for many species of colonial birds; each species or group is more likely to be threatened by a different factor and identifying the significant dangers to each species is important for determining effective management. Burger also explains that the identification of the proximate factors of what threatens colonial birds can have important implications for the ultimate, evolutionary factors that may decrease reproductive success. Knowing these ultimate factors can help in the planning of long-term management.*

\*Burger, J. 1998. Effects of motorboats and personal watercraft on flight behavior over a colony of Common Terns. The Condor 100: 528-534.

**Key Species covered:** Common Terns

**Geographic areas covered:** New Jersey

*This article focused on the effect that recreational activity (in the form of motorboat and personal watercraft operation) affects tern flight behavior over a colony site. Her final data suggest that personal watercraft use should be managed to reduce disturbance to colonial-nesting species, by eliminating them within 100 meters of nesting colonies and restricting speed near such colonies. Her findings illustrate the danger that human boating activity can impose on nesting colonial birds, since a disturbance that forces the bird off the eggs or chicks can result in predation or death from exposure, ultimately resulting in reduced reproductive success.*

Cairns, D. 1980. Nesting density, habitat structure, and human disturbance as factors in Black Guillemot reproduction. Wilson Bulletin 92: 352-361.

**Key Species covered:** Black Guillemot

**Geographic areas covered:** St. Lawrence River estuaries

*This article concentrates mainly on observer disturbance during a study period. The author found that nest productivity was lower, but maximum chick weight was higher, in an area disturbed on a daily basis as compared to a site disturbed once every four days. These findings further support the hypothesis that the presence of humans can have significant effects on the reproductive success of some bird species.*

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\*Carney, K.M. and W.J. Sydeman. 1999. A review of human disturbance effects on nesting colonial waterbirds. Waterbirds 22: 68-79.

**Key Species covered:** various

*This source is a helpful review of all the studies done on human disturbance and colonial waterbirds. It outlines the most significant responses to human disturbances for each of five orders of birds and also makes suggestions for how these negative responses can be minimized. Another useful aspect of this article is the inclusion of recommended minimum approach distances to avoid flushing the birds off the nest. This source was extremely useful in that it develops general guidelines for ecotourism and other forms of recreation.*

Ellison, L.N. and L. Cleary. 1978. Effects of human disturbance on breeding of Double-crested Cormorants. The Auk 95: 510-517.

**Key Species covered:** Double-crested Cormorant

**Geographic areas covered:** St. Lawrence estuary

*This article provides what many of the previous articles have: the determination that human disturbance of colonial nesting areas can result in nest abandonment and gull predation. A few recommendations for visitors to colony-sites are given.*

\*Erwin, R.M. 1980. Breeding habitat use by colonially nesting waterbirds in two Mid-Atlantic US regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

**Key Species covered:** Common Tern, Least Tern, Black Skimmer, Herring Gull

**Geographic areas covered:** New Jersey and Virginia

*This paper is helpful because it compares how these four species of birds use disturbed habitat with how they use relatively protected habitat. The results showed that, in an undisturbed region of coastline, these birds prefer nesting on barrier beaches; in a more disturbed area, dredge spoil islands are more frequently used as nesting sites. The author noted that dredge spoil islands provide a predator-free environment as well as protection from nest washouts due to high tides. However, he recommends careful management of these islands because the terns and laughing gulls can still be adversely affected by the herring gulls.*

\*Erwin, R.M. 1989. Responses to human intruders by birds nesting in colonies: Experimental results and management guidelines. Colonial Waterbirds 12: 104-108.

**Key Species covered:** various

**Geographic areas covered:** Virginia and North Carolina

*This study examines the flushing distances for many species of birds in order to determine how nesting sites should be roped off, both during egg laying and incubation. The author was extremely helpful in providing exact distances for when certain species will flee the nest in response to human presence. He estimated a distance of at least 100 meters for colonies of Least and Royal Terns and wading birds and a distance of at least 200 meters for Common Terns and Black Skimmers. He also recommends details about sign placement and how roped-off areas should change between egg-laying periods and incubation periods.*

Fitzpatrick, S. and B. Bouchez. 1998. Effects of recreational disturbance on the Foraging behaviour of waders on a rocky beach. Bird Study 45: 157-171.

**Key Species covered:** wading birds

**Geographic areas covered:** England

*Although the species examined in this study are not among those covered by the waterbird plan, conclusions about wading bird foraging in the vicinity of human disturbance can perhaps be drawn from the results. This study looked at how the foraging rates of three species of wading birds varied when human disturbance (in the form of walking or running people as well as dogs) was present. The results*

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*gathered can perhaps have implications for the roping-off of important feeding areas during low tide in order to ensure the birds get enough foraging time.*

Hobson, K.A., R.W. Knapton, and W. Lysack. 1989. Population, diet, and reproductive success of Double-crested Cormorants breeding on Lake Winnipegosis, Manitoba, in 1987. Colonial Waterbirds 12: 191-197.

**Key Species covered:** Double-crested Cormorants

**Geographic areas covered:** one lake in Manitoba, Canada

*This article covers the effects of double-crested cormorants on an economically important fish population. The authors found, like many other scientists exploring this topic, that, despite popular opinion, cormorants have relatively little effect on commercially valuable fish species. They also found that the number one cause of adult and young cormorant mortality was human persecution in response to the apparently false idea the cormorants are important competitors of fishermen. Bald eagles also appeared to play a role in the predation of chicks. Ironically, the authors conclude that the recent increase in the numbers of cormorants in this area is probably due to the increased abundance of forage fish available which, in turn, is due to the excessive human exploitation of the larger predatory fish. No management suggestions are made here, so the usefulness of this paper is questionable.*

\*Klein, M.L. 1993. Waterbird behavioral responses to human disturbances.

Wilson Bulletin 21: 31-39.

**Key Species covered:** various waterbirds

**Geographic areas covered:** Sanibel Island, Florida

*The author was interested in how certain species of waterbirds responded to human disturbance and how to classify human activities according to the level of disturbance they can potentially cause. She found that human approach on foot was the most disruptive of human activities and that photographers are the most likely perpetrator of this activity. Klein suggests some management techniques that mostly concern public education as well as the use of observational blinds and guided tours.*

\*Klein, M.L. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

**Key Species covered:** various waterbirds

**Geographic areas covered:** Sanibel Island, Florida

*This paper assessed various forms of ecotourism in a wildlife refuge and how the distribution of foraging waterbird species responded to the human presence. She found that certain species and families of waterbirds responded differently to human presence along a road in the wildlife refuge. Due to these variations, Klein recommends general management techniques, such as public education, guided group tours, establishment of low-disturbance zones, and the reduction of tourists permitted in the refuge. Her ideas are important because a refuge's primary goal is to provide safe and suitable habitat for bird species; great steps should be taken to ensure that this is not overshadowed by tourism. Also, with more habitat destruction occurring all over the U.S., more and more birds will be depending on these refuges at certain times of the year, underlining the need for effective management practices.*

Manuwal, D.A. 1978. Effect of man on marine birds: a review. In Proceedings:

Wildlife and People (C.M. Kirkpatrick, ed.).

**Key Species covered:** all species of marine birds

*This source is a review article that covers all the effects, positive and negative, that humans have on marine bird species. It is helpful in that it includes every known factor of disturbance and what species are most likely to be affected; management suggestions are lacking, but it may be too broad a topic to provide any useful techniques.*

McKnight, D.E. and C.E.Knoder. 1979. Resource development along coasts and on the ocean floor: potential conflicts with marine bird conservation.

Pages 183-194. In *Conservation of Marine Birds in Northern North America* (J.C. Bartonek and D.N. Nettleship, eds.) USFWS Wildlife Research Report 11: Washington D.C.

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**Key Species covered:** Arctic seabirds

**Geographic areas covered:** Arctic North America (Canada, Alaska)

*This paper attempts to identify potential conflicts that resource development may have with seabird conservation. When this article was written in 1979, the regions in question were on the verge of experiencing drastic increases in human population with increased concurrent demands on the natural resources, namely oil, timber, and minerals. The authors outline the direct and indirect effects that oil exploration and extraction may have on seabird populations and they warn of the drastic and devastating effects that may ensue. No management suggestions are given, partially because what is predicted to happen in this area had not yet happened at the time of publication. The authors probably didn't know how to approach the looming issue.*

Piatt, J.F. et al. 1990. Effects of human disturbance on breeding least and crested auklets at St. Lawrence Island, Alaska. The Auk. 107: 342-350.

**Key Species covered:** Least and crested auklets

**Geographic areas covered:** St. Lawrence Island, Alaska

*Not surprisingly, the authors found that the reproductive success of Least Auklets varied inversely with the amount of human disturbance. It was also determined that the main causes of chick mortality in both species was rodent predation and dangerous weather. No management suggestions are provided as to how to curtail the drops in egg success.*

Pierce, D.J. and T.R. Simons. 1986. The influence of human disturbance on tufted puffin breeding success. The Auk 103: 214-216.

**Key Species covered:** Tufted Puffin

**Geographic areas covered:** Barren Island, Alaska

*This source describes yet another study that confirms the negative effects of human disturbance on the reproductive success of a species of waterbird. Tufted Puffin colonies were adversely affected by investigator disturbance; an undisturbed fledging rate of 94% dropped drastically to 18% following several weeks of disturbances. The authors also found that the development of chicks was retarded in the most disturbed study area. One interesting claim made in this article is that Tufted Puffin embryos may be capable of withstanding periods of abandonment early in incubation. Could evolutionary selection have "taken into account" human disturbance?*

Robert, H.C. and C.J.Ralph. 1975. Effects of human disturbance on the breeding success of gulls.

**Key Species covered:** Western Gulls

**Geographic areas covered:** Farallon Islands, CA

*This paper describes the effects that scientific investigators may have on the reproductive success of one species of gull. The authors found that egg hatching success decreased with increased human disturbance but that chick survival increased with more disturbance. This seeming disparity is due to the more frequently disturbed chicks becoming habituated to human presence and thus not wandering as far from the nest during disturbances, which may decrease the likelihood of gull predation.*

\*Rodgers, J.A. and H.T.Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

**Key Species covered:** fifteen waterbird species

**Geographic areas covered:** various colony-sites in Florida

*This study attempted to identify specific set-back distances for fifteen species of waterbird according to how these species responded to three different disturbance regimes. In general, it was found that most "colonial waterbirds exhibited greater flushing distances in reaction to a walking approach than to approaching motorboats". Recommendations include an at least 100 meter set-back distance for wading bird colonies and 180 meter distance for mixed skimmer/tern colonies.*

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Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging  
And loafing waterbirds from human disturbance in Florida. Wildlife Society  
Bulletin 25: 139-145.

**Key Species covered:** sixteen species of waterbirds

**Geographic areas covered:** north and central Florida

*This article examined human disturbance at sites where waterbirds were foraging or loafing in the hopes that the results could contribute to the establishment of "buffer zones" around crucial feeding or nesting sites. These "buffer zones" may be effective management practice because it prevents observers from getting too close but it does not stop them from entering the refuge or park all together.*

Tremblay, J. and L.N. Ellison. 1979. Effects of human disturbance on breeding of  
Black-crowned Night Herons. The Auk 96: 364-369.

**Key Species covered:** Black-crowned Night-Herons

**Geographic Areas covered:** St. Lawrence estuary

*This study confirms that black-crowned night-herons can be adversely affected by human disturbances and that the reactions of this species are similar to that of other species. Black-crowned Night-herons will abandon nests, leaving them more susceptible to predation. The authors recommend a few management techniques to preventing the loss of reproductive success in this species.*

Watts, B.D. and D.S. Bradshaw. 1994. The influence of human disturbance on  
the location of Great Blue Heron colonies in the lower Chesapeake Bay.  
Colonial Waterbirds 17: 184-186.

**Key Species covered:** Great Blue Heron

**Geographic areas covered:** lower Chesapeake Bay

*This short resource looked at great blue heron colony distributions as they relate to man-made structures, such as buildings and roads. The authors found that heron colonies were typically situated farther from man-made structures, and the distance from these structures related to the type of structure involved. The use of "buffer zones" is recommended to diminish the negative effects.*

## CONTAMINANTS

Biderman, J.O. and W.H. Drury. 1980. The effects of low levels of oil on  
aquatic birds. U.S. Fish and Wildlife Service, Biological Service Program.  
FWS/OBS-80/16.

**Key Species covered:**

Blus, L.J. et al. 1998. Contaminants in eggs of colonial waterbirds and hepatic  
cytochrome P450 enzyme levels in pipped tern embryos, Washington  
state. Archives of Environmental Contamination and Toxicology 35:  
492-497.

**Key Species covered:** Forster's terns, Caspian terns, and American  
White Pelicans

**Geographic areas covered:** Washington state

Boersma, P.D. 1986. Ingestion of petroleum by seabirds can serve as a monitor  
of water quality. Science 231:373-376.

**Key Species covered:** Storm-Petrels

**Geographic areas covered:** Barren Islands, Alaska

*This paper gives evidence of storm-petrels ingesting petroleum at sea and concludes, among other things, that natural populations of marine birds are ingesting sublethal amounts of oil from both large scale oil spills as well as longer-term, lower-level continuous pollution. Boersma's results indicate that Procellariiformes can serve as effective monitors of marine environmental quality. An important point*

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*made by this source is that seabirds are just as affected by long-term pollution as they are by massive petroleum catastrophes.*

\*Clark, R.B. 1984. Impact of oil pollution on seabirds. Environmental Pollution 33: 1-22.

**Key Species covered:** various seabird species

**Geographic areas covered:** northeastern Atlantic waters

*This paper contains a large amount of information, including the physical effects of oil on seabirds, estimates of seabird mortality due to oil pollution, and what species are known to be particularly susceptible and why. Clark also outlines the effects of oil pollution on the populations of seabirds and concludes that, despite popular opinion, oil pollution has had very little impact on seabird populations. The author covers some remedial and preventative measures at the end of the paper, including the cleaning and rehabilitation of oiled birds, the restocking of depleted colonies, and scaring birds away from the path of an oil slick. However, he makes the valid point that preventative and remedial measures can only be used locally and might not make too much of a difference.*

Custer, T.W. and R.G. Osborn. 1975. Wading birds as biological indicators: 1975 colony survey. Publication of US Fish and Wildlife Service.

**Key Species covered:** herons and allies

**Geographic areas covered:** Atlantic coast from ME to FL

*This paper is much more general and doesn't deal with specific contaminants as much as it discusses the suitability of wading birds to be environmental indicators because of how contaminants in general biomagnify and remain in their systems.*

Erwin, R.M. and T.W. Custer. ?. Herons as indicators. Publication of Patuxent Wildlife Research Center

**Key Species covered:** herons

*This source recommends using herons as bioindicators but on several different levels, from suborganismal (tissue samples) to population and community. The authors make several good suggestions for how to accurately determine contaminant levels at a suborganismal level from herons.*

Heinz, G.H. 1998. Contaminant effects on Great Lakes fish-eating birds: a population perspective. Pp.141-154 In: Principles and processes for evaluating endocrine disruption in wildlife (R.J. Kendall et al., Eds.) SETAC Press, Pensacola, FL.

**Key Species covered:** double-crested cormorants, ring-billed gulls, black-crowned night-herons, herring gulls, common terns, Forster's terns, and Caspian terns

**Geographic areas covered:** Great Lakes region

*This source looks at how the populations of piscivorous birds in the Great Lakes are faring in the few decades since the banning of DDT. Species such as double-crested cormorants and ring-billed gulls have experienced dramatic population increases since the ban while the other species listed above seem to have shown improved success, but not as dramatically as the former species. The author goes into detail for each species and describes the changes witnessed in the past few decades; however, management recommendations are lacking.*

Henny, C.J. et al. 1984. Current impact of DDE on Black-crowned Night Herons in the intermountain west. Journal of Wildlife Management 48: 1-13.

**Key Species covered:** Black-crowned Night Heron

**Geographic areas covered:** WA, OR, NV

*The authors of this paper discovered that for several black-crowned night heron colonies, a strong north-south clinal pattern of DDE residues existed, with the more southern colonies being the most contaminated. Results from this study show that at DDE levels above a certain ppm, clutch size decreased, productivity decreased, and the incidence of cracked eggs increased.*

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\*King, J.G. and G.A. Sanger. 1979. Oil vulnerability index for marine oriented birds. Pages 227-239 in J. Bartonek and D. Nettleship, eds. Conservation of marine birds in North America.

**Key Species covered:** various marine bird species

*This source goes into great detail about how a bird's vulnerability to oil can be determined; it is most helpful because it provides real numbers for many species included in the plan. This paper will most certainly be helpful in the management sphere.*

Kushlan, J.A. 1993. Colonial waterbirds as bioindicators of environmental change. Colonial Waterbirds 16: 223-151.

*This is a review article that provides innumerable sources on this topic.*

\*Levy, E.M. 1983. Commentary: What impact will the oil industry have on seabirds in the Canadian Arctic? Arctic 36: 1-4.

**Key Species covered:** seabirds in general

**Geographic areas covered:** Canadian Arctic

*This article examines how oil can affect seabirds at sublethal levels, especially on those populations of birds that are already stressed and/or near their levels of tolerance. This study is important because it emphasizes that a relatively small amount of oil that would normally have very little effect on an organism can be devastating to an organism that is already stressed to its limits. The author concludes that, due to these findings and the lack of research done on stress, the development of an oil industry in the Canadian Arctic would have devastating results on the regions seabirds.*

Milloy, S.J. 1997. Mexico moves to phase out DDT and chlordane. Environmental Health Perspectives.

*This short journalistic article describes the Mexico's plan to phase out the use of harmful pesticides by the year 2007. DDT is still in use in Mexico, mostly for the control of the malaria-carrying Anopheles mosquito, but social and educational techniques have succeeded in decreasing deaths from malaria so much that DDT use may no longer be necessary at all. Chlordane has already been phased out of Mexico. Mexico hopes to play an important role in the environmentally healthy future of the Earth.*

Nisbet, I.C.T. 1980. Effects of toxic pollutants on productivity in colonial waterbirds. Transactions of the Linnean Society of New York IX: 103-114.

*This paper is a review of the reported effects of toxic pollutants on the productivity of colonial waterbirds. Nisbet divides his review into four categories of reported effects: acute poisoning of breeding adults or nestlings, delayed lethal effects, effects on reproductive performance in the absence of overt mortality, and effects on reproductive performance which do not lead to reduction in productivity in the absence of other stress factors. This source is rather limited in its usefulness for management but it does provide a great bibliography that contains numerous articles that may make management suggestions.*

World Wildlife Fund. Persistent organic pollutants: hand-me-down poisons that threaten wildlife and people. WWF Issue Brief.

[http://www.wildlife-action.org/toxics/progareas/pop/pop\\_prnt.htm](http://www.wildlife-action.org/toxics/progareas/pop/pop_prnt.htm)

*This article downloaded from the internet outlines the basic characteristics and effects of persistent organic pollutants on wildlife and people. Some suggestions are offered for how to control POPs, but these must be taken with a grain of salt for, according to the author(s), POPs are impossible to manage.*

### SEABIRD BYCATCH

Atkins, N. and B. Heneman. 1987. The dangers of gill netting to seabirds. American Birds 41:1395-1403.

**Key Species covered:** various Pacific and Atlantic seabirds

**Geographic areas covered:** Canada and Alaska

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*This article describes well the problem of seabird bycatch and uses specific case studies to better illustrate the issues associated with seabird bycatch. No management guidelines are offered, but the authors do discuss how some fisheries were closed, permanently or temporarily, due to violation of federal or state law. Court action is described by the authors as being the most effective method of bycatch control, but not the most desirable due to the negative implications for fishery/government relations. This source is valuable in that it concisely illustrates the recent history of seabird bycatch and outlines the biological and legal consequences.*

Conservation of Arctic Flora and Fauna. Incidental take of seabirds in commercial fisheries in the Arctic countries. CSWG Technical Report No. 1. Parts one and three.

[http://www.grida.no/caff/tr1\\_itr1.htm](http://www.grida.no/caff/tr1_itr1.htm)

*Part 1: This part of the report offers extraordinary statistics on seabird mortality as it pertains to fisheries in Alaska and Canada. Management recommendations are offered along with in-depth examinations of the history of several fisheries in these areas.*

*Part 3: This section outlines the most highly affected species in each area. Also included are more detailed management suggestions, both general and specific to an Arctic area. Lastly, the list of references is lengthy and helpful.*

Crowder, L.B. and S.A. Murawski. 1998. Fisheries bycatch: implications for management. *Fisheries* 23: 8-17.

*This is an extremely general article about bycatch, including bycatch in all its forms, from other fish species to seabirds, turtles, and mammals. Not very helpful in a management sense, this paper does provide important issues of comparison between the different forms of bycatch with the potential for discovering ways to eliminate many forms at once.*

\*FAO. 1998. Preparatory meeting for the FAO consultation on the management of fishing capacity, shark fisheries, and incidental catch of seabirds in longline fisheries: draft plan of action for seabirds.

<http://www.nmfs.gov/seabirds.html>

*This resource is extraordinarily helpful in that it not only includes some definitions of terms associated with fisheries, but also provides numerous management suggestions for how to reduce the number of seabird entanglements and drownings. This report recommends technical measures as well as operational measures for how to decrease seabird mortality. This source is invaluable.*

King, W.B., R.G.B. Brown, and G.A. Sanger. 1979. Mortality to marine birds through commercial fishing. Pages 195-199. *In Conservation of Marine Birds of Northern North America* (J.C. Bartonek and D.N. Nettleship, eds.) Washington D.C.

**Key Species covered:** mainly murre

**Geographic areas covered:** North Atlantic and North Pacific

*This source blames the appearance of salmon gillnet fishing for the increased mortality of seabirds in both the North Pacific and North Atlantic. The authors claim that murre are most strongly affected by this at-the-time new fishing method. It is reported in this source that the Atlantic fishery operations are concentrated in one main area, which happens to be an important migration pathway for murre; as a result, the authors affirm that populations of thick-billed murre have severely declined. In contrast, the North Pacific fishery operations are more spread out and affect a larger number of species; for these reasons, seabird populations in the North Pacific seem to be less affected by entanglements. No management guidelines are given but this resource can help to determine which fisheries are most harmful to seabird species.*

Melvin, E.F., L.L. Conquest, and J.K. Parrish. 1997. Seabird bycatch reduction: new tools for Puget Sound drift gillnet salmon fisheries: 1996 sockeye and 1995 chum non-treaty salmon test fisheries final report. Washington Sea Grant Program. Project A/FP-7.

**Key Species covered:** Alcids, especially auklets and murre

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**Geographic areas covered:** Puget Sound, Washington

*This source is the executive summary of this study and describes the research of entanglement rates of seabirds in fishing gear. Management suggestions are made at the end based on the results of this study. Namely, the authors recommend, among other things, eliminating morning change-of-light fishing and replacing traditional monofilament drift gillnets with highly visible seine twine. Acoustic warnings were also tried but more testing is necessary before these too can be recommended. The management suggestions were helpful but they might only apply to the Puget Sound area.*

Ornithological Council. 1997. Catching birds instead of fish: the effects of long-line fishing on seabirds. Bird Issue Brief Vol. 1, No. 4. Washington D.C.  
<http://nmnhwww.si.edu/BIRDNET/OC/Ocinfo/OCBv1n4.html>

*This source blames commercial longline fishing for the high mortality rates of several species of seabirds, especially albatrosses. Included in this brief are short summaries of the measures that have already been taken to prevent seabird bycatch along with some recommendations for how to further decrease seabird mortality. Suggestions such as gear modification and the implementation of more intense monitoring programs are offered in this source. This report is basically a good and brief summary of the bycatch issues that affect seabirds and the steps that can be taken to rectify it.*

Seabird Bycatch Project. Protection of the Marbled Murrelet in the Pacific Northwest: the political and legal controversy.

<http://www.pond.net/~fish1lfr/bycatch3.htm>

**Key Species covered:** Marbled murrelets

**Geographic areas covered:** Pacific Northwest

*This brief source addresses the marbled murrelet specifically, partially because it is the only bird species known to be incidentally caught in fisheries that is also listed under the U.S. Endangered Species Act. Other problems associated with the marbled murrelet are broached, including the widespread destruction of breeding habitat that is occurring as deforestation reaches critical levels in the Pacific Northwest. The authors of this source claim that any mortality to marbled murrelets associated with fisheries pose larger than normal ramifications because of the current fragility of the species. This resource is accompanied by an extremely lengthy and helpful bibliography for the marbled murrelet.*

Waterbird Society Information Page

<http://www.mp2-pwrc.usgs.gov/cws/longline.htm>

COLONY DISEASE TRANSMISSION.

Arboviral Infections of the Central Nervous System--United States, 1996-1997.

<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00053675.htm>

Compendium of measures to control Chlamydia psittaci infection among humans (Psittacosis) and pet birds (Avian Chlamydiosis), 1998

<http://wonder.cdc.gov/wonder/prevguid/m0053877/entire.htm>

Dusi, J.L. 1979. Heron colony effects on man. Proceedings of the Colonial Waterbird Group 3: 143-144.

Histoplasmosis: Protecting workers at risk. 1997 DHHS Publication, No.97-146.

<http://www.cdc.gov/niosh/hi97146.html>

Information on arboviral encephalitis.

<http://www.cdc.gov/nicod/dvbid/arbtor/arbdet.htm>

Literak, I., A. Cizek, and J. Smola. 1996. Survival of Salmonellas in a colony of Common Black-headed Gulls between two nesting periods. Colonial Waterbirds 19: 268-269.

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Moore, C.G. et al. 1993. Guidelines for Arbovirus Surveillance Programs in the United States. Publication of the Center for Disease Control.

Post, D.M. et al. 1998. The role of migratory waterfowl as nutrient vectors in a Managed wetland. Conservation Biology 12: 910-920.

Southern, W.E. 1986. Histoplasmosis associated with a gull colony: health Concerns and precautions. Colonial Waterbirds 9: 121-123.

Webster, R.G. ?. Influenza: an emerging disease. Publication of the National Center for Infectious Diseases.  
<http://www.cdc.gov/ncidod/EID/vol4no3/webster.htm>