Lake Management and **Aquatic Birds**

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Introduction

Birds that live at least part of their lives in or around water are referred to as aquatic birds and/or water birds. Each species has specific requirements that must be met in order to reproduce, survive, grow, and reproduce again to maintain the species over time, so it can be challenging to make broad statements that apply to all aquatic birds. Aquatic birds are often grouped into subclasses based on habitat preference, which allows generalizations to be made about birds with similar requirements. The major subclasses include waterfowl, marsh birds, shorebirds, and wading birds.

Waterfowl are aquatic birds that include all the ducks, geese, and swans. They are strong swimmers with medium to large bodies. They have historically been an important human food source, and continue to be hunted as game, or raised as poultry for meat and eggs. The domestic duck is sometimes kept as a pet.

Marsh birds live in or around marshes (treeless wet tracks of grass, sedges, cattails, and other herbaceous wetland plants) and swamps (wet, soft, low, water-saturated land that is dominated by trees and shrubs). This is a broad category that includes many unrelated species of birds, all of which prefer to nest and/or live in marshy, swampy areas. Marsh birds include herons, storks, ibises, flamingoes, cranes, limpkins, and rails.

Shorebirds inhabit open areas of beaches, grasslands, wetlands, and tundra. These birds, which include plovers, oystercatchers, avocets, stilts and sandpipers, are often dully colored and have long bills, legs, and toes.

Wading birds generally do not swim or dive for prey, but instead wade in shallow water to forage for food that is not available on shore. Wading birds include herons, egrets, spoonbills, ibises, cranes, stilts, avocets, curlews, and godwits. These birds generally have long legs, long bills, and short tails, which allow them to strike and/or probe under the water for fish, frogs, aquatic insects, crustaceans, and other aquatic fauna.

It is easy to see that some bird species can fall into multiple groups, so care should be taken when interpreting statements applied to birds in these generalized groups. These subclasses group birds based on habitat preference, but birds are complex, adaptable animals. Thus, regardless of habitat, it may be possible to observe many different aquatic bird species if adequate food sources are available. The purpose of this article is to describe how aquatic birds are related to lake morphology, water chemistry, and aquatic plants in lake systems and how the management of lake systems may impact aquatic bird communities.

Lakes and aquatic bird communities

Birds are an integral part of all lake systems, but their role in the ecology of lakes has frequently been overlooked. This is surprising, since aquatic birds are often the first wildlife that is seen when visiting a lake and the vast majority of people who visit lakes enjoy the beauty and grace of aquatic birds. However, the majority of earlier research and management conducted on lake systems involved nutrient enrichment problems and aquatic plant management. The focus of this early research was primarily to provide potable water, flood control, navigation, recreational boating, swimming, and fishing and consideration was seldom given to aquatic bird communities that utilized these lakes. As a result, little information is available regarding how these different lake management activities affect aquatic bird communities.

This situation began to change rapidly in the 1980s when many ornithologists (scientists studying birds) and limnologists (scientists studying freshwater systems) became increasingly conscious of the importance of birds to aquatic systems (Kerekes and Pollard 1994; Hanson and Kerekes 2006). These researchers have worked together to identify many significant relationships between lake limnology and aquatic bird populations. This research can be used to predict the impact some lake management programs have on aquatic bird communities. Currently, international meetings are held on a regular basis to examine the role of aquatic birds in the ecology of aquatic systems and to develop information useful to lake management personnel.

Lake area and aquatic bird species richness

There is a strong relationship between aquatic bird species richness (the number of bird species in an aquatic community) and the surface area of the lake they inhabit (Figure 1). Many studies have shown that plant and animal species richness increases as habitat area increases. Most researchers and lake managers agree that larger areas are more likely to include diverse habitats that allow more species niches. This species richness versus lake area relationship is currently being used by Southwest Florida Water Management District to help determine minimum lake levels for lakes in their district.

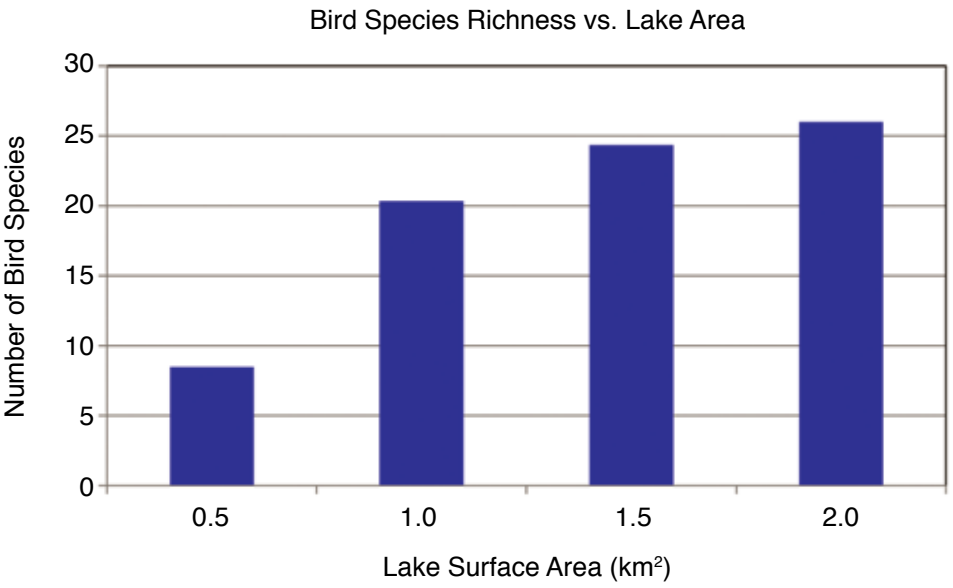

Figure 1. Relation between lake surface area and bird species richness estimated on 46 Florida lakes.

Lake trophic state and aquatic bird abundance

Lake trophic state is the degree of biological productivity of a water body. Biological productivity generally describes the amount of algae, aquatic plants, fish, and wildlife a water body can produce. The level of trophic state is usually set by the background nutrient concentrations of the geology in which the lake lies, because nutrients (primarily phosphorus and nitrogen) are the most common factors limiting growth of algae and plants that form the base of the biological food chain. It is therefore not surprising that lakes with higher trophic states generally support more aquatic birds, since these lakes usually have an abundance of plants and animals that can be used for food and shelter by aquatic birds (Figure 2). Some question whether aquatic birds show up because a lake is productive or whether the lake becomes productive because birds bring nutrients to the system. There have been instances where large flocks of birds such as geese feed on terrestrial agricultural grains and then roost on a lake, ultimately causing elevated nutrient concentrations in a lake. However, most current research suggests that the majority of aquatic bird communities extract their nutrients from the lake and function more as nutrient recyclers than as nutrient contributors.

Most lake management efforts are directed toward the manipulation of lake trophic state, with most resources focused on reducing nutrients caused by anthropogenic activities. However, management agencies in some areas will actually add fertilizer (nutrients) in an attempt to increase productivity of plants, algae, and fish, which increases angling activities. In either case, changes to the trophic state of a lake system will have a corresponding impact on the aquatic birds that utilize the lake. If aquatic birds are an important component of an individual lake, this relationship needs to be considered before nutrient manipulations occur.

Aquatic plants and aquatic bird communities

Aquatic birds rely on aquatic plants to meet a large variety of needs during their life cycles. Some birds nest directly in aquatic plants (Figure 3), whereas others use plants as nesting material, foraging platforms, for resting, and for refuge from predators. Aquatic plants are eaten by some bird species; in addition, some plants support attached invertebrates that are used as a food source by some aquatic birds. Since there are so many associations between the needs of aquatic birds and aquatic plants, it would be reasonable to expect a strong relationship between the abundance of all aquatic birds and the abundance of aquatic plants in a lake system. However, multiple studies have found no such relationship after accounting for differences in lake trophic state. This surprising lack of relationship between total bird abundance and total abundance of aquatic plants can be explained by the fact that individual bird species require different types and quantities of aquatic plants. My research has suggested that aquatic bird species can be divided into three general groups: (1) birds that are directly related to the

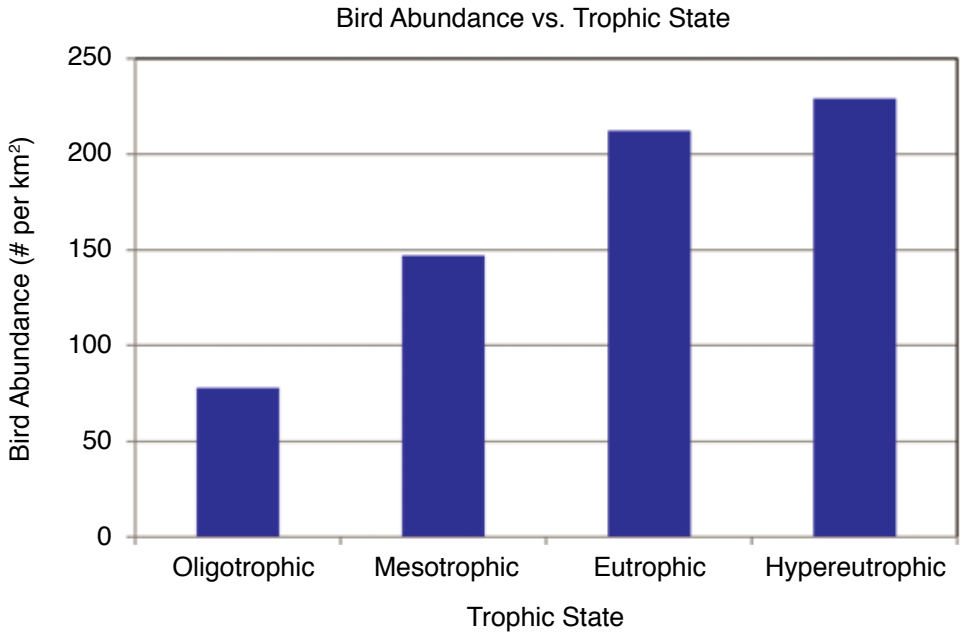

Figure 2. Relation between lakes trophic status and aquatic bird abundance estimated on 46 Florida lakes.

Figure 3. Red Winged Blackbird utilizing emergent vegetation on Lake Tohopekaliga, FL, for nesting site.

abundance of aquatic plants, (2) birds that are negatively affected by an abundance of aquatic plants, and (3) birds that have no relationship to the total abundance of aquatic plants but require the presence of a particular plant type for completion of their life cycle. However, these are loose generalizations and individual species of aquatic birds can transcend these plant groupings depending on the given lake system and the bird's life history requirements.

Birds that are directly related to the abundance of aquatic plants

Many waterfowl, including the American coot (*Fulica americana*) and ring-necked duck (*Aythya collaris*), use aquatic plants as a food source and thus are generally more abundant in lakes with an abundance of aquatic plants. Other aquatic birds that prefer a habitat with plentiful aquatic plants include limpkins and curlews. These species are generalized feeders that consume insects, fish, small animals, snails, and other aquatic fauna that are associated with aquatic vegetation. Limpkins and curlews are often observed walking on and foraging in floating aquatic plants, waterhyacinths, salvinia, native waterlilies, and other plants when this vegetation is present in densities sufficient to support the weight of the birds. If this type of habitat is not available, these birds will forage along sparsely vegetated shorelines and mudflats where water is shallow enough to allow wading. Birds in this group prefer lakes with an abundance of aquatic plants; however, these species will often locate and feed in more diverse habitats when their preferred environment is not available to them.

Birds that are negatively affected by an abundance of aquatic plants

Some bird species, such as snakebirds (*Anhinga anhinga*) and double-crested cormorants (*Phalacrocorax auritus*), must swim through the water to catch fish, crayfish, frogs and other aquatic fauna. Large amounts of aquatic vegetation interfere with the feeding ability of these aquatic birds; therefore, these types of birds tend to decrease in abundance when submersed weeds become abundant in a lake system. Other aquatic birds that prefer sparsely vegetated water are the threatened piping plover (*Charadrius melodus*) and the endangered interior least tern (*Sterna antillarum athalassos*). These species once fed, nested and were abundant on sandbars along the Missouri and Platte Rivers and in other similar areas in the central and northern US; however, piping plovers and interior least terns have experienced major population declines in the last 50 years. Dredging and damming of rivers has destroyed most of the sandbar habitat preferred by these species and flood control projects have reduced scouring and re-forming of new sandbars. In addition, old sandbars have become densely vegetated, further reducing the nesting and feeding grounds required by these aquatic birds. This is particularly problematic in the Midwest, where phragmites (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*) have invaded most sandbars formerly inhabited by piping plovers and interior least terns.

Some aquatic birds are only affected by certain types of aquatic weeds. For example, eagles and ospreys soar over open water in search of fish swimming near the surface of the lake, so submersed aquatic weeds rarely hinder feeding by these species. In fact, since submersed plants reduce wind and wave action and improve water clarity, the presence of these aquatic plants may actually increase the feeding efficiency of sight feeders such as eagles and ospreys. However, dense populations of floating plants and floating-leaved plants (e.g., waterhyacinths, salvinia, waterlilies, etc.) may negatively impact the foraging success of sight feeding aquatic birds because fish are hidden beneath the vegetation. Sight feeders may be forced to abandon lakes that are heavily vegetated with these types of plants and seek out new habitats with open water that provide an unobstructed view of their prey.

Birds that have no relationship to the total abundance of aquatic plants but require the presence of a particular plant type for completion of their lifecycle

Some aquatic bird species – including the secretive American bittern (*Botaurus lentiginosus*) and least bittern (*Ixobrychus exilis*) (Figure 4) – require tall, emergent vegetation like cattails and bulrush for concealment from predators regardless of the total amount of aquatic vegetation present in the lake. Both species of bittern "freeze," with neck outstretched and bill pointed skyward, when danger threatens and sway in imitation of wind-blown emergent vegetation such as cattails. Even nestling least bitterns, still covered with down, adopt this posture when threatened. Invasion by exotic species of aquatic plants would probably not impact this type of bird species unless the exotic species reduces the abundance of the required aquatic plant.

Figure 4. Least Bitterns utilizing floating leaf vegetation on Orange Lake, FL, for breeding activities.

Figure 5. Tri Color Heron resting on matted submersed vegetation in Orange Lake, FL, for foraging activities.

Many wading birds also fall into this group and do well in lakes regardless of the amount of aquatic plants, but one factor that may limit the success of these wading birds is the availability of water shallow enough for them to forage for food. Wading birds that inhabit lakes regardless of the abundance of aquatic plants include great blue heron (*Ardea herodias*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*) and tricolored heron (*Egretta tricolor*) (Figure 5).

Larger wading birds can forage in water of greater depths, which increases the area available for foraging. Therefore, the great blue heron has an advantage over the smaller little blue heron in open water. However, larger wading birds may become tangled in vegetation when an invasive exotic species covers a lake; on the other hand, many of the smaller wading birds can actually wade on top of dense plant growth, which vastly increases their foraging area.

Summary

Aquatic birds come in an almost infinite number of sizes and shapes and require many different resources to complete their life cycles. A number of generalizations can be made regarding groups of similar bird types, but it is important to remember that all species are somewhat different. Also, individual species are adaptable and often able to use available resources even if those resources are not preferred. Nutrient management and encroachment/management of invasive aquatic plants can increase, decrease or have little impact on a particular aquatic bird, which makes it difficult to predict the impact of lake mangement efforts on a given bird species. This dilemma becomes even more challenging when you consider that birds fly and can easily travel from lake to lake to find the habitat that best suits their needs, even though the distance seems prohibitive.

References

Hanson, A.R. and J.J. Kerekes. 2006. Limnology and aquatic birds. Proceedings of the fourth conference working group on aquatic birds of Societas Internationalis Limnologiae (SIL). Springer, Dordrecht, The Netherlands.

Kerekes, J.J. and B. Pollard (Eds.). 1994. Symposium proceedings: aquatic birds in the trophic web of lakes. Sackville, New Brunswick, Canada. Aug. 19-22, 1991. Developments in Hydrobiology, Vol 96. Reprinted from *Hydrobiologia*, Vol. 279/280.

Peterson, R.T. 1980. A field guide to the birds east of the Rockies. Fourth edition. Houghton Mifflin Company, Boston.

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