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Wading bird use of established and newly created reactor cooling reservoirs at the Savannah River Site, near Aiken, South Carolina, USA

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Abstract

We compared wading bird use of a newly created 405-ha reactor cooling reservoir (L-Lake) at the Savannah River Site, near Aiken, South Carolina, with that of two similar > 25-year-old reservoirs (1130-ha Par Pond and 87-ha Pond B) at the same site. L-Lake was constructed in 1984–1985 and filled in late 1985. Approximately 25% of the shoreline of L-Lake was planted with lacustrine vegetation in early 1987 in an attempt to speed the establishment of a self-sustaining balanced biological community (BBC) at the reservoir. Even so, during the course of our studies, L-Lake had considerably less wetland vegetation, especially floating-leaved species such as yellow nelumbo (*Nelumbo lutea*), than did either of the two older reservoirs.

Sixty-three surveys of the avian communities using the three reservoirs were conducted between fall of 1987 and summer of 1989. These surveys indicated that (1) at least seven species of wading birds (order: Ciconiiformes) used L-Lake, (2) wading bird density was higher at L-Lake than at the other two reservoirs, (3) wading birds represented a higher proportion of the total avian community at L-Lake than at the other two, older reservoirs, and (4) wading birds at L-Lake used planted portions of the shoreline more than unplanted portions. We suggest that the inter-reservoir differences we observed represent a 'trophic upsurge' (*sensu* O'Brien, 1990) resulting from the increased availability of fishes at L-Lake compared with the two older reservoirs.

Introduction

The construction of manmade reservoirs offers researchers an opportunity to study the ecological succession of newly created lakes. Although successional rates and processes at artificial impoundments can differ considerably from those occurring at naturally formed lakes (Aggus, 1971; Danell & Sjoberg, 1982; O'Brien, 1990; Wetzel, 1990), studies of reservoir succession can provide insights into fundamental ecological processes. They also offer an unparalleled opportunity to assess mitigation procedures associated with the construction of impoundments (*cf.* Jester, 1971; McCort *et al.*, 1988, Wein & McCort, 1988). Here, we compare the avian communities inhab-

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iting one newly created and two >25 year-old nuclear reactor cooling reservoirs at the Savannah River Site, near Aiken, South Carolina.

The Savannah River Site, located along the Savannah River in southwestern South Carolina, is operated by the U.S. Department of Energy (DOE), for the production of plutonium and tritium for nuclear weapons. Since 1953, cooling water from the site's five nuclear reactors has been introduced into wetlands associated with discharge streams (Sharitz *et al.*, 1974; Scott *et al.*, 1985; Hauer, 1985, McCort, 1987). Historically, Steel Creek, which received heated water from both the L and P Reactors, was one of the site's most perturbed streams. Discharge from the P Reactor was diverted from the creek in 1963, and in 1968, discharge from the L Reactor ceased when that facility was placed on standby status. Steel Creek then began to recover from the thermal and sedimentation insults associated with the earlier discharges (Wein & McCort, 1988). In 1980, when DOE proposed restarting the L Reactor, the Department was required by the Clean Water Act to mitigate the environmental consequences of the anticipated thermal discharge. After evaluating 33 alternatives for cooling discharge from the reactor, DOE decided to construct the once-through 405-ha L-Lake cooling reservoir by impounding a portion of Steel Creek (U.S. Department of Energy, 1984).

L-Lake was designed specifically to mitigate the effects of the reactor's thermal discharge. As part of the effort to hasten the establishment of a balanced biological community of indigenous, thermally tolerant organisms, the lake was stocked with several species of fishes, and a considerable portion of the reservoir's shoreline was planted with lacustrine vegetation (Wein & McCort, 1988; Wein *et al.*, 1987).

In this report we (1) document seasonal wading bird populations at planted and unplanted portions of L-Lake 2–3 years after its formation, (2) compare these populations with those of two older 'control' cooling reservoirs (Par Pond and Pond B) at the site, and (3) discuss the impact of planted lacustrine vegetation on the distribution and abundance of wading birds at L-Lake.

Description of sites studied

L-Lake, Par Pond, and Pond B are generally shallow, warm, monomictic cooling reservoirs, typical of the southeastern United States (cf. Wetzel, 1990). All three impoundments are within 10 km of each other on the 77 701-ha Savannah River Site (SRS), approximately 20 km SW of Aiken, South Carolina. (A map of the site can be found in McCort *et al.*, 1988). Below we briefly characterize the limnology of the three reservoirs. Additional information about each can be found in the references cited herein.

Pond B

Pond B was formed with an earthen dam and filled in July of 1961. The reservoir began to receive effluent from the R Reactor in September of that year. The 87-ha reservoir is 76 m above sea-level, has six small bays, and a shoreline of 9 km. Mean and maximum depths are 4.3 and 12.5 m, respectively. Volume is estimated at 3.9×10^6 m^3 (Whicker *et al.*, 1990). Dissolved oxygen in the reservoir, which stratifies between April and October each year, ranges from <0.5 mg l^{-1} in the hypolimnion to 8 mg l^{-1} at the surface. Conductivity at the surface ranges from 20 to 30 μS, and pH ranges from <5.3 to 6.8 (Alberts *et al.*, 1986; Alberts *et al.*, 1988).

By the time of our study in 1987–1989, a diverse ecological community had developed at Pond B. Most of the prominent aquatic macrophytes, including, *Nymphoides cordata*, *Brasenia schreberi*, *Typha latifolia*, and *Nymphaea odorata*, are restricted to shoreline waters of <6 m. Historically, fish populations apparently survived thermal loadings at Pond B in the cooler waters of the reservoir's bays (Whicker *et al.*, 1990).

Par Pond

Par Pond was formed in 1960 as a source of cooling water for the P and R reactors. The 1100-ha reservoir has more than a dozen small bays, 57 km of shoreline, a maximum depth of