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CHANGES IN THE SEASONAL ABUNDANCE OF GREATER YELLOWLEGS AT TOTTEN INLET, WASHINGTON[1]

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Abstract. The Greater Yellowlegs (*Tringa melanoleuca*) is a relatively common and widespread shorebird along the North American Pacific Flyway. In two distinct study periods, 1980 to 1989 and 1999 to 2007, Greater Yellowlegs at Totten Inlet, Washington, were counted during 563 visits to the site in spring, autumn and winter. Mean abundance of the species declined between the two study periods in all seasons. During the same time periods, Christmas Bird Count data indicated that Greater Yellowlegs abundance in winter increased in British Columbia, Washington, Oregon and California. The escapement of chum salmon (*Oncorhynchus keta*) has increased at Totten Inlet over the last 20 years, and a testable hypothesis is that more abundant salmon has altered the availability of aquatic prey of the Greater Yellowlegs.
Key words: Greater Yellowlegs, local population decline, prey availability, *Tringa melanoleuca*, trophic competition, Washington.

CAMBIOS EN LA ABUNDANCIA ESTACIONAL DEL ARCHIBEBE PATIGUALDO GRANDE EN TOTTEN INLET, WASHINGTON

Resumen. El archibebe patigualdo grande (*Tringa melanoleuca*) es un ave costera relativamente común y ampliamente distribuida a lo largo de la ruta migratoria del Pacífico de Norteamérica. En dos distintos periodos de estudio, 1980 a 1989 y 1999 a 2007, los archibebes patigualdos de Totten Inlet, Washington, fueron contabilizados durante 563 visitas al lugar en primavera, otoño e invierno. La abundancia promedio de la especie declinó entre los los periodos de estudio en todas las estaciones. Durante los mismos periodos, datos del Conteo de Navidad indicaron que la abundancia del archibebe patigualdo en invierno aumentó en British Columbia, Washington, Oregon y California. Las escapadas de salmón chum (*Oncorhynchus keta*) ha aumentado en Totten Inlet durante los últimos 20 años, y una hipótesis testable es que el aumento de los salmones ha alterado la disponibilidad de presas acuáticas del archibebe patigualdo.
Palabras clave: Tringa melanoleuca, archibebe patigualdo grande, declive poblacional local, Washington, disponibilidad de presas, competición trófica.

INTRODUCTION

The Greater Yellowlegs (*Tringa melanoleuca*) is a relatively common and widespread shorebird in the North American Pacific Flyway (Elphick and Tibbitts 1998). Range wide, the status of this species is not well understood, but may be stable (Morrison et al. 2006). During winter it occurs north to coastal portions of Oregon, Washington and southern British Columbia (Elphick and Tibbitts 1998), where it is most

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often found in protected estuaries during winter and migration (Campbell et al. 1990, Contreras 2003, Buchanan 2005). Although the species has a broad distribution in the region, aggregations of ≥20 occur at relatively few sites (e.g., Buchanan 1988). In this paper I describe changes in the abundance of this species at one such site, Totten Inlet, in western Washington.

METHODS

Monitoring of Greater Yellowlegs abundance was conducted at Totten Inlet, a small estuary in southern Puget Sound, Washington. Mud flats at the site extend out from the mouths of two small creeks that enter the inlet adjacent to a small marsh (see Brennan et al. 1985). In the early 1980s this site supported one of the largest winter populations of Greater Yellowlegs in the Pacific Northwest (Buchanan 1988), and among the largest aggregations in Puget Sound during migration (Evenson and Buchanan 1997).

As part of an ongoing shorebird monitoring effort, I counted all Greater Yellowlegs present on every visit I made to the site. I regularly visited Totten Inlet between 1980 and 1988, making a combined 133 visits during spring (March and April), autumn (August through October) and winter (December through February). I visited the site 430 times between 1999 and 2007 during the same seasons. The site was visited during mid- and higher phases of the tide cycle when birds foraged along shorelines and were easily observed and counted.

I evaluated whether changes in Greater Yellowlegs abundance occurred at the site in two ways. First, I determined the high count for each season in each year and compared these mean values from 1980 to 1988 with values from 1999 to 2007 using two-sample t-tests. Next, I calculated the mean value of all counts conducted from each season in each of the two study periods and compared these values also with a two-sample t-test.

Trends or changes in abundance at a single site are difficult to evaluate relative to the range-wide status of a species without additional contextual information. For this reason, I used Christmas Bird Count (CBC) data from the winters of 1980-81 to 1988-89 and 1998-99 to 2006-07 to evaluate whether there had been changes in abundance at CBC locations during the same two periods used in my field effort. I used CBC data from locations that had active count efforts throughout both 9-yr study periods (Appendix 1), from count locations in British Columbia (n = 7), Washington (n = 8) and Oregon (n = 5). Greater Yellowlegs had been identified previously as being common in these locations during winter (Buchanan 1988). In addition, I included 33 sites from California that met the active count criterion. Greater Yellowlegs are conspicuous and therefore easily detected, and use species-rich habitats that are targeted during CBC efforts (B. Tweit, pers. comm.). Consequently, I based subsequent analyses on the total numbers of birds observed and did not correct for observer effort because this would have produced index values that likely would have underestimated the abundance of Greater Yellowlegs. In 3% (n = 29) of the count-years (n = 972) a count was not conducted. In these cases I calculated the mean of the counts both two years before and two years after the missing value and used this estimate for subsequent analysis. I calculated the total number of Greater Yellowlegs observed in the CBCs in each state per year and compared mean values for both study periods with two-sample t-tests.

RESULTS

In all seasons, the abundance of Greater Yellowlegs at Totten Inlet declined significantly between the two 9-yr study periods (Table 1). Declines in mean abundance were greater when all counts were used within each season (reductions by factors of 4.7 to 14.2) compared to seasonal high counts only (reductions by factors of 2.9 to 5.4). The greatest decline (reduction by a factor of 14.2) occurred in all counts from autumn migration.

In contrast to the declines at Totten Inlet, CBC data indicated increases throughout the region. Increases in abundance between 1980-81 – 1988-89 and 1999-2000 – 2006-07 were substantial: British Columbia (factor of 2.4), Washington (factor of 1.9), Oregon (factor of 2.7) and California (factor of 1.5) (Table 2).

DISCUSSION

At least three explanations for the local decline of Greater Yellowlegs abundance at Totten Inlet

TABLE 1. Changes in abundance of seasonal high counts and all seasonal counts of Greater Yellowlegs at Totten Inlet, Washington, between 1980-81 – 1988-89 and 1999-2000 – 2006-07.

	1980-81 – 1988-89			1999-2000 – 2006-07					
Comparison	mean	SE	*n*	mean	SE	*n*	*df*	*t*	*P*
Spring high counts	24.9	2.9	7	8.1	2.4	9	14	4.5	0.0005
Spring all counts	13.5	0.8	44	2.9	0.4	136	178	11.9	<0.0001
Autumn high counts	15.7	1.5	6	2.9	1.1	9	13	7.0	<0.0001
Autumn all counts	8.5	0.5	43	0.6	0.2	168	209	17.4	<0.0001
Winter high counts	15.7	2.0	7	5.5	1.9	8	13	3.7	0.0026
Winter all counts	10.2	0.6	46	1.5	0.3	124	168	14.2	<0.0001

TABLE 2. Changes in abundance of Greater Yellowlegs observed in Christmas Bird Counts conducted in British Columbia (*n* = 7 count locations), Washington (*n* = 8), Oregon (*n* = 5) and California (*n* = 33) in 1980-81 – 1988-89 and 1999-2000 – 2006-07.

	1980-81 – 1988-89			1999-2000 – 2006-07					
Comparison	mean	SE	*n*	mean	SE	*n*	*df*	*t*	*P*
British Columbia	67.7	7.1	9	160.8	15.6	9	16	5.4	<0.0001
Washington	80.3	9.8	9	149.7	17.2	9	16	3.5	0.003
Oregon	70.7	12.8	9	187.7	18.3	9	16	5.2	<0.0001
California	958.3	56.9	9	1412.1	55.1	9	16	5.7	<0.0001

are possible. The first involves a negative numerical response by Greater Yellowlegs to increasing populations of predators. Predators have the ability to influence aspects of the behavior of their prey (e.g., Dierschke 2003), and it has been suggested that the recent recovery of Peregrine Falcon (*Falco peregrinus*) populations has influenced migration behavior and site use patterns of sandpipers along the Pacific coast of North America (Lank et al. 2003, Ydenberg et al. 2004, Pomeroy 2006). Although the abundance of Peregrine Falcons and Bald Eagles (*Haliaeetus leucocephalus*) has increased at Totten Inlet during this study (J. Buchanan, unpubl. data), I believe it is unlikely this is responsible for the decrease in Greater Yellowlegs abundance. The increased presence of Peregrine Falcons and Bald Eagles has occurred region-wide, and an increased effect of predator presence on yellowlegs should have occurred at a number of other sites, and this is not reflected in the CBC data (Table 2) or my own observations at other sites (J. Buchanan, unpubl. data). Also, declines in Greater Yellowlegs abundance were noted in spring and autumn, seasons when Peregrine Falcons and Bald Eagles were virtually absent from Totten Inlet (J. Buchanan, unpubl. data). This indicates that a factor other than predator presence has influenced the changes, at least in those two seasons.

It is also possible that changes in local conditions, such as increased sedimentation, influenced the decreases in Greater Yellowlegs abundance at Totten Inlet. However, beach substrate has not changed in upper Totten Inlet and changes elsewhere in the inlet are minor over the time period involved as this inlet has experienced far less shoreline development than many other areas in Puget Sound (Carrasquero-Verde et al. 2005).

Direct evidence to explain the decreases is lacking and, therefore, I suggest a third possible explanation and present a hypothesis that can be tested to evaluate its potential utility in explaining the changes in Greater Yellowlegs abundance at Totten Inlet. It is related to finding a substantial decrease in abundance of Greater Yellowlegs at Totten Inlet at the same time that increasing trends in the region are indicated by CBC data. Of the eight CBC locations in Washington, none had significant decreases in abundance between the two periods.

I hypothesize that competition for food has increased between yellowlegs and salmon. Over a period from the early 1980s to the early 2000s, the escapement of chum salmon (*Oncorhynchus keta*) increased dramatically at Totten Inlet in response to changes in fisheries management at the site. Mean escapement between 1997 and 2001 was >10 times higher than mean escapement between 1980 and 1984 (Kyle Adicks, pers. comm.). This increased escapement resulted in large numbers of spawned-out salmon carcasses deposited on the tide flats and shores of upper Totten Inlet. This in turn resulted in increases in nutrient levels on the tide flats (Jauquet et al. 2003). Over this same period, the abundance of Black-bellied Plovers (*Pluvialis squatarola*) increased steadily at the site in all seasons, and it has been hypothesized that the increased nutrients produced a greater amount or quality of prey for the plovers (Buchanan 2006). It was noteworthy that whereas escapement biomass of all salmon species, combined, increased at Totten Inlet, increases were not noted at any other sites in Puget Sound that support plovers, nor were there increases in plover abundance elsewhere (Buchanan 2006). In short, changes in abundance of both the plovers and the salmon are apparently unique to Totten Inlet.

Juvenile chum salmon leave freshwater very soon after hatch and move directly to estuarine areas (Pedersen and Williams 2001). This movement occurs between January and July and subsequent residence in estuaries may last up to three months, a longer period than for most other anadromous salmonids (Pearce et al. 1982, Johnson et al. 1997). In these estuaries, juvenile chum salmon feed on epibenthic harpacticoid copepods, gammarid amphipods and aquatic insect larvae (Emmett et al. 1991, Simenstad and Cordell 2000). Food habits of Greater Yellowlegs are not known for most areas but it is likely that they use some of these food items (Elphick and Tibbitts 1998). I hypothesize that the increase in chum salmon abundance at Totten Inlet has resulted in the annual recruitment of a juvenile population that is sufficiently large to effectively reduce resources that directly or indirectly are suitable for Greater Yellowlegs at this site. This hypothesis could be evaluated by determining the abundance of Greater Yellowlegs and their prey in estuaries before and after fisheries management enhancement efforts are put in place.

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APPENDIX 1. Location of Christmas Bird Counts used in the analyses.

British Columbia

Comox, Deep Bay, Ladner, Nanaimo, Vancouver, Victoria, White Rock

California

Bernicia, Centerville, Contra Costa, Del Norte, Hayward-Fremont, Lancaster, Los Angeles, Los Banos, Malibu, Marin County, Mendocino, Monterrey Peninsula, Morro Bay, Moss Landing, Oakland, Oceanside-Vista-Carlsbad, Orange County (coastal), Palo Alto, Palos Verde, Point Reyes Peninsula, Sacramento, Salton Sea (north), Salton Sea (south), San Bernardino Valley, San Diego, San Fernando Valley, San Jose, Santa Barbara, Santa Rosa, Stockton, Thousand Oaks, Ventura, Western Sonoma County

Oregon

Coos Bay, Eugene, Sauvie Island, Tillamook, Yaquina

Washington

Bellingham, Columbia River Estuary, Grays Harbor, Kitsap Peninsula, Leadbetter Point, Olympia, Padilla Bay, Sequim-Dungeness