Summer distribution and foraging behavior of *Histrionicus histrionicus* around Cattle Point on San Juan Island, Washington

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Abstract

Harlequin Ducks molt and winter in the San Juan Islands of Washington state. This study investigated habitat choice and feeding behavior of Harlequin Ducks around Cattle Point on San Juan Island by comparing time foraging versus resting in different habitats. In the water, ducks performed three behaviors while foraging: surface feeding, diving, or dabbling. Across observation periods, Harlequin Ducks spent on average 80% of the time foraging, and only 20% of the time hauled-out and resting. The ducks spent the more time foraging in areas of low current and high vegetation and the least time at areas high current and low vegetation. The mild climate in the San Juan Archipelago could allow the ducks to spend more time foraging to meet their in-molt energetic needs by reducing the need to thermoregulate.

Key Words

Foraging behavior, habitat utilization, Harlequin Duck, Histrionicus histrionicus

Introduction

Harlequin Ducks molt and winter in the San Juan Islands. During the molt period, lasting from June through September in the Pacific Northwest (Robertson et al. 1998), Harlequin Ducks, *Histrionicus histrionicus*, leave inland breeding grounds and occupy areas that are protected from predators and have abundant food (Hohman et al. 1992, Salomonsen 1986 as cited by Adams et al. 2000). While transitioning from alternate to basic plumage, Harlequin Ducks are flightless and have greater nutritional needs to regrow feathers, which makes the topography and productivity of molt areas important

(Adams et al. 2000, Hohman et al. 1992). These molt areas are turbulent, rocky shorelines with patches of calm water in which they feed (Goudie 1999, Kondratyev 1999). Harlequin Ducks spend most of their time within approximately 50 m of the shoreline where they can forage along receding tide lines (Goudie 1999, Cooke et al. 1997). In contrast to other sea ducks like scoters, Harlequin Ducks utilize multiple foraging behaviors in their habitat, including surface feeding, diving, and dabbling (Goudie 1999).

The goal of my study was to investigate habitat choice and feeding behavior of Harlequin Ducks around Cattle Point. I chose to study Harlequin Ducks because there are few previous studies that have been conducted on the population in the San Juan Islands of Washington state. Additionally, Harlequin Ducks remain close to the shore while feeding and resting and are incapable of flight early in basic plumage, making them easy to observe and appropriate subjects for a short-term study. Cattle Point on San Juan Island as a reliable molting ground for Harlequin Ducks (Jensen 2011). Along the approximately 1.5 km stretch of coastline around the Cattle Point Natural Resources Conservation Area, there are a variety of substrate types and water depths in which Harlequin Ducks forage and rest. Specifically, I assessed 1) fraction of time spent in the water foraging versus being hauled out in different areas; 2) habitat characteristics of these areas, including vegetative cover, grainsize of substrate, slope, and relative current exposure; and 3) frequency of different foraging techniques (surface feeding, diving, and dabbling) in relation to water depth and substrate type. I also critiqued my methods to help future investigators.

Methods

Study Area

I conducted this observational study at Cattle Point, which is an exposed point on San Juan Island the Strait of Juan de Fuca. Observations were made along a 1.5 km stretch of shoreline around Cattle Point Lighthouse in the Cattle Point Natural Resources Conservation Area on the southern tip of San Juan Island, N48°27.029' W122°57.789' (Fig. 1). The area is predominantly steep-sided bluffs, with a shallower-sloped tidal zone of boulder to cobble-sized substrate.

I performed a shore survey to characterize the slope, grainsize, and seaweed cover of the regions utilized by the ducks. The results of this shore survey were used to separate the shoreline of the study area into 4 sub-sections based on similar physical characteristics and frequency of utilization by the ducks (Fig. 1, Table 1).

Observations

Over a thirteen-day period between 8 August 2011 and 20 August 2011, I went to the Cattle Point Lighthouse and walked north and northwest along the shore until I encountered a group of Harlequin Ducks to observe; a group was defined as two individuals or more. If necessary, I used binoculars and a spotting scope to locate and observe the ducks. Once I found the ducks, I counted the total number of individuals, noted the gender of each individual, and timed each haul-out and foraging event. I observed the ducks for periods of time no shorter than 20 minutes, and went out at various times in both the morning and the afternoon. Observations were made only in clear weather. I recorded frequency of feeding behaviors (surface feeding, diving, and dabbling) and noted water depth, substrate, and vegetative cover for each feeding event. Surface feeding was when the ducks remained horizontal and only submerged their head to feed while dabbling was the act of turning perpendicular to the water with the head and upper abdomen submerged.

Analysis

I compiled data from my field notes to calculate the fraction of time spent foraging versus resting for each observation event by finding the total minutes the group spent in the water, foraging, versus hauled out, resting, and dividing that by the total time spent watching the ducks. I used these in water versus out of water fractions to compare behavior in each of the shore subsections (Fig. 2). In cases where the flock did not act cohesively, I used the midpoint of the time range used to transition from land to water, or vice versa, to calculate time budgets.

Results

Across observation periods, Harlequin Ducks spent on average 80% of the time foraging, and only 20% of the time hauled-out and resting. The proportion of time spent foraging versus resting varied spatially between the four areas, with the most time spent foraging in area C (84%) and the most time spent resting in area B (30%; Fig. 2). The ducks used each area unequally, visiting areas A and C four times each over the course of the study, and areas B and D three times each (Fig. 3). Within each area, the amount of time spent foraging versus resting varied between observation events. However, time spent foraging was never less than 50% and was usually greater than 70% of the total observation time (Fig. 3).

Each subsection of the observation area had a distinct combination of physical characteristics (Table 1). The substrate at areas A and C was mainly boulder with >50% vegetative cover and shallow to medium slope. Areas B and D differed from areas A and C. Area B had a vegetated boulder substrate, areas of steeper slope, and greater exposure to max ebb and flood currents. Area D was almost exclusively cobble with calm water and moderate vegetation.

During foraging events, surface feeding and diving were relatively common while dabbling was rare (Fig. 4). Surface feeding occurred mainly in shallow water over vegetated substrate, while diving was most frequently observed in shallow to medium water above a cobble substrate.

Discussion

My findings showed that Harlequin Ducks molting at Cattle Point spent more time feeding in the water than resting while hauled out. This result contrasts sharply with findings on the Gannet Islands in Labrador where molting Harlequin Ducks spent more than 50% of the observation time hauled out (Adams et al. 2000). Authors of that study proposed that Harlequin Ducks undergoing molt had three strategies available to them to handle the increased metabolic costs of molting: they can occupy areas that are closer to thermoneutral temperatures, they can forage more, or they can reduce time spent in water and thus save energy by reducing the need to thermoregulate. Of these three strategies, it appears that Harlequin Ducks molting at Cattle Point met their metabolic requirements by increased frequency of foraging. However, at lower latitude, higher mean summer water temperatures at Cattle Point compared to the Gannet Islands could reduce the cost of thermoregulation for Harlequin Ducks molting along the coast, and thus make foraging energetically feasible. Specifically, mean summer temperatures range from 11 ºC to 18 ºC in the southern end of the Strait of Georgia (located slightly north of my study site; Davenne and Masson 2001). In contrast, mean summer temperatures off the coast of Labrador average 12 ºC (Newfoundland and Labrador, 2010, http://www.tc.gc.ca/eng/marinesafety/tp-tp14726-section7-1526.htm).

The fraction of time Harlequin Ducks spent foraging versus resting appeared related to the physical characteristics within each area. Of the four areas, time spent resting was greatest in area B, where there were abundant shallow-sloped boulders available as haul-out sites during low tides (Table 1). Additionally, exposure to currents was greater in area B than in the other three areas. Kondratyev (1999) identified calm waters distributed within stronger currents as the preferred feeding habitats of Harlequin Ducks. Thus, currents at area B may have been too strong for the ducks to feed in. The ducks spent the most time foraging in areas A and C, where the habitat was more complex, with heavily vegetated boulders in the shallow water, some areas of cobble in area A, and kelp beds in deeper waters at both locations (Table 1). The maximum current strength in areas A and C was relatively weak (area C only experienced medium-strength currents at max ebb or flood tides), which in combination with the greater variety and access to foraging locations could explain why the ducks spent most of their time feeding in those areas. In area D, the ducks spent approximately the same amount of time feeding as in area B (72% vs. 70%; Fig. 2). Despite the waters in area D being calm during all observation periods, the substrate is predominantly cobble with no more that 75% vegetative cover, indicating that foraging was only advantageous at certain times compared to areas A and C. Feeding may have been most advantageous when the tide was low, improving the ratio between energy spent by diving versus that gained by the food obtained. Also, in area D, hauling out occurred either on one of the few boulders interspersed among the cobbles or on the boulders along the boundary between areas C and D.

During foraging events, the ducks exhibited three kinds of foraging behaviors, but utilized each unequally. Dabbling was the least common behavior, only observed ten times over the course of the study, and only while also surface feeding in very shallow water over heavily vegetated substrate (Fig. 4). The ducks mostly dove to forage in shallow to medium waters with cobble substrate, but also dove in deeper waters, usually while traveling between foraging locations. Surface feeding, the most frequently used foraging technique, occurred almost exclusively in shallow waters around heavily vegetated boulders. The ducks may have spent more of their foraging time surface feeding because it is potentially the least energetically costly of the three behaviors. Surface feeding allows a duck to remain very close to haul-out spots as it only requires submersing their head in the water, and as the tide changes, new zones on the rock become available for utilization.

The results of my study shed new light on the connection between the physical characteristics of the shoreline and how Harlequin Ducks utilize different habitats. But, time and resources limited the scope of this project and the conclusions I was able to draw from it. My decision to observe the first ducks I encountered meant I may have missed other groups farther along the shoreline. Additionally, I did not perform any prey surveys around the point, so location and abundance of prey and how that may change with time was not a component of my habitat utilization assessment. In the future, a more comprehensive study on Harlequin Duck habitat utilization would involve more than one observer to make sure the whole observation area was surveyed before beginning observations on a flock. Additionally, a more thorough assessment of the physical characteristics of the environment would include more quantitative measurements of vegetative cover, shore slope, water depth at different tides, and dataloggers to measure current speed throughout the observation period. In the behavioral component of the study, defining and timing a greater variety of behaviors, and by following a similar scan observation method as utilized by Adams et al. (2000) would create a more comprehensive picture of how Harlequin Ducks utilize and behave in their environment.

Citations

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Figures and Tables

Table 1. Table presenting the habitat characteristics of each subsection of the observation area. Shore slope and relative current experienced were qualitative assessments, with slope being determined with respect to the sheer-sided bluff on which I made my observations and relative current being assessed around max flood or ebb tides.

Habitat Characteristics					
	Vegetative Cover	Grainsize	Shore Slope	Relative Current Experienced	Area
A	75-100% around boulders 25-50% on cobble Some kelp beds in deeper water	Boulders, interspersed with cobble	Ranging from shallow to medium	Weak	7,196 m^2
B	75-100% around boulders 25-75% on cobble Some kelp beds in deeper water	Boulders Some areas of cobble	Ranging from shallow to medium to steep	Strong	10,563 m^2
C	50-100% Kelp beds in deeper water	Boulders	Ranging from shallow to medium	Medium to strong	33,407 m^2
D	50-75% Kelp bed parallel to shore	Cobble with occasional boulders	Shallow	Weak	8,390 m^2

Figure 1. Map of the study site at Cattle Point on the southern tip of San Juan Island. Blue tabs indicate the edge of the observation area. Grey shaded regions are the habitats utilized by molting Harlequin Ducks. The designations A, B, C, and D refer to subsections of the observation area that are characterized by habitats and frequency of utilization by Harlequin Ducks.

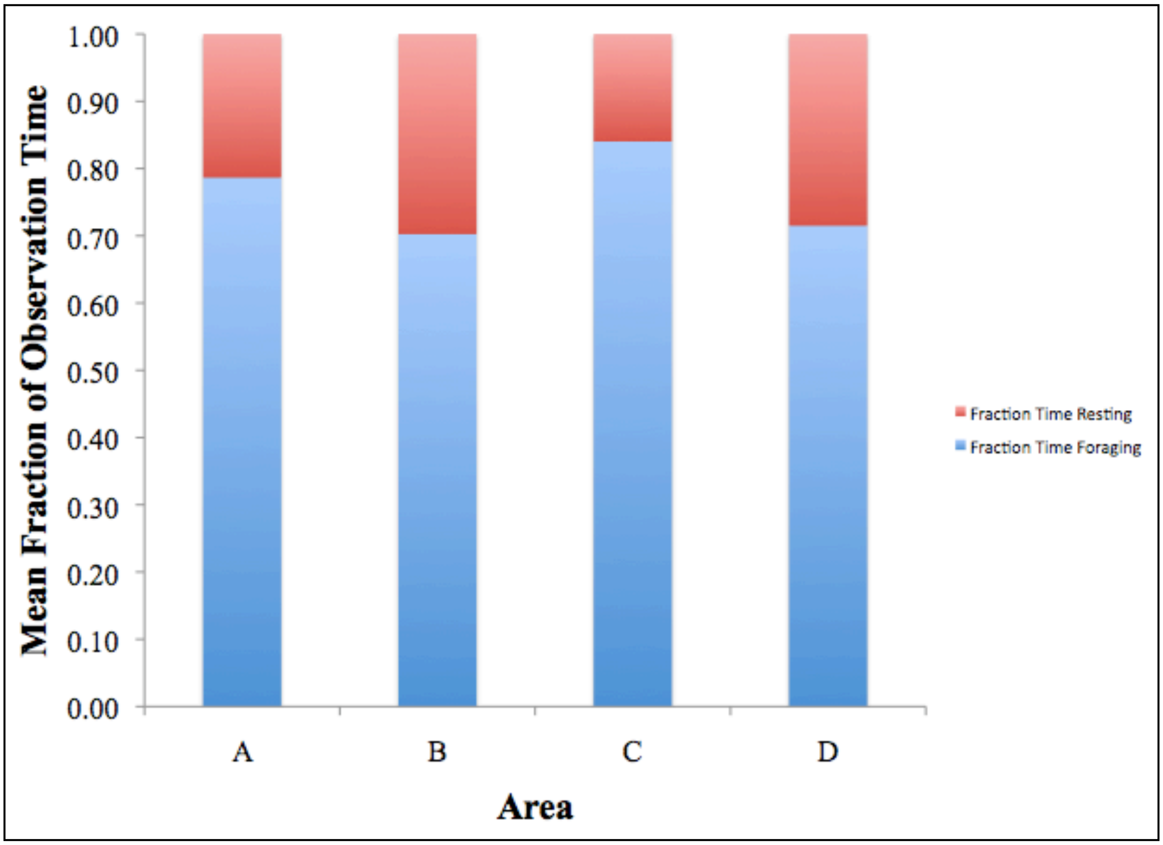

Figure 2. Graph showing the average proportion of time spent in the water foraging versus out of the water resting in each subsection of the observation area.

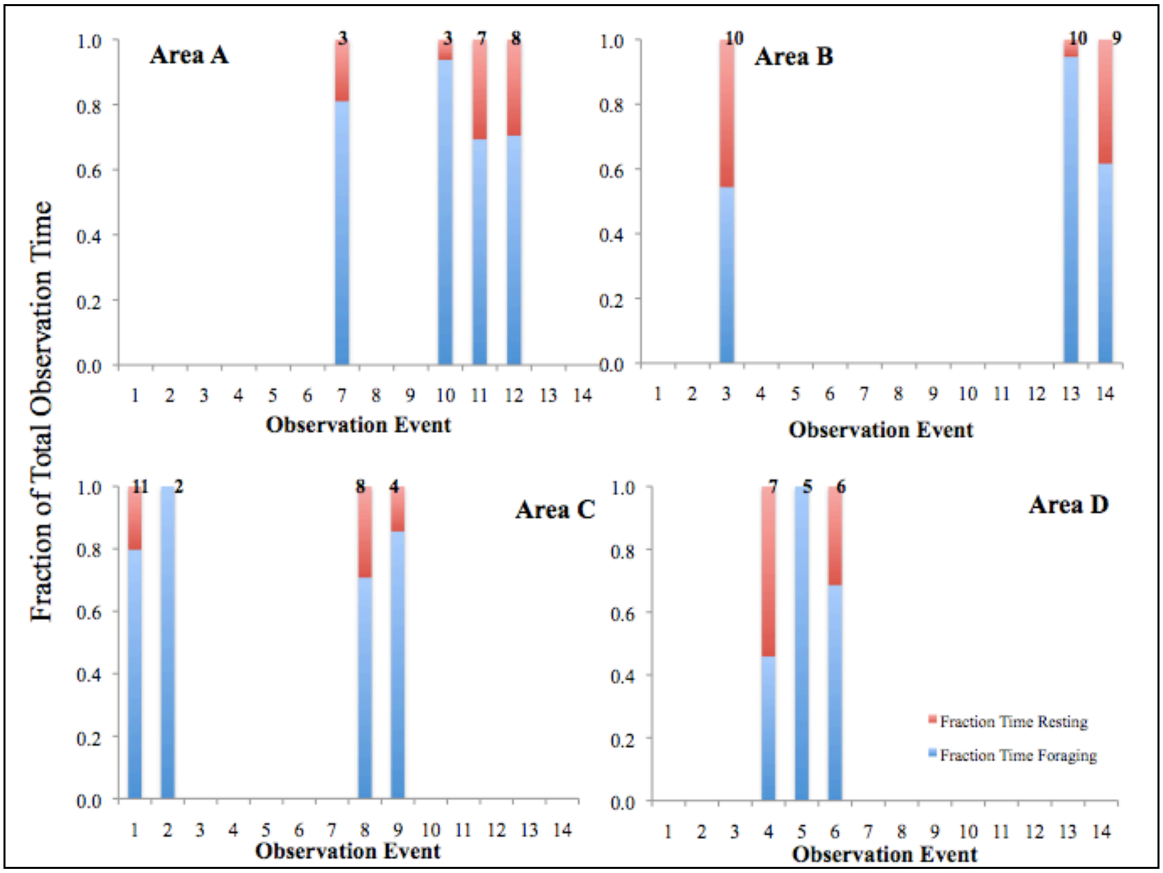

Figure 3. Figure showing the proportion of time spent foraging versus resting in each sub-section of the observation area. Numbers on top of the bars indicate the number of ducks observed at each observation event.

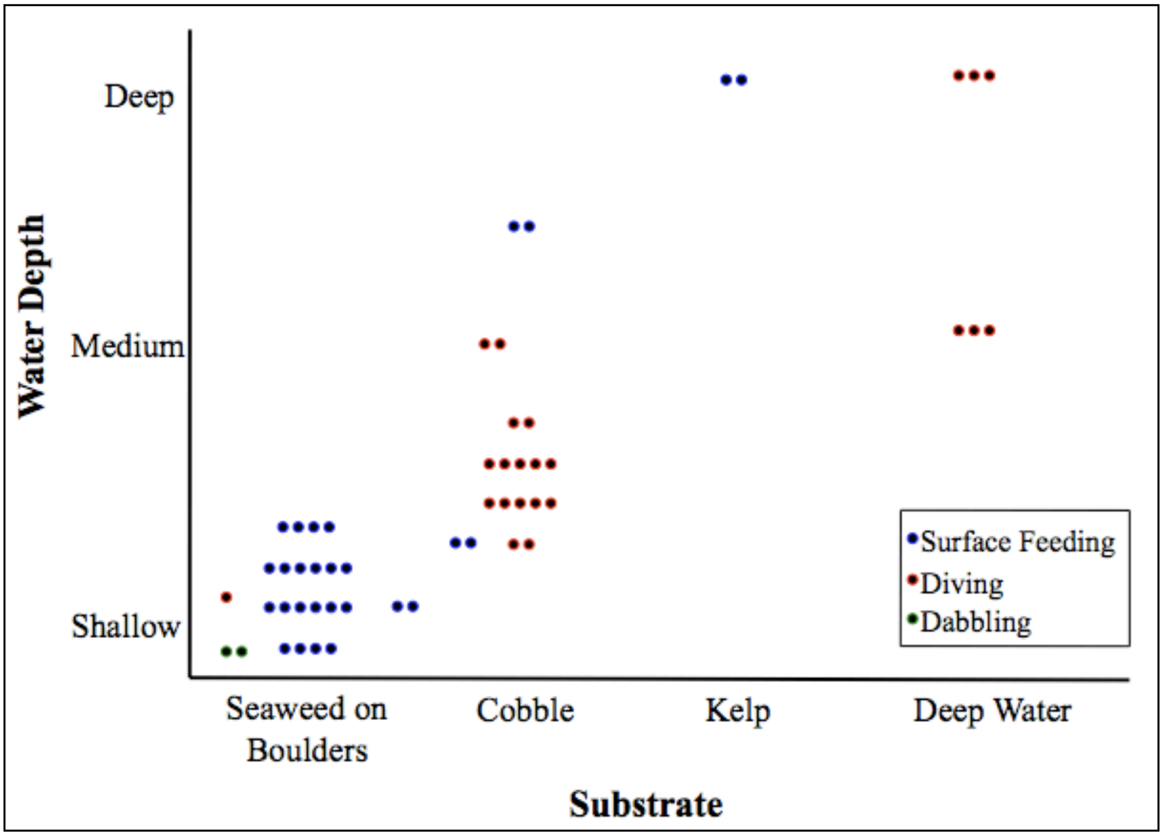

Figure 4. Graph showing the relationship between feeding behavior, substrate, and water type. Each dot represents 5 ducks performing the behavior.