

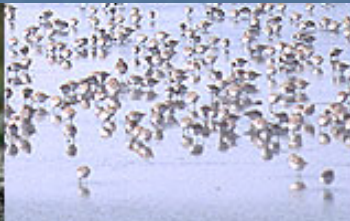
Trail Use Effects on Foraging Waterbirds



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Topics Covered

- Land-based disturbances relevant to Project, especially trails and overlooks
- Foraging shorebirds, waterfowl, egrets/herons/large waterbirds
- Research into trail effects on shorebirds
- Research directions



Large Literature on Impacts of Recreation on Birds

- Non-consumptive uses:
walking, biking, motorboats
- Consumptive uses:
hunting, fishing, some research

Effects of recreation vary based on:

- Qualities of the human activity (duration, intensity, frequency)
- Species characteristics (size, life history)
- Environmental factors (predation, food)

Bird Responses

- *Physiological*: heart rate, body condition
- *Behavioral*: Move, change behavior
- *Distributional*: Change landscape use
- *Survivorship*: Injury or Death
- *Reproductive*: Abandon nests or foraging sites, reduced offspring numbers
- *Population*: Changes in population number



Some Key Findings

- *Nesting birds, esp. colonial nesters* - very vulnerable to disturbance; nest abandonment (Carney and Sydeman, 1999)
- *Hunting* - a major recreational impact; death, changes behavior (Madsen, 1998a,b)
- *Research* - can cause significant impacts; nest abandonment, death (Carney and Sydeman, 1999)
- *Direct Approach* - significant source of disturbance (Klein, 1993, Burger & Gochfeld, 1981)

What about *trail/path use* near foraging waterbirds on trails?

Trail Use and Foraging Egrets/Herons

- Feeding herons often move/fly away from trails as people approach
- Some species show habituation to trail use
- Direct approach disturbs birds more often than indirect - photographers
- Loud noises cause bird response
- Vehicles seem to disturb less than out-of-vehicle approach
- Larger species move sooner than smaller ones



Trail Use and Waterfowl

- Klein, et al. (1995): Dabbling ducks
 - Early migratory arrivals may be esp. sensitive to trail use (people & vehicles)
 - Migratory dabbling ducks seem to be more sensitive to trail use than other waterbird species
- Pease et al. (2005): Dabbling ducks
 - Pedestrians and bikes caused highest percentage of ducks to fly vs. trucks/tram
 - Responses varied by species



Findings on Shorebirds and Trails

- Large body of literature on beach recreation impacts on shorebirds:
 - Burger (1981): Beach walkers always flushed birds; People walking on path did not, but joggers often did
 - Thomas, et al. (2003): Time spent foraging reduced by beach walkers, esp. dogs
 - Lafferty (2001): Beach walkers, joggers disturbed birds; large-scale distribution of birds not significantly altered; dogs again



Findings on Shorebirds and Trails

- Not many studies specific to trails:
 - Burton et al. (2002): Some shorebird spp. numbers reduced near trails
 - But, Gill et al. (2001) and Yasue (2005,2006): No effect of trail use on numbers of shorebirds or foraging rates
- Studies in England, British Columbia, East Coast, but none in SF Bay
- Over 1 million shorebirds migrate to SF Bay and over 7 million people
- Need for studies that compare trail to non-trail sites for controls



Foraging Shorebird Response to Trail Use around San Francisco Bay*

Do trail users have a significant impact
on shorebird use of foraging habitat
adjacent to non-motorized trails in the
Bay Area?



* Trulio, L.A. and J. Sokale. In press. Journal of Wildlife Management

Study Locations

- Bothin Marsh, Marin County
- Redwood Shores, San Mateo County
- Shoreline at Mountain View, Santa Clara County
- Each had a paired trail and non-trail tidal mudflat site
- Set up 100 ft x 100 ft quadrats at each site



Methods

- ✓ Collected data 4 times/month, 2 weekdays and two weekend days
- ✓ 24 months from 1 July 1999-30 June 2000 and 1 Oct 2000 to 30 Sept 2001
- ✓ Two observers at each site collected 4 hours of data during outgoing tide
- ✓ Collected data on
 - ✓ Number and Type of Trail Users
 - ✓ Numbers of Birds, Species Richness and Behavior
- ✓ Repeated Measures
Linear Mixed Model



Models Included...

- Independent variables:
 - Season
 - Location
 - Numbers of trail users
- Dependent variables:
 - Numbers of birds
 - Species richness
 - Foraging behavior



Two Main Analyses

Compared:

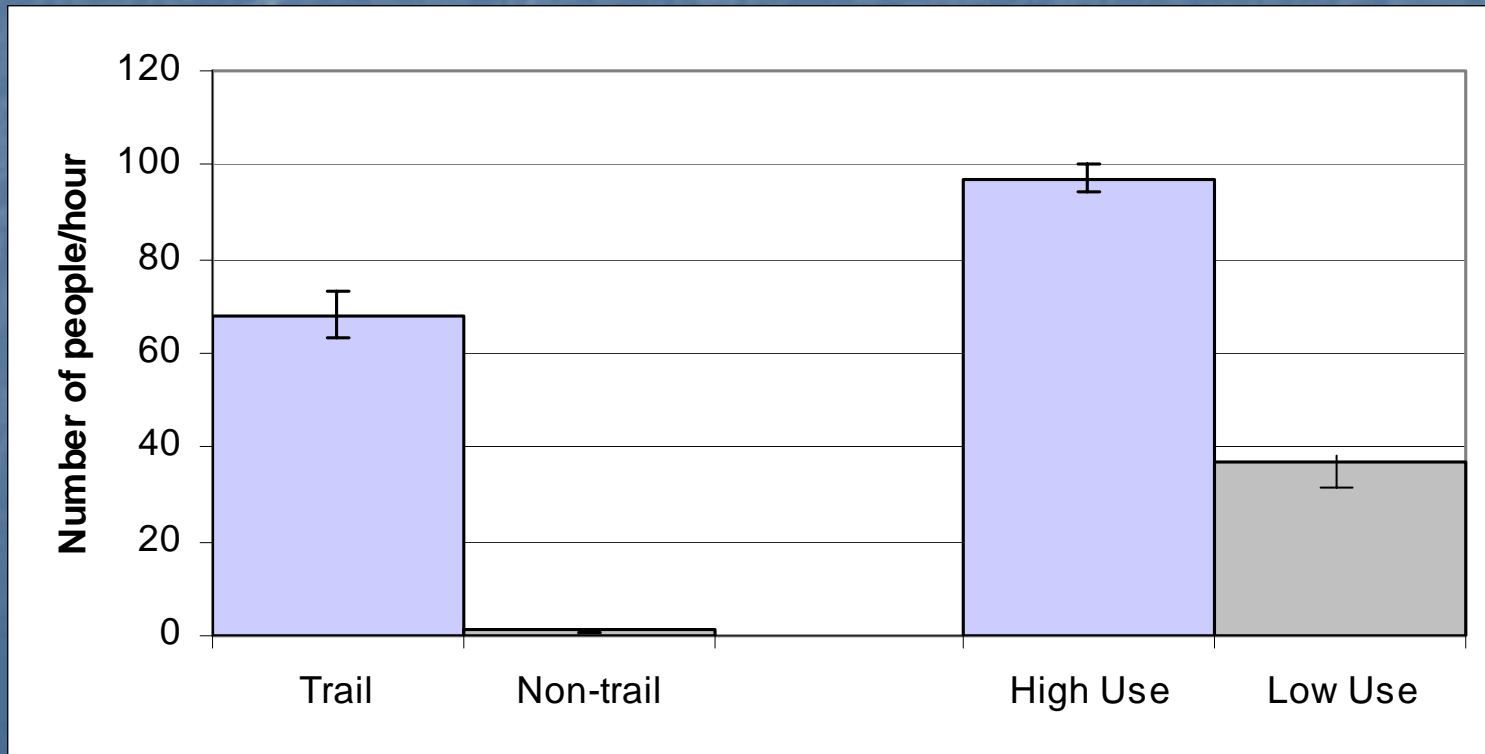
- 1) sites with trails to non-trail sites
- 2) high use (weekends) to low use (weekdays)

To assess whether numbers of trail users affected the number of birds, species richness, or percent of bird foraging, overall or by season.



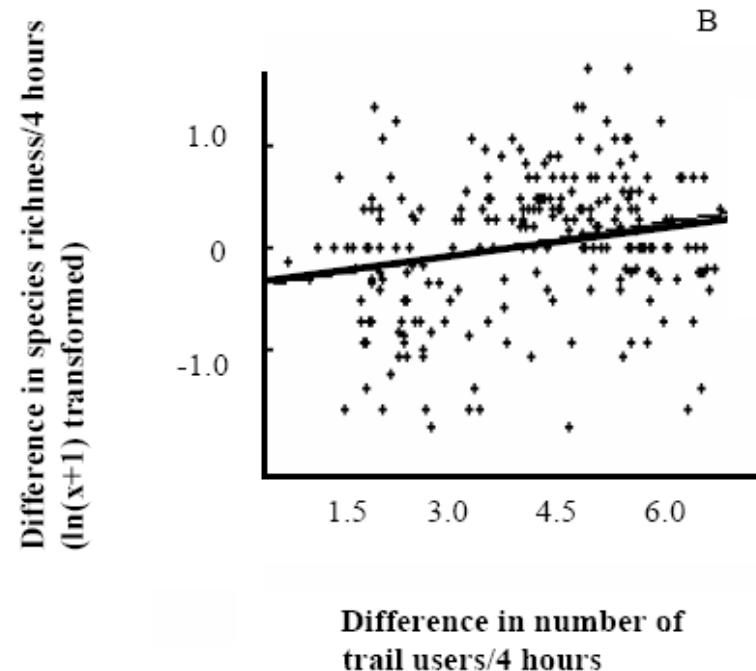
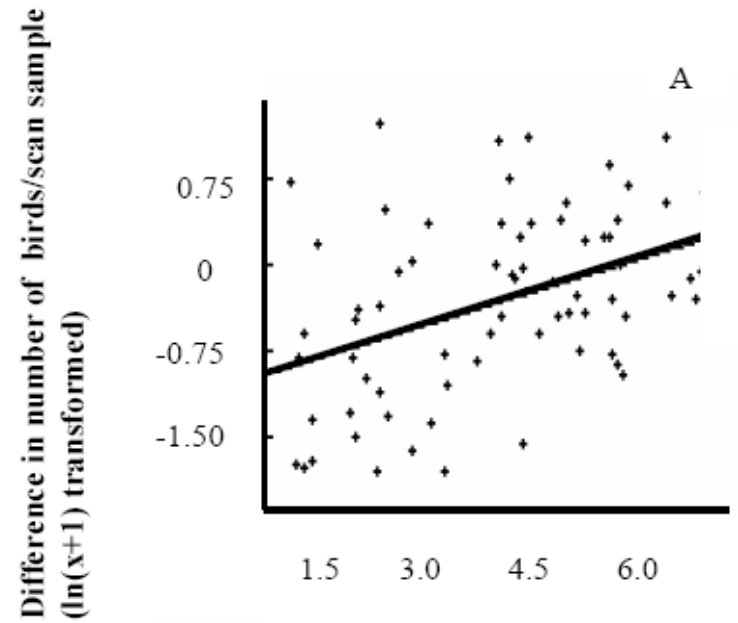
Results

- 85% of birds recorded were shorebirds, western and least sandpipers dominated
- Human use varied greatly



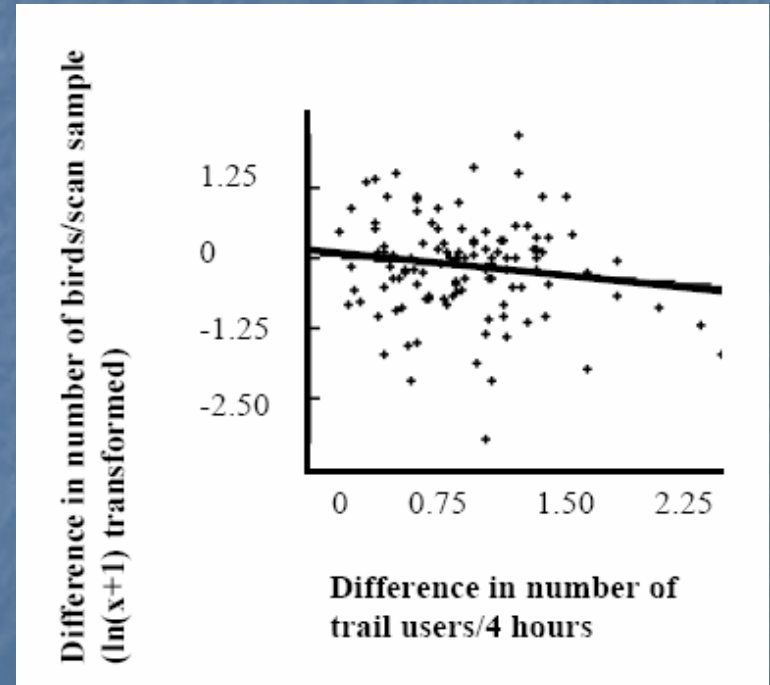
Trail vs. Non-trail Sites

- No adverse effects of trail use on numbers of birds, species richness or percent foraging overall or by season



Higher use vs. Lower Use Days

- Found numbers of birds decreased with increasing trail use
- Species richness, percent of birds foraging showed no response to trail use



Factors contributing to low shorebird response to trail use

- Tangential approach disturbs shorebirds less than direct approach (Burger and Gochfeld 1981, Klein et al. 1995, Gill et al. 2001)
- Rapid movement & loud noises are significant disturbance factors (Rodgers & Schwikert 2002, 2003)
- Large waterbirds respond sooner than small ones (Rodgers & Schwikert 2003, Blumstein 2006)
- Dogs were uncommon (Lafferty 2001, Banks and Bryant 2006)
- Habituation? (Ikuta and Blumstein 2003)

Factors affecting shorebird presence and foraging...

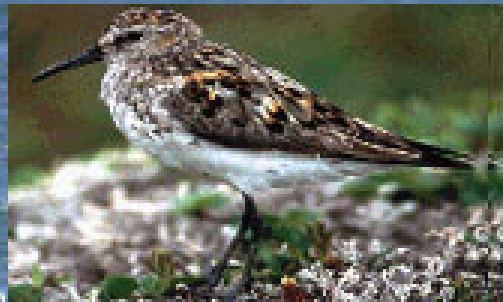
- Habitat Quality
- Predation Risk
- Season
- Tide



Found, in other studies, to be more important than trail use in shorebird use of foraging habitat

Caveats

- Many studies show waterbirds are susceptible to human disturbance
- Increased trail use may increase impacts
- Trail activity may have other impacts, such as preventing use of roosting sites
- Effects of trail use on birds may change over time



Thoughts on Research Directions

- Before-After-Control-Impact (BACI) studies
- Effects of trails on roosting waterbirds and available roosting sites
- Effects of trails on foraging waterfowl
- Studies of specific trail uses
- Trail effects on distribution and nesting success of clapper rails
- Cumulative effects of trail use and habitat change due to climate change
- Information on effective responses to avoid or limit impacts