

The Behavior of the Seaside Dragonlet, *Erythrodiplax berenice* (Odonata: Libellulidae), in a Maine Salt Marsh

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Abstract - The behavior of the marine dragonfly, *Erythrodiplax berenice* (Seaside Dragonlet), was studied over two summers at Weskeag Marsh, South Thomaston, ME. These dragonflies are lethargic, spending over 99% of their time perched on the culm of a salt marsh plant. No evidence of territorial behavior was found. Females oviposit while in tandem in algal mats on the surface of salt-water pannes. These dragonflies perch preferentially into the wind, presumably to aid in providing lift on take-off.

The Seaside Dragonlet, *Erythrodiplax berenice* (Drury), is a widespread libellulid dragonfly associated with marine habitats. In North America, this species is a denizen of salt marshes and other supratidal habitats from Nova Scotia southward to Florida along the Atlantic Ocean and from Florida to extreme southern Texas on the Gulf of Mexico (Needham et al. 2000, Nikula et al. 2003). Disjunct populations are found in saline lakes in Texas and New Mexico. Beyond North America, the Seaside Dragonlet is found along the Atlantic coast from Mexico south to Venezuela, along the Pacific coast from Baja California to Oaxaca, Mexico and on some Caribbean islands (Dunkle 1989, 2000; Shortess 1930).

The Seaside Dragonlet is perhaps most notable for the fact it is the only truly marine odonate (Dunson 1980, Kelts 1977). Nymphs live in salt-water pools with salinities as high as 48‰ (Dunson 1980).

Despite the broad geographic distribution of the Seaside Dragonlet, there is a dearth of information on adult behavior and reproductive ecology. In this contribution, I describe the results of observations of a Seaside Dragonlet population in a Maine salt marsh during the summers of 2001 and 2002.

The data for this study were collected in Weskeag Marsh in South Thomaston, ME (44.04693°N, 69.08454°W). The particular area studied was an arm of Weskeag Marsh on the north side of Buttermilk Lane, extending for about 2 km in a southwesterly to northeasterly direction. The width of this portion of the marsh varies from 100 to 300 m and is bounded by upland forest on either side. Marsh Creek runs in a sinuous fashion through the marsh, flowing into the Weskeag River south of Buttermilk Lane. The marsh is dotted with salt pannes.

Most of the marsh is covered with *Spartina patens* (Ait.) Muhl. (Salt Marsh Hay) although *S. alterniflora* Loisel. (Smooth Cordgrass) is found along the banks of Marsh Creek. A number of other halophytes are present at low densities (e.g., *Salicornia maritima* Wolff & Jefferies [Slender Glasswort], *Limonium carolinianum* (Walt.) Britt. [Carolina Sea-lavender] and *Distichlis spicata* (L.) Greene [Seashore Saltgrass]).

Preliminary visits to Weskeag Marsh in the summer of 2000 indicated that adult Seaside Dragonlets do not appear in significant numbers until early July. In 2001 and 2002, I visited Weskeag Marsh on 18 different days. Observations were made between 0800 and 1700, when the dragonlets are most active. Temperatures ranged from 14 to 27 °C. Skies were clear or partly cloudy on each observation date. Although I did not attempt to do daily censuses, population densities were clearly the highest in the first and second weeks of July.

The primary means of data collection was following a focal individual until the individual flew out of sight or my patience waned because of lack of activity. Most individuals were monitored between 15 and 60 minutes.

I described any behavioral trait (perching height, perching site, flight distance, interaction with conspecifics and other insects) into a hand-held tape-recorder. Observations were made through 8X Bushnell Elite close-focusing binoculars from a distance of 3–4 meters.

On five dates in 2002, I made opportunistic observations on the orientation of perched Seaside Dragonlets with respect to the wind direction. On each occasion, the wind was either from the northeast or southwest so that a considerable fetch resulted. Wind speeds varied from 8 to 16 km per hour on each day.

When I found a perched Seaside Dragonlet, I recorded the quadrant in which its head was directed relative to the wind. For a southwesterly wind, a dragonfly with its head oriented between south and west was scored as upwind. Similarly, a dragonfly oriented between north and east was scored as downwind. Dragonflies oriented between west and north or between east and south were scored as lateral to the wind. Some observations were made from upwind, others downwind and yet others lateral, eliminating any possible bias in direction of my presence on the orientation of the dragonflies. Two sets of observations were made in the morning, one at noon, and two in the mid-afternoon. Thus, orientation with respect to the sun was not a confounding variable.

Oviposition occurred in the many salt pannes in the marsh. To describe oviposition behavior, I stood near the edge of one or more salt pannes and made observations with binoculars, recording data with the tape-recorder.

The adjective that best describes Seaside Dragonlet behavior in this study is lethargic. These dragonflies spent the vast majority of their time perched. Most perched on a culm of *Spartina alterniflora* at a height of 5–10 cm above the marsh surface, although occasionally one perched on *S. patens* thatch that had accumulated on the marsh surface.

Observations of focal individuals indicate that Seaside Dragonlets usually spent more than 99% of their time perched ($n = 37$ [20 males, 17 females]). Of four randomly drawn individuals, a female stayed perched for 55 minutes, a second female made four 3-second flights in 36 minutes, a male made five 3-second flights in 10 minutes and 45 seconds, and a second male made four 3-second flights in 30 minutes. The proportions of the observation period these four individuals spent in flight are 0%, 0.1%, 1.4% and 0.7%. All flights were less than 30 cm in distance, and the dragonfly returned to its original perch in each case.

The sedentary nature of Seaside Dragonlets is striking when compared to other dragonflies in Weskeag Marsh (the libellulids *Libellula pulchella* Drury [Twelve-spotted Skimmer], *Plathemis lydia* (Drury) [Common Whitetail], and *Sympetrum vicinum* (Hagen) [Autumn Meadowhawk], as well as the corduliid *Epitheca cynosura* (Say) [Common Baskettail]). A few comparable rates of perching time in libellulid dragonflies are available in the literature. Campanella and Wolf (1974) showed male Common Whitetails flew 36–68% of the time. Pezalla (1979) found that Twelve-spotted Skimmers spent 64–82% of their time in flight (patrol flights or pursuit flights). Fried and May (1983) showed male *Pachydiplax longipennis* (Burmeister) (Blue Dashers) spent 24–56% of their time in flight.

The short flights made by focal individuals were not impelled by the presence of a conspecific. These forays may have been survey flights or foraging flights (prey items were not seen).

No evidence of territorial behavior by Seaside Dragonlets at Weskeag Marsh was found. Males were frequently observed to be perched within 1 m of each other. On 10 July 2001, four males were seen perched together adjacent to a pool within

a 3-m² area without interacting. On 1 July 2002, a male Seaside Dragonlet flew up and chased a Common Baskettail that was flying over the marsh; the male did not respond to another perched Seaside Dragonlet less than a meter away. I recorded two brief aerial encounters of uncertain function of two Seaside Dragonlets on the same date. Otherwise, aggressive interactions between males were not observed away from oviposition sites.

Table 1 presents data on perching orientation of Seaside Dragonlets with respect to the wind. If the perching orientations were randomly distributed, one would expect a ratio of 1:1:2 for upwind, downwind, and lateral orientations. The upwind and downwind orientations each include 90° of the compass, and the lateral orientation includes 180° of the compass. The observed distribution is statistically different from random by a chi-square test ($\chi^2 = 19.32$, $P < 0.001$).

Pairs of Seaside Dragonlets in tandem flew from the marsh to the pools dotting the marsh. Despite diligent efforts, I was never able to discover where pairing of males and females took place. Coupling presumably takes place on the marsh surface before the tandems approach the salt panne for oviposition.

Each tandem flew over the surface of the pool with the female spanking the water smartly with her abdomen. Oviposition usually occurred in mats of algae growing on the surface of the pool. A pair in tandem would fly over the pool and periodically fly slowly for periods of four to 48 seconds over an acceptable oviposition site. The mean number of dips of the female's abdomen per second was 2.1 (± 0.18 [s.d.]).

Tandems were often attacked by solitary males in flight over the surface of the pool. I never saw a solitary male succeed in uncoupling a tandem, however.

Adult dragonflies can be classified behaviorally as perchers or fliers (Corbet 1999). Fliers, such as most members of the family Aeshnidae, spend much of their time in flight. Perchers, including most libellulids, alternate between flying and perching, often on the same perch. Seaside Dragonlets, libellulid dragonflies, are clearly perchers. However, the time spent on a perch is extraordinarily long in Weskeag Marsh with most individuals spending less than 1% of their time in flight.

With a length of only 28–35 mm (Dunkle 1989, 2000), Seaside Dragonlets are weak fliers. Their reluctance to fly may be an adaptation to minimize predation from birds, other odonates, spiders, and other predators. Seaside Dragonlets were the only odonates that I saw captured in the many spider webs found at Weskeag Marsh, perhaps an indication of its weak flying ability.

I found no evidence of territorial behavior of Seaside Dragonlets at Weskeag Marsh. This report differs from the only information I can find in the literature on adult behavior of Seaside Dragonlets: a single sentence in a field guide (Dunkle 1989) stating that Seaside Dragonlet males in Florida perch near pools and defend about 5 m of shoreline.

Table 1. Orientation of Seaside Dragonlets relative to the wind direction on five days at Weskeag Marsh, South Thomaston, ME.

Date	Wind direction	Upwind	Downwind	Lateral
7/8/02	SW	1	0	0
7/10/02	NE	4	0	0
7/22/02	NE	8	1	0
7/26/02	NE	6	3	2
8/13/02	SW	5	1	0
Total		24	5	2

The lack of territoriality in the Maine population contrasted with territorial populations further south suggests that a biogeographic study of Seaside Dragonlets could be profitable. In Weskeag Marsh, the only aggressive interactions predictably observed were solitary males attempting to break-up ovipositing tandems flying over the salt pannes.

Seaside Dragonlets perch preferentially with their head into the dominant wind direction (Table 1). A reasonable hypothesis for this orienting behavior is the generation of lift when a Seaside Dragonlet takes flight. Odonate wings are fusiform in cross-section and therefore can generate lift through the Bernoulli effect when facing into the wind (Alexander 2002).

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