
The Aquatic Insects of Northern Florida's Gulf Coast Tidal Marshes

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Many species of insects associated with Florida's Gulf coast tidal marshes are dependent upon the water for development. A number of these (especially species of Diptera, such as mosquitoes, sandflies, horseflies, and deerflies) are important nuisance species to both man and animals. These aquatic insects form an important part of the tidal salt marsh ecosystem.

Anyone who has spent any time at all in or around northern Florida's Gulf coast tidal marshes is acutely aware that insects are associated with the marshes. Mosquitoes, sandflies or "no-see-ums," dog flies, deer flies, yellow flies, and horse flies are extremely common and make their presence known to the intruder in an unmistakable way.

These ubiquitous biting inhabitants of the tidal marshes, all of which belong to the insect order Diptera (the true flies), along with other insects (such as dragonflies), are often dependent on water for a developmental habitat. The immature stages of most of these insects are spent in the water or mud substrate of the marsh until they are ready to emerge as adults. After this transformation, they feed on and interact with man and other animals and reproduce, continuing the cycle with their aquatic offspring.

This appendix deals only with those insect inhabitants of Florida's Gulf coast tidal marshes that are usually thought of as truly "aquatic"; viz, those directly dependent upon water for completion of the immature stages of their life cycles. The terrestrial insect fauna are addressed in Chapter 7.

Aquatic Insects

Sandflies

Diptera: Ceratopogonidae

Sandflies are fierce biters and often make a visit to the tidal marshes an excruciatingly painful and unpleasant experience. The females of most species of the common sandfly genus *Culicoides* depend for maturation of their eggs on blood meals which they take by biting vertebrates. Male *Culicoides* (and females of *C. bermudensis*) do not take blood meals; hence they do not bite. Males, and sometimes females, feed on nectar of flowering plants. Larvae of *Culicoides* are not strictly aquatic, but they cannot develop without water. They feed primarily on living food (motile algae and small invertebrates). The larvae of few species can exist at a depth of more than a few centimeters below the air-water interface.

Sandflies can be vectors of several diseases (especially protozoal and viral), affecting birds and mammals (Blanton and Wirth, 1979). It is not known if the sandflies of northern Florida's Gulf coast tidal marshes are important disease vectors.

In the tidal salt marshes of northern Florida's Gulf coast, which are characterized by the growth of black needlerush (*Juncus roemerianus* Scheele), *C. mississippiensis* is the predominant sandfly, and there are lesser numbers of *C. furens*, *C. melleus*, and *C. bermudensis* (Blanton and Wirth, 1979).

Culicoides bermudensis Williams

The sandfly *C. bermudensis* breeds in salt marshes associated with salt spikegrass (*Distichlis spicata* [L.] Greene), in salt marsh pools, and in mud covered with mangroves. Because the females of *C. bermudensis* do not take blood meals, they are not biting pests.

Culicoides furens (Poey)

The sandfly *C. furens* commonly breeds in mangrove swamps and in those northern Florida's Gulf coast tidal salt marshes dominated by smooth cordgrass (*Spartina alterniflora* [Loisel]). The larvae probably feed primarily on living food.

Culicoides melleus (Coquillett)

Females of the sandfly *C. melleus* oviposit on the upper intertidal portion of the beaches. The nymphs are predators on protozoa, motile algae, and small invertebrates.

Culicoides mississippiensis Hoffman

The sandfly *C. mississippiensis* breeds in northern Florida's Gulf coast tidal salt marshes.

Other Sandflies

Rey and McCoy (1986) reported the presence of four species of the sandfly genus *Dasyhelea*, and one species each of the sandfly genera *Forcipomyia*, *Atrichopogon*, *Bezzia*, and *Stilobezzia* in the St. Marks National Wildlife Refuge salt marshes.

Mosquitoes

Diptera: Culicidae

The two most important and dominant salt marsh mosquitoes found along the more than 2000-km coastline of Florida are the black salt marsh mosquito (*Aedes taeniorhynchus* [Wiedemann]) and the eastern salt marsh mosquito (*A. sollicitans* [Walker]) (Nayar, 1985), which at one time made many areas of Florida virtually uninhabitable because of their density and fierce biting habits. The two species are extremely common in northern Florida's Gulf coast tidal marshes.

These two species of mosquito have been shown to have the potential to be good to excellent vectors of human encephalitis and the dog heartworm (*Dirofilaria immitis*) and may be important in the spread of these diseases (King et al., 1960).

Aedes (Ochlerotatus) sollicitans (Walker)

The larvae and adults of the mosquito *A. sollicitans* may be found any time during the year. The adults are strong fliers and often migrate in large numbers to communities many miles from the saltwater marshes in which they breed. The females are persistent biters and will attack any time during the day or night. The adults rest in the vegetation during the daytime and will attack anyone invading their haunts, even in full sunlight (Carpenter and LaCasse, 1955).

The females lay their eggs (which can withstand long periods of dryness) on the mud of the moist marshes, and the eggs hatch when flooded by high tides or rains (Matheson, 1944; King et al., 1960).

Aedes (Ochlerotatus) taeniorhynchus (Wiedemann)

The larvae and adults of the mosquito *A. taeniorhynchus* may be found any time during the year in the extreme south, but populations are usually heavier following high tides or heavy rains during the summer and early fall. The most prolific breeding in the northern Florida salt marshes occurs in temporary ponds and holes in areas dominated by the salt marsh plants *Batis* and *Distichlis* (King et al., 1960). Like *A. sollicitans*, the females rest in the vegetation during the daytime, are fierce and persistent biters, and will attack any time during the night or day, even in full sunlight. The adults of this species are strong fliers

and may be an extreme nuisance many miles from the saltwater marshes in which they breed (Carpenter and LaCasse, 1955).

Other Mosquitoes

Rey and McCoy (1986) also reported the mosquito species *Anopheles atropos* Dyar & Knab, *Anopheles bradleyi* King, and *Culex salinarius* Coquillett as not uncommon in the St. Marks National Wildlife Refuge salt marshes, although these mosquitoes are not considered to be important nuisance species.

Other Diptera

Blind Midges (Diptera: Chironomidae)

The larvae of the blind midge family Chironomidae pass their life in the water. Several species of chironomid midges have been collected or reared from northern Florida's Gulf coast tidal marshes (J. Epler, personal communication). *Apedilum elachistus* Townes, *Dicrotendipes lobus* (Beck), and *Goeldichironomus devineyae* (Beck) breed in pools in the tidal marsh. *Cunio marshalli* Stone and Wirth and *Chironomus* sp. also breed in the marsh. *Dicrotendipes modestus* (Say), *Goeldichironomus holoprasinus* (Goeldi), and *Polypedilum* sp. have been collected in the marshes, but whether or not they breed there is unknown. These blind midges do not bite, but sometimes may become a nuisance because of the large numbers in which they can emerge.

Crane Flies (Diptera: Tipulidae)

Tipulidae, the largest family of Diptera, usually have aquatic larvae which directly depend on atmospheric oxygen and cannot venture far from the water surface. Usually, the larvae leave the water to pupate in nearby soil or litter (Byers, 1978). Rey and McCoy (1986) reported the tipulid species *Limonia floridana* (Osten Sacken) and another undetermined species as uncommon in the St. Marks National Wildlife Refuge salt marshes. Crane flies do not bite and are not considered a nuisance to humans or animals.

Horse Flies and Deer Flies (Diptera: Tabanidae)

Horse flies and deer flies are often painful biters and can be a severe nuisance to vertebrates (including man) in the marsh, especially in late summer and early fall. Adult females lay egg-masses on vegetation close to moist soil suitable for larval development. Principally daylight feeders, the females of most species require a blood meal for development of eggs (Axtell, 1976; Jones and Anthony, 1964). Tabanid larvae are commonly found in areas dominated by *Spartina* and relatively few are found in *Juncus* areas.

Rey and McCoy (1986) reported the tabanid species *Tabanus nigrovittatus* Macquart as common and *Chrysops fuliginosus* Wiedemann and *Chrysops*

atlanticus Pechuman as uncommon in the St. Marks National Wildlife Refuge salt marshes. The larvae of *T. nigrovittatus* tend to congregate in areas of the marsh reached only by high tide. *C. atlanticus* may not actually breed in the salt marsh, but in nearby fresh water (Jones and Anthony, 1964).

Other Aquatic Insects

Many of the insect orders traditionally thought of as aquatic are poorly adapted to and rarely found in heavily saline habitats and are usually lacking from the salt marsh fauna. In particular, the Ephemeroptera (mayflies), the Trichoptera (caddisflies), and the Plecoptera (stoneflies), almost all species of which require water for development of the immature stages, do not occur in northern Florida's Gulf coast tidal marshes (Berner and Pescador, 1988; Leader, 1976; Stark and Gaufin, 1979).

Except for the seaside dragonlet (*Erythrodiplax berenice* [Drury], Dunkle (1989) does not report any dragonflies (Odonata), another water-dependent group, breeding in the northern Florida Gulf coast tidal marshes, although dragonfly adults of several species often perch on *Juncus* stems and apparently feed on small insects flying over the marsh. Except for the seaside dragonlet, the only true saltwater dragonfly in North America, these dragonflies probably breed in nearby brackish and freshwater habitats and enter the marshes only for feeding.

Other groups of insects which are often referred to as "aquatic" (e.g., the order Megaloptera, some groups of Diptera, and some members of the orders Collembola, Coleoptera, Hemiptera, Hymenoptera, Lepidoptera, and Neuroptera) are not dealt with here because of an unfortunate lack of knowledge of this fauna in northern Florida's Gulf coast tidal salt marshes. Many of these groups probably do not occur in the tidal salt marshes. Further general information on salt marsh and marine insects is provided by Cheng (1976).

Effects of Aquatic Insect Control on the Salt Marsh

Attempts—many successful—to control the nuisance aquatic insects in tidal salt marshes have induced important changes to salt marshes in many cases and have the potential for even more. In many places, attempts to control populations of mosquitoes and sandflies have involved extensive modification of the tidal salt marsh environment. Ditching and diking are two important methods often used to control these insects. Both of these methods have been used for some time and result in a major change in the salt marsh and the function of its associated ecosystem. Habitat control has proved of little use in control of

tabanids in the salt marsh. The extensive use of pesticides in and around salt marshes for control of mosquitoes, sandflies, and tabanids has resulted in the introduction of a great deal of toxic material into the ecosystem, with a generally unknown effect on nontarget organisms.

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A Model from the
Gulf of Mexico

Editors

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