



United States Department of the Interior

FISH AND WILDLIFE SERVICE

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August 14, 2006

Michael B. Murray
Superintendent
Cape Hatteras National Seashore
National Park Service
1401 National Park Drive
Manteo, North Carolina 27954

Subject: Biological Opinion for Cape Hatteras National Seashore's Interim Protected Species Management Strategy

Dear Superintendent Murray:

This transmits the U.S. Fish and Wildlife Service (USFWS) Raleigh Field Office's biological and conference opinions based on our review of the Cape Hatteras National Seashore's (CAHA) proposed Interim Protected Species Management Strategy (Strategy) located in Dare and Hyde Counties, North Carolina. These opinions assess the effects of the Strategy on the piping plover (*Charadrius melodus*) of the Atlantic Coast, Great Lakes and Great Plains populations; seabeach amaranth (*Amaranthus pumilus*); and loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) sea turtles. These opinions are provided in accordance with section 7(a)(2) of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). This document addresses the requirements of the Act but does not address other environmental statutes such as the National Environmental Policy Act or Fish and Wildlife Coordination Act. Your January 6, 2006 request for formal consultation was received on January 9, 2006.

We appreciate the time and effort that went into the preparation of the Strategy and your cooperation throughout the consultation process. If you have any questions about these opinions, please contact me at (919) 856-4520 extension 11, or via email at Pete_Benjamin@fws.gov.

Sincerely,

/signed/

Pete Benjamin
Field Supervisor

Attachment

The recovery objectives for Kemp's ridley sea turtles (USFWS and NMFS, 1992) include: to continue complete and active protection of the known nesting habitat, and the waters adjacent to the nesting beach and continue the bi-national protection project; essentially eliminate mortality from incidental catch in commercial shrimping in the U.S. and Mexico through use of turtle excluder devices and to achieve full compliance with the regulations requires such devices; and to attain a population of at least 10,000 females nesting in a season. In addition, all priority one tasks identified in the recovery plan must be successfully implemented (USFWS and NMFS, 1992).

No critical habitat has been designated for the Kemp's ridley sea turtle.

B. Life History

Piping plover

Piping plover breeding activity begins in mid-March when birds begin returning to their nesting areas (Coutu et al., 1990; Cross, 1990; Goldin, 1990; MacIvor, 1990; Hake 1993). Males establish and defend territories and court females (Cairns, 1982). Piping plovers are monogamous, but usually shift mates between years (Wilcox, 1959; Haig and Oring, 1988; MacIvor, 1990), and less frequently between nesting attempts in a given year (Haig and Oring, 1988; MacIvor, 1990; Strauss, 1990). Plovers are known to begin breeding as early as one year of age (MacIvor, 1990; Haig, 1992); however, the percentage of birds that breed in their first adult year is unknown. Observations suggest that this species exhibits a high degree of nest site fidelity (Wilcox, 1959; Haig, 1985; Haig and Oring, 1988).

Piping plover nests can be found above the high tide line on coastal beaches, on sand flats at the ends of sand spits and barrier islands, on gently sloping foredunes, in blowout areas behind primary dunes, and in washover areas cut into or between dunes. The birds may also nest on areas where suitable dredge material has been deposited. Nest sites are shallow, scraped depressions in substrates ranging from fine-grained sand to mixtures of sand and pebbles, shells or cobble (Bent, 1929; Burger, 1987a; Cairns, 1982; Patterson, 1988; Flemming et al., 1990; MacIvor, 1990; Strauss, 1990). Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass or other vegetation (Patterson, 1988; Flemming et al., 1990; MacIvor, 1990). Plover nests may be very difficult to detect, especially during the 6- to 7-day egg-laying phase when the birds generally do not incubate (Goldin, 1994).

Eggs may be present on the beach from early April through late July. Clutch size for an initial nest attempt is usually four eggs, one laid every other day. Eggs are pyriform in shape, and variable buff to greenish brown in color, marked with black or brown spots. The incubation period usually lasts 27 to 28 days. Full-time incubation usually begins with the completion of the clutch and is shared equally by both sexes (Wilcox, 1959; Cairns, 1977; MacIvor, 1990). Eggs in a clutch usually hatch within 4 to 8 hours of each other, although the hatching period of one or more eggs may be delayed by up to 48 hours (Cairns, 1977; Wolcott and Wolcott, 1999).

Piping plovers generally fledge only a single brood per season, but may renest several times if previous nests are lost. Chicks are precocial (Wilcox, 1959; Cairns, 1982). They may move hundreds of yards from the nest site during their first week of life (e.g., see Table 1 in USFWS, 1996a), and chicks may increase their foraging range up to 3,000 feet before they fledge (are able to fly) (Loefering, 1992). Chicks remain together with one or both parents until they fledge at 25 to 35 days of age. Depending on date of hatching, flightless chicks may be present from mid-May until late August, although most fledge by the end of July (Patterson, 1988; Goldin, 1990; MacIvor, 1990; Howard et al., 1993).

Cryptic coloration is a primary defense mechanism for this species; nests, adults, and chicks all blend in with their typical beach surroundings. Chicks sometimes respond to vehicles and/or pedestrians by crouching and remaining motionless (Cairns, 1977; Tull, 1984; Goldin, 1993b; Hoopes, 1993). Adult piping plovers also respond to intruders (avian and mammalian) in their territories by displaying a variety of distraction behaviors, including squatting, false brooding, running, and injury feigning. Distraction displays may occur at any time during the breeding season but are most frequent and intense around the time of hatching (Cairns, 1977).

Plovers feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent, 1929; Cairns, 1977; Nicholls, 1989). Important feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sand flats, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, or salt marshes (Gibbs, 1986; Coutu et al., 1990; Hoopes et al., 1992; Loefering, 1992; Goldin, 1993a; Elias-Gerken, 1994). Studies have shown that the relative importance of various feeding habitat types may vary by site (Gibbs, 1986; Coutu et al. 1990; McConnaughey et al., 1990; Loefering, 1992; Goldin, 1993a; Hoopes, 1993; Elias-Gerken, 1994) and by stage in the breeding cycle (Cross, 1990). Adults and chicks on a given site may use different feeding habitats in varying proportion (Goldin, 1990). Feeding activities of chicks are particularly important to their survival. Most time budget studies reveal that chicks spend a high proportion of their time feeding. Cairns (1977) found that piping plover chicks typically tripled their weight during the first two weeks post-hatching; chicks that failed to achieve at least 60 percent of this weight gain by the twelfth day were unlikely to survive.

During courtship, nesting, and brood rearing, feeding territories are generally contiguous to nesting territories (Cairns, 1977), although instances where brood-rearing areas are widely separated from nesting territories are common. Feeding activities of both adults and chicks may occur during all hours of the day and night (Staine and Burger, 1994), and at all stages in the tidal cycle (Goldin, 1993a; Hoopes, 1993).

Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (USFWS, 1996a). Some mid-continent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert, 2006); use of inland stopovers during migration is also documented, (Pompei and Cuthbert, 2004).

While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to wintering or breeding, information about the energetics of avian migration indicates that this might be a particularly critical time in

the species' life cycle. The possibility of lower survival rates for Atlantic Coast piping plovers breeding at higher latitudes (based on relationships between population trends and productivity) suggest that migration stress may substantially affect survival rates of this species (Hecht, 2006a, pers. comm.). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (CALO, 2003; Noel et al., 2005; CAHA, 2006a; Stucker and Cuthbert, 2006). In addition, this species exhibits a high degree of both intra- and inter-annual wintering site fidelity (Drake et. al., 2001; Noel et al., 2005; Stucker and Cuthbert, 2006).

A growing body of information shows that overwash-created and -perpetuated habitats, including accessible bayside flats, unstabilized and recently healed inlets, and moist sparsely vegetated barrier flats, are especially important to piping plover productivity and carrying capacity in the New York-New Jersey and Southern recovery units.

In New Jersey, Burger (1994) studied piping plover foraging behavior and habitat use at three sites that offered the birds: ocean, dune, and backbay habitats. The primary focus of this study was on the effect of human disturbance on habitat selection, and it found that both habitat selection and foraging behavior correlated inversely with the number of people present. In the absence of people on an unstabilized beach, plovers fed in ocean and bayside habitats in preference to the dunes. Burger concludes that protection of the entire beach ecosystem with high habitat diversity will help mitigate competition with human beach recreation.

Loefering and Fraser (1995) found that chicks on Assateague Island, Maryland that were able to reach bay beaches and the island interior had significantly higher fledgling rates than those that foraged solely on the ocean beach. Higher foraging rates, percentage of time spent foraging, and abundance of terrestrial arthropods on the bay beach and interior island habitats supported their hypothesis that foraging resources in interior and bayside habitats are key to reproductive rates on that site. Their management recommendations stressed the importance of sparsely vegetated cross-island access routes maintained by overwash, and the need to restrict or mitigate activities that reduce natural disturbance during storms.

Dramatic increases in plover productivity and breeding population on Assateague since the 1991-92 advent of large overwash events corroborate Loefering and Fraser's conclusions. Piping plover productivity, which had averaged 0.77 chicks per pair during the five years before the overwash, posted an average of 1.67 chicks/pair in 1992-96. The nesting population on the northern five miles of the island also grew rapidly, doubling by 1995 and tripling by 1996, when 61 pairs nested there (MacIvor, 1996). Habitat use is primarily on the interior and bayside.

In Virginia, Watts et al. (1996) found that piping plovers nesting on 13 barrier islands between 1986 and 1988 were not evenly distributed along the islands. Beach segments used by plovers had wider and more heterogeneous beaches, fewer stable dunes, greater open access to bayside foraging areas, and in proximity to mudflats. They note that characteristics of beaches selected by plovers are maintained by frequent storm disturbance.

At Cape Lookout National Seashore in North Carolina, 32 to 39 pairs of plovers have nested on North and South Core Banks each year since 1992. While these unstabilized barrier islands total

44 miles long, nesting distribution is patchy, with all nests clustered on the dynamic ends of the barrier islands, recently closed and sparsely vegetated “old inlets,” expansive barrier mudflats, or new ocean-to-bay overwashes. During a 1990 study, 96 percent of brood observations were on bay tidal flats, even though broods had access to both bay and ocean beach habitats (McConnaughey et al., 1990).

At CAHA, distribution of nesting piping plovers is also “clumped,” with nesting areas characterized by a wide beach, relatively flat intertidal zone, brackish ponds, and temporary pools formed by rainwater and overwash (Coutu et al., 1990).

Notwithstanding the importance of bayside (soundside) flats, ephemeral pools, and sparsely vegetated barrier flats for piping plover nest site selection and chick foraging, ocean inter-tidal zones are used by chicks of all ages, even in the southern portion of the Atlantic Coast breeding range. Between 1993 and 1996 on the Maryland end of Assateague Island, for example, four to 12 percent of annual observations (n = 368 to 599) of plover broods occurred on the ocean beach (NPS and Maryland DNR, 1993-1996). A three-year study of piping plover chick foraging activity at six sites on four Virginia barrier islands (Cross and Terwilliger, 2000) documented chick use of the ocean intertidal zone at three of six study sites. Furthermore, the total observations at the three sites where chicks were not observed in the ocean intertidal zone had fewer total observations. Intensive observations at Chincoteague National Wildlife Refuge Overwash Zone in 1994, where chicks had unimpeded access to a large, quality undisturbed bayside flat, documented occasional (1 to 5) visits to the ocean intertidal zone by six of eleven broods ranging in age from one to 24 days (Hecht, 2004, in litt.).

Factors affecting the Piping plover during its life cycle

Predation has been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites (Burger, 1987a; MacIvor, 1990; Cross, 1991; Patterson et al., 1991; Elias-Gerken, 1994). As with other limiting factors, the nature and severity of predation is highly site specific. Predators of piping plover eggs and chicks include foxes, skunks, raccoons, rats, opossums, crows, gulls, grackles, American kestrels, domestic and feral dogs and cats, and ghost crabs.

Substantial evidence exists that human activities are affecting types, numbers, and activity patterns of predators, thereby exacerbating natural predation. Non-native species such as feral cats and rats are considered significant predators on some sites (Goldin et al., 1990; Post, 1991). Humans have also indirectly influenced predator populations; for instance, human activities abetted the expansions in the populations and/or range of other species such as gulls (Drury, 1973; Erwin, 1979). Strauss (1990) found that the density of fox tracks on a beach area was higher during periods of more intensive human use.

Predation and nest abandonment because of predators have been implicated as a cause of low reproductive success (Cooper, 1990; Coutu et al., 1990; Kuklinski et al., 1996). Predator trails (of foxes, dogs, and cats) have been seen around areas of the last known location of piping plover chicks. Predatory birds also are relatively common during their fall and spring migration along the Atlantic Ocean coastline, and there is a possibility they may occasionally take piping

plovers.

Piping plover habitats (breeding and non-breeding) are dependent on natural forces of creation and renewal. However, storms and severe cold weather are believed to take their toll on piping plovers. After an intense snowstorm swept the entire North Carolina coast in late December 1989, high mortality of many coastal bird species was noted (Fussell, 1990). Piping plover numbers decreased significantly from about 30 to 40 birds down to 15 birds. While no dead piping plovers were found, circumstantial evidence suggests that much of the decrease was mortality (Fussell, 1990). Hurricanes may also result in direct mortality or habitat loss, and if piping plover numbers are low enough or if total remaining habitat is very sparse relative to historical levels, population responses may be impaired even through short-term habitat losses. Wilkinson and Spinks (1994) suggest that, in addition to the unusually harsh December 1989 weather, low plover numbers seen in South Carolina in January 1990 (11 birds, compared with more than 50 during the same time period in 1991 to 1993) may have been influenced by effects on habitat and food availability caused by Hurricane Hugo which came ashore there in September 1989. Hurricane Elena struck the Alabama Coast in September 1985 and subsequent surveys noted a reduction of foraging intertidal habitat on Dauphin and Little Dauphin Islands (Johnson and Baldassarre, 1988). Birds were observed foraging at Sand Island, a site that was used little prior to the hurricane.

Unrestricted use of motorized vehicles on beaches is a serious threat to piping plovers and their habitats. Vehicles can crush eggs (Wilcox, 1959; Tull, 1984; Burger, 1987b; Patterson et al., 1991; Shaffer and Laporte, 1992) as well as adults and chicks. Plover nests and eggs are particularly vulnerable to destruction during the 6 to 7 day egg-laying phase prior to initiation of full-time incubation. However, the mobility of newly hatched chicks and adults does not lessen the susceptibility to destruction by vehicles. For example, in Massachusetts and New York, biologists documented 14 incidents in which 18 chicks and two adults were killed by vehicles between 1989 and 1993 (Melvin et al., 1994). Goldin (1993b) compiled records of 34 chick mortalities (30 on the Atlantic Coast and four on the Northern Great Plains) due to vehicles. Biologists that monitor and manage piping plovers believe that many more chicks are killed by vehicles than are found and reported (Melvin et al., 1994). Beaches used by vehicles during nesting and brood-rearing periods generally have fewer breeding plovers than available nesting and feeding habitat can support. In contrast, plover abundance and productivity has increased on beaches where vehicle restrictions during chick-rearing periods have been combined with protection of nests from predators (Goldin, 1993b; Melvin, 2006b, pers. comm.).

Typical behaviors of piping plover chicks increase their vulnerability to vehicles. Chicks frequently move between the upper berm or foredune and feeding habitats in the wrack line and intertidal zone. These movements place chicks in the paths of vehicles driving along the berm or through the intertidal zone. Chicks stand in, walk, and run along tire ruts, and sometimes have difficulty crossing deep ruts or climbing out of them (Eddings et al., 1990; Strauss, 1990; Howard et al., 1993). Chicks sometimes stand motionless or crouch as vehicles pass by, or do not move quickly enough to get out of the way (Tull, 1984; Hoopes et al., 1992; Goldin, 1993b). Wire fencing placed around nests to deter predators (Rimmer and Deblinger, 1990; Melvin et al., 1992) is ineffective in protecting chicks from vehicles because chicks typically leave the nest within a day after hatching and move extensively along the beach to feed.

Jones (1997) studied piping plovers on Cape Cod National Seashore in Massachusetts, and observed that unfledged chicks ranged over 600 feet of beach length on average and that vehicle closures would need to encompass at least 1,500 feet from nest sites in order to protect 95 percent of broods until fledging. Rapid chick movements are possible, with downy chicks observed crossing 81 feet in 12 seconds and 10-day old chicks capable of moving 180 feet in 26 seconds (Wilcox, 1959). Three out of 14 incidents in which plover chicks were killed by vehicles between 1989 and 1993 in Massachusetts and New York occurred despite the presence of monitors stationed on the beach to guide vehicles past (Melvin et al., 1994). In a 1996 incident on Long Island, New York, a chick darted in front of a vehicle and was killed in full view of two monitors who had just informed the driver that it was safe to proceed (Hecht, 2006b, in litt.). Despite continuous daylight monitoring of nests and broods at the Overwash Zone, Chincoteague National Wildlife Refuge in Virginia in 1999, an experienced plover biologist traveling along the oceanside beach enroute to another site spotted four chicks from a previously undetected nest standing in vehicle ruts in an area open to ORV travel. Absent the fortuitous presence of this biologist, these chicks would likely have been killed without anyone ever being aware of their existence (Hecht, 2000, in litt.). Following a 2000 incident when a brood of four chicks moved to the ocean intertidal zone before veteran monitors could alert and remove vehicles, the Chincoteague Refuge manager instituted ocean to bay closures within ¼ mile of all unfledged broods (Schroer, 2000, in litt.).

Vehicles also significantly degrade piping plover habitat or disrupt normal behavior patterns. They may harm or harass plovers by crushing wrack into the sand and making it unavailable as cover or a foraging substrate (Hoopes et al., 1992; Goldin, 1993b), by creating ruts that can trap or impede movements of chicks (Jacobs, 1988, in litt.), and by preventing plovers from using habitat that is otherwise suitable (MacIvor, 1990; Strauss, 1990; Hoopes et al., 1992; Goldin, 1993b; Hoopes, 1994). Vehicles that drive too close to the toe of the dune may destroy "open vegetation" that may also furnish important piping plover habitat (Elias-Gerken, 1994). Vehicular and/or pedestrian disturbance that reduces plover use and/or impairs their foraging efficiency on soundside tidal flats is particularly injurious. Multiple studies have shown that bay tidal flats have relatively high indices of arthropod abundance compared with other microhabitats, that piping plover chick peck rates on bay tidal flats are higher than in other microhabitats, and that piping plovers select these habitats in greater proportion than their availability (Loegering and Fraser, 1995; Cross and Terwilliger, 2000; Elias et al., 2000; Houghton, 2005). Zonick (2000) found that ORV density negatively correlated with abundance of roosting plovers on the ocean beach. Studies elsewhere (e.g., Wheeler, 1979) demonstrate adverse effects of ORV driving on soundside beaches on the abundance of infauna essential to piping plover foraging requirements.

Lighting may also negatively affect piping plovers. While the extent that artificial lighting (including vehicle lights) affects piping plovers is unknown, there is evidence that American oystercatcher (*Haematopus palliatus*) chicks and adults are attracted to vehicle headlights and may move toward areas of ORV activity. During a 2005 study at Cape Lookout National Seashore, adult and chick oystercatchers were observed running or flying directly into the headlights of oncoming vehicles, and two two-day old oystercatcher chicks were run over by an

all-terrain vehicle after being observed foraging with the adults near the high tide line at night (Simons et al., 2005).

Pedestrian and non-motorized recreational activities can be a source of both direct mortality and harassment of piping plovers. There are a number of potential sources for pedestrians on the beach, including those individuals driving and subsequently parking on the beach, those originating from off-beach parking areas (hotels, motels, commercial facilities, beachside parks, etc.), and those from beachfront and nearby residences. Essentially, the magnitude of threats to coastal species is particularly significant because vehicles extend impacts to remote stretches of beach where human disturbance would be very slight if access were limited to pedestrians only.

Pedestrians on beaches may crush eggs (Burger, 1987b; Hill, 1988; Shaffer and Laporte, 1992; CACO, 1993; Collazo et al., 1994), or flush plovers from nests exposing their eggs to predators. Concentrations of pedestrians may also deter piping plovers from using otherwise suitable habitat. Ninety-five percent of Massachusetts plovers ($n = 209$) observed by Hoopes (1993) were found in areas that contained less than one person per 2 acres of beach. Elias-Gerken (1994) found that piping plovers on Jones Beach Island, New York, selected beachfront that had less pedestrian disturbance. Sections of beach at Trustum Pond National Wildlife Refuge in Rhode Island were colonized by piping plovers within two seasons of their closure to heavy pedestrian recreation. Burger (1991; 1994) found that presence of people at several New Jersey sites caused plovers to shift their habitat use away from the ocean front to interior and bayside habitats; the time plovers devoted to foraging decreased and the time spent alert increased when more people were present. Burger (1991) also found that when plover chicks and adults were exposed to the same number of people, the chicks spent less time foraging and more time crouching, running away from people, and being alert than did the adults.

Pedestrians may flush incubating plovers from nests, exposing eggs to avian predators or excessive temperatures. Repeated exposure of shorebird eggs on hot days may cause overheating, killing the embryos (Bergstrom, 1991); excessive cooling may kill embryos or retard their development, delaying hatching dates (Welty, 1982). Pedestrians can also displace unfledged chicks (Strauss, 1990; Burger, 1991; Hoopes et al., 1992; Loegering, 1992; Goldin, 1993b), forcing them out of preferred habitats, decreasing available foraging time, and causing expenditure of energy. Cairns (1977) found that piping plover chicks typically triple their weight during the first two week of hatching; chicks that failed to achieve at least 60 percent of this weight gained by day 12 were unlikely to survive.

Fireworks are highly disturbing to piping plovers (Howard et al., 1993). Plovers are also intolerant of kites, particularly as compared to pedestrians, dogs, and vehicles; biologists believe this may be because plovers perceive kites as potential avian predators (Hoopes et al., 1992).

Noncompliant pet owners who allow their dogs off leash have the potential to flush piping plovers and these flushing events may be more prolonged than those associated with pedestrians or pedestrians with dogs on leash. A study conducted on Cape Cod, Massachusetts found that the average distance at which piping plovers were disturbed by pets was 150 feet, compared with 75 feet for pedestrians. Furthermore, the birds reacted to the pets by moving an average of 187 feet, compared with 82 feet when the birds were reacting to a pedestrian, and the duration of the

disturbance behavior stimulated by pets was significantly greater than that caused by pedestrians (Hoopes, 1993). Unleashed dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes et al. 1992), and kill chicks (Cairns and McLaren 1980; Boyagian, 1994, in litt.).

Demographic models for piping plovers indicate that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Melvin and Gibbs, 1994; Amirault et al., 2005). Furthermore, insufficient protection of non-breeding piping plovers has the potential to quickly undermine the progress toward recovery achieved at other sites. For example, a banding study conducted between 1998 and 2004 in Atlantic Canada found lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs, 1996, cited in Appendix E, USFWS, 1996a), Maryland (Loegering, 1992), and Virginia (Cross, 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase abundance despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. over the last 15 plus years (Amirault et al., 2005). Simply stated, this suggests that maximizing productivity does not ensure population increases; management must focus simultaneously on all sources of stress on the population within management control (predators, ORVs, etc.).

Seabeach amaranth

Seabeach amaranth stems are fleshy and pink-red or reddish, with small rounded leaves that are 0.5 to 1.0 inches in diameter. The green leaves, with indented veins, are clustered toward the tip of the stems, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous, borne in clusters along the stems. Germination occurs over a relatively long period, generally from April to July. Upon germinating, this plant initially forms a small unbranched sprig, but soon begins to branch profusely into a clump. This clump often reaches one foot in diameter and consists of five to 20 branches. Occasionally, a clump may get as large as three feet or more across, with 100 or more branches.

Flowering begins as soon as plants have reached sufficient size, sometimes as early as June, but more typically commencing in July and continuing until the death of the plant in late fall. Seed production begins in July or August and peaks in September during most years, but continues until the death of the plant. Weather events, including rainfall, hurricanes, and temperature extremes, and predation by webworms have strong effects on the length of the reproductive season of seabeach amaranth. Because of one or more of these influences, the flowering and fruiting period can be terminated as early as June or July. Under favorable circumstances, however, the reproductive season may extend until January or sometimes later (Radford et al., 1968; Bucher and Weakley, 1990; Weakley and Bucher, 1992).

Factors affecting the Seabeach amaranth during its life cycle

The most serious threats to the continued existence of seabeach amaranth are construction of beach stabilization structures, natural and man-induced beach erosion and tidal inundation, fungi (i.e., white wilt), beach grooming, herbivory by insects and mammals, and off-road vehicles.