Audubon NORTH CAROLINA

September 14, 2015

Via U.S. and Electronic Mail
Mr. Mickey Sugg
U.S. Army Corps of Engineers
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Wilmington, NC 28403
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RE: Figure Eight Island Shoreline Management Project – SAW-2006-41158

Dear Mr. Sugg:

Please accept these comments on behalf of the National Audubon Society's North Carolina State Office regarding the draft Supplemental Environmental Impact Statement (SEIS) for the project known as "Figure Eight Island Shoreline Management Project."

The Figure 8 Island Homeowners Association Board of Director's (HOA) preferred alternative is to construct a ~1,500 foot-long terminal groin on the northern end of Figure 8 Island and to periodically renourish approximately one mile of oceanfront beach and approximately 1,500 feet of back barrier shoreline with sand obtained from adjacent Nixon Channel and three upland spoil islands located at the junction of Nixon Channel and the Atlantic Intracoastal Waterway. This alternative, as well as all other alternatives that include the construction of a terminal groin or any other hard structure (Alternatives 5A-5D), the stabilization of the inlet through channelization (Alternative 3), beach renourishment activities (Alternatives 1, 3-5D), or the dredging or other removal of sand from Rich Inlet or the associated ebb and flood tidal deltas (Alternatives 1, 3-5D) will have significant and lasting negative direct, indirect, and cumulative impacts on birds and other wildlife that depend on the dynamism of mid-Atlantic coastal inlets at critical points in their life cycles.

After reviewing the document and appendices, we find that the SEIS:

1. Fails to consider negative biological impacts of the preferred alternative and other proposed alternatives on federally listed species, state-listed species, Critical Habitat for a federally listed species, and essential habitats for state and federally listed species.
2. Fails to accurately describe the negative physical impacts of a terminal groin (Alternatives 5A-5D), beach renourishment, dredging, and inlet channelization (Alternative 3) on habitats for state and federally listed species.
3. Draws significant conclusions based on questionable models that have already failed to predict current conditions, that the SEIS itself admits should not be used to predict future

conditions, and that experts in the field have stated are being misused in this application.
4. Lacks the basic legal requirements to proceed.
5. Omits or distorts relevant, peer-reviewed, and significant research and data regarding impacts of terminal groins and other engineering practices, as proposed, on wildlife, wildlife habitats, and the physical properties of the project area; and omits the conclusions and recommendations of every relevant Threatened and Endangered species recovery plan.

We believe the SEIS does not satisfy the basic requirements of NEPA and cannot proceed, and no Final Environmental Impact Statement can be issued. Furthermore, due to the numerous, egregious errors and omissions in the SEIS, we recommend that the SEIS be rejected until such a time that the most basic information regarding the alternatives and impacts can be accurately and objectively presented for review and the legal requirements for the project to proceed have been satisfied.

We are also seriously concerned that data used throughout the SEIS and upon which many conclusions are drawn, are not available for public or peer review. For example, a report that was cited several times in the SEIS, “Cleary, W.J. 2009. Rich Inlet: History and inlet related oceanfront and estuarine shoreline changes. Final report submitted to Figure Eight Beach Homeowners Association. 61 p.”, does not exist. Audubon North Carolina contacted Dr. Cleary, CP&E, USACE, and the Figure 8 Island HOA in an attempt to obtain a copy of this report, yet no one could or would produce it, even though it was stated CP&E could answer questions about the content of the report. We were informed by Dr. Cleary, the author, that the report and the data were deliberately “destroyed” when he retired.

The SEIS consistently takes the “make them go somewhere else” approach when addressing the impact of the preferred alternative and most of the other alternatives on birds. It perpetuates the common misconception that breeding and non-breeding shorebirds and waterbirds have alternative places to go when habitat is lost and that, because birds have wings, they will simply move somewhere else. Truth is, the birds are already occupying alternative locations. They have been relentlessly forced to abandon high-quality habitats throughout their range because of habitat loss and degradation. Shorebirds like Piping Plovers, as well as terns and skimmers are now confined to a small fraction of the habitat once available to them, and if alternative locations were available, the birds would already be there. This is reflected in the elevated conservation status of many of the species that depend on inlets and barrier islands, including those that depend on Rich Inlet; nearly all are state listed, federally listed, listed as species of conservation concern, or similarly designated in documents such as the U.S. Shorebird Conservation Plan (Brown *et al.* 2001).

The SEIS is a public document and transparency is essential. All data, modeling, reports, literature cited, and any other information used in preparation of the draft SEIS should be made available to the public for review and analysis. It is clear that the SEIS was not prepared by the responsible federal agency, and it is equally clear that it has not been reviewed for accuracy, environmental impacts, reasonable alternatives, or completeness. As such, the draft SEIS should be rejected.

**Rich Inlet**
Rich Inlet is one of approximately 20 inlets in North Carolina. It is located in southeastern North Carolina between privately developed Figure 8 Island to the south and undeveloped Hutaff Island to the north. Rich Inlet is one of the most stable inlets in the state, having **remained in the same general location for the past two centuries** (Cleary and Marden 1999). The inlet connects with the Atlantic Intracoastal Waterway through Nixon Channel on its south side and Green Channel on its north. Major features in the inlet include extensive ebb and flood tidal deltas and dynamic sandy spits at the north end of Figure 8 Island and south end of Hutaff Island, which have accreted and eroded periodically throughout its recorded history (SEIS Appendix A, Subappendix B, Cleary and Marden 1999). Rich Inlet is also one of the least modified inlets in the state; aside from periodic dredging in Nixon Channel, it has been allowed to exist naturally, unlike the majority of inlets in the state (Rice 2012a). Rich Inlet is part of the Lea-Hutaff Important Bird Area (Golder and Smalling 2011) and is within Piping Plover Critical Habitat Unit NC-11 which includes Lea-Hutaff Island and the emergent shoals and sandbars within Rich Inlet (USFWS 2001).

**Private Property:** Prior to addressing environmental impacts and other considerations, it is necessary to evaluate if the proposed project can be legally constructed.

Similar to the 2012 draft environmental impact statement (DEIS), the SEIS does not demonstrate that the HOA has acquired the easements necessary to construct its preferred alternative. Until such rights have been acquired, this process should be halted and public funds should cease to be used to evaluate a project that cannot legally proceed.

The preferred alternative in the DEIS was a terminal groin that crossed an estimated 15 lots, all of which are privately owned and none of which are owned by the HOA. HOAs do not have the authority to condemn property, so easements are required for construction to occur on all affected properties. Such easements on all properties were not obtained in 2012 and have not since been obtained.

In Alternative 5D, the preferred alternative in the 2015 SEIS, and Alternative 5C, the HOA relocates the terminal groin approximately 420 feet north of its original proposed position. Alternatives 5A and 5B keep the terminal groin in its original location. According to the SEIS, the change was “based upon the potential complications in obtaining all the necessary easements for constructing 5A and 5B, as some of the property owners on the extreme north end of the island were concerned about the position and alignment of Alternatives 5A and 5B” (p. 64).

An examination of the location of the terminal groin in the preferred alternative shows that the groin would still cross about 10 privately owned lots (Figure 1). There is no evidence within the SEIS that the HOA has obtained rights to construct a terminal groin across private property. Easements are only mentioned once elsewhere in the document, in order to state that “the obtaining of an easement for the construction of a terminal groin” was an issue identified in the 2007 scoping process (p. 9).


Figure 1. The terminal groin proposed in Alternative 5D and property lines obtained from New Hanover County's property tax department.

**Geophysical Impacts of Terminal Groins, Other Hard Structures, and Beach Renourishment:** In order to assess environmental impacts, it is necessary to accurately describe how terminal groins and other coastal engineering projects affect inlets and adjacent beaches. The SEIS fails to cite the applicable, most recent scientific literature and fails to accurately describe the impacts a terminal groin, beach renourishment, and inlet channelization would have on Rich Inlet and adjacent areas. Some of the impacts that are insufficiently addressed are the narrowing of downdrift oceanfront beach, loss of sediment from the inlet system, impacts to spits at ends of adjacent islands, loss of critical wildlife habitat, and cumulative impacts of the alternatives, among others. The model outcomes and the predicted results of the preferred alternative—a spit persisting on the north end of Figure 8 Island—are not seen at any other inlet on the U.S. Atlantic coast.

Terminal groins are designed to interrupt longshore transport of sand. It is well documented that terminal groins actually accelerate erosion of the shoreline downdrift of the structure (McDougal *et al.* 1987, Kraus *et al.* 1994, Bruun 1995, Cleary and Pilkey 1996, Komar 1998, McQuarrie and Pilkey 1998, Pilkey *et al.* 1998, Brown and McLachlan 2002, Greene 2002, USACE 2002, Morton 2003, Morton *et al.* 2004, Basco and Pope 2004, Speybroeck *et al.* 2006, Rice 2009, Riggs *et al*. 2009, Riggs and Ames 2011, Ells and Murray 2012, Knapp 2012, Pietrafesa 2012, Berry *et al.* 2013), which in turn requires regular replenishment of sand to compensate for sand loss (Hay and Sutherland 1988, Bruun 1995, McQuarrie and Pilkey 1998, French 2001, Galgano 2004, Basco 2006, Riggs *et al.* 2009, Riggs and Ames 2011, Pietrafesa 2012).

An open letter on the subject of downdrift erosion signed by 43 of the leading coastal geologists in the U.S. states:

*The negative impact of groins and jetties on downdrift shorelines is well understood. When they work as intended, sand moving along the beach in the so-called downdrift direction is trapped on the updrift side, causing a sand deficit and increasing erosion rates on the downdrift side. This well-documented and unquestioned impact is widely cited in the engineering and geologic literature* (Young *et al.* undated).

Fenster and Dolan (1996) found that inlets in Virginia and North Carolina exert influence over adjacent shorelines up to 5.4-13.0 km away and that they are a dominant factor in shoreline change for up to 4.3 km. Permanently modifying Rich Inlet through construction of a terminal groin, or through channelization (Nordstrom 2000), will significantly increase the erosion rate on the downdrift shoreline of Figure 8 Island. Longshore currents run predominantly north to south in the area of Figure 8 Island, placing nearly all of the oceanfront homes on Figure 8 Island in danger from accelerated erosion, should a terminal groin be built.

The SEIS forecasts a five-year interval for beach renourishment for all alternatives that include a terminal groin (Alternatives 5A-D). Despite the well-known downdrift impact of terminal groins, the SEIS does not address the very real likelihood that in response to the terminal groin, the beach will narrow farther to the south and require additional and more frequent beach renourishment over the years. The proposed five-year interval for beach renourishment is also questionable given that Wrightsville Beach, Masonboro Island, Mason Inlet, southern Figure 8 Island, Oregon Inlet, and Ft. Macon, just to name a few, are dredged and replenished more frequently than five-year intervals. **The near certainty that Figure 8 Island will need to mine sand from Rich Inlet and replenish the downdrift beach on Figure 8 Island more frequently than every five years has not been accurately assessed in the preferred or other alternatives presented in the SEIS**.

Downdrift effect can be seen elsewhere in North Carolina where terminal groins have been installed. At Fort Macon, which the SEIS cites as a success, three years after the completion of the terminal groin a beach renourishment project occurred because the groin itself was exacerbating erosion, and from 1973-2007, seven renourishment projects have occurred at Fort Macon at the cost of nearly $45 million (Pietrafesa 2012).

The SEIS also cites Oregon Inlet, NC as an example of a successful terminal groin project that has not "caused adverse impacts to the shoreline" (p. 232). One need only drive Highway 12 along Pea Island to see the fallacy of this conclusion. Riggs and Ames (2011) also provide an excellent review of the impacts of the modifications to Oregon Inlet.

The SEIS relies exclusively on one source—Overton (2011) and personal communications with Overton—to make this assertion. Recent and relevant literature is available, and the conclusions are different than those cited in the SEIS. To minimize impacts of the Oregon Inlet terminal groin on the downdrift shoreline of Pea Island, sediment from routine Oregon Inlet channel dredging has been placed either directly on the Pea Island beach or in shallow nearshore disposal area near northern Pea Island (Riggs and Ames 2011). Human efforts have only temporarily slowed the process of shoreline recession in a small portion of northern Pea Island by the regular addition of dredged sand at a very high cost, but each new beach nourishment project has quickly eroded away (Riggs and Ames 2009, Riggs *et al.* 2009). Based on several studies, the data strongly suggests that the terminal groin itself is contributing to the accelerated erosion and shoreline recession problems on Pea Island (Riggs and Ames 2003, 2007, 2009; Riggs *et al.* 2008, 2009; Mallinson *et al.* 2005, 2008, 2010; Culver *et al.* 2006, 2007; Smith *et al.* 2008).

In addition to impacts on downdrift shorelines, hard structures at inlets permanently remove sand from the inlet system, reducing or eliminating shoal systems from affected inlets (Pilkey *et al.* 1998) and accelerating the loss of saltmarsh in the vicinity of the inlet (Hackney and Cleary 1987). The loss of saltmarsh at Rich Inlet would have significant negative impacts on fisheries, other wildlife, recreation, small businesses, and the local economy. **These impacts and the loss of saltmarsh resulting from removal of sand from Rich Inlet have not been assessed for the preferred or other alternatives in the SEIS.**

The loss of ebb and flood tidal shoals is illustrated clearly by the case of Masonboro Inlet. A terminal groin was installed on the north end of Masonboro Island; construction of the groin was completed in April 1981 (Cleary and Marden 2009). At the time, the north end of the island featured an extensive sand spit, wide beach, and extensive flood and ebb tidal deltas (Figure 2). In less than one year following the completion of the terminal groin, the spit at the north end of Masonboro Island vanished, and the amount of intertidal shoals in the inlet, already diminished by other coastal engineering projects, had decreased as well (Figure 2). Downdrift of the terminal groin, Masonboro Island's oceanfront beach can be seen forming the expected fillet immediately adjacent to the terminal groin, while narrowing significantly along the downdrift beach.

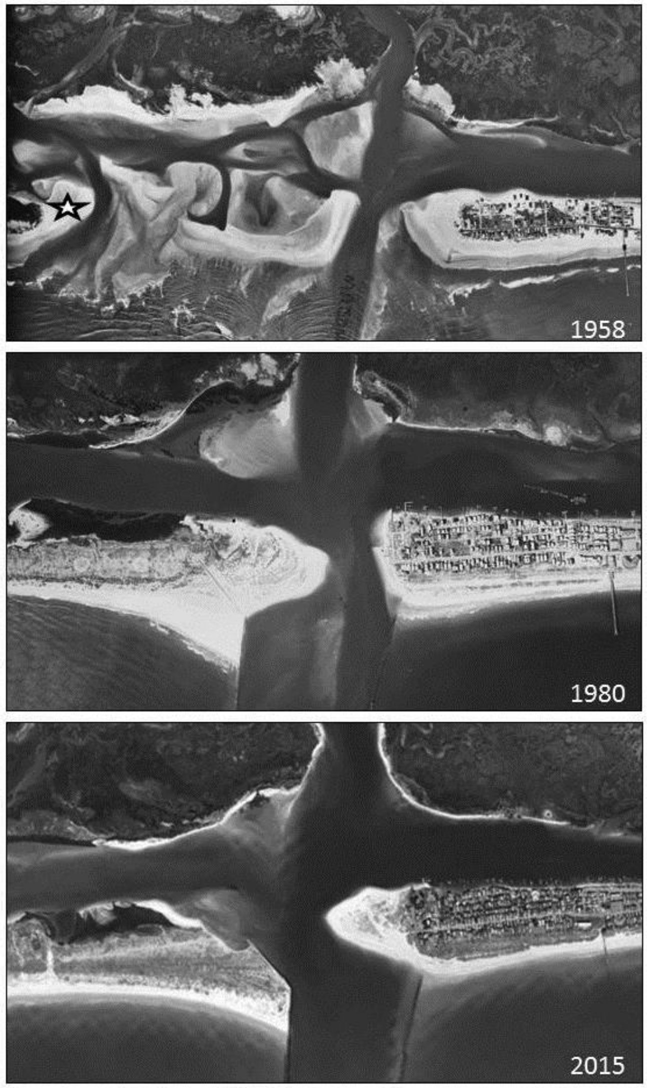


Figure 2. Masonboro Inlet before and after the installation of a terminal groin on the north end of Masonboro Island. The star represents the north end of Masonboro Island.

This situation is analogous to the proposed terminal groin on Figure 8 Island. Not only would the shoals and the sand spit be lost from the north end of Figure 8 Island, but oceanfront beach narrowing would occur downdrift of the groin, placing nearly all oceanfront homes and real estate at risk and increasing the need for more frequent beach renourishment projects.

Despite predictions of losses of shoals and other intertidal habitats in modeling for Alternatives 5A-C under 2012 conditions (see summary table on p. 202), the SEIS predicts that the result of Alternative 5D under 2012 conditions will be the persistence of a smaller spit north of the terminal groin (Figure 5.45b on p. 261). The SEIS states, "The sand spit on the north end of Figure Eight Island experienced some erosion under Alternative 5D, but the mean high water shoreline did not reach the terminal groin" (p. 261). Meanwhile, the modeling reported for Alternatives 5A-5C under 2012 conditions predict that the spit would disappear, resulting in the loss of about 35 acres of current intertidal habitat.

This is a gross underestimate of the amount of habitat that will be lost under all alternatives that include a terminal groin (Alternatives 5A-5D). **The amount of habitat that will be lost is actually approximately 241 acres of high quality habitat that supports shorebirds, including two federally-listed species, plus additional saltmarsh.** The habitat lost would be primarily low-energy shoals and sandbars which provide habitat for a variety of benthic invertebrates that are essential food for shorebirds and fishes, and the sandy spit which is prime nesting habitat. Such a loss constitutes the some of the highest quality habitat in the entire Rich Inlet complex. This disparity in the predicted fate of the spit on the north end of Figure 8 Island is not explained in the SEIS.

This calls into question the utility of the Delft3D models in predicting the responses of Rich Inlet to the placement of a terminal groin or the channelization of the inlet. In comments responding to the 2012 DEIS, experts cited "inappropriate use of models" as one of the major flaws in the document. In practice, the Delft3D models produced with 2006 data failed to accurately predict the state of the inlet in 2012. It is not clear how results that have been proven to be inaccurate can be used to assess environmental impacts, calculate costs, or make any other determinations regarding the proposed project.

Furthermore, in order to see how hard structures affect habitat in real life, we used Google Earth to examine the U.S. Atlantic and Florida Gulf coasts for inlets with one or more hard structures. We found 144 inlets with one or more hard structures; 124 had a terminal groin or a jetty. None of the 124 inlets had a spit extending from the terminal groin or jetty into the inlet as predicted in some of the Delft3D models. In addition, only 26 of the inlets with terminal groins or jetties had apparent intertidal shoals. Reality suggests that if a terminal groin is installed on the north end of Figure 8 Island, whether it is 400 feet to the north or the south, or 200 feet longer or shorter, intertidal habitat will be permanently lost, along with the spit on Figure 8 Island.

The SEIS also fails to address the cumulative impacts of sand mining and the proposed terminal groin at Rich Inlet, and the frequent sand mining at Mason Inlet, on the adjacent downdrift beach. The regular removal of sand from both inlets and the proposed terminal groin at Rich Inlet would disrupt the longshore transport of sand and potentially threaten Wrightsville Beach—the adjacent downdrift shoreline—and the real estate thereon.

There are at least 100 published studies that address the impacts of terminal groins on inlets, beaches, and natural resources. The majority (78%) of peer-reviewed literature we collected regarding the impacts of hard structures at inlets concluded that terminal groins do not function in the manner presented in the SEIS and cause more harm than good. The wealth of literature on the impacts of terminal groins is not discussed nor cited in the SEIS. A complete review of the relevant literature is necessary to accurately and objectively evaluate all alternatives presented in the SEIS.

**Biological Impacts of Terminal Groins, Other Hard Structures, and Beach Renourishment:** The SEIS is extraordinarily flawed in its treatment of environmental impacts to birds. The SEIS fails to accurately and objectively describe the environmental impacts of the alternatives, especially the HOA's preferred alternative on birds and essential habitats for birds. In particular, the SEIS:

- inaccurately summarizes and in some cases omits entirely the vast majority of the scientific literature that is available regarding birds;
- misrepresents, misinterprets, and otherwise fails to accurately summarize data provided by relevant agencies and organizations;
- inaccurately summarizes the direct, indirect, and cumulative impacts to state and federally listed bird species and omits key state-listed species;
- inaccurately summarizes the impacts on habitats for shorebirds, waterbirds, and other wildlife, including severe and permanent adverse impacts to the NC-11 Piping Plover Critical Habitat Unit;
- ignores and disregards the pertinent recommendations of leading scientists, including those made in U.S. Fish and Wildlife Service (USFWS) Threatened and Endangered species recovery plans;
- relies on dubious models that were not intended for this application in order to predict how habitat in Rich Inlet would respond to the alternatives; and
- presents an extraordinary number of factual errors.

Eight alternatives are presented in the SEIS. Four alternatives (5A-5D) include terminal groins that would, as described in the section above, permanently eliminate habitats for nesting, migrating, and wintering birds, and would threaten state and federally listed species. Seven alternatives (1, 3, 4, 5A, 5B, 5C, and 5D) include sand mining in Rich Inlet, primarily in Nixon Channel, that would directly and/or indirectly eliminate foraging habitat required by migrating and wintering shorebirds, threaten nesting habitat for birds, and threaten state and federally listed species. Seven alternatives (1, 3, 4, 5A, 5B, 5C, and 5D) include beach fill, in which dredged material would be placed on oceanfront beach. Placement of dredged sand would adversely impact foraging habitats used by migrating and wintering shorebirds by directly killing their prey species and removing their prey species' habitat.

Therefore, Alternatives 1, 3, 4, 5A, 5B, 5C, and 5D have significant direct, indirect, and cumulative adverse impacts on habitats used by state and federally listed species, including migrating, wintering, and nesting Piping Plovers (federally Threatened), migrating Red Knots (federally Threatened), and other species of shorebirds, as well as negative impacts on nesting terns and Black Skimmers (all beach-nesting species nesting on Figure 8 Island are state-listed with the exception of the Willet).

Natural, unmodified coastal inlets are essential to many shorebird species (sandpipers, plovers, and their allies), as well as other coastal species because they provide the variety of habitat types these species require at critical times of their annual and lifecycles. Inlets have expansive, low-energy intertidal flats which are rich with invertebrate prey that wintering and migrating shorebirds require to fuel their migratory flights, sustain them during winter, and support adults and chicks during the nesting season. Inlets have open, sandy spits that serve as resting and roosting sites that shorebirds need to rest, digest, and conserve energy; and they have open or sparsely vegetated sandy habitat that many shorebird species, as well as terns and skimmers require for nesting. (Gochfeld and Burger 1994, Thompson *et al.* 1997, Elliott-Smith and Haig

2004, Nol and Humphrey 2012).

Shorebird communities require habitat heterogeneity to meet their basic and varied fundamental needs for survival, which is why unmodified inlets containing a mosaic of habitat types are essential to sustaining shorebird communities (VanDusen *et al.* 2012). Many shorebird species breed in the far north in order to exploit the seasonal abundance of food resources and they stopover around inlets during migration in order to refuel before continuing migration (Colwell 2010). Proximity between foraging and roosting sites has been found to be a key element in determining habitat suitability and use for shorebird species such as the Piping Plover (Cohen *et al.* 2008), Dunlin (*Calidris alpina*) (Dias *et al.* 2006) and Red Knot (Rogers *et al.* 2006), and others. In short, natural inlets provide all the resources and habitats shorebirds require in a small geographic area and at the locations essential to meeting their spatial and temporal energetic needs. These resources are generally not available or not sufficient to meet the energetic needs of shorebirds at other coastal features.

Reflecting this fact, the occurrence and numbers of shorebirds that use coastal habitats in the southeastern U.S. is greater at inlets than most other coastal features. Seven shorebird species: the Threatened Piping Plover (*Charadrius melodus*) and the Threatened Red Knot (*Calidris canutus rufa*), as well as Black-bellied Plovers (*Pluvialis squatarola*), Ruddy Turnstones (*Arenaria interpres*), Snowy Plovers (*Charadrius alexandrinus*), Western Sandpipers (*Calidris mauri*), and Wilson's Plovers (*Charadrius wilsonia*) are significantly more abundant at inlets than other coastal habitats (Harrington 2008). Multiple studies support the significance of inlets to birds, designating inlets as essential habitat by Red Knots, as well as breeding and non-breeding Piping Plovers (Nicholls and Baldassarre 1990, Harrington 2008, Kisiel 2009a, 2009b, Riggs *et al.* 2009, Niles *et al.* 2010, Maslo *et al.* 2011, USFWS 2012a, 2013).

<u>Piping Plovers</u>: Piping Plovers are an excellent example of a species that relies on inlet-associated habitats throughout the year. During nesting, Piping Plovers are often associated with natural coastlines, including unmodified inlets and overwash fans. In New Jersey, Piping Plovers nest primarily near inlets, particularly those that were not stabilized with structures: 70.6% of all Piping Plover pairs nested closer to an unstabilized inlet than a stabilized inlet (Kisiel 2009a, 2009b). Piping Plovers in North Carolina also exhibit a pattern of nesting near inlets, and the majority of Piping Plover nests in Cape Hatteras National Seashore and Cape Lookout National Seashore were located near inlets (NPS 2014a, 2014b), largely because suitable nesting habitat does not exist elsewhere on the coast.

Piping Plovers spend up to nine months out of the year away from nesting grounds (Elliott-Smith and Haig 2004). During this time, Piping Plovers engage in two essential behaviors, foraging and roosting (resting). A core wintering area or stopover site must provide habitat suitable for roosting, typically backshore above the high-tide line, and foraging, typically wet sand in low-energy intertidal areas that support invertebrates such polychaetes which are an important prey item for wintering and migrating Piping Plovers (Elliott-Smith and Haig 2004).

There is a robust body of peer-reviewed scientific literature showing use of inlets and associated low-energy intertidal flats by Piping Plovers, particularly migrating or wintering Piping Plovers (Haig and Oring 1985, Johnson and Baldassarre 1988, Nicholls and Baldassarre 1990), and indicating that Piping Plovers have a small home range during the non-breeding season and use a variety of habitats throughout the tidal cycle (Drake *et al.* 2001, Rabon 2006, Cohen *et al.* 2008, Maddock *et al.* 2009). Foraging activity is strongly associated with mud or sandflats (Nicholls and Baldassarre 1990), and roost sites are most used by Piping Plovers when located within close proximity to foraging areas (Cohen *et al.* 2008). Piping Plovers also exhibit strong site fidelity both during the same year and across several years (Drake *et al.* 2001, Noel and Chandler 2006). These characteristics demonstrate that Piping Plovers depend on very specific places that with these habitats, and that these places are important year after year as the same birds return to them every migration or winter.

<u>Critical Habitat Unit NC-11 for Wintering Piping Plovers</u>: Rich Inlet and the north end of Figure 8 Island are within the NC-11 Critical Habitat Unit for wintering Piping Plovers (Figure 3). By eliminating the spit on the north end of Figure 8 Island and interfering with natural sediment transport throughout the inlet system, the preferred alternative would severely and adversely impact the Critical Habitat Unit, eliminating approximately 60% (241 acres) of the total primary constituent elements of habitat for Piping Plovers in Rich Inlet and at least 25% of all the primary constituent elements of habitat for Piping Plovers in Critical Habitat Unit NC-11. The preferred alternative, as well as Alternatives 5A-5D, would not only destroy essential foraging and roosting habitat in the Critical Habitat Unit NC-11, but also prevent such habitats from forming again. All other alternatives besides Alternative 2, would also result in negative impacts to Piping Plovers and Critical Habitat Unit NC-11.

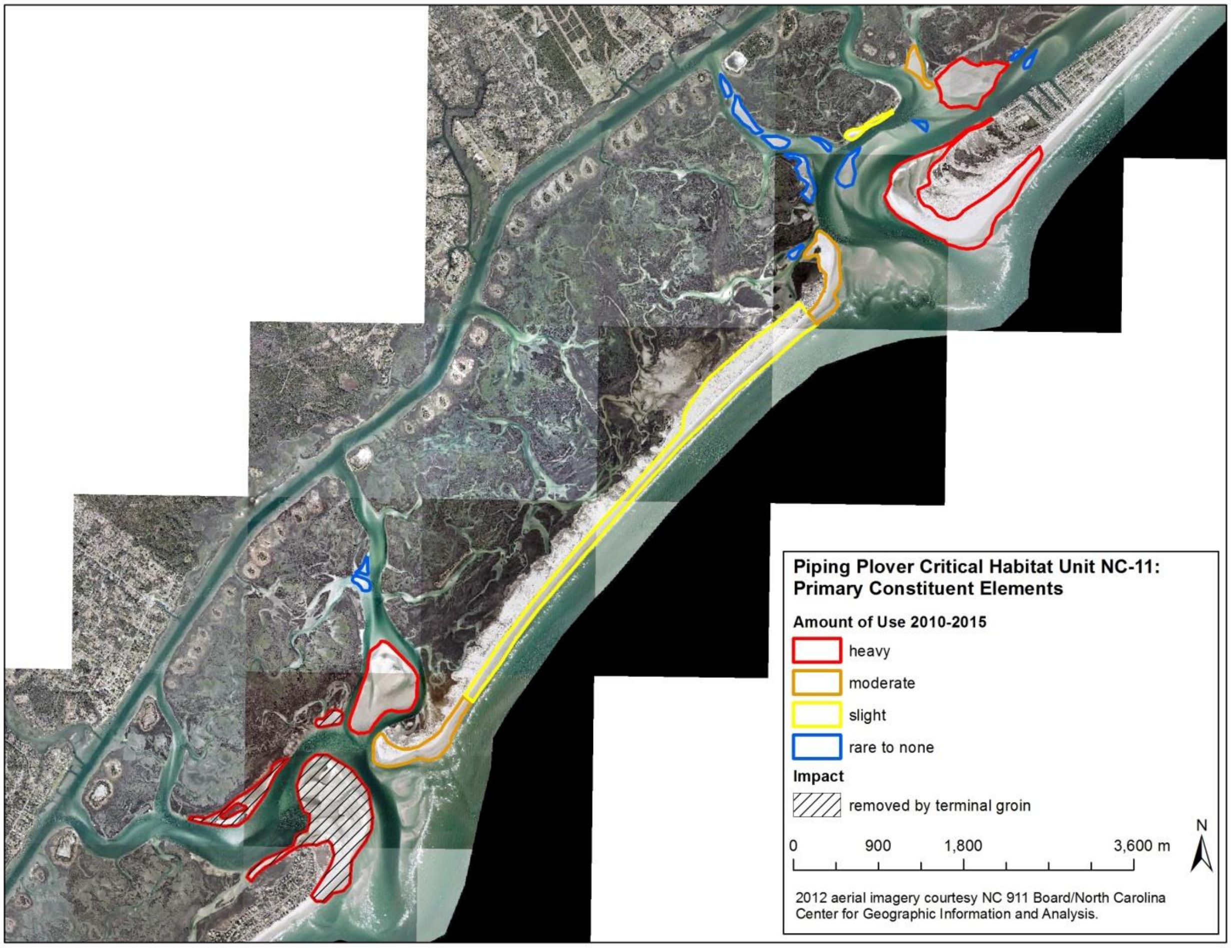


Figure 3. Primary constituent elements of habitat in NC-11 Critical Habitat Unit and rates of Piping Plover use during 2010-2015 (heavy: seen on appropriate tide approximately >75% of visits; moderate: seen on appropriate tide approximately 25%-50% of visits; slight: seen on appropriate tide approximately <25% of visits; rare to none: not seen or seen fewer than 5 visits in a year).

The NC-11 Critical Habitat Unit is described as follows:

*Unit NC–11: Topsail. 451 ha (1114 ac) in Pender County and Hanover County. The entire area is privately owned. This unit extends southwest from 1.0 km (0.65 mi) northeast of MLLW of New Topsail Inlet on Topsail Island to 0.53 m (0.33 mi) southwest of MLLW of Rich Inlet on Figure Eight Island. It includes both Rich Inlet and New Topsail Inlet and the former Old Topsail Inlet. All land, including emergent sandbars, from MLLW on Atlantic Ocean and sound side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. In Topsail Sound, the unit stops as the entrance to tidal creeks become narrow and channelized* (USFWS 2001).

Critical habitat is defined the Endangered Species Act (ESA) as

*the specific areas within the geographical area occupied by a species, at the time it is listed in* *accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species* (Section 3 (5) (A)).

Primary constituent elements (PCEs) of critical habitat for the Piping Plover

*are the habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are: (1) Intertidal sand beaches (including sand flats) or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae. (2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather. (3) Surf-cast algae for feeding. (4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms. (5) Spits, especially sand, running into water for foraging and roosting. (6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water. (7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions. (8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites)* (USFWS 2008).

Of these seven PCEs, only two, salterns and artificial habitat such as dredge spoil, are not found in Rich Inlet. It is important to note that in the context above, “beaches” are oceanfront or sound side and include intertidal flats and sandbars.

The ESA requires that actions are funded, authorized, or carried out by federal agencies are “not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species” (Section 7 (a) (2)). According to the USFWS,

*The key factor related to the adverse modification determination is whether, with implementation of the proposed Federal action, the affected critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established) to serve its intended conservation role for the species. Activities that may destroy or adversely modify critical habitat are those that alter the physical and biological features to an extent that appreciably reduces the conservation value of critical habitat for the piping plover* […]

*These activities include, but are not limited to: (1) Actions that would significantly and detrimentally alter the hydrology of tidal flats. (2) Actions that would significantly and* *detrimentally alter inputs of sediment and nutrients necessary for the maintenance of geomorphic and biologic processes that insure appropriately configured and productive systems. (3) Actions that would introduce significant amounts of emergent vegetation (either through actions such as marsh restoration on naturally unvegetated sites, or through changes in hydrology such as severe rutting or changes in storm or wastewater discharges). (4) Actions that would significantly and detrimentally alter the topography of a site (such alteration may affect the hydrology of an area or may render an area unsuitable for roosting). 5) Actions that would reduce the value of a site by significantly disturbing piping plovers from activities such as foraging and roosting (including levels of human presence significantly greater than those currently experienced). (6) Actions that would significantly and detrimentally alter water quality, which may lead to decreased diversity or productivity of prey organisms or may have direct detrimental effects on piping plovers (as in the case of an oil spill). (7) Actions that would impede natural processes that create and maintain washover passes and sparsely vegetated intertidal feeding habitats* (USFWS 2008).

When critical habitat was designated for wintering Piping Plovers, the USFWS specifically addressed the fact that habitats they depend upon are dynamic:

*These habitat components are a result of the dynamic geological processes that dominate coastal landforms throughout the wintering range of piping plovers. These geologically dynamic coastal regions are controlled by processes of erosion, accretion, succession, and sea-level change. The integrity of the habitat components depends upon daily tidal events and regular sediment transport processes, as well as episodic, high-magnitude storm events; these processes are associated with the formation and movement of barrier islands, inlets, and other coastal landforms. By their nature, these features are in a constant state of change; they may disappear, only to be replaced nearby as coastal processes act on these habitats. Given that piping plovers evolved in this dynamic system, and that they are dependent upon these ever-changing features for their continued survival and eventual recovery, our critical habitat boundaries incorporate sites that experience these natural processes and include sites that may lose and later develop appropriate habitat components* (USFWS 2001).

<u>Impact of the Proposed Project on Piping Plover Critical Habitat PCEs</u>: The HOA's preferred alternative includes actions 1, 2, 4, 5, and 7 above. As a result, all of the PCEs found in Rich Inlet would be adversely impacted by the HOA's preferred alternative, as well as by Alternatives 1, 3, 4, 5A, 5B, and 5C.

As explained above, the consequences of different management practices (e.g., dredging, beach fill, hard structures [jetties, groins, sea walls, and breakwaters], and coastal development) can lead to extensive changes in coastal and inlet habitats, resulting in a permanent loss of habitat that birds require for nesting, foraging, and roosting. Terminal groins permanently eliminate habitat that Piping Plovers rely on throughout the year and prevent the formation of new habitats. Dredging and beach nourishment cause disturbances to both borrow and placement sites and cause significant changes in habitat structure that can lead to decreased diversity and abundance in invertebrate species that shorebirds prey upon. Channelization of inlets in order to maintain a particular channel alignment has similar effects on bird habitats.

The construction of a terminal groin at Rich Inlet and alternatives that include channelization of the inlet will permanently and adversely impact critical habitat for Piping Plovers, and threaten the Endangered Great Lakes breeding population and the recovery of the Threatened Atlantic breeding population. **The USACE should not permit an action that would degrade high-quality habitat in a critical habitat unit and jeopardize either the survival or recovery of a species.**

<u>Breeding Sites of Banded Piping Plovers Found at Rich Inlet</u>: Piping Plovers nest in three breeding populations: the Great Plains, Great Lakes, and Atlantic coast. All Piping Plovers are considered Threatened in their non-breeding rage. The Great Lakes breeding population is Endangered, and the Atlantic coast and Great Plains breeding populations are Threatened. Banded Piping Plovers seen at Rich Inlet represent all three nesting populations. A total of 43 uniquely banded individual Piping Plovers were observed at Rich Inlet during January 2007-September 2015. These birds were banded in Michigan, South Carolina, New York, Canada, North Dakota, North Carolina, Wisconsin, Virginia, and the Bahamas and resighted throughout their breeding and non-breeding range. The greatest number of banded Piping Plovers (29 individuals) documented at Rich Inlet were from the Endangered Great Lakes breeding population; 9 were from the Atlantic coast population, 4 were from the Great Plains population, and 1, which was banded in the Bahamas, was not seen on its breeding grounds. More recently, from September 2009-September 2015, we documented 38 individuals (9 Atlantic coast, 25 Great Lakes, 3 Great Plains, and 1 unknown) (Audubon North Carolina unpublished data).

The Endangered Great Lakes breeding population consisted of between 55-73 breeding pairs from 2010-2015 (Vincent Cavalieri pers. com.), with an average of 64 pairs or 128 breeding adults. Between January 2007 and September 2015, Audubon North Carolina documented at least 29 banded individuals from the Endangered Great Lakes breeding population (Addison and McIver 2014, Audubon North Carolina unpublished data). It is highly likely that more individuals from the Great Lakes breeding population depend on Rich Inlet during migration and winter, because it is highly unlikely weekly surveys document every individual that utilizes Rich Inlet during migration, and sub-adults in the Great Lakes are banded with identical “brood marker” bands therefore distinguishing individuals is not possible. Furthermore, an estimated 5% of the Great Lakes population is not banded.

**The importance of Rich Inlet to the Endangered Great Lakes breeding population of Piping Plovers cannot be overstated**. Based on published rates of adult survival, juvenile survival, fledging success, and detectability, we estimate that Rich Inlet supports between 18% and 24% of the Great Lakes breeding population.

Modeling shows that Piping Plover populations in general (Calvert *et al.* 2006, Brault 2007) and the Great Lakes population in particular (Wemmer *et al.* 2000) are most sensitive to small variations in adult survivorship. In the Atlantic coast population, modeled decreases of 5% in first-year plovers and 10% in after-first-year adult plovers found high probabilities of the population going extinct within 100 years, even with a very high productivity rate of 1.5 fledglings/pair (Melvin and Gibbs 1994). The authors found such declines could be caused by one or more of several factors, including declines in availability of high-quality winter and migration habitat and increased human disturbance on wintering grounds (Melvin and Gibbs

1994). In the New England and Canadian population of Piping Plovers, modeling found that that populations' growth rate was most affected by adult annual survivorship. A 1% decline in annual adult survival would have to be offset by a 2.25% increase in productivity—an unrealistic goal—in order to prevent impacts to the population's growth rate (Brault 2007). Population growth rates modeled among eastern Canadian breeding Piping Plovers were also found to be sensitive to small changes in adult and post-fledging survival (Calvert *et al.* 2006).

Modeling specific to the Great Lakes population produced similar findings. In a habitat-based population model of the Great Lakes population, when productivity rates and habitat capacity were high, decreasing adult or fledging survivorship by 20% resulted in never achieving the recovery goal of 100 breeding pairs, and the probability of the population persisting for 100 years dropped to 0; conversely, increasing those rates by 20% resulted in 100% of model runs meeting the recovery goal (Wemmer *et al.* 2001). The authors point out that increasing productivity as well as increasing adult survival are challenging, but both are necessary for the population's survival.

Conditions on wintering grounds can impact fitness and productivity during spring migration and the subsequent nesting season, in addition to affecting survival (Fernandez *et al.* 2003, Baker *et al.* 2004, Norris *et al.* 2004, Morrison *et al.* 2007). Since adults spend the majority of the year away from nesting sites, habitat availability and quality during migration and winter are important factors in the survival and recovery of Piping Plovers, especially for the small, Endangered Great Lakes population. Adversely impacting the NC-11 Critical Habitat Unit by removing 60% of the foraging habitat, plus additional roosting habitat from Rich Inlet where significant numbers of Piping Plovers stop over and winter, and preventing any future chance of this habitat being restored, would threaten the Great Lakes population's prospect for recovery.

The five-year status review of the Piping Plover states:

*The most consistent finding in the various population viability analyses (PVAs) conducted for piping plovers (Ryan et al. 1993, Melvin and Gibbs 1996, Plissner and Haig 2000, Wemmer et al. 2001, Larson et al. 2002, Calvert et al. 2006, Brault 2007) is the sensitivity of extinction risk to even small declines in adult and/or juvenile survival rates.* […]

*Calvert et al. (2006) found that changes in productivity (% increase in chicks fledged per pair) required to attain long-term growth rates in eastern Canada would be approximately threefold the change required in adult apparent survival (% increase in annual survival of adults). Similarly, modeling by Brault (2007) for the New England and Eastern Canada recovery units indicated that a 1% reduction in annual adult survival would need to be offset by a 2.25% increase in fledglings produced in order to maintain a stable population. Progress toward recovery would be quickly slowed or reversed by even small sustained decreases in survival, and it would be difficult to increase current fecundity levels sufficiently to compensate for widespread long-term declines in survival* (USFWS 2009).

In addition to the 29 banded Great Lakes population individuals, additional banded individuals from the Atlantic coast and Great Plains populations have been seen at Rich Inlet (Audubon North Carolina unpublished data). Though the Atlantic coast population is larger than the Great

Lakes population, proportionally very few birds from the Atlantic breeding population have been banded. A range-wide band resight study found that Piping Plovers using the southeast coast during non-breeding months are predominantly from the Atlantic and Great Lakes breeding populations (Gratto-Trevor *et al.* 2009).

The population of Atlantic coast breeding Piping Plovers averaged 1,836 pairs or 3,672 breeding adults from 2008-2012 (the most recent years for which final data is available) (USFWS 2010, 2011, 2012b). The peak, single survey counts of Piping Plovers at Rich Inlet in fall 2014 and 2015 (38 and 44, respectively) comprise more than 1% of the Atlantic breeding population of Piping Plovers (Addison and McIver 2014, Audubon North Carolina unpublished data). This qualifies the Rich Inlet complex as a Wetland of International Importance under the Ramsar Convention and a site of hemispheric significance by the Western Hemisphere Shorebird Network.

Peak migration counts <u>do not</u> reflect the total number of individual Piping Plovers that depend on habitats at Rich Inlet. Most individuals using Rich Inlet during migration to refuel, rest and gain sufficient energetic reserves to make the next leg of migration that may carry them to breeding areas or wintering areas. Stopover duration can vary from just a few days to as much as one month (Noel and Chandler 2005; Stucker and Cuthbert 2006). Surveys conducted weekly during migration surveys at Rich Inlet indicated that stopover duration for the majority of banded Piping Plovers was one week or less during spring (99.1%) and fall (63.2%). The mean number of non-breeding Piping Plovers that depend on Rich Inlet based on stopover duration of one week for calendar years 2011-2015 is estimated at 256 individuals (range 96-443).

At Rich Inlet, from 2010-2014 the total number of Piping Plovers was greatest during fall migration, but the species is present every month of the year (Addison and McIver 2014). Seasonal use of Rich Inlet by Piping Plovers during the most recent years (2014 and 2015) is presented in Figure 4.

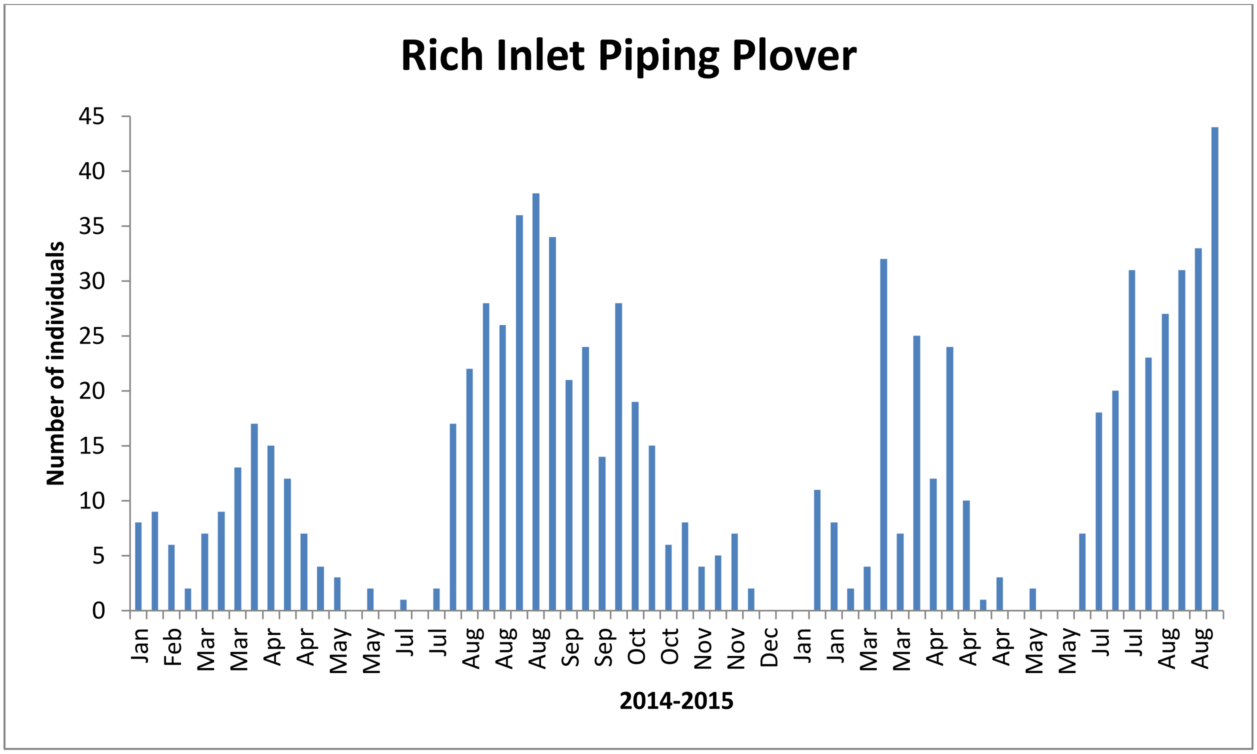

Figure 4. Abundance of Piping Plovers at Rich Inlet during 2014 and 2015.

Piping Plovers used all areas of Rich Inlet, but most often utilized sheltered, low-energy shoals, bay beaches, inlet spits, and sandbars on the sound side of the inlets for foraging (75.2%), and when foraging, Piping Plovers strongly favored the intertidal zone (89.1% of observations) (Addison and McIver 2014). Primary foraging sites were the sound side of the spit at the north end of Figure 8 Island and Green Shoal, which is located in Green Channel opposite Hutaff Island. Piping Plovers preferred to roost in habitat (backshore and old wrack) and in landscapes (ocean beach or inlet spit) that were most likely to have sandy substrate. The primary roost site was on the spit on the north end of Figure 8 Island. **Most of these habitats would be lost from Rich Inlet if a terminal groin were built; even Green Shoal could be affect by loss of sediment from the system of by additional sand mining, if, as is likely, oceanfront beach narrowing requires more frequent beach renourishments**.

Red Knots: At Rich Inlet, 2010-2014, Red Knots were observed in the greatest numbers during spring migration (Addison and McIver 2014). Peak counts in 2014 and 2015 were 253 and 190, respectively (Addison and McIver 2014, Audubon North Carolina unpublished data). During January 2007-2015, banded Red Knots were observed on 60 occasions, representing at least 28 individuals (Addison and McIver 2014, Audubon North Carolina unpublished data). Individuals were banded in Florida, Delaware, New Jersey, Massachusetts, and Argentina and resighted in Ontario, Massachusetts, New Jersey, Delaware, North Carolina, South Carolina, Georgia, and Florida.

Importance of Rich Inlet to Nesting Birds: Rich Inlet is also important to nesting birds. The shorebird and waterbird species that nest at Rich Inlet include Least Tern, Common Tern, Black Skimmer, Gull-billed Tern (historically), Wilson's Plover, Piping Plover, American

Oystercatcher and Willet. All of these species with the exception of the Willet require open, sandy, sparsely vegetated habitats for nesting. These habitats occur on spits at the ends of barrier islands, such as the spit on the north end of Figure 8 Island, and on overwash fans where storms push dunes backwards, creating wide, sandy areas along the length of barrier islands. Historically, prior to the development of many barrier islands, overwash fans were more common, as buildings, roads, and other developments were not present to block their formation following hurricanes or nor'easters. The limitations on the formation of overwash fans makes inlet spits essential to nesting birds as few alternatives exist. This is reflected in southern North Carolina where, from New River Inlet south to Brunswick County, little quality beach-nesting bird habitat exists due to hardened structures at inlets, channelization of inlets, other coastal engineering projects, and development.

**The north end of Figure 8 Island has provided some of the best nesting habitat in southern North Carolina the past several years. American Oystercatchers, Piping Plovers, Wilson's Plovers and 840 pairs of Least Terns nested on the north end of Figure 8 Island in 2014**. The Least Tern colony represented nearly all of southern North Carolina's Least Tern population and was the largest on record in North Carolina in 41 years of record-keeping; additionally, it represented 26% of the state's nesting Least Terns (NCWRC Colonial Waterbird Database). This year, two pairs of Piping Plovers nested on the north end of Figure 8 Island (Schweitzer 2015). Other nesting species were not counted in 2015, as it was not a state census year, but another large colony of Least Terns formed there. The peak count of Least Tern adults in the area was 816, suggesting approximately 400 pairs (Audubon North Carolina unpublished data). Common Terns, American Oystercatchers, and Wilson's Plovers also nested there in 2015.

No terns or skimmers have nested on the north end of Masonboro Island since 1989, though prior to the construction of the jetty there, a large amount of suitable habitat supported large nesting colonies of Least Terns, Common Terns, and Black Skimmers (NCWRC Colonial Waterbird Database). A similar pattern is found at all inlets with terminal groins.

<u>Importance of Rich Inlet to all Birds</u>: A total of 90 species of birds were observed at Rich Inlet from January 2010-September 2014, including 25 species of shorebirds (sandpipers, plovers, and their relatives) (Addison and McIver 2014). One additional species, the Snowy Plover, was observed in 2015, for a total of 91 species observed at Rich Inlet (Audubon North Carolina unpublished data). **Of these 91 species, 28 (31%) are of conservation concern, either as federally listed species, state-listed species, or identified as declining or otherwise vulnerable by various watch lists.**

Birds use Rich Inlet in large numbers throughout the year (Figure 5). Migrating birds pass through from late February to late May; wintering birds arrive as early as mid-July and stay as late as late May; nesting birds begin to arrive in March and remain through August. Annual peak counts from 2010-2015 occurred in the spring, winter, and fall, and were as great as 3,532 birds seen on one occasion (Addison and McIver 2014, Audubon North Carolina unpublished data). From January 2010-September 2014, a total of 228,823 birds were observed at Rich Inlet (Addison and McIver 2014).

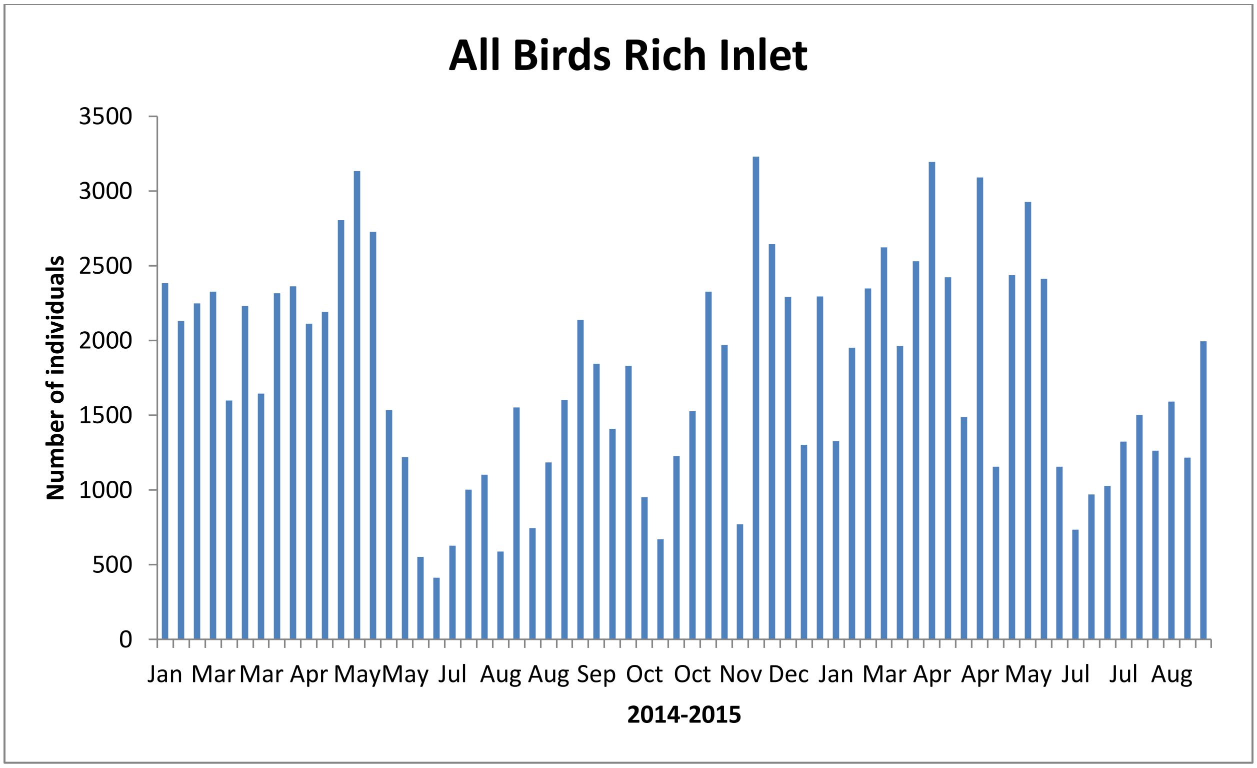


Figure 5. Abundance of all birds at Rich Inlet from the most recent surveys (2014-2015).

Modified vs. Unmodified Inlets: Audubon North Carolina has conducted weekly (during migration) and bi-weekly (during winter) bird surveys at New Topsail Inlet, Rich Inlet, Mason Inlet, and Masonboro Inlet. Since Rich Inlet is a relatively unmodified, natural inlet and Masonboro Inlet is significantly modified with two hard structures and regular dredging, we wanted to determine if birds use the two inlets in the same manner. We also wanted to compare Rich Inlet with the relocated and artificially stabilized Mason Inlet. In order to provide the most recent data for these comments, we compared survey results between Rich Inlet and Mason and Masonboro Inlets for the period from January 2014-September 2015.

For all birds, shorebirds, and Red Knots observed during January 2014-September 2015, significant differences occurred between Rich, Mason and Masonboro Inlets (Kruskal-Wallis test, $p<0.001$). Pairwise multiple comparison tests indicated that significantly more birds, shorebirds, and Red Knots were observed at Rich Inlet than Mason and Masonboro Inlets (Dunn's test, $p<0.05$).

For Piping Plovers observed during January 2014-September 2015, significant differences occurred between the three inlets (Kruskal-Wallis test, $p<0.001$). Pairwise multiple comparison tests indicated that significantly more Piping Plovers were observed at Rich Inlet compared to highly modified Mason and Masonboro Inlets (Dunn's test, $p<0.05$). The numbers of Piping Plovers observed at Masonboro Inlet and Mason Inlet were not statistically different.

It is readily apparent from analysis of the survey data that birds, shorebirds, Red Knots, and Piping Plovers in particular all rely on Rich Inlet to a significantly greater extent than they rely on the two nearby modified inlets. Because Piping Plovers exhibit site fidelity (Drake *et al.* 2001, Noel and Chandler 2006, Addison and McIver 2014) and use small core home ranges during the winter months (Drake *et al.* 2001), the importance of specific inlets such as Rich Inlet to individuals is magnified even more, since they are unlikely to move between inlets and because they return to the same site year after year.

<u>Modification of Inlets and Beaches</u>: Despite the importance of natural inlets to birds such as the Piping Plover, **inlets are one of the most anthropogenically altered features on the coast**. In North Carolina, 85% of inlets have been modified, and 57% of Atlantic coast inlets in the migration and winter range of the Piping Plover have been modified, including 43% that have been stabilized with hard structures (Rice 2012a). At least 32% of sandy beach habitat in the winter range of the Piping Plovers has received beach nourishment (Rice 2012b).

Many shorebird populations, including those of many species that occur at inlets, are declining and are of conservation concern (Brown *et al.* 2001, Winn *et al.* 2013). **Loss or degradation of wintering habitat, including that associated with coastal engineering projects, is identified as a primary threat in all shorebird conservation and management planning documents, including those addressing Piping Plovers and Red Knots.**

For example, the impacts of terminal groins and modifications of inlets are specifically addressed in the five-year status review for the Piping Plover:

***Inlet stabilization/relocation***
*Many navigable mainland or barrier island tidal inlets along the Atlantic and Gulf of Mexico coasts are stabilized with jetties, groins, or by seawalls and/or adjacent industrial or residential development (see section WM 2.2.1.4 summary of studies documenting piping plover reliance on inlet habitats). Jetties are structures built perpendicular to the shoreline that extend through the entire nearshore zone and past the breaker zone (Hayes and Michel 2008) to prevent or decrease sand deposition in the channel. Inlet stabilization with rock jetties and associated channel dredging for navigation alter the dynamics of longshore sediment transport and affect the location and movement rate of barrier islands (Camfield and Holmes 1995), typically causing downdrift erosion. Sediment is then dredged and added back to islands which subsequently widen. Once the island becomes stabilized, vegetation encroaches on the bayside habitat, thereby diminishing and eventually destroying its value to piping plovers. Accelerated erosion may compound future habitat loss, depending on the degree of sea-level rise. Unstabilized inlets naturally migrate, re-forming important habitat components, whereas jetties often trap sand and cause significant erosion of the downdrift shoreline. These combined actions affect the availability of piping plover habitat (Cohen et al. 2008).*

***Sand mining/dredging***
*Sand mining, the practice of extracting (dredging) sand from sand bars, shoals, and inlets in the nearshore zone, is a less expensive source of sand than obtaining sand from offshore shoals for beach nourishment. Sand bars and shoals are sand sources that move onshore over time and act as natural breakwaters. Inlet dredging reduces the formation of exposed ebb and flood tidal shoals considered to be primary or optimal piping plover roosting and foraging habitat. Removing these sand sources can alter depth contours and change wave refraction as well as*

*cause localized erosion (Hayes and Michel 2008).*

*Exposed shoals and sandbars are also valuable to piping plovers, as they tend to receive less human recreational use (because they are only accessible by boat) and therefore provide relatively less disturbed habitats for birds. We do not have a good estimate of the amount of sand mining that occurs across the piping plover wintering range, nor do we have a good estimate of the number of inlet dredging projects that occur.* […]

***Groins***

*Groins (structures made of concrete, rip rap, wood, or metal built perpendicular to the beach in order to trap sand) are typically found on developed beaches with severe erosion. Although groins can be individual structures, they are often clustered along the shoreline. Groins act as barriers to longshore sand transport and cause downdrift erosion, which prevents piping plover habitat creation by limiting sediment deposition and accretion (Hayes and Michel 2008). These structures are found throughout the southeastern Atlantic Coast, and although most were in place prior to the piping plover's1986 ESA listing, installation of new groins continues to occur* (USFWS 2009).

The impact of projects, such as proposed in Alternatives 1, 3, 4, and 5A-5D in this SEIS, on Threatened Red Knots is addressed specifically in the "Status of the Red Knot in the Western Hemisphere":

*NC: Along the coast, threats to migrant and wintering Red Knot habitat include beach stabilization works (nourishment, channel relocation, and bulkhead construction), and housing development.* [Note: Terminal groins and hardened structures were illegal in NC at the time when this paper was published.]

*FL: Shoreline hardening, dredging, and deposition, including beach-nourishment activities, are significantly altering much of Florida's coastline. … Furthermore, the impacts on Red Knots and other shorebirds is [sic] not well known but is thought to be significant* (Niles *et al*. 2008).

The Red Knot was listed as Threatened under the Endangered Species Act in November 2014. One of the primary factors in its listing was "U.S. shoreline stabilization and coastal development" (USFWS 2013):

*In addition to directly eliminating red knot habitat, hard structures interfere with the creation of new shorebird habitats by interrupting the natural processes of overwash and inlet formation. Where hard stabilization is installed, the eventual loss of the beach and its associated habitats is virtually assured (Rice 2009, p. 3), absent beach nourishment, which may also impact red knots as discussed below. Where they are maintained, hard structures are likely to significantly increase the amount of red knot habitat lost as sea levels continue to rise* (USFWS 2013).

Beach renourishment and inlet channelization are also cited as threats to Red Knots because they impact prey availability, habitat suitability, and habitat formation (USFWS 2013).

<u>Factual Errors and Other Inaccuracies Regarding Impacts to Birds</u>: Because accurate information

is a prerequisite for accurately assessing environmental impacts and meeting NEPA standards, we will highlight some of the most serious factual and other errors and omissions within the SEIS. In general, the overwhelming number of errors in the SEIS calls into question the validity and credibility of the entire document, and on that basis alone should exclude the document from being released to the public for review. Some of the more egregious factual errors are present as Appendix 1.

<u>Impacts on Infauna</u>: The SEIS largely overlook impacts of the alternatives on the infaunal community (species that live within the sediment) at Rich Inlet and Figure 8 Island, and consistently marginalizes and understates impacts to these organisms. The infaunal community is comprised of multiple different species that have variable recovery rates. The SEIS treats the infaunal community as a single species and states, "In general, the recolonization of these infaunal species typically tends to occur within the order of several months, which depends greatly on the compatibility of the material used for nourishment" (p. 282). The SEIS repeatedly uses the terms "short-term" and "resilient" (for examples, see pages 102, 268, 269, 279, 282, 318, 319, 320, 332, 337, 341, 367, 369, 393, 394) when addressing the impacts to the infaunal community, which is misleading because some organisms take up to four years to recover (Jaramillo *et al.* 1987, Peterson *et al.* 2014).

The majority of peer-reviewed literature demonstrates that infaunal species are negatively impacted by beach nourishment, and that the length of time for recovery varies by species (Hayden and Dolan 1974, Jaramillo *et al.* 1987, Rakocinski *et al.* 1996, Peterson *et al.* 2000a, Peterson *et al.* 2000b, Bishop *et al.* 2006, Dolan *et al*. 2006, Peterson *et al.* 2006, Bertasi *et al.* 2007, Colosio *et al.* 2007, Cahoon *et al.* 2012, Leewis *et al.* 2012, Schlachler *et al.* 2012, Viola *et al.* 2013, Manning *et al.* 2014, Petersen *et al.* 2014). In North Carolina, *Emerita talpoida* (mole crab) abundance recovered within months on nourished beaches compared to control beaches, but *Donax* spp. (coquina clam) and amphipods did not recover within the time frame of the study (Peterson *et al.* 2006). Peterson *et al.* (2014) monitored the recovery of a sandy beach community for 3-4 years following nourishment and documented that haustoriid amphipods (small crustaceans) and *Donax* spp. had reduced densities for 3-4 years following nourishment, *E. talpoida* had lower densities for 1-2 years following nourishment, and ghost crabs had lower abundances for four years.

For all alternatives except Alternative 2, beach nourishment is proposed. Historically, north Figure 8 Island was nourished in 1983, 1993, 1997, 2001, 2005, 2009, and 2011. For the preferred Alternative 5D and all other alternatives that include a terminal groin, the SEIS states that nourishment will occur every five years. However, at inlets where terminal groins were constructed, the beach nourishment cycle is every 1-4 years (Riggs *et al.* 2009, Riggs and Ames 2011, Pietrafesa 2012). Pea Island was renourished every year from 1990-2004, and Fort Macon was renourished every 2-6 years from 1973-2007 (Pietrafesa 2012). If some species of the infaunal community recover in 3-4 years, the cumulative impact to the infaunal community due to nourishment at such sites is that the community cannot recover before the next nourishment cycle. In some cases, local extinction of benthic species has occurred (Colosio *et al.* 2007).

The compaction of sand by heavy machinery and changes in grain size and shape, permeability, and penetrability are other common results of beach nourishment that impact infaunal organisms

(Greene 2002, McLachlan and Brown 2006). Further, though timing of activity is important to avoid periods of larval recruitment, all work is assumed to take place within existing environmental windows. However, beach renourishment projects took place in the region outside these widows in 2014 and 2015, and the firm that prepared the SEIS has also authored a white paper proposing the expansion of environmental windows into months when infaunal recruitment occurs (Hackney *et al.* 1996). The potential for additional impacts both from more frequent renourishments and out-of-season renourishments should be addressed by the SEIS.

Beach nourishment degrades beach habitats, thus decreasing densities of invertebrate prey for shorebirds. Each shorebird species has its own foraging microhabitat as well as its own feeding techniques. Shorebirds that collect food from specific depths beneath the sand can no longer rely on food from traditional habitats on nourished beaches (Peterson *et al.* 2006). This will negatively impact species that often forage in oceanfront intertidal and swash habitats, specifically Sanderlings (Macwhirter *et al.* 2002), Willets (Lowther *et al.* 2001), and the Threatened Red Knot (Baker *et al.* 2013). Speybroeck *et al.* (2006) documented that the mortality of just one species of polychaete due to nourishment resulted in decreased abundances of foraging Sanderlings. Piping Plovers forage less on oceanfront beaches than other habitats during non-breeding months (Haig and Oring 1985, Cohen *et al.* 2008), but they have been documented foraging occasionally on oceanfront beaches at Rich Inlet (Addison and McIver 2014). Therefore, renourishment activities also affect this Piping Plover foraging habitat.

Decreased abundances of shorebirds after nourishment may be due to decreased foraging area, decreased prey densities, and the occurrence of coarse sediments further reducing foraging habitat (Peterson *et al.* 2006). Coastal armoring caused beach widths to narrow significantly in southern California, which resulted in the loss of intertidal habitat available to macroinvertebrates, and, therefore, the abundance of macroinvertebrates decreased (Dugan and Hubbard 2006, Dugan *et al.* 2008). The diversity and abundance of shorebirds on beaches was positively correlated with the diversity and abundance of macroinvertebrate prey, and since a decline in prey was observed, a decrease in foraging shorebirds, gulls, and other seabirds was also observed (Dugan and Hubbard 2006, Dugan *et al.* 2008). **These authors concluded that increasing coastal armoring accelerates beach erosion and increases ecological impacts to sandy beach communities.**

The SEIS states:

*Nelson (1985) indicates that organisms that reside in intertidal zones are more adaptable to fluctuations in their environment, including high sediment transport and turbidity levels. This may support the reasoning for some organisms to withstand burial up to 10 cm. Other studies reported by Maurer (National Research Council, 1995) supported the burial capabilities of nearshore species, which found that these species are capable of burrowing through sand up to 40 cm* (p. 269).

Even if some of the infauna can survive burial up to 10-40 cm, nearly all bird species that utilize Rich Inlet would not have access to prey at those depths.

**Any hard structure placed in a coastal environment modifies physical processes there, and**

**these changes will impact the species composition, abundance, and structure of invertebrate communities, and therefore birds that consume these prey will also be impacted.** Hard-engineered structures are thought to be responsible for the loss of more than 80% of sandy beach shorelines globally (Brown and McLachlan 2002). Additionally, the placement of a terminal groin as called for in Alternatives 5A-5D, will result in the loss of the spit on the north end of Figure 8 Island. Although it's been stated above, it bears repeating that the modeling reported for Alternatives 5A-5C all indicate that a significant amount of sediment would be lost from the system, resulting in the loss of 241 acres of habitat, primarily low-energy shoals and sandbars which provide habitat for a variety of benthic invertebrates that are consumed by shorebirds and fishes. Such a loss constitutes more than half (60%) of such habitats currently in Rich Inlet. For reasons not explained, the preferred alternative, 5D, does not forecast such a loss.

Despite this, the SEIS preferred Alternative (5D) and most other alternatives assert few impacts on infauna, and impacts that are acknowledged are marginalized: "there may be less inlet flats and/or shoals than pre-construction conditions in certain areas, but there also may be more of these habitats in other areas" (p. 429).

**Every recovery or management plan that pertains to species of shorebirds that use the coast recognizes the importance of infaunal organisms and their habitats.** These species include the Piping Plover (USFWS 1996a, 2001, 2003, 2009), Red Knot (USFWS 2013), Sanderling (Payne 2010), and Dunlin (Fernández *et al.* 2010).

Audubon North Carolina conducted an extensive review of literature regarding the impacts of hardened structures and beach fill activities with a focus on scientific, peer-reviewed articles. We found 43 peer-reviewed articles and included three reports regarding the impacts of renourishment on benthic organisms. Of these 46 documents, 34 (74%) found an impact to one or more species of benthic organism, 4 (9%) found no impact, and 8 (17%) were ambiguous or found equivocal results.

Of the 43 peer-reviewed, scientific articles that found an impact to infaunal organisms, only two (Peterson *et al.* 2000 and Rakocinski *et al.* 1996) are cited in the SEIS. Peterson *et al.* (2000a) was cited in order to make a general statement about the biomass of mole crabs and coquinas: "Therefore, mole crabs and coquina clams dominate the benthic infaunal community due to their biomass (Peterson *et al.* 2000a)" (p. 128). The conclusions of the paper, however, were omitted from the SEIS and are significant and relevant to an evaluation of the impacts of all alternatives except Alternative 2.

*Our studies of the ecological consequences of beach nourishment and bulldozing demonstrate large short-term effects on dominant species of beach macro-invertebrates. Abundances of both* Emerita talpoida *and* Donax spp. *were 86-99% lower on nourished beaches in late June-early July, 5 and 10 weeks after cessation of nourishment (Figure 3). This is a season of the year when abundances of both of these dominant species of burrowing macro-invertebrates are typically at their maximum (Diaz, 1980; Leber 1982) and when they are providing the important ecosystem service of feeding abundant surf fishes (Leber, 1982; Delancey, 1989) and ghost crabs (Wolcott 1978). This transfer of energy to higher trophic levels was almost certainly dramatically reduced* *by nourishment. Our short-term observation period does not suffice to allow estimation of the length of time over which this tertiary production was diminished* (Peterson *et al.* 2000).

The results of the other scientific paper that was cited, (Rakocinski *et al.* 1996), were not accurately reported by the SEIS because relevant findings were omitted. The authors studied the impacts of a beach and profile nourishment project on the Gulf coast of Florida for about two years following the initial beach fill event. The SEIS states, "Rakocinski *et al.* (1996) found that the mole crab populations exhibited a pattern of initial depression after being covered by sediment but fully recovered in less than one year after beach nourishment." However, the SEIS does not mention that the same study also found that the dominant species of amphipod and a dominant species of polychaete had not recovered within that same time frame and that the amphipod did not recover until two years after the beach renourishment. Like the mole crab, amphipods and polychaetes are common shorebird prey items. Further, the SEIS use the authors' summaries of nearshore (0-100 m) and offshore (125-825 m) impacts:

*Various macrobenthic responses attributable to beach restoration included: decreased species richness and total density, enhanced fluctuations in those indices, variation in abundances of key indicator taxa, and shifts in macrobenthic assemblage structure.* […] *Considerable macrobenthic recovery was apparent during the study, although macrobenthic recovery remained indeterminate in some places.* […] *One long-term impact of beach nourishment at several nearshore stations was the development of assemblages characteristic of deep nearshore profiles. This implied that typical shallow-water macrobenthic assemblages characteristic of the usual dissipative beach morphometry was reduced after beach nourishment to a narrower zone like that of a reflective beach morphometry.*[…] *Two long-term negative impacts of beach restoration at offshore stations included impacts from both beach nourishment and profile nourishment. After beach nourishment, macrobenthic assemblage structure shifted at intermediate seaward distances for roughly 6 km parallel with the shoreline, probably in response to increased silt/clay loading. Macro-benthic impacts from silt/clay loading still were evident at the end of the study, more than two years after beach nourishment* (Rakocinski *et al.* 1996).

Two of the three reports that found an impact to benthic organisms were cited in the SEIS (Hackney *et al.* 1996 and Reilly and Bellis 1983), but their findings were only used to populate a table illustrating presence and recruitment periods of surf zone invertebrates in the South Atlantic Bight (Hackney *et al.* 1996) and to describe a direct impact of dredging: "Recruitment of invertebrate larvae, growth of filter feeding invertebrates, and visual foraging for prey by adult fish are also affected by turbidity from dredging" (Reilly and Bellis 1983).

The SEIS uses reports and other documents that were not peer-reviewed to make several assertions regarding the duration and severity of impacts to benthic organisms:

*Some negative effects from covering the existing dry beach include the immediate mortality of macro invertebrates such as ghost crabs and with the potential of sand compaction from heavy equipment. However, these communities are expected to recover within the order of months to more than one year (National Research Council, 1995; Carter and Floyd, 2008) allowing several years of recovery time prior to any subsequent renourishment event* (p. 336).

*The macrobenthic communities of the intertidal and nearshore subtidal environments were sampled during the construction of the jetties and once again five (5) years later. Comparison of species abundance between years and among localities (updrift and downdrift) suggested no widespread impacts to macrobenthic fauna were attributable to jetty construction"* (Knott *et al.* 1984) (p. 368).

Carter and Floyd (2008) is a report prepared by CP&E, and Knott *et al.* (1984) is a report written by the USACE. The report results include community composition data and seasonality of dominant species; pre- and post-project abundance is not included in the body of the report, but is one of six appendices (counting Appendices 6a-e as one appendix). The appendices were not supplied when the document was requested. The findings of these reports are not consistent with findings of readily available peer-reviewed scientific literature.

In its treatment of impacts to the infauna, the SEIS relies nearly exclusively on outdated literature that is generally not peer-reviewed, and it omits the many recent, peer-reviewed scientific papers that are available on the subject. The SEIS's reliance on non-peer-reviewed reports and other gray literature is troubling, and this has been recognized as such by experts in the field. Peterson and Bishop (2005) suggested that weaknesses in nourishment studies are due to studies being conducted by project advocates with no peer review process and the duration of monitoring being inadequate to characterize the fauna before and after nourishment. Thus, uncertainty surrounding biological impacts of nourishment can be attributed to the poor quality of monitoring studies, not to an absence of impacts.

**We find it extraordinary that in a 513-page SEIS and over 2,000 additional pages of appendices only two peer-reviewed scientific articles are cited in reference to infauna—and that one is not cited to report its findings.** It is equally troubling that a good-faith effort to accurately and fully describe and discuss the impacts these actions would have on the infaunal community would fail to actually describe the results of the only other peer-reviewed article it did reference.

<u>Impacts on Seabeach Amaranth</u>: Seabeach amaranth (*Amaranthus pumilus*) is a federally **Threatened** plant historically found on Atlantic beaches from Massachusetts to South Carolina; it currently occurs in New York, New Jersey, Delaware, Virginia, North Carolina, and South Carolina (USFWS 2007). It is found on barrier island beaches where it occurs in sparsely vegetated areas on overwash fans, the accreting ends of barrier islands, and the toe of foredunes.

**Seabeach amaranth was listed due to its extirpation from two-thirds of its historic range and its vulnerability to threats including the construction of beach stabilization structures, beach erosion, beach grooming, pedestrian and vehicular traffic, and consumption by insects and feral animals.** Of these threats, habitat loss and degradation resulting from coastal engineering were considered the most serious (USFWS 1996b, USFWS 2007).

Because of its reliance on dynamic, newly formed habitat and its inability to persist in heavily vegetated areas, according to its recovery plan, it "appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner, allowing it to move around in the landscape, occupying suitable habitat as it becomes available" (USFWS 1996b). Therefore, attempts to stabilize shorelines that lead to vegetative succession are detrimental to seabeach amaranth. Due to these needs,

*Attempts to halt beach erosion in the Carolinas and New York through beach hardening (sea walls, jetties, groins, bulkheads, etc.) appear invariably to destroy habitat for seabeach amaranth. Simply put, any stabilization of the shoreline is detrimental to a pioneer, upper beach annual, whose niche of "life strategy" is the colonization of unstable, unvegetated, or new land and which is unable to compete with perennial grasses. […] Groins have mixed effects on seabeach amaranth. Immediately upstream from a groin, accretion sometimes provides or maintains, at least temporarily, habitat for seabeach amaranth; immediately downstream, erosion usually destroys seabeach amaranth habitat. [...] In the long run, groins (if they are successful) stabilize upstream beach, allowing succession to perennials, rendering even the upstream side only marginally suitable for seabeach amaranth* (USFWS 1996b).

In addition to these problems, "jetties and terminal groins may prevent the movement of seabeach amaranth seeds along the beach (by blocking blowing sand) or in the water (by affecting longshore current at the micro level" (USFWS 2007).

According to the SEIS, seabeach amaranth has been documented on Figure 8 Island in six of the nine years from 2002-2010; no plants were found in 2008 and 2009, and no data was collected in 2006 (p. 161). As many as 768 plants were found on the island during those years, and plants were located within the permit area in 2002, 2003, 2004, 2005, and 2010 (p. 162-170). The SEIS presents no data from 2011-2015. In the early to mid-2000s the spit at the north end eroded and was replaced with intertidal shoals. It was following 2011 that the north end of Figure 8 Island again transitioned from a shoal complex to an attached spit that remained emergent more regularly than the shoals, creating dry, sandy habitat that seabeach amaranth colonizes. Since recent, relevant data was lacking, we surveyed from the north end of Figure 8 Island. We found 262 seabeach amaranth plants, concentrated in the area north of the location proposed for a terminal groin in Alternative 5D.

The SEIS mischaracterizes the impacts that the alternatives would have on seabeach amaranth. Regarding impacts to seabeach amaranth from Alternative 2, the SEIS states:

*Seabeach amaranth prefers overwash flats at accreting ends of islands and lower foredunes and upper strands of non-eroding beaches; these preferred habitats are located on the middle and southern portions of Figure Eight Island. As mentioned in Chapter 4, seabeach amaranth is an effective sand binder, building dunes where it grows. Due to lack of long-term protection against storm influenced damage, negative cumulative impacts to the dune-stabilizing seabeach amaranth, and subsequently the dune communities at Figure Eight Island in general, are expected* (p 294).

Seabeach amaranth's preferred habitats are found in some years along the length of Figure 8 Island, as demonstrated by its distribution in 2004 and 2005 (p. 164-165). However, as can be seen in Figure 6, it also prefers accreting ends of islands, which is habitat the construction of a terminal groin would remove. Second, storms are natural events that can create or maintain habitat suitable for seabeach amaranth. An 18-year review of rangewide data did not find a correlation between population size and tropical storm or hurricane activity (Rosenfeld *et al.* 2006), suggesting that seabeach amaranth **does not need** "protection" from these events. The five-year review found that impacts of beach renourishment, which is included in all alternatives but Alternative 2, are not fully known, but that in cases where beaches have severely eroded back to sea walls, buildings, or dense vegetation it may create wider, vegetation-free beaches that seabeach amaranth can colonize; however, work during outside environmental windows, which is becoming more common in North Carolina, can bury living plants (USFWS 2007).


Figure 6. The locations of Seabeach Amaranth plants found during surveys that occurred from September 3-7, 2015.

In its discussion of impacts to seabeach amaranth from alternatives that include the construction of a terminal groin, the SEIS attempts to compensate for the loss of a natural inlet spit and associated dry sandy habitat. For example:

*As discussed for Alternative 5B, the Delft3D 5-year model simulation for Alternative 5D indicated erosion is expected to occur on the north side of the terminal groin potentially affecting the habitat for nesting turtles, seabeach amaranth, and shorebirds. The location of the groin structure is situated near the transition point from oceanfront dry beach to inlet dry beach habitats, but is 420 feet closer to the inlet throat than Alternative 5B. The increased area of dry beach on the south side of the groin as a result of nourishment as well as the retention of sediment within the accretion fillet will result in positive indirect impacts including the increased habitat for nesting sea turtles, resting and nesting shorebirds, and seabeach amaranth* (p. 433).

It is not clear how much wide, vegetation-free beach would persist south of the terminal groin, as downdrift erosion is likely to cause narrowing of the oceanfront beach on Figure 8 Island. Further, the stabilization of the fillet adjacent to the terminal groin would result in vegetative succession and the likelihood that seabeach amaranth would be crowded out by other species. Therefore, the habitat lost by the removal of the spit would not be compensated for.

In order to mitigate for potential impacts to seabeach amaranth, the SEIS proposes monitoring (p. 451). Monitoring in and of itself does not affect negative impacts, and no remedies are proposed if negative impacts should be detected.

We are also concerned that the SEIS does not cite the recovery plan or status review for seabach amaranth and only cites the 1993 final rule for its listing in order to describe its colonization of dynamic, newly formed habitats (p. 161).

<u>Impacts on Sea Turtles</u>: Threatened loggerhead sea turtles (*Caretta caretta*) nest along the length of North Carolina's coast, including on Figure 8 Island, which is adjacent to the LOGG-N-04 critical habitat unit. Information on the impacts of hard structures to sea turtles is extremely limited, but the few studies that exist found negative impacts to sea turtles. Lamont and Houser (2014) documented that loggerhead turtle nest site selection is dependent on nearshore characteristics, therefore any activity that alters the nearshore environment, such as the construction of groins or jetties, may impact loggerhead nest distribution. Loggerhead nesting activity decreased significantly in the presence of exposed pilings, and a 41% reduction in nesting occurred where pilings were present (Bouchard *et al.* 1998). In a study of the impact of coastal armoring structures on sea turtle nesting behavior, Mosier (1998) demonstrated that fewer turtles emerged onto beaches in front of seawalls than onto adjacent, non-walled beaches, and of those that did emerge in front of seawalls, more turtles returned to the water without nesting. Loggerhead sea turtle nests on North Carolina beaches increased in number as distance from hard structures including piers and terminal groins increased (Randall and Halls 2014). Studies in Florida have also found avoidance behavior and decreased hatching success associated with a managed inlet (Herren 1999).

**Beach renourishment also negatively impacts loggerhead sea turtle nesting.** Renourishment can cause beach compaction, which can decrease loggerhead nesting success, alter nest chamber geometry, and alter nest concealment, and nourishment can create escarpments, which can prevent turtles from reaching nesting areas (Crain *et al.* 1995). Nourishment can decrease survivorship of eggs and hatchlings by altering characteristics such as sand compaction, moisture content, and temperature of the sand (Leonard Ozan 2011), all of which are variables that can affect the proper development of eggs. The success of incubating eggs may be reduced when the sand grain size, density, shear resistance, color, gas diffusion rates, organic composition, and moisture content of the nourished sand is different from the natural beach sand (Nelson 1991). Negative impacts from beach renourishment include decreases in nesting activity and decreases in hatching success due to the use of incompatible material, sand compaction, and suboptimal beach profile (NMFS and USFWS 1991).

Sea turtles may be impacted by construction on beaches or dredge equipment, especially when work takes place outside the environmental window for sea turtles. During the spring and summertime construction phase of the Bald Head Island terminal groin, an adult female was trapped inside the construction zone for one day and a nest was destroyed when it was dug up by construction equipment (Sarah Finn pers. com. 2015). Pipeline and other obstructions placed on the beach may obstruct hatchling emergences or impede their path to the ocean (NMFS and USFWS 1991). Hopper and cutterhead dredges may also kill sea turtles during dredge work (NMFS and USFWS 1991). The loggerhead sea turtle recovery plan emphasizes that the only beneficial impacts of nourishment are in cases where beaches are so highly eroded, there is “a complete absence of dry beach” (NMFS and USFWS 1991).

Although the SEIS states that beach renourishment activities would take place outside of the sea turtle nesting season, in both 2014 and 2015 beach renourishment projects extended far into the nesting season exposing sea turtles not only to interference during nesting emergences but also to hazards from active dredges (NMFS and USFWS 1991). The possibility that beach renourishment will take place during nesting season is not discussed in the SEIS, although in addition to the now commonplace exceptions to the environmental windows, the CRC has actively been pursuing the expansion of the windows.

**The SEIS does not address the impacts to sea turtles should beach renourishment intervals turn out to be similar to those at other North Carolina inlets with hardened structures, rather than at the five-year intervals it forecasts.** Nesting activity on nourished beaches decreased for one to three years following a nourishment event due to changes in the sand compaction, escarpment, and beach profile (NMFS and USFWS 1991, Steinitz *et al.* 1998, Trindell *et al.* 1998, Rumbold 2001, Brock *et al.* 2009). The SEIS also does not address the impacts to sea turtle nesting should Figure 8 Island experience downdrift erosion that would narrow the beach south of the groin where, as maps in the SEIS (p. 146-155) show, nesting occurs. Unlike the SEIS, the loggerhead recovery plan does include these negative impacts: “In preventing normal sand transport, these structures accrete updrift beaches while causing accelerated beach erosion downdrift of the structures [groins and jetties] (Komar 1983, Pilkey *et al.* 1984, National Research Council 1987), a process that results in degradation of sea turtle nesting habitat” (NMFS and USFWS 1991).

**Finally, the SEIS does not cite the recovery plan or the status review for the Threatened loggerhead sea turtle.** Such documents are blueprints for conservation of listed species, and we are seriously concerned that the SEIS apparently overlooked and does not cite these documents.

<u>Impact on Fishes</u>: **No mention of direct or indirect mortality or other impacts on fishes was made in the SEIS other than acknowledging that increased turbidity would clog fish gills.** Fishes would be negatively impacted by the construction of a terminal groin and the subsequent beach nourishment projects at Rich Inlet in the following ways: 1) the groin would interrupt larval transport through the inlet, therefore impacting recruitment; 2) the native fish community would be replaced with a completely different structure-associated fish community; and 3) surf zone fishes would suffer from direct mortality. Hard structures reduce the successful passage of fish larvae from the open ocean to the estuarine nurseries they inhabit until reaching maturity (Hettler and Barker 1993, Pilkey *et al.* 1998). Inlets are critical pathways for adult fishes to get to offshore spawning sites and larvae immigrate through inlets to get to estuarine nurseries (Able *et al.* 2010).

Many surf zone fishes are larval and juvenile individuals that benefit from the shallow water nursery habitat because it provides refuge from predators and foraging areas (Layman 2000). Due to their early weak swimming ontogenetic stage, fish larvae are not adapted for high mobility in response to habitat burial or increased turbidity levels. Studies have shown that beach nourishment degrades the important swash-zone feeding habitat for both probing shorebirds and demersal surf fishes (Quammen 1982, Manning *et al.* 2013, VanDusen *et al.* 2014). Surf habitats with hardened structures typically support a different community of fishes and benthic prey. Impacted species would include Atlantic menhaden, striped anchovy, bay anchovy, rough silverside, Atlantic silverside, Florida pompano, spot, Gulf kingfish, and striped mullet. Florida pompano and Gulf kingfish use the surf zone almost exclusively as a juvenile nursery area and as juveniles, they are rarely found outside the surf zone (Hackney *et al.* 1996). The dominant benthic prey for pompano and kingfish were coquina clams (*Donax*) and mole crabs (*Emerita*). Despite the fact that fishes in the surf zone are adapted to a high energy environment, rapid changes in their habitat can still cause mortality and other negative impacts. **There are documented negative impacts of renourishment on some of the invertebrates (especially mole crabs and coquinas) that are major foods of the fishes (Reilly 1978, Baca *et al.* 1991); therefore, negative impacts could be indirectly transferred to the surf zone fish community.**

Manning *et al.* (2013) states:

*Beach nourishment can degrade the intertidal and shallow subtidal foraging habitats for demersal surf fishes by three major processes: (1) inducing mass mortality of macrobenthic infaunal prey through rapid burial by up to 1 m or more of dredged fill materials; (2) modifying the sedimentology of these beach zones through filling with excessive proportions of coarse, often shelly sediments that are incompatible with habitat requirements of some important benthic invertebrates, such as beach bivalves; and (3) incorporating into the beach fill excessive quantities of fine sediments in silt and clay sizes, which can induce higher near-shore turbidity during periods of erosion as onshore winds or distant storms generate wave action, thereby inhibiting detection of prey by visually orienting fishes. The opinion repeated in many environmental impact statements and environmental assessments that marine benthic invertebrates of ocean beach habitats are well adapted to surviving the sediment deposition of beach nourishment because of evolutionary experience with frequent erosion and deposition events associated with intense storms and high waves is unsupportable. A recent review of the* *literature on impacts of storms on ocean-beach macrofauna (Harris et al. 2011) reveals that about half the studies report massive reductions of beach infaunal populations after storms.*

**Recreational Impacts and Take of Public Trust Resources:** Alterations to Rich Inlet as proposed by the preferred alternative and most other alternatives would negatively impact opportunities for human recreation at Rich Inlet and the enjoyment of public trust resources that belong to all citizens of North Carolina.

Rich Inlet is currently a favorite destination for local boaters, anglers, and beachcombers. These user groups often make use of the extensive Figure 8 Island spit and associated shoals and sandbars. They also anchor on the narrow bay beach on the sound side of Figure 8 Island and in various locations on Hutaff Island. Should a terminal groin be constructed at Rich Inlet, these recreational resources would be diminished. There would be fewer place to anchor and due to impacts on fishes and birds, opportunities for fishing and nature watching would be decreased. The SEIS promotes the wider oceanfront beach it forecasts on Figure 8 Island as an increase of recreational area for the public, but as a private island, Figure 8 Island is only accessible to the public by boat, and boaters use the spit on Figure 8 Island and associated shoals, as well as the sound side beach at Nixon Channel, not the oceanfront beach so it would be of little to no benefit to the general public.

**SEIS Fails to meet NEPA Standards:** The SEIS does not conform to NEPA guidelines in multiple regards, making it inadequate as a tool to assess environmental impacts.

NEPA is intended to ensure that all major projects that involve federal funding, work by the federal government, or federal permits evaluate environmental impacts rigorously and objectively when undertaking projects that have will have environmental impacts. This legislation guides the environmental impact statement process. Section 1500.1 of NEPA states:

*NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. Most important, NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail.*

As has been described in detail above, the SEIS does not utilize accurate scientific analysis or demonstrate expert knowledge in its evaluation of the alternatives. Instead, the document contains numerous factual errors, repeated misrepresentations and misuse of data, a biased literature review, and inaccurate summaries of impacts. It is a skewed vehicle that appears to be designed to promote the HOA's preferred alternative, not an objective evaluation of the alternatives presented. Therefore, the SEIS does not "rigorously explore and objectively evaluate all reasonable alternatives" (Section 1502.14), and the "professional integrity, including scientific integrity" (Section 1502.24) of the SEIS is fatally compromised.

NEPA also states that "text of final environmental impact statements […] shall normally be less than 150 pages and for proposals of unusual scope or complexity shall normally be less than 300 pages" (Section 1502.7). Even excluding the extraneous sections not within NEPA's required contents, the SEIS is 477 pages. The entire SEIS is 513 pages and includes an additional 2,229 pages of appendices. The language of both the main body of the SEIS and appendices does not conform to Section 1502.8: “Environmental impact statements shall be written in plain language and may use appropriate graphics so that decision makers and the public can readily understand them.”

**Improper Notice of Intent and Scoping:** The preferred alternative, a terminal groin, was not mentioned in the February 26, 2007 Notice of Intent and it was not included the scoping meetings (Appendix A of the SEIS), which took place when hardened structures were illegal in North Carolina. It is unclear, therefore, how a terminal groin could be included in this project.

**Costs Are Not Accurately Represented:** The SEIS does not accurately report the costs of the alternatives, biasing its cost estimates by conflating value with cost and cherry-picking data to make the HOA’s preferred alternative appear to be the least costly.

The North Carolina Coastal Resources Commission estimated the cost of constructing and maintaining one terminal groin in North Carolina over 30 years to be around $55,000,000 (NCCRC 2010). Meanwhile, a tax revenue-based accounting of the fiscal implications of the construction of terminal groins found that the costs of constructing and maintaining a terminal groin exceeds potential fiscal benefits at every developed North Carolina inlet (Coburn 2011). In order to make the cost of implementing the HOA’s preferred alternative more appealing, the SEIS had to omit, overestimate, or underestimate costs associated with other alternatives, primarily Alternative 2. It also overstates the current threats in order to justify the construction of a terminal groin in the first place.

Currently, no properties that might be protected by a terminal groin on Figure 8 Island are threatened. Despite this, the SEIS uses outdated aerial imagery (e.g. Figure 3.1 p. 32) and calls houses “imminently threatened” (e.g. Figure 2.7 p. 25) to give this impression. In the early 2000s, 19 houses along the oceanfront of the island received sandbags as the beach in front of them narrowed. Another house on the soundside at Nixon Channel also has sandbags, but its situation is independent of the beachfront homes, and a terminal groin would have no bearing on its status. One house has been moved to another lot, leaving 18 houses with sandbags; however, contrary to what the SEIS states, the sandbags are no longer providing protection because the beach has naturally widened as the inlet channel shifted naturally.

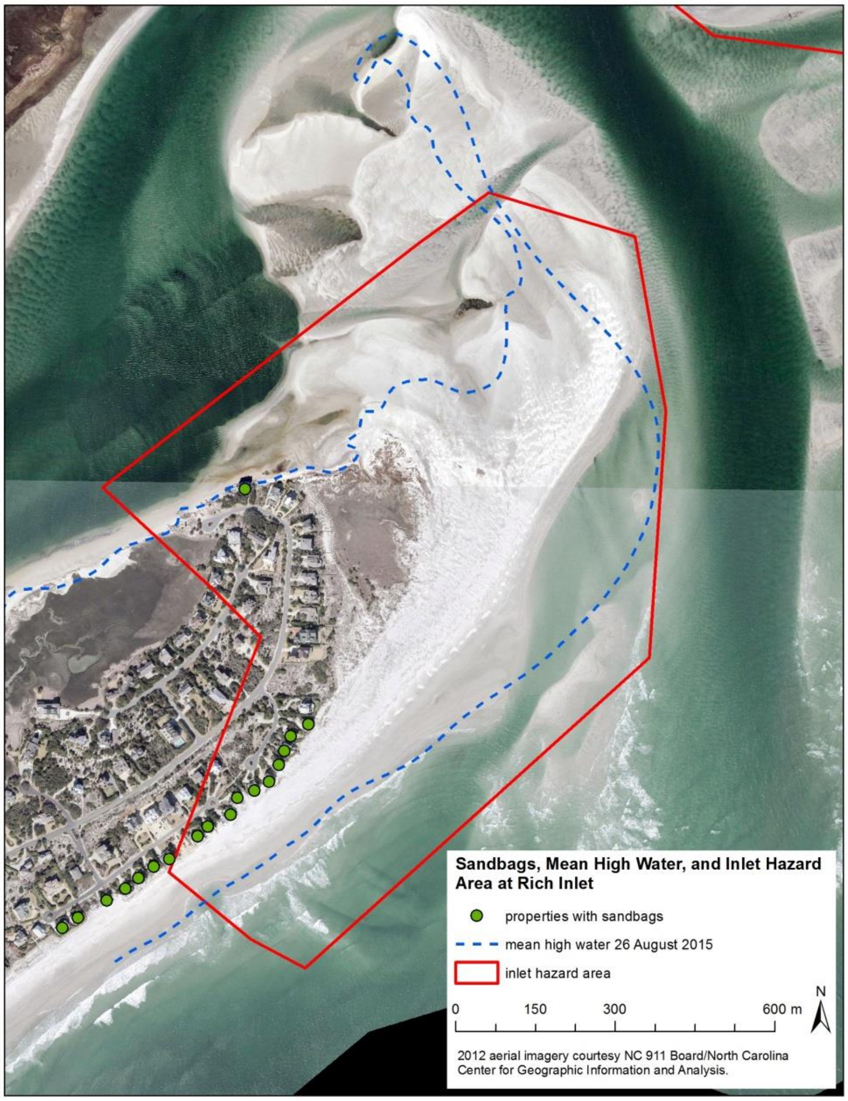


Figure 7. Houses with sandbags on the north end of Figure 8 Island.

In order to lower projected costs of beach fill activities, the SEIS optimistically forecasts five-year intervals for beach renourishment events following the installation of a terminal groin. Beaches near Fort Macon and Oregon Inlet require renourishment at more frequent intervals than the SEIS predicts, and nearby Wrightsville Beach and the south end of Figure 8 Island receive sand every three or four years. Using the SEIS's cost per nourishment, shorter beach fill intervals would increase costs by $2.5 to $3 million per event, or over $10 million over a 30-year period, greatly increasing the cost of a terminal groin.

Further, in Tables 3.11a and 3.11b (p. 96), the SEIS states that there will be a $0 cost for long-term erosion damages for Alternatives 3-5D. A zero dollar amount in the Long-Term Erosion Damages & Response Cost column is inaccurate, given the downdrift effects of terminal groins. Potential damage to properties from downdrift erosion is not discussed in the SEIS. Fenster and Dolan (1996) found an area of inlet influence between 5.4 km and 13.0 km, and Riggs and Ames (2011) found increased rates of erosion over 6 miles (9.6 km) south of Oregon Inlet following minor and major alterations to the inlet and report erosion hot spots up to 12 miles (19.3) south of the inlet. Even the smaller areas of influence cover substantial oceanfront shoreline and pose a risk to many more properties than the beach fill footprint in Alternative 5D would address (Figures 8 and 8). The SEIS also relies on beach fill to repair accelerated erosion near the western terminus of the terminal groin (clearly visible on Masonboro Island) that would threaten three houses and four vacant lots.


Figure 8. Extent of shoreline within the range of inlet influence found by Fenster and Dolan (1996).


Figure 9. Potentially impacted shoreline on the north end of Figure 8 Island.

The SEIS vastly overstates the risks associated with its non-preferred alternatives. For example, the SEIS uses atypical worst-case erosion rates to assume that 40 houses will be at risk over the next 30 years—over twice as many more than the 19 oceanfront homes that received sandbags when the beach was in its narrowest condition—and that all but 10 of the 40 would be demolished instead of relocated (p. 34). However, even its own consultant's report (Appendix B, Sub-appendix A) found that from 1938-2007, on Figure 8 Island, "net progradation has characterized the past seven decades of oceanfront shoreline change" (p. 56). Therefore, it is also possible that no houses would have to be moved or demolished in the next 30 years. What is most likely, however, is that some houses would eventually need to be moved in response to natural barrier island shoreline change. Though the SEIS does not consistently report the number of unbuilt lots available on Figure 8 Island—80 or 93—with scores of lots available, 76 of which are waterfront (p. 33), if a future change at the inlet necessitates relocating, lots could be purchased without much trouble.

The SEIS also persistently conflates value with cost in its estimates. The tax-assessed value of property that might be lost due to erosion or demolition is not the same as the cost to construct and maintain a terminal groin or carry out beach renourishment. For example, a cost of $4.7 million for damage to roads and infrastructure it predicts will wash away under Alternative 2. However, even if roads on the north end of the island were lost, there would be no cost, as they would not be rebuilt in the water. Similarly, the cost of Alternative 2 includes $16.9 million, the tax-assessed value of the 30 houses that the SEIS projects will be demolished, and $38.3 million for the value of the projected lost land. The only actual costs Alternative 2 includes is $1.4 to demolish the 30 houses and $2.4 million to relocate the 10 houses for a total cost of $3.8 million, orders of magnitude less than the $63.7 million in Tables 3.12a and 3.12b (p. 96-97). Even if the cost of purchasing new lots for relocated homes were accounted for—the 16 lots that were listed in 2013 cost an average of $1.5 million (p. 301)—the cost would come in under the cost of a terminal groin, if a reasonable number of houses were projected to be relocated.

Finally, there is also no predicted loss of tax revenue for Alternatives 3-5D. If a terminal groin is installed, the aesthetic value of the lots at the north end of the island would be diminished by replacing a natural beach view with loss of beach and a rock pile in the viewshed and replacing the shoreline with large boulders. This could affect tax-assessed value which could decrease tax revenue. Similarly, tax revenue is projected to be lost in Alternatives 1 and 2 due to loss of houses, but the increases in tax revenue from previously vacant lots, should houses be relocated, are not taken into account.

**Conclusion**: Alternatives 1, 3, 4, and 5A-5D as presented in the SEIS would negatively impact many species of birds, as well as infauna, fishes, and sea turtles. The SEIS in its current form does not carry out the functions required by NEPA. It fails to provide an objective, scientific evaluation of environmental impacts, fails to accurately describe the biological resources in the project area, obfuscates the financial costs of the alternatives, fails to address key legal requirements, and throughout contains misleading and factually incorrect information that prevents a real assessment of the proposed project. These flaws are so egregious and so systemic that the document appears to have been written in order to arrive at the conclusions desired by the HOA rather than to objectively evaluate environmental impacts and give due consideration to all reasonable alternatives.

In particular, as regards biological impacts to the naturally functioning Rich Inlet system, a stable inlet that has remained in the same general location for the past two centuries, the SEIS omits or misrepresents the vast majority of the ample body of scientific literature that is available to describe the well-known and accepted physical impacts of terminal groins and beach fill. It then fails to accurately describe the direct, indirect, and cumulative impacts that these activities would have on biological resources within Rich Inlet, particularly the Piping Plover. Instead, adverse impacts to Piping Plovers, Red Knots, and other bird species are largely dismissed or ignored. The best, most recent data and peer-reviewed literature available to assess those impacts are omitted, misrepresented, or misused, and the recommendations of multiple management and recovery plans, including USFWS recovery plans, are largely disregarded.

Alternatives 1, 3, 4, and 5A-5D as presented in the SEIS would jeopardize the recovery and/or persistence of the Great Lakes breeding population of Piping Plover, the Atlantic coast breeding population of Piping Plover, Seabeach Amaranth, and Red Knot; and a terminal groin would permanently eliminate habitats for these species listed under the Endangered Species Act without any chance of restoration or reformation in other areas. Alternatives 1, 3, 4, and 5A-5D as presented in the SEIS would jeopardize state populations of Least Terns, Black Skimmers, and American Oystercatchers, among other species.

Lastly, the SEIS fails to acknowledge the human impacts: the impacts to public trust resources that belong to every citizen of North Carolina.

The SEIS should be rejected by the permitting agencies and the alternatives that involve hard structures or channelization at Rich Inlet should be permanently removed from further consideration.

Sincerely,

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Derb Carter, Southern Environmental Law Center

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**Appendix 1:**
<u>Factual Errors and Other Inaccuracies Regarding Impacts to Birds</u>: Because accurate information is a prerequisite for accurately assessing environmental impacts and meeting NEPA standards, we will highlight some of the most serious factual and other errors and omissions within the SEIS. In general, the overwhelming number of errors in the SEIS calls into question the validity and credibility of the entire document, and on that basis alone should exclude the document from being released to the public for review.

1. The SEIS cites major conservation planning documents such as the U.S. Shorebird Conservation Plan and Atlantic population Piping Plover recovery plan, but it uses these documents only to establish basic facts about the species' range and biology. The threats, recommendations, and conclusions within these documents are not cited.

All USFWS Piping Plover conservation documents plans cite the need to protect Piping Plover habitat from both the direct and indirect impacts of shoreline stabilization, inlet dredging, and beach maintenance. The Piping Plover Atlantic Coast Population Revised Recovery Plan (USFWS 1996) states, "Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the species' decline." It cites the cumulative effects of structures that "cause significant habitat degradation by robbing sand from the downdrift shoreline" as well as more localized impacts at the sites of these structures. It recommends the discouragement of stabilization projects and suggests creation or enhancement of habitat in affected areas as mitigation. These conclusions are not referenced in the SEIS. Instead, it uses the recovery plan to cite the Piping Plover's use of overwash habitats (p. 124, 125), its listing status (p. 172), and its nest construction and clutch size (p. 172).

The Recovery Plan for the Great Lakes Piping Plover, which the SEIS does not reference, states:

*Beach stabilization and 'nourishment' projects also degrade the quality of beach habitat for piping plovers and other coastal species. To ensure adequate habitat for survival, reproduction and recovery, natural processes within the ecosystems piping plovers utilize must be protected* (USFWS 2003).

The Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation identifies sand placement projects, inlet stabilization/relocation, sand mining/dredging, groins, and seawalls and revetments as threats to Piping Plovers.

*Habitat loss and degradation remains very serious threats to Atlantic Coast piping plovers, especially in the New York-New Jersey and Southern recovery units. Artificial shoreline stabilization projects perpetuate conditions that reduce carrying capacity and productivity and exacerbate conflicts between piping plovers and human beach recreation. As discussed in section AC 2.5.3.5, many activities that artificially stabilize barrier beaches will further exacerbate threats from projected sea-level rise* (USFWS 2009).

The review also explains the importance of high-quality stopover and wintering habitat in the context of a small population that spends most of its annual cycle away from nesting grounds:

*Piping plover populations are highly vulnerable to even small declines in survival rates of adults and fledged juveniles. Population growth gained through high productivity on the breeding grounds will be quickly reversed if survival rates or breeding fitness decline due to stressors experienced during the two-thirds of the annual cycle spent in migration and wintering. Although management of threats in the nonbreeding range has begun to increase in recent years, considerably more attention and effort are required* (USFWS 2009).

Other shorebird species conservation plans are clear about the importance of non-breeding habitat. The U.S. Shorebird Conservation Plan is cited twice in the SEIS, on p. 104 to substantiate use of salt marsh habitat for foraging by shorebirds and on p. 176 in reference to the conservation status of the Wilson's Plover. Other examples include:

*To safeguard Dunlin populations, we have to protect the interconnected chains of wetlands they depend upon from further deterioration and disappearance. Because adult survival is a critical variable in determining population size of [long-lived] migratory shorebirds, it is very important to maintain and secure high-quality habitats* (Fernández et al. 2010)

and

*Habitat loss has particularly significant implications for Sanderlings during migration—a time when they must put on fat to fuel their long flights—and also in winter (stressful weather). The potential cost during migration is clear: without enough fuel (fat), Sanderlings may not be able to complete the next leg of their journey, may arrive on breeding grounds with too few resources to breed, or may not survive. On the wintering grounds (e.g., California, North Carolina, and Peru), many individuals exhibit strong site fidelity and spend most of their time (or return to) the same 5- to 10-kilometer stretch of beach year after year (Myers et al. 1979a, Connor et al. 1981, Myers et al. 1988, Dinsmore et al. 1998). Thus, the loss of even small stretches of coastline could alter social dynamics of local winter populations, with potentially harmful (although currently unknown) consequences* (Payne 2010).

2. The SEIS does not accurately assess impacts to birds. Most critically, it fails to consider cumulative impacts. Cumulative impacts to birds in and around Rich Inlet would be the continued loss of habitat due to repeated beach fill activities and the permanent removal of shoals and the spit on the north end of Figure 8 Island. The natural inlet system needed to sustain wintering Piping Plover critical habitat would be lost, and the carrying capacity for shorebirds, including Piping Plovers, and nesting terns and skimmers in the region would be diminished. Typically, when a groin fails, it is not removed, but additional structures are constructed, thus impacting even more habitat.

Cumulative impacts not only ripple through time, but through geography. Comparable habitats elsewhere in North Carolina are few. After New Topsail Inlet, the next closest comparable inlet to Rich Inlet is Ophelia Inlet on Cape Lookout National Seashore, 100 miles north. To the south, the next best Piping Plover habitat is in Cape Romain, SC, approximately 150 miles south. Humans are not creating new habitat for birds to use in North Carolina or indeed on the Atlantic

Flyway, only removing habitat that birds need to survive through coastal engineering projects such as the proposed groins on Ocean Isle Beach and Holden Beach, the proposed groin on Kiawah Island, SC and, farther afield, the response to Hurricane Sandy on Long Island, NY.

Currently 14% of the U.S. shoreline has been hardened, 66% of which has occurred along the south Atlantic and Gulf coasts (Gittman *et al.* 2015), 57% of Atlantic coast inlets in the migration and winter range of the Piping Plover have been modified, and at least 32% of beaches have received fill (Rice 2012b). Currently, 72% of Atlantic and Gulf coast states permit hard structures at inlets (Titus 2000). If inlets continue to be stabilized one by one, the cumulative impact will be that eventually there will be no suitable high-quality inlet habitat left on the Atlantic coast. Whether this habitat is taken piecemeal by one project at a time or all at once, the result will be the same: Piping Plovers, Red Knots, and other shorebirds will no longer have the habitat they need to survive, and recovery of listed species will be impossible.

The SEIS fails to accurately characterize indirect impacts. In all of its assessments of indirect impacts to shorebirds, the SEIS predicts that of intertidal flats and shoals will be reduced (Table 5.1, p. 202), but it declines to state that loss of this habitat will have a significant negative impact on wintering and migrating shorebirds such as the Piping Plover that require these habitats for foraging and survival. This omission is most evident in the discussion of the HOA's preferred alternative, indicating a bias towards the HOA's desired outcome, not an objective evaluation of the facts.

For example, although intertidal habitat would be lost under Alternatives 5A-D as well as under Alternative 3, the SEIS neglects to mention these negative impacts to Piping Plovers, Red Knots, and other birds in its discussion of its preferred alternative. However, the statement below is as true for Alternatives 5A-D as it is for Alternative 3:

*These impacts will result in the conversion of intertidal flats and shoals to alternate habitat types; namely subtidal habitat in the dredged area and dry beach habitat in the dike construction area; consequently removing the infaunal community residing in these areas. The removal of this habitat and the encompassed infaunal community is expected to negatively affect various foraging bird species, including piping plovers and the red knot, who utilize the intertidal flats and shoals for feeding in this location* (p. 311).

Finally, the Summary of Impacts Table (Appendix E) relies on the highly questionable predictions of the Delft3D models, and does not accurately describe negative impacts to birds, infaunal organisms, or habitat. Many impacts are simply left off of the table.

3. The SEIS mischaracterizes birds' habitat use in several ways. First, states repeatedly that the creation of stabilized dunes and dry beach habitats will benefit a variety of species of birds. However, the preparers and reviewers misunderstand the habitat that terns, skimmers, and shorebirds at Rich Inlet require for nesting, as well as where shorebirds roost within inlets.

The SEIS states, "This stabilization measure [the creation of a dune] will allow for long term growth and development of dune vegetation and provide habitat for roosting, foraging and nesting shorebirds" (p. 362). To the contrary, overwash fans and elevated inlet spits constitute the best habitat for beach-nesting birds, such as Least Terns, Common Terns, Black Skimmers, American Oystercatchers, and Wilson's Plovers, which are found on Figure 8 Island (Gochfeld and Burger 1994, Thompson *et al.* 1997, Nisbet 2002, Corbat and Bergstrom 2000, Nol and Humphrey 2012). This is because they are sparsely vegetated or bare and maintained in that state through natural processes. Within three to five years without overwash, dune vegetation will become too dense and eliminate or significantly degrade nesting habitat (Parnell and Shields 1990). Roosting shorebirds also prefer elevated but open areas that allow them to see the approach of predators. They do not roost within dune systems or seek vegetation. When assessing impacts to birds, the SEIS fails to make the connection between stabilizing the north end of Figure 8 Island, vegetative succession, and the loss of nesting and roosting habitat for shorebirds during both the breeding and non-breeding season that will result from the construction of a terminal groin and other actions proposed in the SEIS.

Second, the SEIS repeatedly attempts to substitute the dry beach habitat currently found on the large spit on the north end of Figure 8 Island for oceanfront beach that it predicts will be maintained or created by a terminal groin (p. 426). However, these two habitats are not interchangeable. The inlet spit dry beach provides habitat for nesting and roosting birds, and there is also a large amount of intertidal zone for foraging on the sound side. If the spit is removed by a terminal groin, the oceanfront dry beach on the south side of the groin will not be suitable habitat for the birds. Shorebirds at Rich Inlet prefer to roost on spits, where they are far away from dunes and other features that would block their view of avian or other predators. Most of the nesting at Rich Inlet also takes place on the spit.

Third, the SEIS misrepresents Piping Plover habitat use in various ways. When the Delft3D model predicts an increase in beach width or oceanfront beach, either on Hutaff or Figure 8 Island, the SEIS attempts to emphasize the importance of wide beaches to Piping Plovers: "As shown by research, wintering plovers on the Atlantic coast prefer wide beaches in the vicinity of inlets (Nicholls and Baldassarre 1990, Wilkinson and Spinks 1994)" (p. 354).

However, Nicholls and Baldassarre (1990) found that wide beaches were a significant predictor of Piping Plover presence on the Gulf Coast, not the Atlantic coast, and differentiated between the more important predictive factors for Piping Plover occupancy on the Atlantic coast—the number of large inlets and passes, the presence of mudflats, and the number of tidepools—and the Gulf coast—beach width, number of small inlets, and beach area.

Similarly, Wilkinson and Spinks (1994) found Piping Plovers were on open sandy beaches near inlets, but the SEIS does not examine the factors that attract Piping Plovers to the vicinity of inlets. There is a growing body of peer-reviewed scientific literature emphasizing habitat heterogeneity at inlets and use of inlet-associated low-energy intertidal flats, particularly by migrating or wintering Piping Plovers (Haig and Oring 1985, Johnson and Baldassarre 1988, Nicholls and Baldassarre 1990), and indicating that Piping Plovers use a variety of habitats throughout the tidal cycle within a small home range during the non-breeding season (Drake *et al.* 2001, Rabon 2006, Cohen *et al.* 2008, Maddock *et al.* 2009).

The SEIS misreports the results of Audubon North Carolina's Rich Inlet report (Addison and McIver 2014a) when it states:

*A review of data collected by Audubon North Carolina for piping plover between 2008 and 2014 showed that piping plovers have continued to utilize the habitats within the Rich Inlet complex despite the natural modifications over time. Specifically, of the seven landscape types where piping plovers were observed foraging within this area, the oceanfront beach in proximity to the inlet was the second most utilized habitat type for foraging piping plovers (Addison and McIver, 2014)* (p. 275).

The seven landscape types listed in the report were ocean beach, bay beach, inlet spit, ebb shoal island, flood shoal island, sandbar, and tidal creek/lagoon. However, many of these landscape types provide the same habitat type: intertidal habitat. The SEIS does not mention the report's results on habitat use, which documented far more observations on landscapes that provided low-energy intertidal habitats (75.2% of Piping Plover observations) than high-energy intertidal habitat on oceanfront beaches. Those are the habitats that a terminal groin would have the greatest negative impact on.

Additionally, asserting that because Piping Plovers have used Rich Inlet even though it changes naturally over time has no bearing on whether they would be able to use it if significant amounts of foraging and roosting habitat were permanently lost due to the construction of a terminal groin or the channelization of the inlet. The accretion of the spit at the north end of Figure 8 Island has improved habitat in Rich Inlet, which is reflected by the increase in Piping Plover sightings at Rich Inlet; peak counts in 2013, 2014, and 2015 are greater than they have been in previous survey years (Addison and McIver 2014a and Audubon North Carolina unpublished data).

4. The SEIS does not correctly describe the timing of birds' use of Rich Inlet. The SEIS states:

*Under Alternative 5D, the groin and beach nourishment construction activity may stress shorebirds, including the endangered piping plover, from foraging along the intertidal flats that are located in close proximity of the construction area. However, as shown with the channel relocation project in New River Inlet discussed in Alternative 3 and 5A, during-construction bird monitoring revealed continual bird use of the inlet resources as dredging and inlet beach activity was in operation. As with that project, construction for Alternative 5D will take place between November 16th and March 31st when some migratory bird species are not present and bird populations are at their lowest* (p. 428).

Because it does not acknowledge the seasonal patterns of inlet use by migrating and wintering shorebirds, the SEIS cannot accurately assess impacts of wintertime construction activities. Such activities would directly impact migrating and wintering shorebirds, including the Piping Plover, whose spring migration numbers peak in March or April, and which overwinters at Rich Inlet (Addison and McIver 2014). Other species that winter at Rich Inlet include Dunlin (peak November-March count: 1,446), Short-billed Dowitcher (peak November-March count: 384), Semipalmated Plover (peak November-March count: 250), and Black-bellied Plover (peak November-March count: 164) (Addison and McIver 2014). From fall 2009-spring 2015, average November 16-March 31 counts were higher by 9-48% than average counts during the rest of the year in all years but one (Audubon North Carolina unpublished data). A substantial portion of this data was provided to CP&E during the previous DEIS process.

5. Several figures in Addison and McIver (2014) are interpreted incorrectly in the SEIS. Correctly represented, the figures in the report show that Piping Plovers used the spit on the north end of Figure 8 Island throughout the study period (2010-2014) and that the spit was used for foraging and roosting. However, the SEIS repeatedly treats the dots as actual numbers of Piping Plovers. This misrepresentation is used to state that the habitats used by birds on the north end of Figure 8 Island and the south end of Hutaff Island are comparable and interchangeable, and that the loss of the spit on Figure 8 Island will not impact birds because they will move to Hutaff Island: "Like the Figure Eight side of the inlet, Hutaff's southern spit has been shown by the Audubon North Carolina 5-year survey data to be heavily used for foraging and roosting by piping plover" (p. 354).

In order to determine whether birds used north Figure 8 Island to the same degree as Hutaff Island, we statistically compared the mean numbers of Piping Plovers, Red Knots, and all shorebirds observed at these two locations from 2010-2015. Significantly more Piping Plovers, Red Knots, shorebirds, and all birds were observed on north Figure 8 Island than Hutaff Island during 2010-2015 (Mann-Whitney test, $p<0.001$). This indicates that Hutaff Island is not equivalent to the north end of Figure 8 Island since significantly more Piping Plovers, Red Knots, shorebirds, and birds used north Figure 8 Island.

6. The SEIS fails to include the recent return of nesting Piping Plovers to the north end of Figure 8 Island, does not report the most recent 2015 nesting numbers, and includes Piping Plovers nesting outside of the project area which has the effect of minimizing the relative significance of the north end of Figure 8 Island to nesting Piping Plovers.

The NCWRC collects data for a statewide nesting Piping Plover census every year. Neither the single pair of Piping Plovers that nested on north Figure 8 Island in 2014 nor the two pairs of Piping Plovers that nested in 2015 are reported (Schweitzer 2015, Schweitzer and Abraham 2014). Instead, about nesting Piping Plovers, the SEIS states:

*The UNCW, NCWRC, Audubon North Carolina and partners have conducted piping plover surveys of the project area during various seasons since 1987. There are three areas that have been monitored, Figure Eight Island, Rich Inlet and Hutaff Island. Only one (1) breeding pair, observed in 1996, has been located on Figure Eight Island. Hutaff Island, however, appears to be an important breeding area based upon the annual observations of breeding pairs. Since 1989, the peak number of breeding pairs observed on Hutaff was five (5) (Cameron pers. comm., 2007)* (p. 172-173).

Dating back to 2003, no Piping Plovers have been reported nesting on Hutaff Island within the project area. The project area includes only a small portion of Hutaff Island. Piping Plover nesting on Hutaff Island occurred farther north and has not occurred at all since 2013.

7. The SEIS misrepresents the results of monitoring that took place at Mason Inlet following the relocation and channelization of Mason Inlet. Accurately understanding the impacts of other inlet management projects are essential to assessing potential impacts at Rich Inlet. The SEIS states:

*It should be noted that inlet intertidal flats and shoals are not fixed stationary habitats, and are considered to be ephemeral and dynamic in natural conditions. Consequently, bird resources are known to adjust to these changes. This ability for birds to adjust is also known after man-induced changes as shown in the Mason Inlet Relocation Project* (p. 430).

The relocation and maintenance of the Mason Inlet channel within a prescribed corridor through dredging at a three-year interval has had negative impacts to nesting birds at that inlet. In 2013, the most recent year of productivity monitoring for nesting birds, productivity was very low. Only 7% of nests hatched and no chicks survived (Gilstrap *et al.* 2013), far below what is considered "moderately successful" (0.25-0.5 fledglings/pair) (Burger 1984).

Figure 1 illustrates how the stabilization of Mason Inlet impacted nesting birds on the north end of Wrightsville Beach. Because the inlet was stabilized and spits were not allowed to form, erode away, and reform, vegetative succession eventually overtook the open, sandy habitat that was used by Least Terns and other beach-nesting birds. Without suitable habitat, the inlet became largely unsuitable for nesting birds. The effects on other nesting species (Black Skimmer, Common Tern, American Oystercatcher, and Wilson's Plover) were similar. Though yearly data from the south end of Figure 8 Island are not available, no large numbers of birds nested there since the relocation project took place (NCWRC Colonial Waterbird Database).

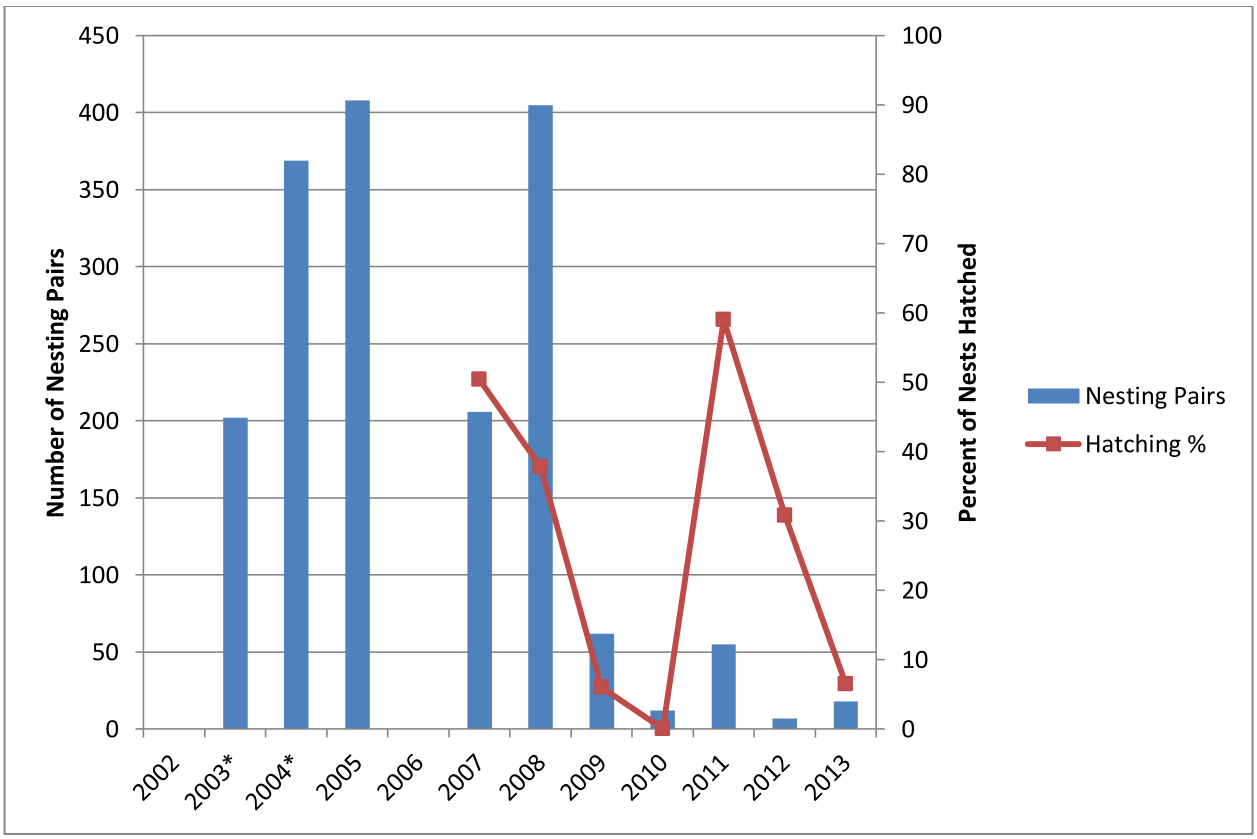


Figure 1. Least Tern nesting pairs and productivity at the north end of Wrightsville Beach, 2002-2013. *Total nests found annually.

In summarizing the overall outcome of the project, it was concluded that “given the continued degradation of the habitat that shore and waterbirds require for nesting, along with the extremely low hatching success and no chicks surviving to fledge, the Mason Inlet Waterbird Management Area currently provides poor-quality habitat for nesting terns, skimmers and shorebirds” (Gilstrap *et al.* 2013).

8. The SEIS makes large claims with no publications or other data to support its assertions. For example:

*On-going monitoring along the North Carolina coastline by private, local, and State entities has shown the presence of shorebirds continuing to use the oceanfront beach resources. This is occurring even with more recent beach fill activities and the presence of existing structures. Much of this can be attributed to more public awareness of the species, an expected shortened recovery time for their benthic community food source, the presence of adjacent undisturbed protected beaches, and the inclusion of beach fill moratoriums. These factors are also part of the Figure Eight proposal and if implemented, should reduce any potential cumulative impacts on shorebird resources* (p. 27).

Accurate baseline information for birds using oceanfront beach is lacking for most of the state’s developed beaches and does not show what the SEIS asserts (S. Schweitzer pers. com. 2015). The rest of the paragraph is also incorrect since there is no moratorium mentioned in the SEIS for placement of beach fill as part of the Figure 8 Island project, the firm producing the report was directly involved in the North Topsail Island beach renourishment project that occurred during the environmental window for birds and sea turtles, and no reason to expect shorter infaunal recovery times is provided.

9. The SEIS inaccurately downplays the conservation status of the shorebirds it considers, citing a 2006 report from the North Carolina Natural Heritage Program: “All shorebirds considered for the purpose of this CEA, with the exception of the piping plover, are globally ranked as G4 (apparently globally secure) or G5 (globally secure)” (Appendix F, p. 16), ignoring several other assessments such as North Carolina NCWRC, the Partners in Flight Watchlist, and U.S. Shorebird Conservation Plan which consider state populations as well as hemispheric populations and do not draw the same conclusions.

10. The SEIS does not address avoidance or mitigation in a meaningful way, and it does not present a robust monitoring protocol. Instead, after selecting an alternative that would significantly and permanently adversely impact Piping Plover, Red Knot, and other wildlife habitat, it proposes:

*The University of North Carolina at Wilmington (UNCW), under the direction of Dr. David Webster, conducts shorebird and colonial waterbird monitoring throughout the year along the beachfront of Figure Eight Island and the areas surrounding Mason and Rich Inlet. In addition, Audubon North Carolina has monitored the Rich Inlet complex which includes Figure Eight Island’s northern spit since 2008. These monitoring efforts are expected to continue for the foreseeable future (Webster, pers. comm.)* (p. 450).

Monitoring is not mitigation. Further, monitoring one side of an inlet, as Dr. Webster does, is not adequate to assess impacts to birds. Monitoring does nothing to minimize adverse impacts to resources. Without thresholds for unacceptable impacts and a detailed, enforceable, feasible plan to reverse those impacts, monitoring does little to no good.