UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

SEP 17 2012

Kostas Svarnas
U.S. Department of Transportation
Federal Highway Administration
New Jersey Division
840 Bear Tavern Road
Trenton, New Jersey 08628

RE: Route 52 Causeway Replacement & Somers Point Circle Elimination Contract B

Dear Mr. Svarnas,

In May 2012, we were made aware of the New Jersey Department of Transportation's (NJDOT) near completion of the Route 52 Causeway Replacement & Somers Point Circle Elimination Contract B project, which spans Great Egg Harbor and is located in Somers Point City, Atlantic County, and Ocean City, Cape May County, New Jersey. Completion of the project, however, has been halted due to the difficulty in removing the last eight concrete piers, which are proposed to be removed via blasting. Coordination between NOAA's National Marine Fisheries Service (NMFS) and the Federal Highway Administration (FHWA) has been ongoing since May 2012 to discuss project details, the blast plan, as well as potential mitigation measures that can be implemented to avoid any adverse effects to listed species.

On August 23, 2012, we received your August 20, 2012 letter requesting consultation pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended, regarding the removal of the eight concrete piers, via blasting. Mitigation measures previously discussed amongst both agencies were also incorporated within your request. You have made the preliminary determination the proposed action is not likely to adversely affect any species listed by NMFS and have requested our concurrence with this determination. With the appropriate mitigation measures in-place throughout the proposed action, we agree all effects to listed species will be insignificant and discountable. Therefore, we concur with your determination that the proposed action is not likely to adversely affect any NMFS listed species. The justification for our determination is provided below.

Proposed Project

The NJDOT is proposing to remove a section of the Route 52 Causeway (i.e., the Ship Channel section). Contractors will mechanically remove the superstructure and part of the substructure, leaving the tops of the piers just above high water for drilling and blasting access. Once the top of the piers area exposed, a drill rig, placed on a barge, will be used to drill the bore holes at designated locations within concrete piers number 1 through number 11. Each hole will be filled with explosives and stemmed at the top. Each bore hole will be detonated independently (delayed) of the other holes in the same pier, with approximately 11.7 to 26.6 pounds per delay of explosives used. The blasting will be broken into 11 events on separate days. Once the piers have been blasted, all debris will be removed from the Ship Channel in Great Egg Harbor.

Throughout all phases of blasting/demolition, a turbidity curtain will be placed 100-feet from each pier being blasted. Additionally, all bore holes within the concrete piers will be stemmed prior to blasting to reduce blasting pressures within the surrounding waters. Work is estimated to begin at the end of September 2012 or the beginning of October 2012 and be completed by the end of December 2012.

NMFS Listed Species in the Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR § 402.02). For this project, the action area includes the project footprint as well as the underwater area where effects of blasting (i.e., elevated levels of underwater noise) will be experienced within Great Egg Harbor. This area is expected to encompass all of the effects of the proposed dredging project.

Sea Turtles
Four species of federally threatened or endangered sea turtles under our jurisdiction may be found seasonally in the coastal waters of New Jersey: federally threatened Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead (*Caretta caretta*), and the federally endangered Kemp's ridley (*Lepidochelys kempi*), green (*Chelonia mydas*) and leatherback (*Dermochelys coriacea*) sea turtles, although the latter species is found in deeper, more offshore waters and as such, is unlikely to occur in the action area. Sea turtles may occasionally occur in Great Egg Harbor; however, this is not known to be a high use area for sea turtles. Sea turtles are expected to be in these waters in warmer months, generally when water temperatures are greater than 15°C. This typically coincides with the months of May through mid-November, with the highest concentration of sea turtles present from June – October.

Atlantic Sturgeon
There are five DPSs of Atlantic sturgeon listed as threatened or endangered. Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs are listed as endangered, while the Gulf of Maine DPS are listed as threatened (77 FR 5880; 77 FR 5914). The marine range of all five DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida.

Atlantic sturgeon spawn in their natal river, with spawning migrations generally occuring during February-March in southern systems, April-May in Mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco 1977; Smith, 1985; Bain 1997; Smith and Clugston 1997; Caron *et al.* 2002). Young remain in the river/estuary until approximately age 2 and at lengths of 30-36 inches before emigrating to open ocean as subadults (Holland and Yelverton 1973; Dovel and Berggen 1983; Dadswell 2006; ASSRT 2007). After emigration from the natal river/estuary, subadults and adult Atlantic sturgeon travel within the marine environment, typically in waters between 16 to 164 feet in depth, using coastal bays, sounds, and ocean waters (Vladykov and Greeley 1963; Murawski and Pacheco 1977; Dovel and Berggren 1983; Smith 1985; Collins and Smith 1997; Welsh *et al.* 2002; Savoy and Pacileo 2003; Stein *et al.* 2004; Laney *et al.* 2007; Dunton *et al.* 2010; Erickson *et al.* 2011).

As the distribution of Atlantic sturgeon is strongly associated with prey availability, Atlantic sturgeon may occur in nearshore waters, such as the action area, if suitable forage exists. Atlantic sturgeon feed on benthic invertebrates (e.g., mollusks, gastropods, annelids, anphipods) and occasionally on small fish. Foraging often occurs at, or near, mudflats with areas of submerged aquatic vegetation (SAV) or shellfish resources. The action area, specifically the area where pier removal (i.e, blasting) will occur, has limited suitable forage and foraging habitat for Atlantic sturgeon (e.g., no SAV, gravel to shell hash substrate, limited benthic invertebrates, no shellfish beds) and thus, the action area is not suspected to serve as a foraging area for Atlantic sturgeon. The lack of suitable forage in the action area reduces the likelihood that foraging Atlantic sturgeon will be present in the action area, specifically within the vicinity of the piers to be blasted; however, as Atlantic sturgeon originating from any of five DPSs may occur in other regions of Great Egg Harbor, Atlantic sturgeon exposure to effects of the proposed project (e.g., elevated levels of noise, increased turbidity), which may extend into other portions of Great Egg Harbor, is possible. Because of their life history, only sub-adult or adult Atlantic sturgeon may be present in this body of water and are likely to be migrating and possibly foraging opportunistically should suitable forage be available.

Effects of the Action

Blasting

Acoustic Effects: Atlantic Sturgeon

There have been numerous studies that have assessed the direct impact of underwater blasting on fish (e.g., Teleki and Chamberlain 1978; Wiley *et al.* 1981; Burton 1994; Moser 1999). While none of the studies have focused on Atlantic sturgeon, the results demonstrate that blasting does have an adverse impact on fish. Teleki and Chamberlain (1978) found that several physical and biological variables were the principal components in determining the magnitude of the blasting effect on fish. Physical components include detonation velocity, density of material to be blasted, and charge weight; while the biological variables are fish shape and size, location of fish in the water column, and swim bladder development. Composition of the explosive, water depth, and bottom composition also interact to determine the characteristics of the explosion pressure wave and the extent of any resultant fish kill. Furthermore, the more rapid the detonation velocity, the more abrupt the resultant hydraulic pressure gradient, and thus, the more difficult fish have in adjusting to the pressure changes. That is, it is the pressure oscillations created by the detonation that cause a rapid contraction and over-extension of the swim bladder as pressure gradients change; this results in internal damage and/or mortality to species of fish (Wiley *et al.* 1981). If blasting detonations are undertaken at one time (i.e., not set up to be delayed), fish cannot recover from these pressure oscillations, resulting in internal injuries (e.g., swim bladder ruptures) that may result in death. However, as described above, explosives will be placed within the concrete piers. This, combined with delayed blasting and stemming of each borehole, reduces the overpressures that will enter the surrounding water per blasting event, thus reducing the pressure gradients experienced by species of fish, such as Atlantic sturgeon. However, even with this reduction, elevated levels of pressure and noise will still be emitted within the waters surrounding the demolition site and thus, have the potential to affect Atlantic sturgeon.

Currently, NMFS has no acoustic guidelines or protective criteria for listed species of fish in regards to blasting. As noted above, there have been no studies undertaken to assess the effects of blasting on Atlantic sturgeon; however, a study done by Moser (1999) on the effects of blasting on shortnose sturgeon has been undertaken. This study will serve as the best available information on the effects of blasting on Atlantic sturgeon, and thus, serve as guidance in determining levels of pressure that will cause effects to Atlantic sturgeon.

Moser (1999) conducted test blasting in the Wilmington Harbor, North Carolina, in December 1998 and January 1999 in order to adequately assess the impacts of blasting on shortnose sturgeon and the size of the LDI area (the lethal distance from the blast where 1% of the fish died). As explained in Moser (1999), the test blasting consisted of 32-33 blasts (3 rows of 10 to 11 blast holes per row with each hole and row 10 feet apart), about 24 to 28 kg of explosives per hole, stemming each hole with angular rock, and an approximate 25 msec delay after each blast. During test blasting, 50 hatchery reared juvenile striped bass and shortnose sturgeon were placed in 0.25" plastic mesh cylinder cages (2 feet in diameter by 3 feet long) 3 feet from the bottom (worst case scenario for blast pressure as confirmed by test blast pressure results) at 35, 70, 140, 280, and 560 feet upstream and downstream of the blast location.

Results of the study indicated that there was a low survival rate for both species of fish located 35 feet from the detonation site; however, at distances of 70 feet, caged fish showed no sign of hemorrhage or swim bladder damage, although two fish exhibited extended intestines, which may have been caused by the blast. Necropsy results indicated that shortnose sturgeon juveniles were less seriously impacted by test blasting than were the juvenile striped bass; that is it is believed that shortnose sturgeon would have survived more frequently than striped bass following blasting treatments, even within the 35-foot distance of the blast area (i.e., 88% of shortnose sturgeon would have survived versus 34 % of the striped bass)[1] and that at distances at and beyond 70 feet (i.e., 140 feet or more), all shortnose sturgeon would survive blasting, even after 24 hours of exposure (Moser 1999). Therefore, although fish located at 140 feet from the blast area were never necropsied, based on the above information, the 100% survival rate of shortnose observed 140 feet from the blast area was expected to continue even 24 hours or more after the blast. Average peak pressure and peak impulse pressure levels at 140 feet were 75.6 psi and 18.4 psi-msec, respectively, with peak impulse pressure being a better indicator of blast impacts than peak pressure (Moser 1999). Moser (1999) stipulated that shortnose sturgeon may be less susceptible and less sensitive to blasting effects due to the fact that the swim bladder in shortnose sturgeon is connected to the esophagus, allowing gas to be expelled rapidly without damage to the swimbladder (i.e., physostomus).

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[1] After 24 hours of the blast treatments, fish located at 35 feet and 70 feet from the blast area were necropsied.

Based on this and the best available information, we believe that peak pressure levels at, or below, 75.6 psi, and peak impulse levels at, or below 18.4 psi-msec, will cause no injury or mortality to species of sturgeon, including Atlantic sturgeon. The FHWA provided us with information on estimated levels of overpressure produced during the detonation of each pier. Within 100 feet of each pier, psi levels were estimated to be 6.6 psi, which is below levels believed to cause injury or mortality to species of sturgeon; however, at a distance closer to the pier (i.e., within 10 feet), these over pressure levels will be higher and therefore, have the potential to adversely affect Atlantic sturgeon. To ensure Atlantic sturgeon are not exposed to these elevated levels of pressure, a turbidity curtain will be placed around each pier at a distance of at least 100 feet from the pier, and in a manner that will prevent Atlantic sturgeon from entering the area to be blasted (i.e., bottom of curtain approximately 0.3-0.6 meters above bottom (DOER 2005); sturgeon occur in waters no shallower than 1 meter), thereby ensuring sturgeon cannot enter the immediate construction site and thus, ensuring that Atlantic sturgeon are not exposed to overpressure levels that will cause injury or mortality.

In addition to physical effects, blasting operations may also cause changes in behavior of the species affected. Currently, we have no information on the underwater noise levels or overpressures produced during blasting that may cause behavioral changes in Atlantic sturgeon. However, for purposes of assessing behavioral effects resulting from pile driving at several West Coast projects, NMFS has employed a 150 dB re 1 μPa_{RMS} sound pressure level criterion at several sites, including the San Francisco-Oakland Bay Bridge and the Columbia River Crossings. As we are not aware of any studies that have considered the behavior of Atlantic sturgeon in response to blasting noise, given the available information from studies on other fish species (i.e., Anderson *et al.* 2007; Purser and Radford 2011; Wysocki *et al.* 2007), we consider 150 dB re 1 μPa_{RMS} to be a reasonable best estimate of the blasting noise level at which exposure may result in behavioral modifications. As such, for the purposes of this consultation, we will use 150 dB re 1 μPa_{RMS} as a conservative indicator of the blasting noise level at which there is the potential for behavioral effects. That is not to say that exposure to noise levels of 150 dB re 1 μPa_{RMS} will always result in behavioral modifications, but that there is the potential, upon exposure to noise at this level, to experience some behavioral response (e.g., temporary startle to avoidance of an ensonified area).

As noted above, Atlantic sturgeon will only be permitted to be within 100 feet of the piers to be removed. Based on the information provided to us from the FHWA, we have estimated that underwater noise levels of 150 dB re 1 μPa_{RMS} may be experienced within 200 feet of the piers to be blasted.[2] As noted above, the habitat characteristics of the action area (i.e., no SAV, no shellfish beds, limited benthic invertebrates) are not preferred by Atlantic sturgeon and as such, it is extremely unlikely that Atlantic sturgeon will be found in the vicinity of the piers where blasting operations will occur and thus, within 200 feet of the piers to be blasted. Should an Atlantic sturgeon occur within this area, it is reasonable to assume that sturgeon, on hearing blasting, would either not approach the source or move around it. If any movements away from this area do occur, it is extremely unlikely that these movements will amount to substantial changes to essential Atlantic sturgeon behaviors (e.g., reproduction, foraging, resting, and

[2] $SPL_{dB}=20 \text{ Log } P_{psi} + 170.8$ (Kinsler and Frey, 1962).

migration). Additionally, the extent of underwater noise is not likely to present a barrier to Atlantic sturgeon movements and as such, if individuals are present within the vicinity of the action area, they are likely to veer/swim away from the blasting site and continue normal behaviors (e.g., feeding, resting, and migrating) in other portions of the action area and/or in other locations within Great Egg Harbor. Based on this and the best available information, we believe that the effects of blasting on Atlantic sturgeon will be insignificant and discountable.

Acoustic Effects: Sea Turtles

As noted above, pressure oscillations created by blasting cause a rapid contraction and over-extension of gas filled cavities (e.g., swim bladders, lungs, blood vessels) as pressure gradients change resulting in internal damage and/or mortality to aquatic species. For sea turtles, tissues that could be affected by detonations are mainly those at the air-fluid interface (e.g., ear cavities, lungs, gastrointestinal tract; Koschinski 2011).

Currently, NMFS has no acoustic guidelines or criteria for sea turtles in regards to blasting levels that will cause injury or mortality to the animal. Several studies have been undertaken that have demonstrated that explosions can injure and kill sea turtles (Duronslet *et al.* 1986; Gitschlag 1990; Gitschlag and Herczeg 1994; Kilma *et al.* 1988; O'Keefe and Young 1984); however, these studies have been based on the removal of large oil platforms, which involved the use of large, undelayed charges (i.e., 50 to 1,200 pounds per detonation) that were detonated in the open water (i.e., unconfined), which will produce greater levels of underwater noise and pressure levels than blasting operations that are confined and delayed (i.e., blasting with a delay creates its own internal shock absorber, as does the use of stemming material (Moser 1999)[3]). In general, most sea turtles assessed in these studies suffered internal injuries (e.g., dilation of blood vessels, unconsciousness); only those exposed to the 1,200 pound charge within 656 feet of the blast succumbed to death. As the proposed action will be undertaken with small, delayed, and stemmed charges (i.e., no more than approximately 26.6 pounds/delay), it is extremely unlikely that sea turtles will be exposed to levels that will cause death to animals in the vicinity of the blast area, especially as large changes in overpressure are only expected to occur within several feet of the pier, which is a portion of the action area sea turtles cannot enter due to the presence of a turbidity curtain within 100 feet of the pier. In addition, although NMFS has not yet developed acoustic criteria for blasting activities, based on studies done by Yelverton and Richmond (1981), Finneran *et al.* 2002, and Southall *et al.* 2007, we believe that blasting levels:

- ≥46 psi, 230$_{peak}$ dB re 1 μPa or 198 dB re 1 μPa^2-s (SEL) will cause injury or mortality[4];
- ≥23 psi, 224$_{peak}$ dB re 1 μPa or 183 dB μPa^2-s will cause harassment, via temporary threshold shifts (TTS)[5]; and,

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[3] Information on the associated underwater noise and pressure levels (i.e., psi) were not available for these studies.

[4] Sound Exposure Level (SEL) is defined as that level which, lasting for one second, has the same acoustic energy as the transient and is expressed as dB re: $1\mu Pa^2$•sec.

[5] TTS-Temporary, fully recoverable reduction in hearing sensitivity caused by exposure to sound.

- levels at or above 166 dB_{RMS} re 1μPa will cause behavioral modification (Baker 2008).[6]

As described above, underwater pressure levels produced as a result of blasting will be approximately 6.6 psi within 100 feet of the piers being blasted. Based on information provided to us by the FHWA, this pressure level will result in peak underwater sound levels of approximately 187 dB_{peak} re 1μPa. As a turbidity curtain will be put into place within 100 feet of the piers to be blasted, sea turtles are, therefore, only expected to be exposed to noise and overpressure levels no greater than 6.6psi, 187 dB_{peak} re 1μPa at 100 feet or more from the piers being blasted as sea turtles will be prevented from entering the immediate construction site where elevated levels of underwater noise and overpressure may reach levels that could cause injury, mortality, or TTS. As psi levels of 6.6 psi and 187 dB_{peak} re 1μPa are below those believed to cause injury, mortality, or TTS in sea turtles, injury, mortality, or harassment (in the form of TTS) to sea turtles is not expected to occur as a result of the proposed action; however, elevated levels of underwater sound (i.e., in dB) will be experienced beyond the turbidity curtain (i.e., approximately 200 feet from the piers), and thus, changes to sea turtle behavior may occur. However, it is reasonable to assume that sea turtles, on hearing blasting, would either not approach the source or move away from it. If any movements away from this area do occur, it is extremely unlikely that these movements will amount to substantial changes to essential sea turtle behaviors (e.g., reproduction, foraging, resting, and migration). Additionally, the extent of underwater noise (e.g., potentially up to 200 feet) is not likely to present a barrier to sea turtle movements and as such, if individuals are present within the vicinity of the action area, they are likely to veer/swim away from the vicinity of the blasting area and continue normal behaviors (e.g., feeding, resting, and migrating) in other locations within Great Egg Harbor. Based on this information, and that fact that sea turtles are only expected to occasionally be present within the action area, we believe that the effects of blasting on sea turtles will be insignificant and discountable.

Habitat Alteration

Blasting operations have the potential to reduce the forage base of Atlantic sturgeon and sea turtles via the alteration of existing biotic assemblages. However, as described above, the area action area, specifically where blasting will be undertaken, is unsuitable for Atlantic sturgeon and sea turtle foraging (e.g., no SAV, limited benthic invertebrates, no shellfish beds). Based on this information, blasting operations are not likely to disrupt normal feeding behaviors for sea turtles or Atlantic sturgeon and are not likely to remove critical amounts of prey resources from the action area or Great Egg Harbor. In addition, the proposed blasting operations are not likely to alter the habitat in any way that prevents sea turtles or Atlantic sturgeon from using the action area now and in the future as a migratory pathway to other areas with more suitable foraging habitat. As such, the effects of blasting operations on foraging or migrating sea turtles or Atlantic sturgeon will be insignificant.

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[6] Root Mean Square (RMS) pressure is the square root of the time average of the squared pressure and is expressed as dB re: 1 μPa.

Water Quality Effects of Blasting

Blasting operations within a concrete structure, such as a pier, is likely to cause a temporary increase in suspended sediment as pieces of debris hit the benthos. However, little increase in sedimentation or turbidity is expected to result from the proposed action due to the use of a turbidity curtain. If any sediment plume does occur, it is expected to be small and suspended sediment is expected to settle out of the water column within a few hours and any increase in. Turbidity levels associated with blasting within a pier structure are expected to be only slightly elevated above background levels (average range of 10.0 to 120.0 mg/l) (ACOE 2007, Anchor Environmental 2003).

No information is available on the effects of TSS on juvenile and adult sea turtles. Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). TSS is most likely to affect sturgeon and sea turtles if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting sea turtle prey. As Atlantic sturgeon and sea turtles are highly mobile they are likely to be able to avoid any sediment plume and any effect on sea turtle movements is likely to be insignificant. Additionally, the TSS levels expected for blasting within a confined structure (10.0 to 120.0.0 mg/L) are below those shown to have an adverse effect on fish (580.0 mg/L for the most sensitive species, with 1,000.0 mg/L more typical; see summary of scientific literature in Burton 1993) and benthic communities (590.0 mg/L (EPA 1986)); therefore, effects to benthic resources that sturgeon or sea turtles may eat are unlikely. Additionally, while the increase in suspended sediments may cause Atlantic sturgeon or sea turtles to alter their normal movements, any change in behavior is likely to be insignificant as it will only involve movements to alter course out of the sediment plume and is not likely to affect the movement or migration ability of sturgeon and sea turtles. Based on this information, the effect of suspended sediment resulting from blasting activities on Atlantic sturgeon or sea turtles will be insignificant.

Other Construction Activities

Removal of debris produced by the demolition of the piers will be undertaken via mechanical means (e.g. a clamshell bucket dredge). Although sea turtle and sturgeon interactions with mechanical devices are possible during the removal process, as described above, a turbidity curtain will be present throughout all phases of the action and thus, prevent sturgeon or sea turtles from entering the portion of the action area within the turbidity curtain where these operations will take place, and thus, prevent any sea turtles or sturgeon from coming in contact with equipment used in debris removal. Based on this information, we have determined that the interaction between an Atlantic sturgeon or a species of sea turtles with equipment used in debris removal is discountable.

Conclusion

Based on the analysis that any effects to listed species of Atlantic sturgeon or sea turtles will be insignificant or discountable, we are able to concur with your determination that the proposed project is not likely to adversely affect any listed species under NMFS jurisdiction. Therefore, no further consultation pursuant to section 7 of the ESA is required.

Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) If a new species is listed or critical habitat designated that may be affected by the identified action. No take is anticipated or exempted. If there is any incidental take of a listed species, reinitiation would be required. Should you have any questions about this correspondence please contact Danielle Palmer at (978) 282-8468 or by e-mail (Danielle.Palmer@noaa.gov).

Sincerely,

John K. Bullard
Regional Administrator

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