South Carolina Department of
Natural Resources

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April 28, 2015

Dr. Arie Kaller
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Dear Dr. Kaller:

Thank you for the opportunity to provide comments from the South Carolina Department of Natural Resources (SCDNR), Division of Marine Resources relative to several permit applications currently under consideration by the Bureau of Ocean Energy Management (BOEM) for Geological and Geophysical (G&G) seismic survey work proposed in the BOEM Mid-Atlantic and South Atlantic Planning Areas. The comments are meant to be of a general nature regarding any proposed use of 2D or 3D airgun survey methodologies that might be employed in the waters off the coast of South Carolina. As such, we would request that these comments be considered germane to all such permit applications under review at this time or in the near future.

As a wide-ranged, multifaceted, science-based natural resource management agency, the SCDNR clearly understands the importance of acquiring the best possible data in making decisions regarding the wise use and stewardship of all natural resources, both living and non-living, in the waters of the state as well as those located off the coast in adjacent federal waters. The agency is aware of the current interest in exploration for possible oil and gas resources in the Atlantic Outer Continental Shelf (OCS) Region off South Carolina, and of the importance of effective G&G seismic surveys in obtaining a clear understanding of what resources may exist in our offshore waters. However, the SCDNR has concerns regarding effects of the proposed G&G airgun survey work on various living marine resources in the state's coastal and offshore waters. Of particular concern are both short term and cumulative effects of such activities on marine mammals (including the endangered North Atlantic Right Whale), four species of endangered or threatened sea turtles (see Enclosure 1), several protected finfish species (including Atlantic sturgeon, shortnose sturgeon, smalltooth sawfish, and scalloped hammerhead shark), and a wide range of finfish species associated with extensive areas nearshore and offshore essential fish habitats located within the proposed survey areas (see Enclosure 3, very high resolution version available upon request).

In reviewing the BOEM Atlantic Geological and Geophysical Activities Programmatic Environmental Impact Statement (PEIS) for the Mid- and South Atlantic Planning Areas, it is apparent that a great deal of attention is given to consideration of possible impacts on endangered and protected marine

mammals and sea turtles, as well as operational considerations for minimizing and mitigating these impacts. Even with such operational procedures in place, avoiding these particular resources through temporal or significant geographic separation during periods of peak abundance in South Carolina's offshore and coastal waters would be the best overall approach to ensure that these resources are protected.

The BOEM PEIS does a good job of describing important fish resources and associated essential habitats in the waters of the Mid- and South Atlantic Planning Area. It should be noted that this detailed description and understanding of these resources is based significantly on work done over the past four-plus decades by SCDNR personnel, mainly associated with the Marine Resources Monitoring, Assessment, and Prediction program (MARMAP). However, in reviewing the possible impacts of seismic airgun work on these fish in general, the SCDNR disagrees with the PEIS assumption that many of the demersal reef fish species located on hard and soft bottom habitats year round would "temporarily move away from noise that is affecting them" (page 4-134) and therefore avoid injury (see Enclosure 2). This particular assumption, which is not well supported in direct observations of species within this area, is central to the PEIS conclusion that "impacts from airguns to fisheries resources and EFH would be **minor** to **moderate**". SCDNR is concerned that this assumption could contribute to a serious underestimation of the significance of potential sound-related impacts to these resources.

Another assumption in the PEIS--that the area of seafloor affected by an individual survey effort when compared to the overall Area of Interest (AOI) is relatively small and therefore the impacts from survey efforts would likely be minor to moderate--is a bit misleading and potentially inaccurate. Given the relatively small nature and inherent patchiness of some hard bottom reefs in offshore and nearshore waters, even one pass of an average airgun survey run could generate significant harm (physical injury and disturbance) to the resident fish community over much of the area of an individual reef. A single track line could impact multiple patches of hard bottom reef as well as large portions of hard bottom ledge areas. From estimates provided during discussions with BOEM technical staff at public meetings, it has been concluded that a typical 2D survey with an initial sound source of 230 dB and a transect speed of 5 knots over bottom at a depth of 100 m would generate an area of sound at 190 dB or greater (once every 10 to 12 seconds) over a 500 meter swath which could affect individual fish for as long as three minutes at this intense and potentially harmful level of sound. Multiple passes over a period of time from one or more survey companies could have significant cumulative impacts on the long-term health of the overall reef ecosystem.

Given the importance of these hard bottom reef communities to South Carolina's commercial and recreational fisheries, the minimal amount of mapping data available to clearly identify areas of essential fish habitat, and the lack of assurance through a large body of research that G&G seismic survey work will not harm finfish communities associated with these bottoms, the SCDNR would suggest not permitting any survey work within 50 miles of the South Carolina coast line and at depths less than 100 meters, especially in light of the BOEM's stated intent **not to issue any future drilling permits with 50 miles of shore**. If areas inside of 50 miles from shore or 100 meters in depth were to be surveyed, we would recommend that this only be done with careful coordination of such efforts with knowledgeable state and federal resource management entities such as the SCDNR, the South Atlantic Fishery Management Council, and the National Marine Fishery Service. We would ask that such efforts include, but not be limited to, development of a draft in-situ monitoring plan to be used during test runs in order to determine if there are or are not direct impacts to fisheries resources. At a minimum such a plan would be reviewed and designed in conjunction with the agencies noted above

and the results would be used to employ adaptive management strategies during later testing, particularly if adverse impacts are demonstrated.

The SCDNR greatly appreciates the opportunity to provide these comments on the proposed G&G seismic survey activities under consideration for the Mid-Atlantic and South Atlantic Planning Areas and particularly off the coast of South Carolina. This agency understands the importance of such work in providing an informed assessment of the potential oil and gas resources off of our coast, and as the principal steward of South Carolina's natural resources we want to make sure this work is done in a manner which minimizes risks to the extremely valuable known living natural resources off South Carolina.

We ask that you give full consideration to the above comments as you make any determinations on the issuance of permits to perform this work. We will be more than happy to work with BOEM or any entities permitted for survey work in providing additional advice on how best to minimize impacts to our living marine resources. If you have any questions concerning these comments please contact me at (843) 953-9304 or Mel Bell at (843) 953-9007.

Sincerely,

Robert H. Boyles, Jr.
Deputy Director for Marine Resources

Enclosures:
(1) SCDNR Staff Input on Marine Turtles
(2) SCDNR Staff Input on Possible Sonic Impacts on Fish
(3) SAFMC Map Related to SC Coastal/Offshore Resources

cc: Glenn McFadden, Chairman, SCDNR Board
Alvin Taylor, Director, SCDNR
Bob Perry, Director, Office of Environmental Programs, SCDNR
Ken Rentiers, Deputy Director, Land, Water, & Conservation Districts, SCDNR
Curtis Joyner, Manager, Coastal Zone Consistency Section, SCDHEC

Enclosure (1)

SCDNR-MRD Staff Comments on South Carolina Sea Turtles

Four species of federally and state protected endangered or threatened sea turtles occur in South Carolina waters; green (*Chelonia mydas*), kemps ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*).

Loggerhead sea turtle:
The loggerhead was federally listed worldwide as a threatened species on July 28, 1978 (43 FR 32800). On September 22, 2011, the single threatened species of loggerhead sea turtle was revised to nine distinct populations segments (DPSs) including the Northwest Atlantic Ocean DPS, one of four globally-declared "threatened" populations. This determination was based on genetics, tagging, satellite telemetry, demographics, and oceanographic features with each segment listed as either endangered or threatened. Within the Northwest Atlantic DPS there are five identified recovery units. Loggerhead turtles nesting in southern VA, NC, SC and GA are part of the Northern Recovery Unit (NRU). The nesting trend from daily beach surveys indicate nest numbers in the NRU declined significantly at 1.3 percent annually from 1983 to 2007 (NMFS and USFWS 2008). Nest totals from aerial nest surveys conducted by SCDNR showed a 1.9 percent decline in South Carolina from 1980-2007(NMFS and USFWS 2008). Currently, the nesting data for the NRU show possible signs of a stabilizing trend.

Adult female loggerheads inhabit South Carolina coastal waters during the nesting season, from April to early September and nest up to an average of 4.1 times a season. During the inter-nesting period, the turtles remain inactive while they prepare for the next nesting cycle (ovulate and shell eggs, return to nesting beach). The average inter-nesting period is 14 days. After nesting, females migrate to foraging areas both north and south of their nesting beaches. Studies involving satellite telemetry, flipper tagging, and isotopic research indicate that most loggerheads from the NRU migrate to foraging grounds along continental shelf from Cape Hatteras, NC to New Jersey post-nesting, as do a sizable portion of loggerheads nesting in the Peninsular Florida Recovery Unit (Ceriani et al. 2012).

Due to sea turtles in the NRU being genetically different sub population, they cannot be replaced by others from neighboring recovery units. Nest numbers in South Carolina represent over 65% of the total number of nests for the entire NRU. The Cape Romain National Wildlife Refuge in South Carolina is the highest density nesting beach within the NRU with an annual average of 1,000 or more nests per year. It is considered the most significant Loggerhead nesting beach north of the state of Florida.

Juvenile foraging guild:
Juveniles from various subpopulations that include greens, loggerheads, and kemps mix on foraging grounds, which include estuarine, neritic and continental shelf waters on the eastern seaboard. Juvenile

loggerheads occur in South Carolina nearshore waters on a seasonal basis from early March to early December (Arendt et al. 2012; NMFS and USFWS 2008).

Leatherback sea turtles:
Leatherbacks are predominately observed in our coastal waters from March – July with a smaller secondary peak in the fall based on strandings and leatherback aerial surveys conducted by SCDNR (Murphy et al 2006). Leatherbacks arrival and departure suggest a northward migration to foraging areas. The main prey, cannonball jellyfish, exhibits a seasonal northward population distribution along the eastern seaboard and leatherback forage on those jellyfish in that northward direction. Nest numbers in South Carolina for this species are low despite the larger numbers present in our coastal waters.

Potential effects of the proposed seismic survey activities in coastal and offshore waters off South Carolina include abandonment of habitat, disruption of mating and nesting attempts, potential vessel strikes, entanglement in debris, ingestion of marine debris and habitat contamination.

The SCDNR Marine Turtle Conservation Program would like a time area closure off the entire South Carolina coast during the sea turtle season from 1 May – 31 October.

Literature cited:

Arendt MD, Segars AL, Byrd JI, Boynton J, Whitaker JD, Parker L, Owens DW, Blanvillain G, Quattro JM and MA Roberts (2012) Seasonal distribution patterns of juvenile loggerhead sea turtles (*Caretta caretta*) following capture from a shipping channel in the Northwest Atlantic Ocean. Mar Biol 159(1):127–139.

Murphy, T.M., Sally R. Murphy, DuBose B. Griffin and Charlotte P. Hope. 2006. Recent occurrence, spatial distribution and temporal variability of leatherback turtles (*Dermochelys coriacea*) in nearshore waters of South Carolina, USA. Chelonian Conservation and Biology 5(2): 216-224.

National Marine Fisheries Service and U.S. Fish and Widlife Service. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), Second Revision. National Marine Fisheries Service, Silver Spring, MD.

Ceriani SA, Roth JD, Evans DR, Weishampel JF, Ehrhart LM (2012) Inferring Foraging Areas of Nesting Loggerhead Turtles Using Satellite Telemetry and Stable Isotopes. PLoS ONE 7(9): e45335. doi:10.1371/journal.pone.0045335Ceriani

Enclosure (1)

Enclosure (2)

SCDNR-MRD Coastal Finfish Research Section Staff Comments on Potential effect of Seismic Survey Activities on (reef) Fish.

Hearing is an important sense used by marine fishes. Many fish are able to derive significant information about their surrounding environment in addition to sight and other senses. Available published data on lethal and sublethal effects of acoustic testing/surveys on reef fish are sparse. Depending on the intensity of the sounds blasts, all organs of the fish may be affected, but we expect that the swim bladder, vestibular apparatus (semicircular canal system that includes the otoliths), sound producing structure, and gonad tissues may be particularly vulnerable to damage. In addition, many species (e.g. grunts, groupers) produce sound as part of spawning and social behavior. Sound has been shown to be used by fishes for communication (Myrberg, 1980), navigation, predation, etc. While the majority of fish species can only detect sounds up to 500-1000 Hz, certain species have been shown to exhibit hearing specialization (Mann et al. 2001). Source level sounds in excess of 230 dB have been recorded for seismic airgun arrays (Cummings, 2003). Ambient sound levels of 131 dB produced by ships alone have been shown to decrease hearing sensitivities up to 40 dB, and reduce the detectability of communication sounds for certain species of marine fishes (Vasconcelos et al. 2007, Codarin et al. 2009). Acoustic surveys may affect sound reception and sound production by fish and disrupt behavioral interactions.

We strongly feel that the idea that most fish will swim out of the testing area when loud sound (blasts) approaches is incorrect, even if acoustic activities are "ramped up gradually". It is possible that larger and faster swimming pelagic species may swim out of the impacted area, but it will force them to leave feeding grounds, spawning areas, or other important habitat. This may have deleterious effects on survivability and reproduction for certain species (Engas et al., 1996). However, based on our general knowledge of fish behavior, as well as our video observations, bottom dwelling and reef species such as groupers, Gray triggerfish, porgies, flounders, rays, and many others, will not swim away if a potential threat approaches. Reef fishes will hide near available bottom structure, under ledges, or in crevices. Species such as flounders, rays, shrimp, etc. will most likely try to hide by burying in the sediment if they can. Fish hiding from potential threats will likely try to stay hidden until they feel the threat is gone. This makes them extremely vulnerable for potentially damaging effects of acoustic surveys. In addition, some published information points at possible effects to larval stages. Many reef fish species undergo larval development offshore before settling on reefs that they will inhabit for the rest of their lives (McCormick 2002). Research by Tolimieri et al. (2002) shows that these larval fish use sounds to find these reefs, and that intense offshore sounds may mask reef sounds, preventing larval fish from finding suitable reef habitat.

Given its long history with monitoring reef fish populations, including the current use of video cameras on the gear, MRRI's Reef Fish Survey (MARMAP and SEAMAP-SA) could play a significant role in investigating and monitoring the effect of this testing. We can observe fish in and around chevron traps during testing, and examining pathology of fish after testing is completed. Furthermore, our extensive long-term data-set can provide information as to the location of live-bottom and other habitat, and species composition and abundance in those habitats.

Literature cited:

Codarin A, Wysocki LE, Ladich F, PicciulinM(2009) Effects of ambient and boat noise on hearing and communication in three fish species living in a marine protected area (Miramare, Italy). *Mar Pollut Bull* 58:1880–1887.

Engas, A.S., Lokkeborg, E. Ona, and A.V.Soldal. 1996. Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). *Bioacoustics*, 12: 313-315.

Mann, D.A., Higgs, D.M., Tavolga, W.N., Souza, M.J., and A.N. Popper. 2001. Ultrasound detection by clupeiform fishes. Journal of the Acoustical Society of America, 109: 3048-3054.

Myrberg, A.A., Jr. 1980. Ocean noise and the behavior of marine animals *Bioacoustics*, 12: 313-315.

Popper, A.N. 2002. Effects of Anthropogenic Sounds on Fishes. Fisheries, 28(10): 24-31.

Tolimieri, N., O.Haine, J.C. Montgomery and A. Jeffs. 2002. Ambient sound as a navigational cue for larval reef fish. *Bioacoustics*, 12: 214-217.

Vasconcelos RO, Fonseca PJ, Amorim MCP, Ladich F. 2011. Representation of complex vocalizations in the Lusitanian toadfish auditory system: evidence of fine temporal, frequency and amplitude discrimination. Proc. Roy. Soc. Lond. B. Biol. Sci. 278:826–834.

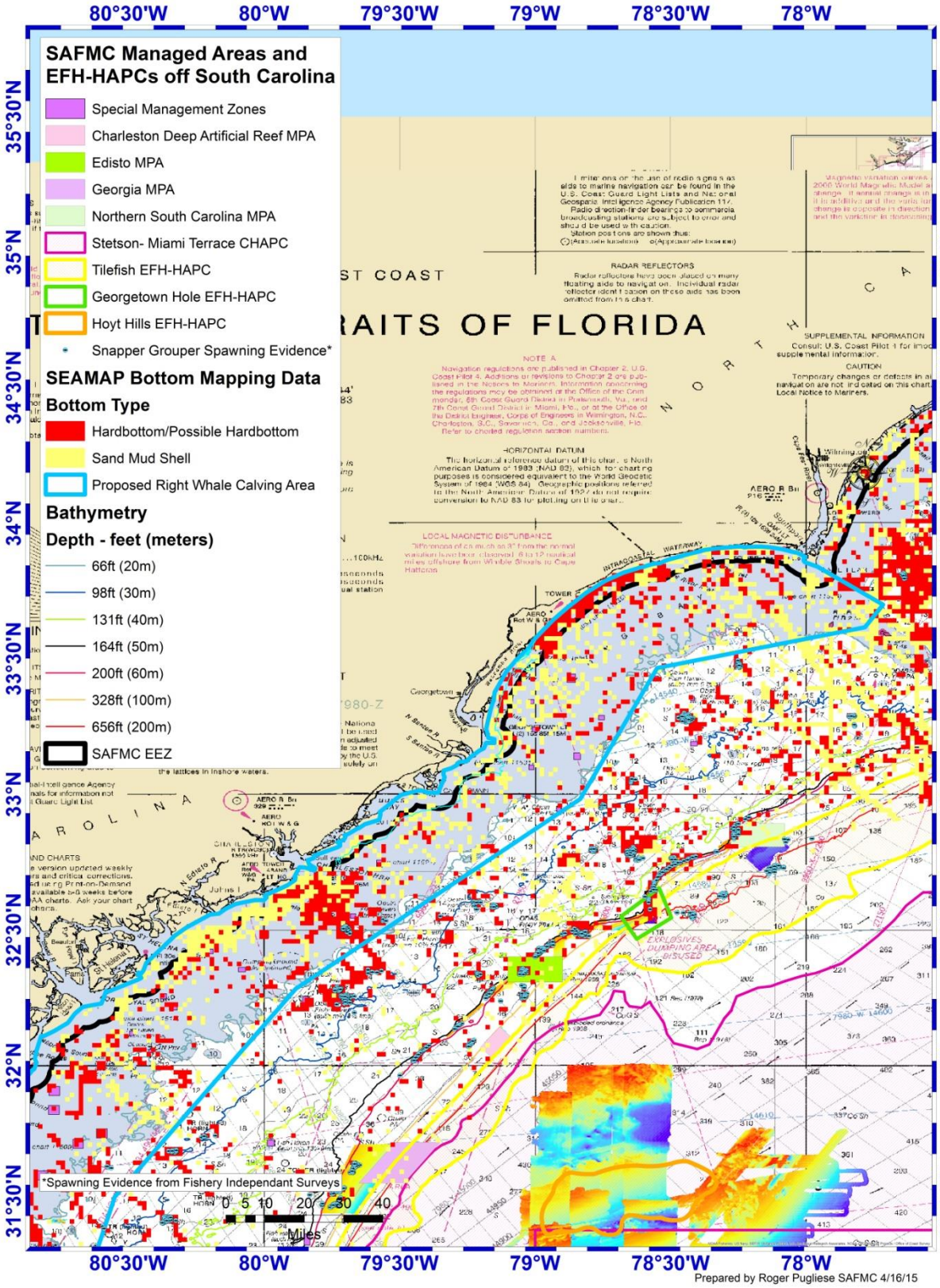
Other papers and potential sources of information:

Handegard, N.O., T.V. Tronstad, J. M. Hovem. (2013) Evaluating the effect of seismic surveys on fish — the efficacy of different exposure metrics to explain disturbance. Can.J. Aquat. Sci., 2013, 70(9): 1271-1277.

Hirst, A.G., P.G. Rodhouse. (2000) Impacts of geophysical seismic surveying on fishing success. Reviews in Fish Biology and Fisheries.

Pearson, W.H., et al. (1992) Effects of sounds from a geophysical survey device on behavior of captive rockfish (*Sebastes* spp.). Can.J. Aquat. Sci. 49:1343-1356.

Enclosure (2)


SAFMC Managed Areas and EFH-HAPCs off South Carolina
Special Management Zones
Charleston Deep Artificial Reef MPA
Edisto MPA
Georgia MPA
Northern South Carolina MPA
Stetson- Miami Terrace CHAPC
Tilefish EFH-HAPC
Georgetown Hole EFH-HAPC
Hoyt Hills EFH-HAPC
Snapper Grouper Spawning Evidence*
SEAMAP Bottom Mapping Data
Bottom Type
Hardbottom/Possible Hardbottom
Sand Mud Shell
Proposed Right Whale Calving Area
Bathymetry
Depth - feet (meters)
66ft (20m)
98ft (30m)
131ft (40m)
164ft (50m)
200ft (60m)
328ft (100m)
656ft (200m)
SAFMC EEZ
*Spawning Evidence from Fishery Independant Surveys
0 5 10 20 30 40
Miles
80°30'W
80°W
79°30'W
79°W
78°30'W
78°W
35°30'N
35°N
34°30'N
34°N
33°30'N
33°N
32°30'N
32°N
31°30'N
Prepared by Roger Pugliese SAFMC 4/16/15

Enclosure (3)