



NORTH CAROLINA
Environmental Quality

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Director

April 11, 2019

Mr. Gary Poole
WesternGeco
100001 Richmond Avenue
Houston, TX 77042

SUBJECT: Incomplete Submission (DCM#2019001X)

Dear Mr. Poole:

On March 12, 2019, the Division of Coastal Management (DCM) received your consistency submission regarding your application to the Bureau of Ocean Energy Management (BOEM) to conduct marine Geological and Geophysical (G&G) surveys in the Atlantic Ocean off the North Carolina coast related to oil and gas resource development. DCM has evaluated your submission and concludes that it fails to include all necessary data and information required by 15 CFR 930.58(a).

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Area Management Act (N.C.G.S. § 113A-100 et seq.), the State's Dredge and Fill Law (N.C.G.S. § 113-229 and -230), and Chapter 7 of Title 15A of North Carolina's Administrative Code. In your submission, you identify 15A NCAC 07M .0801 "Declaration Of General Policies" and deem that your proposal is consistent with North Carolina's enforceable policies; however, your submission does not fully evaluate the relationship between the reasonably foreseeable coastal effects of your proposal and all of the relevant enforceable policies of North Carolina's coastal zone management program, and it does not provide necessary data and information to demonstrate that your proposal will be consistent with North Carolina's enforceable coastal policies as required by 15 CFR 930.58. DCM requests you fully evaluate all reasonably foreseeable impacts and state policies that apply to your proposal, including relevant policies within 15A NCAC Subchapters 07H and 07M; at a minimum those rules found in 15A NCAC 07H .0200 "The Estuarine And Ocean System" and in 15A NCAC 07M .0400 "Coastal Energy Policies."

North Carolina's coastal area supports industries that are critical to the State's economy, including the commercial and recreational fishing industries that occur more than three miles offshore. On November 18, 2014, the National Oceanic and Atmospheric Administration's Office for Coastal Management (NOAA OCM) approved DCM's request to review your application for consistency with the enforceable policies of the State's coastal management program, determining that proposed activities, if permitted, could have reasonably foreseeable effects on coastal uses or resources of North Carolina's coastal zone. NOAA OCM approval pertained primarily to any potential impacts on commercial and recreational fisheries, including catch reductions and consequential economic impacts.

Your submission acknowledges that "mitigations, including closures, are aimed at reducing impacts on marine mammals, but fish and fisheries are also present in these areas, and areas where many marine



mammals are likely to concentrate and trigger mitigation are areas where fish prey are likely in higher availability.” You further indicate that “impacts on recreational and commercial fisheries are expected to be minimal,” but that proposed survey transects will intersect with Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC). You indicate that there will be “relatively small amount of work” in those areas but do not provide specific information related to the proposed density of transects, duration, or timing that would minimize impacts to these most sensitive fisheries habitats, which are also important areas for commercial and recreational fishing. You also indicate that continued NEPA analysis specific to WesternGeco’s proposed activity may result in different mitigation requirements than the BOEM Record of Decision. The State cannot adequately review this proposal with respect to impacts on fisheries without specific and predictable mitigation measures.

In addition, your consistency certification submission did not address recently published research regarding the potential impacts of G&G survey activities on marine resources, as detailed below. Your review of this recently published research as it relates to the proposed G&G activities is necessary for DCM to determine whether your proposal is consistent with North Carolina’s enforceable policies.

New Research

The Atlantic Programmatic Environmental Impact Statement (PEIS) reports impacts to fish ranging from mortality to injury to behavioral responses. Section 4.2 and Appendix J of the Programmatic EIS describe the relevant research regarding effects of airguns on fish and note that there has been limited research on these topics that makes drawing conclusions of any type of effect on fish populations problematic. According to Appendix J of the Programmatic EIS, sound plays a major role in the lives of all fishes, as it is attenuated at a much lower rate than other forms of energy, such as light. The lower frequencies of sound are important for communication and environmental sensing. Using sound, fish can obtain a great deal of biotic (living) and abiotic (environmental) information, important for the detection of a reef or swimming predators. Boney fishes use sound for a wide range of behaviors including communication, mating, and territorial interactions. Sound produced from anthropogenic sources, such as the array of airguns used in the proposed survey activities, can impede the ability of fishes to hear biologically relevant sounds, a phenomenon known as “masking.” Anthropogenic sound can also have a direct impact on the catchability of fishes by altering normal behaviors, and possibly affecting the survival of individuals or populations.

Anthropogenic sound effects on fish, specifically from seismic surveys, can be described as physiological and behavioral. The most critical issue regarding the effect of anthropogenic sound on fishes is behavioral and thus can impact catchability by potentially impacting fish over a broad area, impeding their ability to interpret and produce biologically relevant sounds. While a limited number of well-controlled studies on the effects of sound on fishes and fish species exist, it has been demonstrated both nationally and internationally that loud intermittent sounds have the potential to cause physiological injury or death if the animal is located close to the source. These sounds can also result in hearing impairment, masking, and behavioral effects at distances beyond those that would result in death or injury.

Interim criteria for regulatory levels of sound arose on the U.S. West Coast out of concern about effects of pile driving activities on fish. The current interim criteria established a peak sound level of 206-dB and a sustained exposure level of 187-dB for individual fishes weighing more than two grams, or 183-dB for fishes below two grams. These criteria are for the onset of easily identifiable physiological effects, rather than behavioral effects which occur at a much lower sound levels and are much harder to identify. The sound levels released from the arrays of the proposed projects are expected to exceed these levels. The sound levels at the sea floor may be somewhat less due to some loss with propagation distance. The Programmatic EIS summarizes the radial distances in meters to the 160-dB and 180-dB received sound pressure level from a single pulse of a 2D airgun array (Programmatic EIS Table 4-8). The 180-dB radius

ranges from 799 to 2,109 meters (0.5-1.1 nmi) and the 160-dB radius ranges from 5,184 to 15,305 meters (2.8-8.3 nmi). It should be noted that the threshold for Level B behavioral harassment on marine mammals is set at 160-dB; depending on water depth, this sound pressure level could be received by animals over 15,305 meters or 8 nautical miles from the source.

While the potential for physiological damage is lowered by fishes' ability to move away from the high intensity seismic sound, behavioral studies have shown reduced catch rates lasting for several days after the termination of airgun use. The decline in catch rates was assumed to be from fish moving away from the fishing site, and either moving into deeper water or being killed. A new study specific to North Carolina, (Paxton *et al.* 2017), demonstrated a 78 percent decline in snapper grouper complex species abundance during evening hours at a reef habitat site off the central North Carolina coast after seismic testing occurred. During the three days prior to survey activity, fish habitat use was highest during those same hours based on analysis of video data. It is important to note that this site was not directly in line with the survey track, and of the three sites in the study, was in fact the farthest away (7.9 km) from the survey track. Researchers also deployed hydrophones at the reef sites and noted that while noise levels exceeded 170 dB re 1 μ Pa, the peak levels were unknown as the noise levels overloaded the instruments. Both spherical and cylindrical spreading models were used to estimate peak noise levels at the sites closest to the survey track based on a sound source level of 258.6 dB re 1 μ Pa. Model results indicated the received sound levels ranged from 202-230 dB re 1 μ Pa.

While the Paxton *et al.* study was limited, the resultant reduction in abundance occurring from a single seismic survey is cause for concern given the multiple overlapping proposed surveys and the extended timeframes over which they would occur. As noted above, such significant decreases in abundance can lead to reduced catch rates, especially during peak seasons for commercial and recreational fisheries, and will have a large impact on coastal communities that are dependent on the 22,500 jobs, \$787 million in income, and \$1.96 billion in business sales annually generated by these industries. Seismic surveys occurring during October through December have the greatest potential to impact commercial fisheries, as these months represent the peak of commercial harvest, while surveys occurring from May through October have the most potential to impact recreational fisheries.

Other issues of concern regarding the effects of anthropogenic sound on the catchability of fish include increased production of stress hormones in fish, impacts on invertebrates, and impacts from vessel noise. A study of Atlantic salmon that were subjected to up to 10 simulated seismic airgun explosions showed that exposure caused the release of primary stress hormones, adrenaline and cortisol, as a physiological and biochemical response. Even though the study recorded no mortalities and that fish returned to normal levels after 72 hours, the temporal impact of stress from seismic sound could affect catchability. Carroll *et al.* (2017) summarized documented effects to different life stages of fish to low-frequency seismic sounds. More studies have found physical, behavioral, and physiological responses from juvenile and adult fish than from eggs and larvae, although there have been fewer studies looking at these early life stages.

Limited information and data exists on the hearing of aquatic invertebrates and the impacts from high intensity sound. It is thought that the chance of physiological damage is lowered due to the lack of resonating sound structures in invertebrates, normally damaged by high intensity sounds. However, a recently published study (McCauley *et al.* 2017) designed to investigate the impacts of a single airgun (similar to those used in commercial arrays) on the local zooplankton field demonstrated significant differences in both zooplankton abundance and mortality after airgun exposure. Comparison of control and exposed tows showed a greater than 50 percent decrease in abundance in 58 percent of all individual zooplankton taxa. The distribution of abundance decreases between exposed and control tows for all taxa showed a median decrease in abundance of 64 percent. Additionally, comparison of control tows (e.g., those occurring prior to airgun blasts) between day 1 and day 2 of the study demonstrated a decrease in mean and median zooplankton abundance of 89 percent and 96 percent, respectively. Assessment of

mortalities from each day of the study showed two- to three-fold increases across all taxa as compared to controls. Finally, impact ranges (i.e., the distances at which no impact versus varying degrees of impact would be expected) were calculated for both abundance and mortality and were found to be more than two orders of magnitude greater than previously assumed. The results of this study raise concerns regarding effects on fish eggs and larvae, given similar size ranges as the zooplankton in the above experiments, as well as potentially cascading impacts to the base of the food chain. It should be noted that larval fish are also briefly part of the zooplankton community. Both juveniles and species that are forage for higher trophic level fishes depend on zooplankton for their dietary needs. Concerns about impacts to plankton were also recently described by the Canadian Department of Fisheries and Oceans following seismic surveys in waters off of Newfoundland and Labrador (<https://ipolitics.ca/2019/01/14/calls-to-end-seismic-testing-off-nfld-and-labrador-as-plankton-levels-plunge/>).

Additional field studies on bivalve molluscs and crustaceans have determined varying physiological and behavioral impacts of repeated exposure to seismic air gun signals. Day *et al.* (2017) demonstrated significant increases in mortality of scallops, as well as changes in behavioral patterns and consistent disruption of hemolymph (blood analog) chemistry, resulting in potential immunodeficiency. Fitzgibbon *et al.* (2017) also found significant changes to hemolymph cell counts in spiny lobsters subjected to repeated air gun signals up to a year post-exposure, suggesting compromised immunological capacity. The results of these studies have biological and economic implications for North Carolina's molluscan bivalve and crustacean fisheries. Bivalves such as clams and scallops are particularly vulnerable to the effects of repeated exposure due to their sessile nature, while the state's hard blue crab fishery is the highest revenue-generating fishery, consistently grossing over \$20 million in ex-vessel value.

The recently-published research cited above shows that sound produced from the proposed G&G survey activities has a direct impact on fishes by masking biologically-relevant sounds and altering normal behaviors, and can possibly affect the survival of individuals or populations. Sound-related disturbances in areas of concentrated fish and sensitive fish habitat could impact local fish abundance by deterring foraging, refuge, and spawning activities. The resultant displacement of fish could change distributions of fish in the water column, reduce catches, and affect economically valuable fisheries and operations throughout the regional survey area. Additionally, changes in zooplankton abundance could result in cascading impacts on various trophic levels within the food chain.

Conclusion

For the reasons described above, DCM finds that your consistency submission dated March 12, 2019 is an incomplete submission. Because the necessary data and information described in 15 CFR 930.58(a) was not received, the North Carolina Coastal Management Program's three-month review period will not commence until the date of receipt of all necessary data and information described above. The additional information will allow DCM to determine whether your proposal is consistent with North Carolina's enforceable coastal policies.

Sincerely,



Braxton Davis
Director, N.C. Division of Coastal Management

Cc: Michael Regan, Secretary, N.C. Department of Environmental Quality (DEQ)
Daniel Govoni, Federal Consistency Coordinator, (DEQ), NC Division of Coastal Management

Brian Cameron, Environmental Scientist, U.S. Bureau of Ocean Energy Management
David Kaiser, Senior Policy Analyst, Office for Coastal Management, NOAA
Kerry Kehoe, Federal Consistency Specialist, Office for Coastal Management, NOAA
Jeff Payne, Director, NOAA Office for Coastal Management

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