6 July 2017

Ms. Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, Maryland 20910-3226

Dear Ms. Harrison:

The Marine Mammal Commission (the Commission), in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the applications submitted by Spectrum Geo Inc. (Spectrum), TGS-NOPEC Geophysical Company (TGS), ION GeoVentures (ION), WesternGeco LLL (Western), and CGG seeking incidental harassment authorizations under section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA). The companies could take small numbers of marine mammals by harassment incidental to conducting geophysical (seismic) surveys in the Atlantic Ocean during a one-year period. The Commission also has reviewed the National Marine Fisheries Service's (NMFS) 6 June 2017 notice (82 Fed. Reg. 26244) announcing receipt of the applications and proposing to issue the authorizations subject to certain conditions.

Background

The companies are proposing to conduct two-dimensional (2D) marine seismic surveys of varying durations in the mid- and south-Atlantic planning areas[1] of the Atlantic Ocean Outer Continental Shelf (OCS). The surveys would be conducted in an area extending from Delaware to Florida. The outer boundaries of each of these surveys are illustrated in Figure 1[2]. Specifics on each company's proposed surveys include—

Company	Number of days	Area	Trackline[3] (km)	Minimum distance from coast (km)	Number of airguns	Airgun volume (in^3)	Number of source vessels
Spectrum	165	DE to FL	21,635	35	32	4,920	1
TGS	308	DE to FL	58,300	25	40	4,804	2
ION	70	DE to FL	13,062	20	36	6,420	1
Western	208	MD to FL	27,300	30	24	5,085	1
CGG	155	VA to GA	28,670	80	36	5,400	1

[1] Planning areas as defined by the Bureau of Ocean Energy Management (BOEM; http://www.boem.gov/Atlantic-Oil-and-Gas-Information/).
[2] Figure 1 was generated by the Commission using a map of all geological and geophysical (G&G) applications received by BOEM for the Atlantic OCS region. It displays only the boundaries for the five applications reviewed herein. GXTechnology is a division of ION.
[3] Trackline lengths include turns, transits between lines, and operations at the start (run in/ramp up) and end (run out) of lines.

NMFS preliminarily has determined that the proposed activities could cause Level A and/or B harassment of small numbers of several species of marine mammals, but that the total taking would have a negligible impact on the affected species or stocks. NMFS does not anticipate any take of marine mammals by death or serious injury. It preliminarily determined that the potential for temporary or permanent hearing impairment will be at the least practicable level because of the companies' proposed mitigation measures. The mitigation[4], monitoring, and reporting measures that would apply include—

(1) implementing time-area closures that comprise:
   i. a 30-km coastal strip throughout both planning areas year-round to minimize impacts on coastal bottlenose dolphins;
   ii. (1) the furthest of (a) a 47-km coastal strip throughout both planning areas, (b) within 10 km of designated North Atlantic right whale critical habitat, or (c) within 10 km of a right whale Seasonal Management Area from November through April, and (2) within 10 km of a designated Dynamic Management Area (DMA), when a DMA is active, to minimize impacts on North Atlantic right whales;
   iii. a 100-km coastal strip from just south of the South Carolina-North Carolina state line to the southernmost extent of the south-Atlantic planning area in Florida from June to August to minimize impacts on Atlantic spotted dolphins (Area #1 in Figure 4 and Table 3 of the *Federal Register* notice; not applicable to ION or CGG);
   iv. within the three designated deepwater canyon areas year-round to minimize impacts on beaked and sperm whales (Areas #2, 3, and 4 in Figure 4 and Table 3 of the *Federal Register* notice);
   v. within the shelf break area off Cape Hatteras and to the north (including slope waters around 'The Point') from July to September to minimize impacts on beaked, sperm and pilot whales (Area #5 in Figure 4 and Table 3 of the *Federal Register* notice);
   vi. within 15 km of Gray's Reef and Monitor National Marine Sanctuaries year-round;
(2) using at least two protected species observers to monitor visually the Level A and B harassment zones[5] for 30 minutes before, during, and for 60 minutes after[6] the surveys;
(3) using passive acoustic monitoring (PAM) operators to provide 24-hour acoustic monitoring during use of the active sound source to supplement visual monitoring, with no more than 4 hours per day of operation of an active acoustic source without PAM;
(4) using standard ramp-up, delay, and shut-down procedures, as well as:
   i. requiring ramp up when activating the array, including at night or at times of poor visibility as long as there are no acoustical detections of marine mammals 30 minutes prior to ramp up;
   ii. shutting down the array when (a) a North Atlantic right whale, any large whale with a calf, or any aggregation of six or more marine mammals is observed visually at any distance, (b) a diving sperm whale is observed visually centered on the forward track of the source vessel, and (c) a beaked whale or *Kogia* spp. is observed visually at any distance or acoustically;

[4] Based on compliance with the Coastal Zone Management Act, Spectrum also agreed to not operate (1) within 232 km of Maryland's coast from 15 April to 15 November, (2) within the 30-m isobath off South Carolina year-round, (3) within 37 km of Georgia's coast from 1 April to 15 September, and (4) within 56 km of Georgia's coast from 15 November to 15 April.
[5] Which include a 500-m exclusion zone and a 1,000-m buffer zone.
[6] Or until 30 minutes past sunset.

iii. shutting down the array when a fin whale is observed at any distance for TGS only;
iv. not requiring shut downs for small delphinoids[7] that are traveling and voluntarily approaching the source vessel to interact with the vessel and/or airgun array;

(5) prohibiting the use of a mitigation gun and power downs;
(6) minimizing the use of acoustic source when not acquiring data;
(7) using vessel strike avoidance measures while in transit and speed restrictions in designated time-area restriction areas[8] for North Atlantic right whales or when female-calf pairs, pods, or large groups of cetaceans are observed;
(8) maintaining a minimum distance of 500 m from any North Atlantic right whale, 100 m from other whale species listed under the Endangered Species Act (ESA), and 50 m from all other marine mammals;
(9) requiring each vessel to have a functioning Automatic Identification System (AIS) onboard and operating at all times;
(10) reporting injured and dead marine mammals to the Office of Protected Resources and the Greater Atlantic Regional Fisheries Office Stranding Coordinator using NMFS's phased approach and suspending activities, if appropriate; and
(11) submitting field and technical reports and a final comprehensive report to NMFS.

Density estimates

The *Federal Register* notice stated that NMFS considered the best available scientific information in determining marine mammal take estimates. At the time the companies' applications initially were submitted, NMFS considered the U.S. Navy's Navy Operating Area (OPAREA) Density Estimates (NODEs; Department of Navy 2007) to be the best available source for marine mammal densities. Habitat-based density models however have been made available since the applications have been submitted. Specifically, Roberts et al. (2016) provided models that better incorporate factors that affect the probability of detecting marine mammals[9] and include additional aerial and shipboard survey data, which is a significant improvement over the NODEs densities. As stated in the *Federal Register* notice, NMFS considers Roberts et al. (2016) to be the best available source of cetacean density data for the Atlantic (82 Fed. Reg. 26287).

The Commission therefore questions why NMFS included a different approach for estimating densities for two of the companies, TGS and Western, both of which had their applications prepared by the same contractor, Smultea Environmental Sciences, LLC (SES). Specifics regarding SES's density estimation methodology are described in the *Federal Register* notice (82 Fed. Reg. 26289–26291). The Commission has numerous concerns with SES's approach, beyond SES opting not to use the best available data. For example, SES suggested that the density models developed by Roberts et al. (2016) overpredict the occurrence of species, particularly for species that are not commonly sighted. This misses a crucial point, namely that the Roberts et al. (2016) models already account for availability and detection biases for all species, including the less-commonly

[7] Small delphinoids include rough-toothed dolphins, common bottlenose dolphins, Clymene dolphins, Atlantic spotted dolphins, pantropical spotted dolphins, striped dolphins, common dolphins, Fraser's dolphins, and Atlantic white-sided dolphins.
[8] Time-area closure areas for North Atlantic right whales include NMFS-designated critical habitat areas off Florida and Georgia, all-coast seasonal management areas in the mid-Atlantic from the Delaware Bay to Cape Canaveral, and active DMAs.
[9] Including Beaufort sea state, group size, availability bias, and perception bias.

encountered ones[10]. SES also indicated it was more appropriate in certain circumstances to use less complex models that require less knowledge of habitat preferences and do not risk overprediction of occurrence of species in areas where those species have not been observed. Given that habitat is one of the most important explanatory variables in density models, omitting it would result in a less robust model overall. Thus, SES is using a less robust model.

In addition, SES used the average of aerial and vessel-based densities, which could introduce substantial biases in terms of distribution of survey effort (i.e., aerial surveys occurred primarily on-shelf, while vessel-based surveys mainly occurred off-shelf). It would have made more sense for SES to divide the survey transects into segments, estimate densities separately for aerial and shipboard surveys, and then produce a combined estimate that accounts for the area effectively surveyed by each platform rather than simply averaging the two densities. Further, SES appeared to have excluded sightings data from surveys conducted outside, but adjacent to, the proposed seismic survey areas.

SES did include more recent sightings data from the Atlantic Marine Assessment Program for Protected Species (AMAPPS) in its density estimates. However, those additional data do not supplant the shortcomings of SES's overall density estimation method. More importantly, it does not make sense for the various companies to use different density estimates for the exact same areas. As noted previously, NMFS stated that the models produced by Roberts et al. (2016) provide the best available source of data regarding cetacean density in the Atlantic, and those are what should have been used by TGS and Western. The Commission recommends that NMFS require TGS and Western to use the Roberts et al. (2016) models for their cetacean densities rather than the densities derived by SES.

Lastly on the topic of marine mammal densities, SES assumed that extremely rare species[11] have a very low probability of being encountered, and thus it assumed that a single group could be taken. ION implemented a similar approach when it estimated that a single rough-toothed dolphin could be taken during its proposed survey and increased the requested number of takes to reflect the average group size of the species. The Commission commends NMFS for using group size to inform take estimates when densities do not exist or are extremely low, or when the take estimation process yields zero or unrealistically low numbers of marine mammal takes.

Level B harassment zones

The Commission notes some discrepancies in the estimated range to effects for Level B harassment in the ION and Spectrum applications, which modeled sound propagation independently at the same 18 sites. ION used the same modeling method used by the Bureau of Ocean Energy Management (BOEM)[12] in its Final Programmatic Environmental Impact Statement for Geological and Geophysical Activities in the Atlantic Ocean (FPEIS; BOEM 2014), and its results were quite similar to those generated by the BOEM model. Conversely, Spectrum used a

[10] Roberts et al. (2016) developed detection functions for species that had fewer than 60 sightings, using proxies as necessary.
[11] i.e., less than four sightings in the proposed survey area.
[12] The BOEM modeling results were used by TGS, Western, and CCG in their incidental harassment authorization applications.

different model, and its Level B harassment zones were two to seven times larger than ION's Level B harassment zones in intermediate and shallow water, respectively[13] (see Tables 8 and 9 in the *Federal Register* notice). Those discrepancies would affect the numbers of marine mammals estimated to be taken by both ION and Spectrum and also call into question the modeling results generated by BOEM.

Although those discrepancies could be attributed to several factors, Tables 8 and 9 provide indications of the primary contributing factor. Based on the companies' applications, the ranges to the 180-dB re 1 μPa root-mean-square (rms) threshold were similar in deep water, which implies that the source models[14] and associated source levels and directivity patterns are consistent despite the two different source models used. The sound propagation model is not responsible for those discrepancies either, as both ION and Spectrum used sound propagation models based on the Navy's Range-dependent Acoustic Model (RAM). Seasonal differences in sound speed profiles also would not explain the discrepancies in Level B harassment zones, because those zones differed by only 10–20 percent between the two seasons (see Tables 11–16 in ION's application). Further, airgun signals that have the greatest energy in the 200-Hz range would not be affected by sound speed profiles in shallow water (e.g., 30 m at site 12). Yet, those shallow-water sites exhibited the largest discrepancies in Level B harassment zones (4,860 km for ION vs. 24,300 km for Spectrum at site 12[15]).

Given that the largest discrepancies were observed at the shallow-water sites, the Commission believes that differences in modeled geoacoustic properties likely were responsible for the discrepancies in the two companies' Level B harassment zones. The sediment composition[16] and the layering of those sediments affect the depth-dependent sound speed and attenuation profiles[17], which are dominant factors when modeling sound propagation in shallow water. Although both ION and Spectrum[18] used sediment data obtained from cores collected during the Ocean Drilling Program, those data were based on core samples taken from different sites, and potentially different assumptions regarding sediment attenuation (see section 4.3.3 in ION's Appendix A and section 4.1.4 in Spectrum's Appendix A). Geoacoustics data often are scant, but can cause major discrepancies even when the same sites are modeled. Thus, the Commission recommends that NMFS determine whether ION's or Spectrum's Level B harassment zones are the most appropriate and re-calculate the numbers of takes accordingly. Because geoacoustic properties have such a large effect on sound propagation in shallow water, the Commission also recommends that NMFS require each of the five companies to (1) conduct sound source verification (SSV) measurements using a mitigation airgun or a few airguns of the full array when operating in different geoacoustic environments in waters less than 100 m in depth and adjust the Level B harassment zones, as necessary and (2) use the geoacoustics data gleaned from those SSV measurements to inform the extent of the Level B harassment zones in similar environments. The Commission further recommends that NMFS (1), in consultation with BOEM, ION, and Spectrum, determine the

[13] Intermediate waters range from 100–1,000 m in depth and shallow waters are less than 100 m in depth.
[14] ION used JASCO's Airgun Array Source Model (AASM); whereas, Spectrum used the Gundalf source model.
[15] Spectrum also did not specify how it converted sound exposure level (SEL) to sound pressure level rms (SPL_{rms}) estimates, which requires some method for estimating airgun pulse length. Although Spectrum should have specified this, that correction should not lead to such large discrepancies in shallow water.
[16] i.e., sediment porosity and particle size.
[17] Both compressional and shear wave velocities and attenuation coefficients.
[18] Spectrum also used data from the Atlantic Margin Coring Project.

appropriate baseline geoacoustic model for the region, including sediment sound speed and attenuation coefficients and (2) require its use in future incidental harassment authorizations for seismic activities in the Atlantic.

Estimated numbers of marine mammal takes

To determine the estimated numbers of Level A and B harassment takes, the five companies used various methods. The Commission questions the validity of some of those methods. For example, Spectrum seeded its animat modeling analysis with a lesser animat density (0.05 animats/km^2) than some of the other companies[19] that used a density of 0.1 animats/km^2. The animat density used by the other companies generally is greater than what occurs in the real environment and is more appropriate for use in Monte Carlo simulations[20]. Although Spectrum stated that the modeled animat density was determined through a sensitivity analysis, the appropriateness of the 0.05-animat/km^2 density is questionable given that it was less than numerous delphinid densities[21] that Spectrum had originally used from Department of Navy (2007)[22]. Further, marine mammal densities substantially changed through the use of Roberts et al. (2016). NMFS did not delineate in the *Federal Register* notice the specific densities that informed the take estimation processes for the five seismic companies, but many of the densities from Roberts et al. (2016) also exceeded 0.5 animals/km^2. Thus, the density of animats used by Spectrum likely was less than the density of animals in the real environment, which could have affected the distribution tails.

Spectrum also included a mitigation assumption within its animat modeling process. Specifically, it reduced the numbers of takes based on the assumption that the airgun array would shut down for 60 minutes[23] whenever an animal is detected within the 500-m exclusion zone. Spectrum used detection probabilities from Carr et al. (2011), whose appropriateness will be debated in a subsequent section of this letter, and outdated Level A harassment thresholds[24] to quantify mitigation implementation. In general, the numbers of takes were reduced by a factor of 1.4 to 4. It is important to note that Spectrum did include the estimated numbers of Level A and B harassment takes absent mitigation implementation (Table 16 in Appendix A of its application), which is consistent with the methods used by the other companies. It is unclear why NMFS chose to take a different tack with Spectrum, especially given the multiple flaws in Spectrum's approach. Thus, the Commission recommends that NMFS (1) determine whether Spectrum's animat density of 0.05 animats/km^2 is sufficient based on the revised densities from Roberts et al. (2016) and (2) if it is sufficient, authorize the uncorrected numbers of Level B harassment takes from Table 16 rather than Table 15 in Spectrum's application—if Spectrum's animat density is insufficient, Spectrum

[19] And BOEM (2014). ION used variable animat densities but indicated that, in most cases, the simulated density of animats was greater than the density of animals in the real environment.
[20] Which assumes overpopulation of animats needed for the results to converge and produce more realistic results that then are scaled to the actual real-world densities.
[21] In some instances by nearly a factor of 2.
[22] See Table 7 in Spectrum's application.
[23] NMFS indicated it would require that seismic operators employ 15-minute clearance times for small odontocetes and 30-minute clearance times for all other species rather than a 60-minute clearance time for all species, as required by BOEM (in its Record of Decision on the FPEIS) and thus proposed by Spectrum.
[24] Including NMFS's previous step-function threshold of 180 dB re 1 μPa_{rms} and the M-weighted SEL thresholds from Southall et al. (2007).

should re-estimate the numbers of Level B harassment takes using a higher animat density and absent mitigation implementation.

Although the multiple companies estimated numbers of Level A harassment takes, NMFS decided to use the results from BOEM (2014) in a way that it believed both adequately considers NMFS's new Technical Guidance (NMFS 2016) and provides a reasonable approximation of Level A harassment takes. The Commission disagrees with that approach. In short, NMFS's proposed Level A harassment takes were derived from (1) correction factors based on NMFS's previous step-function threshold of 180 dB re 1 μPa and the M-weighted SEL thresholds from Southall et al. (2007), (2) scaled 2D tracklines across all seven years from BOEM (2014), and (3) marine mammal densities from Department of Navy (2007; see 82 Fed. Reg. 26292 for specifics). None of NMFS's inputs were based on best available science. Rather, NMFS should have used (1) the actual thresholds from NMFS's Technical Guidance[25], (2) each company's proposed trackline locations, and (3) marine mammal densities from Roberts et al. (2016).

In addition, some of the Level A harassment takes included in Table 11 of the *Federal Register* notice are not plausible. For example, TGS had zero Level A harassment takes and 1,057 Level B harassment takes[26] estimated for fin whales. Similarly for Spectrum, zero Level A harassment takes and 428 Level B harassment takes were estimated for Bryde's whales; while 16 Level A harassment takes and 46 Level B harassment takes were estimated for minke whales. Given that the same thresholds are used for low-frequency cetaceans (LF) no matter the species, those estimated takes do not make sense. The ratio between Level A and B harassment takes should have been similar among species within the same functional hearing group. That is, one would not expect zero Level A harassment takes with more than 1,000 Level B harassment takes estimated for fin whales, when 16 Level A harassment takes were estimated with only 46 Level B harassment takes for minke whales. Similar illogical estimates were provided for the mid- and high-frequency cetacean functional hearing groups as well. Interestingly, multiple species, including four mysticetes, had zero Level A harassment takes estimated but varying numbers of Level B harassment takes. This likely was an artifact of BOEM estimating zero Level A harassment takes for certain species (BOEM 2014) and NMFS incorporating the takes 'as is' rather than concluding that Level A harassment would not occur.

It is unclear why NMFS did not use the simple area x density method that it routinely uses to estimate the numbers of Level A harassment takes for other incidental harassment authorizations. The area x density method should have incorporated the Level A harassment zones NMFS estimated based on its Technical Guidance (82 Fed. Reg. 26254)[27], each company's proposed trackline locations and extent, and the densities from Roberts et al. (2016). That simple method is more justifiable than the method ultimately employed. Further, NMFS did not provide the estimated Level A harassment zones for each company in the *Federal Register* notice, it merely provided a general range for each functional hearing group. Thus, neither the public nor the Commission is able

[25] The metrics used in NMFS's Technical Guidance are based on peak SPL and A-weighted SELs rather than SPL_{rms} and C-weighted (which is M-weighted) SELs from BOEM (2014). Thus, the thresholds and resulting numbers of Level A harassment takes are not comparable.

[26] Which were reduced from 1,148 takes (Table 10) based on the 30-percent limit that is discussed in a subsequent section of this letter.

[27] NMFS did inform the Commission that that Level A harassment zones noted in the *Federal Register* notice for LF were incorrect. The zones range from 80–951 m rather than 80–4,766 m.

to evaluate the extent of the Level A harassment zones. The Commission recommends that NMFS (1) provide company-specific Level A harassment zones for each functional hearing group and (2) re-estimate the numbers of Level A harassment takes based on the ranges to the Level A harassment thresholds from NMFS's Technical Guidance, each company's actual trackline locations and extent, and densities from Roberts et al. (2016).

Mitigation measures

In addition to the standard mitigation measures, NMFS would require time-area closures[28] and other species-specific measures[29] to mitigate impacts from the five proposed seismic surveys[30]. The Commission agrees that the proposed mitigation measures are prudent, but believes that some of the measures should be supplemented or revised to provide additional protection for certain species.

To minimize impacts on Atlantic spotted dolphins, NMFS would restrict Spectrum, TGS, and Western from operating on the shelf south of Cape Hatteras (see Area #1 in Figure 4 of the *Federal Register* notice) from June through August. NMFS based that time-area closure on the likelihood of Atlantic spotted dolphins occurring in the greatest numbers in summer, defined as June through September. It is unclear why September was not included in the closure. NMFS did note that the companies had relatively little interest in that area. Therefore, it should not be an impediment for NMFS to require the three companies to not operate in September as well. The Commission recommends that NMFS restrict Spectrum, TGS, and Western from operating on the shelf south of Cape Hatteras (Area #1) from June through September to reduce impacts on Atlantic spotted dolphins when they are likely to be in the greatest abundance.

To minimize impacts[31] on deep-diving whales, NMFS would require each company to shut down the seismic array if a diving sperm whale is observed visually at any distance centered forward of the vessel track and if a beaked whale or *Kogia* spp. is observed visually or acoustically at any distance. NMFS indicated that the shut-down requirement for sperm whales assumes that whales dive to avoid the vessel and may remain undetected on the vessel trackline during their vertical descent before traveling horizontally, as postulated by Weir and Dolman (2007). Weir and Dolman (2007) also noted that implementing mitigation measures for animals below the surface is clearly limited when using only visual methods, which was not accounted for by NMFS. For beaked whales and *Kogia* spp., NMFS indicated that those species generally have low detection probabilities and that many animals of those species may go undetected. Thus, NMFS proposed to require shut-down procedures be implemented whenever beaked whales or *Kogia* spp. are detected either visually or acoustically. Given the similar difficulties in visual detections of all deep-diving whale species, the Commission questions why the use of acoustic data was not required as a mitigation measure for sperm whales. Sperm whales may be easier to observe visually than beaked whales or *Kogia* spp., but

[28] The description of the project areas for TGS and ION indicate that those companies have proposed to operate a minimum of 25 and 20 km from shore, respectively; however, NMFS has proposed that all companies restrict operations within 30 km of shore.
[29] Some of which were based on results from NMFS's proposed negligible impact analysis framework that is discussed in a subsequent section.
[30] And, in some instances, reduce the number of Level B harassment takes.
[31] Including severe behavioral responses.

they dive for 45 minutes on average (Watwood et al. 2006), which limits their availability for visual detection.

Sperm whales were among the first deep-water species to be studied and surveyed using passive acoustic methods. Because sperm whales are acoustically active, they can be detected reliably within 4 to 6 km using a towed array (see Figure 7b in Barlow and Taylor 2005) — well within the Level B harassment zones stipulated in Tables 7–9 of the *Federal Register* notice. Sperm whales also can be localized in a relatively short timeframe using a towed array and the method described in Barlow and Taylor (2005; see Figure 2). Thus, the Commission considers it both feasible and practicable for NMFS to require implementation of shut-down procedures based on both visual and acoustic detection of sperm whales. The acoustic detection methods also would bolster mitigation efforts as a whole, affording NMFS the ability to better minimize the impacts on sperm whales. Therefore, the Commission recommends that NMFS require each company to use both visual observations and passive acoustic methods to implement shut-down procedures when sperm whales are detected, similar to the proposed measures for beaked whales and *Kogia* spp.

To minimize impacts on North Atlantic right whales, the proposed closure areas should be expanded to reflect analyses of acoustic data from recent and ongoing studies. New data reflect peaks in acoustic detections that coincide with the previously observed, high-use period from November to April. However, whales are being detected farther offshore than historically observed in the northern parts of the U.S. mid-Atlantic, including areas off Virginia (Salisbury et al. 2016). The Commission previously recommended to NMFS[32] that critical habitat for North Atlantic right whales include the migratory corridor within 56 km of the mid-Atlantic coast, however that area was not included in the revised critical habitat designation. Critical habitat for right whales includes feeding areas in the north (from Chatham Harbor, Massachusetts, to Rye Harbor, Maine) and the calving areas in the south (from Cape Canaveral, Florida, to Cape Fear, North Carolina) based on more recent acoustics information and tracks of whales from telemetry studies (81 Fed. Reg. 4838). The area from Cape Fear to Chatham Harbor is an essential part of the species' migratory corridor and appears to be more important than previously thought for significant numbers of overwintering whales (Kraus et al. 1986, Kenny et al. 2001, Knowlton et al. 2002, Schick et al. 2009).

Although location data for right whales based on acoustic studies off the mid-Atlantic coast are currently being analyzed, preliminary results indicate that right whales tend to occur closer to shore south of Cape Hatteras and further from shore north of there. The Commission therefore considers the current 47 km-wide closure area along much of the northern parts of the migratory corridor to be inadequate for protecting right whales from acoustic disturbance during the proposed seismic surveys. The Commission therefore recommends that NMFS expand the seaward boundary of the coastal strip closure area north of Cape Hatteras from 47 km to at least 66 km (56 km plus a 10 km buffer zone) to protect North Atlantic right whales from November through April. Results from more recent acoustic analyses led by the Northeast Fisheries Science Center (NEFSC) are expected to be available shortly. Those data should provide further insights with regard to the occurrence of right whales at different distances from shore along the Atlantic coast. The Commission encourages NMFS, if it has not already done so, to consult with the NEFSC's staff on the status of those analyses and the availability of the results.

[32] In the Commission's 21 April 2015 letter.

Reporting measures

To ensure that the authorized numbers of takes are not exceeded, NMFS would require all companies with estimated numbers of takes that exceed its proposed 30-percent limit[33] to submit monthly interim reports. Those reports would include the amount and location of line-kilometers surveyed, all marine mammal sightings with the associated closest approach distances, and corrected numbers of marine mammals 'taken'. NMFS would require the four companies to correct their sightings data using detection probabilities from Carr et al. (2011) to better assess the numbers of marine mammals taken. The Commission supports such an approach. However, it is unsure why NMFS chose to use Carr et al. (2011) given that a more recent publication from Barlow (2015) included updated $f(0)$ and $g(0)$ values that have been corrected for Beaufort sea state (BSS). Barlow (2015) indicated that ignoring the effects of BSS results in a non-trivial bias in cetacean abundance estimates, or in this case take estimates. The Commission fully agrees.

Although NMFS would require the four companies to estimate the numbers of marine mammals taken, it did not address the fact that visual observers can detect marine mammals only at distances of approximately 1–5 km depending on the species. The size of the Level B harassment zones are quite large and extend well beyond what can be reasonably observed. Thus, the numbers of marine mammals potentially taken could be vastly underestimated.

To better estimate the numbers of marine mammals taken, NMFS should have required the companies to extrapolate the corrected marine mammal sightings data based on the extent of the Level B harassment zones[34]. The Commission believes those shortcomings should be addressed and proposes a simple extrapolation method to estimate the number of marine mammals potentially taken by Level A and B harassment (see Addendum). That method[35] also incorporates the $f(0)$ and BSS-specific $g(0)$ values from Barlow (2015).

The Commission acknowledges that neither Carr et al. (2011) nor Barlow (2015) accounts for the presence of an active sound source, and therefore extrapolations may underestimate the numbers of marine mammals in the farther extents of the Level B harassment zone[36]. Nevertheless, the Commission considers that its extrapolation method, as described in the Addendum, provides a better approximation of the numbers of marine mammals taken than the method proposed by NMFS. Therefore, the Commission recommends that NMFS require the companies to use values from Barlow (2015) and the Commission's extrapolation method to estimate the numbers of marine mammals taken by Level A and B harassment in the monthly interim reports.

Determinations under the MMPA

Under section 101(a)(5)(D) of the MMPA, NMFS must make various determinations before it can issue an incidental harassment authorization, including negligible impact, small numbers, and least practicable adverse impact. In this particular *Federal Register* notice, NMFS proposed to

[33] ION is the only company to which this requirement would not pertain.
[34] Which generally range to 10 km but also extend beyond 24 km in some instances.
[35] A nearly identical method was provided to NMFS nearly a year ago to better ascertain the numbers of marine mammals taken during geophysical surveys funded by the National Science Foundation.
[36] That is, marine mammals may be avoiding the sound source and may be occurring in greater numbers beyond the visual detection range of the observers.

authorize taking of no more than 30 percent of any stock abundance estimate by any of the five seismic operators as meeting the small numbers determination, and thus the negligible impact and least practicable adverse impact determinations as well. NMFS also developed a negligible impact analysis framework based on Wood et al. (2012) that incorporates the magnitude[37], consequence, and context of the impacts to inform an overall impact rating for each proposed seismic survey. Those factors were based on both quantitative and qualitative metrics. The Commission commends NMFS for formulating the proposed framework and considers such a framework a reasonable first step to assess whether an activity would have a negligible impact on a marine mammal species or stock. However, there are some issues with how it was applied.

Section 101(a)(5) limits incidental take authorizations to small numbers of marine mammals. Congress, in the MMPA's legislative history[38], recognized "the imprecision of the term 'small numbers' but was unable to offer a more precise formulation because the concept is not capable of being expressed in absolute numerical limits." It did, however, note that incidental taking authorizations under section 101(a)(5) were to be available only to "persons whose taking of marine mammals is infrequent, unavoidable, or accidental."

For the proposed authorizations, NMFS proposed to use a 'relative approach' for making a small numbers determination that would cap the numbers of takes to be authorized at 30 percent of the abundance estimate for each stock. NMFS noted that the proposed 30-percent limit is not a 'hard and fast cut-off' for what constitutes small numbers, but NMFS believed that it is appropriate in this instance, "where exposure estimates constitute sizable percentages of the stock abundance and there are no qualitative factors to inform why the actual percentages are likely to be lower…." The Commission has several concerns with this approach.

First, as was the case with the proposed rule for the Navy's Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar, it seems that NMFS may be using a specific authorization to develop generally applicable guidance and policies. In the Commission's 30 May 2017 comments concerning NMFS's application of the least practical adverse impact standard, it noted that generally applicable interpretations and policy guidance should be adopted through agency policy statements or in broader regulations implementing section 101(a)(5), after opportunity for public comment, rather than in specific authorizations. Here, it is not clear whether the proposed 30-percent limit is intended to set a precedent or be a more broadly applicable statement of how NMFS interprets the MMPA's small number standard. If it is intended to be more broadly applicable, then it too, should be developed in interpretive regulations or a more widely applicable policy statement.

Second, the selection of the 30-percent limit is not well supported. NMFS focused on providing support for using a proportional standard in general, but not on its choice of a particular proportion. NMFS should explain why the proposed 30-percent limit is an appropriate demarcation between a number that it considered small and one that is not. To support its use of a proportional standard, NMFS cited *CBD* v. *Salazar*. In that case, the court ruled that "the Service need not quantify the number of marine mammals that would be taken…so long as the agency reasonably determines through some other means that the specified activity will result in take of only 'small

[37] Which includes the amount of take and both the spatial and temporal extent of the potential impacts.
[38] See H.R. Rep. No. 97-228 at p. 19.

numbers' of marine mammals." The court found it acceptable for the agency to analyze small numbers "in relation to the size of the larger population, so long as the 'negligible impact' finding remains a distinct, separate standard." Although the court embraced the use of a proportional standard for making small numbers determinations, it did not say that the selection of any proportion would satisfy it. The *Salazar* decision noted that, under the facts of that case, "the number of animals coming in contact with the industrial activity will be small by an order of magnitude to the [relevant walrus and] polar bear populations." In this instance, NMFS proposed to adopt a proportional standard that is three times greater than the standard in the *Salazar* decision. The Commission therefore recommends that NMFS provide additional explanation to support its selection of the 30-percent limit on marine mammal taking as meeting the small numbers determination for the proposed authorizations.

The court in *Salazar* also discussed the interplay between the small numbers and negligible impact determinations. There are instances when the number of marine mammals expected to be taken might be small, but the activity would still not have a negligible impact on the species and stocks that are taken. "Likewise, a proposed activity might harass a large portion of the relevant marine mammal population, but have only a negligible impact on the species or stock because the harassment is merely trivial and fleeting." The court noted that in neither of those situations could an authorization be issued.

For some species or stocks (e.g., North Atlantic right whales or Cook Inlet beluga whales), taking the entire population may arguably constitute a small number. However, taking more than a small fraction of these endangered populations at that level may easily run afoul of the negligible impact standard. At the other extreme, certain types of taking from large populations (e.g., northern fur seals) may have a negligible impact, but push the limit of what reasonably may be considered a small number. Because of this, the one-size-fits-all standard proposed by NMFS, even one that is not considered a hard and fast rule, may create problems at the extremes.

Although the court ruled that a proportional standard, rather than an absolute number, is a permissible construction for expressing what constitutes small numbers, the MMPA's standard is not a 'small proportion' of the affected stocks. At some point applying the same proportion to all stocks pushes the boundaries of what might be considered a reasonable interpretation of the statute. As such, the Commission recommends that, in developing generally applicable guidance for using a proportional standard to make small numbers determinations, NMFS either use a sliding scale that accounts for the abundance of the species or stock or explain why it believes that a single standard should be applied in all cases.

Moreover, in the *Salazar* case, FWS used a proportional approach to determine that the expected level of taking would involve only small numbers "because a numerical estimate…could not be practically obtained." In the proposed authorizations, that is not the case. In fact, NMFS provided exact numerical values for the upper bounds of what it considered to be small numbers, deriving them using the specified 30-percent limit. Unlike in *Salazar*, NMFS did not use the proportional standard to determine that the expected levels of take, although unquantified, met the small numbers determination. Rather, NMFS used a proportional standard to quantify the extent to which the expected take, which it believed would otherwise exceed the small numbers limit, needed to be reduced.

With respect to the least practicable adverse impact requirement, the *Federal Register* notice referenced the framework for evaluating that standard as being included in its proposed rule to authorize the taking of marine mammals incidental to the operation of the Navy's SURTASS LFA sonar. The Commission commented on that framework in its 30 May 2017 letter on that proposed rule and those comments remain equally applicable and should be read in conjunction with the comments herein.

NMFS stated that it has preliminarily determined that the proposed authorizations met the least practicable adverse impact standard, but provided virtually no analysis to support that conclusion. Other than referencing the framework previously noted, the only support for its determinations was to identify three general factors it used in its assessments. A more thorough analysis and better justification for those determinations is needed. Consistent with its comments on the SURTASS LFA sonar proposed rule, the Commission recommends that NMFS (1) identify the potential adverse impacts it has identified and is evaluating[39], (2) specify what measures might be available to reduce those impacts, and (3) evaluate whether such measures are practicable to implement.

In addition, the Commission has identified a few more specific issues pertaining to the small numbers and negligible impact analyses. Neither framework incorporated Level A harassment takes, rather those analyses assessed only the proposed Level B harassment takes. Specifically, Table 11 in the *Federal Register* notice should have evaluated the total number of takes[40] for each species against the small numbers limit. In some instances, NMFS reduced the estimated number of Level B harassment takes to meet the proposed 30-percent limit. That reduction should have been based on the total number of Level A and B harassment takes rather than only the number of Level B harassment takes. In addition, NMFS indicated that it did not define quantitative metrics related to Level A harassment because the number of potential Level A harassment takes was expected to be low. NMFS did not appear to evaluate Level A harassment takes against the qualitative metrics for the various factors under the proposed negligible impact analysis framework either. These issues were further compounded by NMFS failing to estimate the numbers of Level A harassment takes accurately, as delineated in a previous portion of this letter. Thus, the Commission recommends that NMFS (1) include both the numbers of Level A[41] and B harassment takes in its analysis of small numbers, which would be limited in this instance to 30 percent of the stock abundance and (2) evaluate the numbers of Level A harassment takes, in concert with the Level B harassment takes, using the negligible impact analysis framework. The quantitative and qualitative metrics used in the framework may need to be reconsidered or supplemented to account for the greater severity of Level A than Level B harassment takes.

Collaboration among seismic companies

As indicated in Figure 1, all of the seismic surveys are extensive and cover essentially the same broad area from Delaware to Florida. The Commission considers the large numbers of estimated takes from the multiple seismic surveys to be of concern. NMFS's regulatory authority to

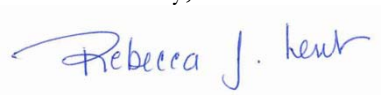
[39] For example, is NMFS concerned only with the potential for temporary or permanent hearing loss, or with exposures to sound levels above certain thresholds, behavioral disruption, etc.
[40] For both Level A and B harassment.
[41] Which should be revised based on a previous recommendation herein.

minimize large-scale, overlapping seismic surveys is provided in section 101(a)(5)(A)(i)(II)(aa) of the MMPA, which directs NMFS to structure incidental take authorizations so that they prescribe "other means of effecting the least practicable adverse impact on such species or stock and its habitat…." NMFS has had some success in the past in having seismic companies collaborate on seismic surveys in the Arctic. The Commission believes that NMFS should work closely with BOEM[42] on parallel measures to encourage companies to combine their efforts and collaborate to reduce the number of incidental take authorizations and geological and geophysical permits issued for seismic surveys in the Atlantic.

Collaboration on seismic surveys has become increasingly common as companies seek to reduce costs and maximize efficiencies associated with large-scale, 2D seismic surveys. Precedent for collaborations on seismic surveys can be found in the Barents Sea[43] and off Mexico[44]. The 'multi-client survey' approach also has been recommended as an option for minimizing overall exposure of marine mammals to underwater sound (Nowacek and Southall 2016). Alternatively, BOEM and NMFS could seek to reduce the number of surveys authorized such that not more than one survey is conducted in any particular area in a given year. The Commission recommends that NMFS work with BOEM to require companies to minimize cumulative impacts on marine mammals by collaborating on seismic surveys or devising other means to reduce the potential for multiple overlapping surveys.

The Commission hopes you find its letter useful. Please contact me if you have questions regarding these recommendations.

Sincerely,



Rebecca J. Lent, Ph.D.
Executive Director

cc: Jill Lewandowski, Bureau of Ocean Energy Management

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[42] Who also has jurisdiction under the Outer Continental Shelf Lands Act to ensure activities are conducted "in a safe and environmentally sound manner so as to prevent harm or damage to, or waste of, any natural resources (including any mineral deposit in areas leased or not leased), any life (including fish and other aquatic life), property, or the marine, coastal, or human environment" (30 CFR § 251.2).

[43] http://www.statoil.com/en/NewsAndMedia/News/2014/Pages/02Oct_Barents_seismic.aspx

[44] https://www.slb.com/news/press_releases/2017/2017_0428_slb_pemex_campeche_pr.aspx; http://subseaworldnews.com/2015/07/01/pgs-spectrum-and-schlumberger-cooperate-off-mexico

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ADDENDUM

The Commission's recommended method for estimating the number of cetaceans in the vicinity of seismic surveys based on the number of groups detected

For each seismic survey, observers collect the number of sightings observed, group size, distance and angle to sighting, distance travelled on survey effort, Beaufort sea state (BSS), wind speed, swell height, etc. A simple method to estimate the total number of cetaceans potentially taken by Level B harassment[45] can therefore be used. This method incorporates $f(0)$ and BSS-specific $g(0)$ values from Barlow (2015) that were derived using Distance sampling methods (Buckland et al. 2001, 2004) and sightings data from each seismic survey. The number of animals detected by an observer on a ship is an underestimate of the true number of animals in the vicinity of the ship because the observer inevitably misses some groups. If we know that we have detected n objects, and the probability of detecting each object is p, a standard way to estimate the total number of objects is n/p. We know n for each species from the data collected on each survey, so the problem is to find p for each species. Normally p is estimated from the data collected on each survey as part of a line-transect analysis. The probability p for each species depends principally on the distance of the animals from the observer, but may also depend on other factors such as group size and sea state.

In the absence of a line-transect analysis, the Commission suggests taking estimates of p from other studies which use ships of similar size and searching methods. In the parlance of line-transect analysis, p is a product of the probability of detecting a group of animals directly on the trackline ($g(0)$) and the probability of detecting a group of animals within the half-strip width on each side of the trackline (μ/w, where w is the transect truncation distance beyond which data are not recorded and μ is the effective strip half-width). The effective strip half-width also may be expressed as $\mu = 1/f(0)$, where $f(0)$ is the estimated probability density function of observed perpendicular distances y evaluated at $y = 0$.

Based on the Commission's understanding of the ships and areas for the seismic surveys, $g(0)$ and $f(0)$ from Barlow (2015) should be appropriate. The species discussed in the references may be different from those observed during the seismic survey, but data from similar species can be used. Since $g(0)$ and $f(0)$ values for each species or genera depend on group size, BSS, swell height and other factors, those factors should be taken into account if possible.

The probability of detecting a group of cetaceans can therefore be expressed as

$$p = g(0)\frac{\mu}{w} = \frac{g(0)}{w\,f(0)} \ .$$

[45] Given the slow speed of the vessel during geophysical surveys and the perceived abilities of the observers, animals taken by Level A harassment should be reported as the actual number of animals observed during surveys for all but minke whales observed during the ION survey and *Kogia* spp. observed during the Spectrum survey. In those two circumstances, the BSS-specific effective strip half-width may be less than the extent of the Level A harassment zones. If so, the extrapolation method discussed herein should be used rather than reporting the uncorrected number of animals observed.

If there are n sightings of a species along a section of trackline, the estimated number of groups within a given BSS, within a perpendicular distance w on each side of the trackline, and within a given Level B harassment zone[46] is

$$N_{groups} = \frac{n}{p} = \frac{n w f(0)}{g(0)} = \frac{n w}{\mu g(0)} \ ,$$

and the estimated number of individual animals in that given BSS then is

$$N \ = \frac{n}{p} S = \frac{n w}{\mu g(0)} S \ ,$$

where S is the mean group size for the species.

The number of animals seen within each BSS should be summed for each Level B harassment zone. That total number then must be scaled by the distance to the Level B harassment threshold relative to the truncation distance to estimate the total number of animals potentially taken during a given survey.

Example calculation for common dolphins when sightings data are partitioned by group size and BSS

Suppose we have detected n = 3 groups within a BSS of 2, with a mean group size of S = 120, and n = 2 groups within a BSS of 3, with a mean group size of S = 130—both in a Level B harassment radii = 11 km. From Table 2 of Barlow (2015), μ = 3.54 km and w = 5.5 km and μ = 3.24 km and w = 5.5 km from Table 3, $g(0)$ = 0.940. The estimated total number of dolphins potentially taken during the survey is therefore

$$N = \frac{(3)(5.5)}{(3.54)(0.94)} 120 = 595$$
$$N = \frac{(2)(5.5)}{(3.24)(0.94)} 130 = 470$$
$$N = 595 + 470 = 1065 \ \frac{11}{5.5} = 2130$$

One has to be particularly careful when enumerating the number of sightings and mean group size for seismic surveys. Given that the vessel is traveling so slowly, often a sighting of a large group of animals is observed at a distance and a smaller sub-pod can break off and close in on the vessel. Ideally, each vessel would have a tracker who monitors the position of the different sightings. If the seismic operators are not able to afford a separate individual to track each sighting, the observers must be cognizant of tracking each sighting until it passes abeam. For example, if 65 Pacific white-sided dolphins are observed 2 km from the vessel and then a group of 7 Pacific white-

[46] Which differ depending on water depth and seismic operator.

sided dolphins are observed approaching the vessel[47] a short time later, this should be enumerated as a single sighting of 65 dolphins rather than 2 sightings of 65 and 7 dolphins each. Further, large whales can be documented via multiple sightings. If there are 4 sightings of a single humpback whale and its trajectory has taken it across the path of the vessel, that sighting should be documented as 1 sighting of 1 whale rather than 4 sightings of 1 whale.**

If sightings data partitioned into the various BSSs are not available, an even more simple and rapid method can be used by assuming single, overall values for the various parameters for each species or genera. Those values can be obtained from Barlow and Forney (2007).

The probability of detecting a group of cetaceans again is expressed as

$$p = g(0)\frac{\mu}{w} = \frac{g(0)}{w\,f(0)} \ .$$

If there are n sightings of a species along a section of trackline, the estimated number of groups within a perpendicular distance w on each side of the trackline and within a given Level B harassment zone is

$$N_{groups} = \frac{n}{p} = \frac{n\,w\,f(0)}{g(0)} = \frac{n\,w}{\mu\,g(0)} \ ,$$

and the estimated number of individual animals is

$$N \ = \frac{n}{p}S = \frac{n\,w}{\mu\,g(0)}S \ ,$$

where S is the mean group size for the species. That total number then must be scaled by the distance to the Level B harassment threshold relative to the truncation distance to estimate the total number of animals potentially taken during a given survey.

<u>Example calculation for common dolphins when sightings data partitioned into the various BSSs are not available</u>

Suppose we have detected n = 10 groups, with a mean group size of S = 120 within a Level B harassment radii = 8 km. From Table 1 of Barlow and Forney (2007), μ = 2.22 km and w = 4.0 km and from Table 3, $g(0)$ = 0.970. The estimated total number of dolphins potentially taken during the survey is therefore

$$N = \frac{(10)(4)}{(2.22)(0.97)}120\ \frac{8}{4} = 4458$$

[47] And, if that smaller sub-pod comes within the Level A harassment zone, it should be enumerated as such.

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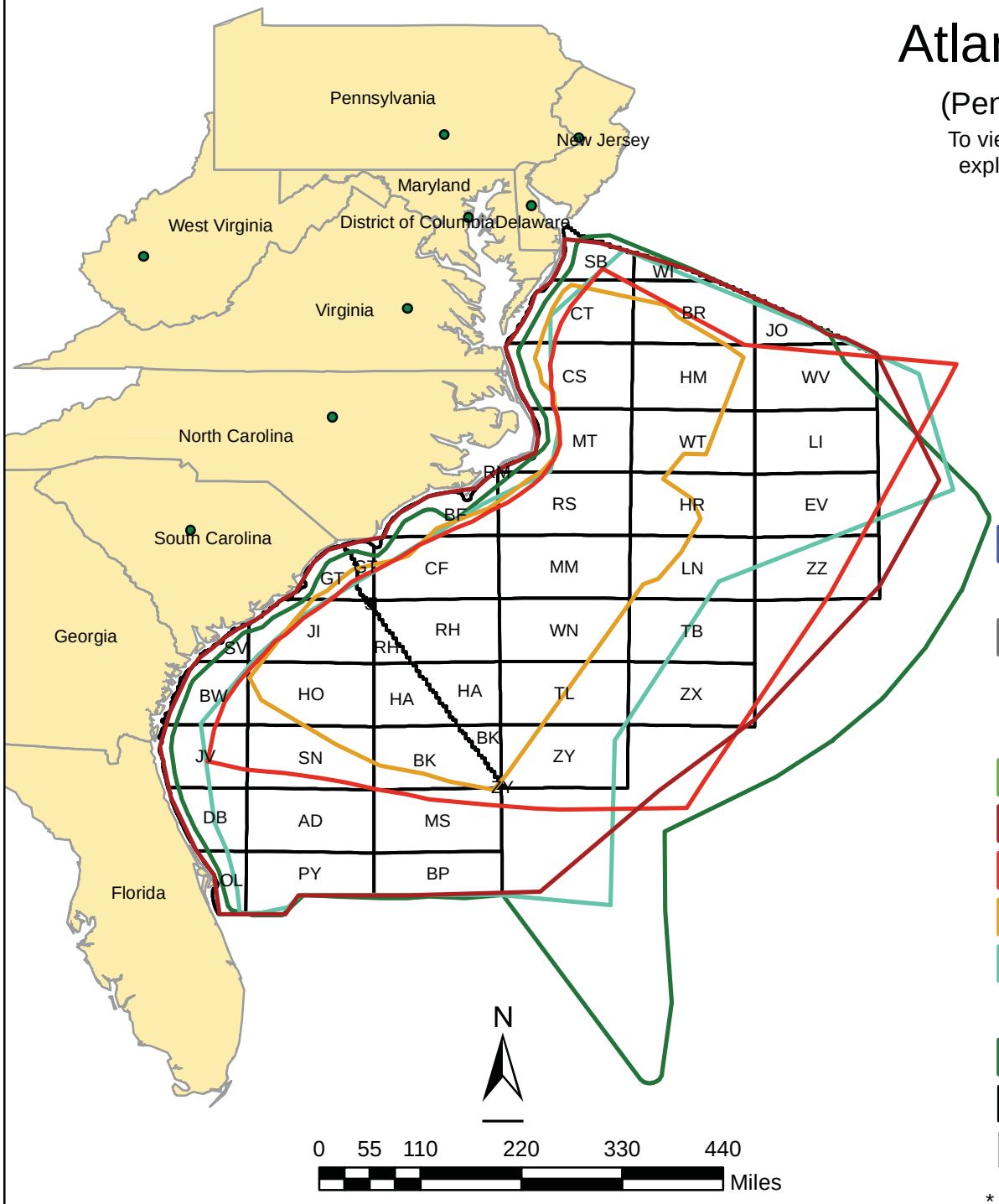
FIGURE 1



Atlantic Permit Applications

(Pending, Issued, Withdrawn, Expired)

To view individual permit outlines, click on the Layers icon, expland the Layers folder then the Public Outlines folder. Toggle each permit outline off/on.

Legend

- E15-002 NeosGeo Aerial Grav/Mag ISSUED
- E15-001 WITHDRAWN
- E14-010 TDI-Brooks Hi-Res
- E14-009 WITHDRAWN
- E14-008 EXPIRED
- E14-007 PGS 3D
- E14-006 SpectrumGeo 2D
- E14-005 CGG 2D
- E14-004 WesternGeco 2D
- E14-003 GXTechnology 2D
- E14-002 WITHDRAWN
- E14-001 TGS 2D
- PEIS Planning Areas
- Atlantic States

* Survey polygons are derived from public information maps