Quieting the Gulf of America as We Survey Its Energy Resources

Meeting Summary | September 23-24, 2025

Overview

On Tuesday, September 23, and Wednesday, September 24, 2025, the National Fish and Wildlife Foundation (NFWF), in partnership with the National Oceanic and Atmospheric Administration (NOAA), convened a workshop in Washington, DC. The purpose of this workshop was to explore ideas regarding quieting the Gulf of America for the benefit of cetaceans (whales and dolphins) while conducting marine seismic and other geological surveys of its energy resources. Facilitated by the Consensus Building Institute (CBI), the workshop brought together industry, government, and research experts from across the landscape to discuss their ideas regarding barriers, incentives, and possible actions to deepen voluntary uptake of quieter approaches to conducting these surveys. The workshop's topics were informed by stakeholder interviews and a pre-workshop webinar that sought to better understand stakeholder interests and options viable for the scope of this discussion. The following is a summary of the key themes, insights, and collaborative actions that workshop participants surfaced as potential pathways towards a quieter Gulf.

Day 1: Key Insights & Findings

The first day of the workshop focused on framing the context of the workshop based on the goals of the *Deepwater Horizon Restoration Program Open Ocean Trustee Implementation Group Marine Mammal Projects*, specifically regarding reducing the impacts of anthropogenic noise on marine mammals. Representatives from NFWF and NOAA opened the two days by grounding the group in the Workshop's goals and sharing research regarding current noise levels in the Gulf. This data indicated that the baseline problem is that the Gulf is loud due to persistent noise from a number of sources, of which seismic surveys are a significant contributor. Despite highlighting that surveying effort has decreased overall, noise levels in the Gulf remain constant or have increased.

Following these introductory presentations, participants were asked to consider how adjusting several proposed "dials" (e.g., frequency, impulsivity, amplitude, duration, space, and time) might reduce the overall noise footprint, as well as which could be catalyzed by $2 million in NFWF grant funding. The following is a high-level summary of the key observations and findings that emerged for further discussion.

- Participants determined that they could explore taking meaningful voluntary action to adjust the following "dials:"
    - Reduce amplitude
    - Reduce incidental frequencies
    - Reduce area ensonified
    - Maintain data quality with less energy input

- There was continuing interest in better understanding marine mammals' response to "seismic" noise, though recognizing that while work has been done on this issue, there is much to learn, and such studies can be expensive and challenging
- New technologies would benefit from a better understanding of agency application of the 160 dB and non-continuous sound policy, and agency staff expressed interest in providing that clarification, encouraging entities to reach out
- There is space and appetite for updating the 120 dB guidance, which is based on older data and understanding; however, it is not a roadblock to moving forward, and some precedent has already been set
- Moving from mitigation Tier 1 to Tier 2 (or higher!) is one of the strongest incentives for industry to move to newer technologies, given the cost savings in survey time by reducing shutdowns
- There are adjusted conditions that could result from greater or less propagation, but seasonal closures are not desired for a host of reasons for geological and geophysical surveying and may have adverse, unanticipated consequences (i.e., survey vessels continuing to work in other areas during closures, resulting in no less days of surveys)
- Agencies are VERY open to working with industry

CBI facilitators asked participants to consider what “success” in five years would look like, to identify critical barriers to this success, and to think expansively about how these challenges might be jointly addressed. Across the groups, participants collectively envisioned that success includes, but is not limited to:

- Reducing amplitude levels across all surveys year-round, while acknowledging that shortening the survey season is not realistic for operational and economic reasons.
- Reducing the overall acoustic footprint in the Gulf by shrinking the geographic and ensonified area to reduce the number of animals exposed, while still maintaining imaging energy
- A public access seismic survey across newer technologies to generate trusted shared full datasets that would allow companies to assess performance without bearing all the risk themselves
- Developing clear and practical shared metrics to define and measure success that can track changes and guide decision-making
- Identifying other key technical “dials” that can be adjusted, in addition to amplitude: frequency, swept source strategies, and receiver configurations
- Aligning incentives and policy tools that encourage uptake of lower-impact technologies (e.g., lease cost reductions, market incentives, and/or regulatory integrations), thus providing industry with more certainty in their investment

Following further iterative discussions, both small and large groups were asked to consider collaborative and voluntary actions that could meet the needs of both industry and marine life in a meaningful way. Through this process, the group generated the following list of viable Potential Actions for further consideration throughout Day 2 (in no particular order).

- Reduce amplitude
- Reduce incidental higher frequency

- Improve receiver quality, cost, and/or density
- Generate comparable quality data for less energy
- Reduce area ensonified
- Public seismic survey with accessible data to prove out new technologies
- Focus noise reduction efforts more on production rather than exploration, given more surveys are dedicated to highly specific data to optimize the performance of existing production
- Interim workaround for 120dB threshold, or change the threshold
- Clarify the 160dB threshold and duty cycle around non-continuous sound
- More clearly quantify success, acknowledging that behavioral criteria are not currently nor soon available and therefore we can establish other shared metrics to use as a benchmark in the short to medium term.

Day 1 adjourned with broad alignment on areas for potential action that could achieve the shared visions of success for reducing noise in the Gulf overall while maintaining geophysical objectives.

Day 2: Potential Directions

The second day of the workshop focused on building out the most promising ideas surfaced by participants on Day 1. In particular, the facilitators asked participants to consider which of these potential actions could use the $2 million grant funding available from NFWF to concretely advance progress on reducing noise in the Gulf. Following a refining discussion, the group elaborated on the ideas from Day 1 to create the following set of "pitch" options (in no particular order). For their pitches, CBI facilitators asked the group to select three of the most promising ideas from this refined list and make them as compelling and actionable as possible.

Actions	**Enabling Activities**
1. Strategies and incentives to increase uptake of commercially available technologies 2. Foster the development and use of new quieting technologies 3. Support for calibrating baseline data for production surveys from older to newer technologies 4. Create testing field to yield publicly available sound source verification data and assess data quality for multiple technologies 5. Shared parameterization for comparison of technologies	6. Refine the tier table to incentivize the uptake of quieter technology 7. Develop a calculator that can assign new technologies to tiers 8. Technical assistance for preparing a permitting package to reduce the risk of engagement with new technologies (e.g., overcome 120dB threshold barrier - meet 160dB threshold)

From this list, stakeholders selected the three ideas they wanted to explore in detail and present to one another. Their pitches had to consider reducing sound at the source, be implementable in

a two to five-year time frame, and require partnership across key stakeholders. The group chose the following ideas amongst which to divide themselves:

- “Create testing field to yield publicly available sound source verification data”
- “Strategies and incentives to increase uptake of commercially available technologies”
- “Refine the tier table to incentivise the uptake of quieter technology”

Following breakout design sessions, each group presented its pitch in plenary and then engaged in a brief Q&A session to offer further insights and clarity. The following is a high-level summary of each pitch and a synthesis of the discussion that followed:

- Pitch Group 1: “Create testing field to yield publicly available sound source verification data”
    - Conduct a collaborative, multi-party field test to characterize and compare multiple source types under standardized measurement protocols
    - Essential to success are public data availability, generating trusted benchmark datasets, and shared participation among industry agencies and researchers to de-risk the uptake of lower-impact technologies
- Pitch Group 2: “Strategies and incentives to increase uptake of commercially available technologies”
    - Establish a simple, credible, and widely accepted metric to compare source technologies and evaluate survey acoustic performance
    - Essential to success would be a metric that is scientifically sound, operationally practical, and tech-agnostic, so it can serve as a tool for both technical evaluation and regulatory decision-making.
- Pitch Group 3: “Refine the tier table to incentivise the uptake of quieter technology”
    - Integrate acoustic performance into regulatory tiering, creating pathways for lower-impact operations to receive permitting benefits or incentives
    - This was framed as a way to operationalize the metric and support flexible, adaptive regulatory structures that keep pace with evolving technologies.

The discussion following the pitches emphasized that these three ideas were ultimately interdependent and could be sequenced strategically. Pitch 1 would generate necessary data, Pitch 2 would provide a standardized metric to evaluate that data, and the tiering would apply the new metric within regulatory processes. Participants also underscored the importance of collaborative governance, transparent data sharing, and clear roles amongst the key stakeholder groups. They also raised practical considerations like cost-sharing, stewardship, and balancing proprietary interests. Additionally, participants acknowledged the need to coordinate efforts, align with existing regulatory processes, and leverage the field test as a foundation for subsequent action. Finally, the discussion underscored the necessity of scientific rigor and standardized methods to ensure that the resulting data and metrics would be credible and broadly accepted to catalyze further adjustment. When asked by CBI facilitators to choose their theory of change for a quieter Gulf, the majority of participants selected Pitch Idea 1 (the joint field test) as the collaborative path forward, with Pitches 2 and 3 as necessary elements of Pitch Idea 1.

The meeting concluded with the meeting convenors thanking everyone for their attendance and contribution to advancing these goals for the benefit of cetaceans (whales and dolphins).

Appendices

A. Workshop Agenda
B. Workshop Attendees
C. Matrix of Current Technologies
D. Diagram of the NUT Permitting Process

In-Person Workshop
Quieting the Gulf as We Survey Its Energy Resources
September 23-24, 2025
Venue: API | 200 Massachusetts Avenue NW, Washington D.C.

Participant Agenda

Goal

- A quieter Gulf for the benefit of marine mammals

Meeting Objectives

- Explore barriers and incentives to moving toward quieter approaches
- Explore possible actions / pathways to deepen opportunities for voluntary uptake of quieter approaches (including how best to use $2 million in grant funding available through NFWF)

Assumptions

- Shared goal of maintaining industry needs for ongoing oil and gas exploration while benefiting the marine environment
- A number of barriers contribute to slower progress than we would like
- Near-term action in this space will be voluntary and require partnership and collaboration
- A lack of regulatory pressure could cement the status quo, but it could also unleash opportunity to experiment, innovate, and improve!
- We will get stuck if we focus only on barriers and universal metrics (how quiet is quiet?). Let's keep those things in mind while we are imaginative and creative in naming actions or experiments that are worth taking and then talk about how to get there, including overcoming barriers and desired goals.
- We need to all break out of our thinking to unlock value

Rules of the Road

- Dress relaxed business casual (be comfortable)
- Participate actively
- Minimize electronic distractions (we will provide real breaks to catch up)
- Share the floor
- Be curious
- Think different
- Follow anti-trust and avoid technology preferencing

Agenda Day 1

9:00 Welcome

9:05 Meeting purpose, agenda, rules of the road

9:15 What is the Project and Goal

9:30 Introductions

9:50 What are we trying to accomplish?

10:30 What other efforts do we need to be mindful of as we do our work together?

10:55 Break

11:10 In 5 years, success is . . . *(small and large group)*

- If we were successful in 5 years, what would success look like? How do we meet this moment when regulation is not the solution, energy dominance is the goal, and we all want marine mammals to thrive in the Gulf?

11:50 What's Getting in the Way of our North Star (s) - Barriers *(full group)*

12:30 Lunch

1:45 What's Getting in the Way of Our North Star (s) – Opportunities to Address Barriers Part II : Prioritizing Actionable Barriers *(full group)*

2:30 How do we quiet the Gulf as We Survey its Energy Resources *(small group)*

- In a moment when regulation is constrained, energy is sought, what can we do together to break open innovation, adoption, and action?

3:00 Break

3:30 Where do we Focus our Time and Energy Tomorrow *(full group)*

- Given the prioritized barriers and the various ideas generated from today, which are the ones we together could prioritize for and take action?
- Identify at least three potential actions/levers we are going to delve into and advance what, who, when, why and how on Day 2.

4:15 Quick take (full group)

5:00 Adjourn

<u>Day Two</u>

9:30 Welcome Back

9:35 Summary of Day 1

10:00 Building out the Most Promising Ideas: Breakout "Pitch" Groups (including break as needed)*(small group)*

- The breakouts, balanced across interests, seeks to make the case for the priority actions/levers identified at in day 1 as if making the case to the funder

11:30 Lunch

- Facilitators assist leads from the groups to refine a pitch deck for each

1:00 Building out the Most Promising Ideas: Pitches (full group)

- Each breakout group "pitches" their idea in 7 minutes
- The rest of the group peppers each with questions for up to 10 minutes

2:15 Break

2:30 Getting Down to Business (full group)

- Given all we have discussed, how might that $2 million be spent?
- Given what direction we are heading, who needs to do what when to get moving now?

3:15 Where to from here?

3:45 Closing

4:00 Adjourn

Quieting the Gulf as We Survey its Energy Resources
September 23-24, 2025

Participant List

Eric Abercrombie	MITRE
James Caplinger	NOAA Fisheries Office of Protected Resources
Sarah Courbis	EPI Group
Sam Denes	JASCO
Jason Gedamke	NOAA Fisheries Office of Science and Technology
Tre Glenn	Bureau of Ocean Energy Management
Karen Godfrey	Shell
David Hedgeland	BP (retired)
Darren Ireland	LGL
Mike Jenkerson	ExxonMobil (retired)
Zack Lawrence	Sound and Marine Life JIP
Ben Laws	NOAA Office of Protected Resources
Alex Loureiro	EnerGeo
Morgan Martin	Bureau of Ocean Energy Management
Gaetan Mellier	Sercel
Andrey Morozov	Teledyne Marine Systems
Jeff Nealon	Chevron
Shawn Rice	Teledyne Geophysical Instruments
Shuki Ronen	Stanford University
Daniel Roy	General Dynamics
Simon Stockwell	TGS - NOPEC
Steve Thornton	NOAA Fisheries Office of Protected Resources

Convening Team

Christy Fellas	NOAA Fisheries Office of Habitat Conservation
Libby Fetherston	NOAA Fisheries Southeast Region Office
Nora Ong	National Fish and Wildlife Foundation
Michelle Pico	National Fish and Wildlife Foundation
Bennett Brooks	Consensus Building Institute
Pat Field	Consensus Building Institute
Sofia Soto-Reyes	Consensus Building Institute

Working Draft

Source	Type	Commercially available	Size	Typical shot interval	Frequency	Signal type	Uptake	Environmental efficacy 1 = Max 5 = None	Operational impact 1 = Low impact 5 = high impact	Order of magnitude est. cost $ < $10k $$ < $100k $$$ < $1m $$$$ < $10m $$$$$< $100m
Gemini (TGS)	'Low-frequency source' - dual barbell	Yes	8,000 in^3, 2000 psi (also available 4,000 in^3, 2000 psi)	7 sec	P_F = 3.4 Hz (8,000 in^3) P_F = 4.3 Hz (4,000 in^3)	Impulsive, intermittent	Yes	3	2	I - $$ E - $$
Harmony (Shearwater)	'Low-frequency source' -hypercluster	Yes	6 – 1000 in^3 1500LL air guns	10 sec in flip-flop	P_F = 4 Hz	Impulsive, intermittent	Yes	3	2	I - $$ E - $$
Tuned Pulse Source (TPS; Sercel)	'Low-frequency source'	Yes	28,000 in^3, 1000 psi	20 sec (12 – 40 sec)	P_F = 2.6 - 2.8 Hz	Impulsive, intermittent	Yes	3	2	I - $ E - $$$
eSource (Teledyne)	Air gun modified design	Yes	Types A, B, and C. All include a variety of chamber sizes.	Same as equivalent air gun array	P_F = Same as equivalent air gun array	Impulsive, intermittent	Yes	3-4	2	I - $$ E - $$$
Bluepulse (Sercel)	Air gun modified design	Yes	100 Hz and 200 Hz models. Both include a variety of chamber sizes from 45 – 520 in^3.	Same as equivalent air gun array	P_F = Same as equivalent air gun array	Impulsive, intermittent	Yes	3-4	2	I - $ - $$ E – $$ - $$$

Working Draft

C-BASS (Geospectrum Inc.)	MV	1 unit is complete Not optimized for seismic. Optimization to follow first test.	TBD – current MV design has 6 M72-15 units and 2 M72-30 units.	8 sec sweep; 50% duty cycle	Sweep: 10 – 50 Hz, minimal energy > 50 Hz. Optimized version will extend to 2 Hz.	Non-impulsive, intermittent	TBD - NUT permit for bp survey -awaiting sea trial	2	3*	I - $$$$ E - $$$$
BASS (Shearwater)	MV	2 units are complete. Need more units to increase source level.	TBD		Sweep: 3 – 150 Hz; customizable	Non-impulsive, continuous or intermittent	TBD – sea trial completed in 2022	2	3*	I - $$$$ E - $$$$$
APS IPN / MV JIP (Sound and Marine Life JIP)	MV	2 units are complete. Need more units to increase source level.	TBD	5 sec sweep; 50% duty cycle	Sweep: 5 – 100 Hz, minimal energy > 100 Hz; customizable	Non-impulsive, intermittent	TBD – sea trials completed	2	3*	I - $$$$ E - $$$$$
Marine Vibrator (SAExploration)	MV	2 units are complete. Have conducted small scale commercial surveys.	Comparable with 900 - 1200 in^3 array	Variable	Sweep: 2 – 250+ Hz; customizable	Non-impulsive, continuous or intermittent	Yes	2	3*	I - $ - $$$$ E - $ - $$$$$

Working Draft

Marine Vibrator (Teledyne)	MV	One minimal complete (two sources 5-16 Hz and 15-100 Hz), very easy to expand	Radius x Length 5-16 Hz: 0.5 x 5m 15-100 Hz: 0.2 x 1m	5 sec sweeps 50% duty cycle	5-100 Hz	Arbitrary: Non-impulsive and intermittent	Sea trial with USGS September 2019 New England Shelf	2	3*	$$

I = Implementation; E = Equipment

Relative estimated cost key in USD: $ = <$10,000; $$ = < $100,000; $$$ = < $1M; $$$$ = < $10 M; $$$$$ = < $100 M.

*For MV, the estimated costs and operational inefficiencies are expected to reduce over time.

Other technologies which are sometimes mentioned but not currently used:

- Wolfspar – a low frequency source built by bp that is no longer prominent. Circa ~2007-2015 https://library.seg.org/doi/10.1190/segam2016-13762702.1
- eSeismic – TGS owns it, it is a legacy patent from PGS. And Popcorn™ – this is trademarked by BP. These are methods that can desynchronize the firing of air guns in an array. It essentially creates a continuous noise source instead of an impulsive source. There is some interest in using it down the road but not much ongoing currently.
- Mufflers around air guns – “Using mufflers, such as a bubble curtain, to lower the high frequencies is complex operationally, high cost, and not very viable, though a small bubble curtain in a ring around the air gun ports has shown some efficacy (Wehner and Landrø 2020).” -Weilgart, 2023

Working Draft

Table 1. Structured evaluation of possible quieting solutions for seismic airgun surveys.

Method	Envt. Efficacy	Operational Impact	Order of Magnitude Est. Cost	Quieting Timing	
Temporal avoidance	1	1	I-$0 E-$0	1	Low environmental impact and minimal cost or operational impact if no overlap between optimum operational and temporal closure periods.
Marine Vibroseis	2	3	I-$$$$ E-$$$$$	3	Marine vibrators will allow an output signature that is highly controllable. The cost and operational inefficiencies are expected to be reduced over time.
Hypercluster air guns (Harmony, Gemini)	3	2	I-$$ E-$$	2	Hyperclustering is an efficient way to tilt the spectrum to lower frequencies at minimal cost and operational impact. Note: *techniques are restricted by IP.*
Tuned Pulse Source (TPS)	3	2	I-$$ E-$$$ *(depends on whether higher frequencies are required)*	1	The TPS use lower operating pressures (6-1000 psi) and larger volume chambers (4800 in^3). It releases a large volume of air over a controlled time generating a long rise time and low frequency bubble oscillations with less bubble turbulence and cavitation.
Modify air gun mechanical design (eSource, Bluepulse)	3-4	2-3	I-$$ E-$$$	2	The techniques reduce the high frequency output from the array with minimal operational impact.
Desynchronize air gun arrays (eSeismic, Popcorn)	4	2	I-$$ E-$$$	1	The techniques are mainly to increase the sampling of the wavefield. If goal is overall noise reduction, it is likely more effective to reduce array output directly.
Reduce array output	4	1	I-$0 E-$0	1	It is generally a permit requirement to reduce the array output to the minimum required for imaging, so there is probably not significant leeway to further reduce the output from an array.
Temporal avoidance	*	5	I-$0 E-$0	1	If the only effective operational times overlap with the temporal closure periods the cost and impact can be significant.
Areal avoidance	*	5	I-$0 E-$0	1	Closing an area permanently will not allow operations to be conducted on a license.
I = Implementation E = Equipment	**1 - Max**	**1 - Low**	**$ <$10,000**	**1 - 0 yrs**	
	5 - None	**5 - High**	**$$$$$ <$100M**	**5 - >5 yrs**	

Relative Cost Keys: [1-immediate; 2 - <1 yr; 3: 1-3 yr; 4: 3-5 yr; 5: > 5yr]

$0	no cost	$	<$10,000
$$	<$100,000	$$$	<$1,000,000
$$$$	<$10,000,000	$$$$$	<$100,000,000

General Oil & Gas NMFS // BOEM/BSEE Step-Down Review Process | Decision Flow for Activities Under the 2025 Biological Opinion

Proposed Oil & Gas Activity

BOEM completes ESA Consistency Determination and applies protocols

Is the activity routine, with well-understood effects, under the 2025 BiOp?

YES → **Does this activity fall under NMFS Step-down review requirements?**

NO → **New and Unusual Technology (NUT)**

Special Process for New & Unusual Technologies (NUTs)

Required documentation:
- Source signal characteristics
- Usage environmental details
- Physical construction specs
- Prior testing data

Key Benefits
- Clear pathway for innovation
- Predictable timelines
- Potential to become "routine"
- Incentivizes quieter tech

Does this activity fall under NMFS Step-down review requirements?

NO *(No NMFS review needed)*

Activities NOT Requiring Review

- Standard tiered G&G surveys
- Pipelines not making landfall
- Routine vessel operations
- Moon pools & in-water lines
- Equipment above 180 kHz
- Coring activities
- Subsea tie-ins (SSTI) abandonment

YES

Activities Requiring NMFS Step-Down Review for potential addtl mitigation

- New pipelines expected to make landfall
- Decommissioning in-place of subsea equipment other than pipelines and SSTIs (i.e., manifolds, valves, pumps, or other various equipment as described in 83 FR 67343)
- Any pile driving activity within 100-400 m isobaths
- Any vibratory pile driving activity
- Activity/vessels transiting in '20 Rice's Whale Area (RWA)

NMFS Role in Step-Down Review

- NMFS' step-down review assesses and confirms whether the anticipated effects of actions are consistent with and addressed by the programmatic effects analysis in the 2025 BiOp.
- Where step-down review indicates activities may have adverse effects to listed species, NMFS may recommend additional mitigation measures, or include requests for information

Activities Requiring NMFS Step-Down and BOEM Assessment

- **New & Unusual Technologies (NUTs)** [not analyzed in the '25 BiOp or used in the Gulf]
- Examples: marine vibroseis, C-BASS, AquaVibe, etc.

Prior to application submittal

Industry Proponent Meets with NMFS & BOEM/BSEE Together (starting process of getting ESA coverage and MMPA)

- Present on new technology (plan, use, etc.); slides presentation
- Suggesting at least 6 mo lead time

No formal time limit; typically takes 1-2 months

BOEM/BSEE Makes NUT Consistency Determination (Similar to site-specific Biological Assessment)

Application has been submitted

1) Effects consistent with 2025 BiOp? (noise, entanglement issues, etc.)
2) Any new effects to species?
3) Assign new technology to a preliminary tier

BOEM/BSEE sends to NMFS for step-down review and confirms their findings with NMFS ESA staff in writing

Industry may use calculator to determine if 'takes' of MM trigger LOA (MMPA) requirement via NMFS (PR1)

NMFS reviews BOEM/BSEE Consistency Determination

Internal NMFS coordination (MMPA and ESA sections) to determine takes and availability: non-sequential

30-day time limit

BOEM writes SEA (site-specific environmental assessment)

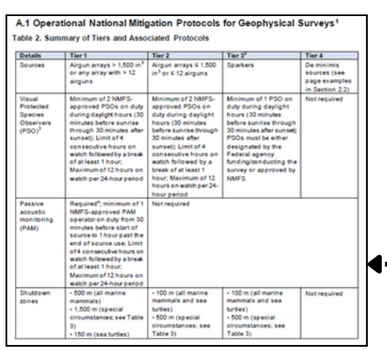
- Includes NUT consistency determination (w/o proprietary info)
- Assigns activity internal permit #

Approved with LOA executed by NMFS, BOEM issues permit

Proceed with activity (may include additional mitigation measures)

Post-Activity Review and Action

- Proponent uses and monitors new technology in field
- Based on assessment in consultation with BOEM/BSEE/NMFS, either further modifications and evaluation or, if ready to go, assigned final position in tier



A.1 Operational National Mitigation Protocols for Geophysical Surveys[1]

Table 2. Summary of Tiers and Associated Protocols

Details	Tier 1	Tier 2	Tier 3[2]	Tier 4
Sources	Airgun arrays > 1,500 in^3 or any array with > 12 airguns	Airgun arrays ≤ 1,500 in^3 or ≤ 12 airguns	Sparkers	De minimis sources (see page examples in Section 2.2)
Visual Protected Species Observers (PSO)[3]	Minimum of 2 NMFS-approved PSOs on duty during daylight hours (30 minutes before sunrise through 30 minutes after sunset); Limit of 4 consecutive hours on watch followed by a break of at least 1 hour; Maximum of 12 hours on watch per 24-hour period	Minimum of 2 NMFS-approved PSOs on duty during daylight hours (30 minutes before sunrise through 30 minutes after sunset); Limit of 4 consecutive hours on watch followed by a break of at least 1 hour; Maximum of 12 hours on watch per 24-hour period	Minimum of 1 PSO on duty during daylight hours (30 minutes before sunrise through 30 minutes after sunset); PSOs must be either designated by the Federal agency funding/conducting the survey or approved by NMFS	Not required
Passive acoustic monitoring (PAM)	Required[4]; minimum of 1 NMFS-approved PAM operator on duty from 30 minutes before start of source to 1 hour past the end of source use; Limit of4 consecutive hours on watch followed by a break of at least 1 hour; Maximum of 12 hours on watch per 24-hour period	Not required		
Shutdown zones	- 500 m (all marine mammals) - 1,500 m (special circumstances; see Table 3) - 150 m (sea turtles)	- 100 m (all marine mammals and sea turtles) - 500 m (special circumstances; see Table 3)	- 100 m (all marine mammals and sea turtles) - 500 m (special circumstances; see Table 3)	Not required