

Detailed Comments – IAGC

CMS Family Guidelines on Environmental Impacts Assessments for Marine Noise-generating activities - Main Document, Sections I to III

#	Page #	Text from CMS	Comment
1	1	Section I, sub-section 4, first sentence	Point considered irrelevant
2	1	Section I, sub-section 5, first sentence	Use of doubling is misleading since sound perception and the physical effects of sound progress on a logarithmic scale. Doubling is a barely noticeable difference. A ten-fold increase would be more comparable to our ideas of "doubling".
3	1	Section I, sub-section 5, second sentence; use of '...increase in noise levels can be life-threatening...'	Conveys potential but undemonstrated effects as if they were widely known and well demonstrated.
4	1	Section I, sub-section 6, last sentence	This infers that sound generated by human activities is somehow different from sound generated by wind, waves, water, earthquakes, and other animals. It is not.
5	1	Section I, sub-section 7, first sentence	Stated consequences only potentially occur under very rare circumstances, e.g. military sonars used in specific ways, and under extremely high levels of exposure that are rare or absent from most anthropogenic noise scenarios.
6	1	Section I, sub-section 7, last sentence	Statement ignores that these groups do not have the same hearing range or sensitivities and in fact do not even process sound energy in the same way. Simply because a species can detect sound or vibration does not mean that it can or does experience TTS/PTS, masking or use sound to detect mates, predators or prey.
7	2	Section II, sub-section 11, text relating to 'Module D: Decompression Stress'	This phenomenon remains controversial among scientific experts and is not considered a realistic effect of sound, including anthropogenic sound, at this time. There are no diagnostic features to determine if this effect has occurred and no evidence that it is associated with sound directly, though it may be a consequence of behavioural responses to disturbance (not limited to noise related disturbance) of deep divers. But even this is unknown and disputed.
8	3	Section II, sub-section 12, first sentence; use of 'The Weight of evidence...'	"Loaded" terminology. Adding "weight" to the expression of evidence gives it more verbal impact but does not change the evidence.
9	3	Section II, sub-section 12, first sentence; use of '...are fully justified'	Incorrectly infers that there is some level of justification other than "fully".
10	3	Section II, sub-section 12, second sentence; use of '...transparent EIAs...'	Question what is meant by transparent in the context of EIAs where there is no alternative

11	3	Section II, sub-section 12, second sentence; use of ‘...are required to assess...’ and leading from earlier comment regarding transparency	How exactly are they "required"? What is it that makes the criteria of "full" and "transparent" a requirement in one case but apparently not in others
12	3	Section II, sub-section 12, last sentence	Question the demonstrated understanding of propagation modelling and derivation of SELcum of current document
13	3	Section III, sub-section 17, second sentence	Felt that the text isn’t helpful in explaining when any particular model should be used over another, based on the variables identified
14	4	Section III, sub-section 18, second sentence	Intensity is the product of pressure and particle motion. Most long range ocean acoustic propagation models only model pressure. But all of the near field seismic models are full waveform models, and model both pressure and particle motion.
15	4	Section III, sub-section 18, third sentence	Clarification that statement is true of some fish, not all fish
16	4	Section III, sub-section 18, last sentence; use of ‘over-ensonification’	Question terminology
17	4	Section III, sub-section 18, last sentence	Frequency is unrelated to barotrauma
18	4	Section III, sub-section 18, last sentence	Barotrauma injury does not arise from sound, but from supersonic acceleration and movement of the surrounding medium, as in an explosion. Sources like compressed air seismic sources produce sound by bubble expansion and the bubble expansion never exceeds the speed of sound, so these sources are not capable of producing barotrauma.
18	4	Section III, sub-section 20, last sentence; use of ‘...fully disclosed...’	Hyperbole. ‘Disclosure’ should be sufficient.
19	4	Section III, sub-section 21,	Statement incorrect. SPL and SEL are two different metrics.
20	4	Section III, sub-section 22	There are multiple errors in this paragraph. Not all fish and invertebrates detect only particle motion. The difference has nothing to do with “a tympanic mechanism” and the NOAA guidance uses both SEL and SPL criteria, clearly states that its criteria contain multiple uncertainties.
21	4	Section III, sub-section 23	This is a gross oversimplification of what SELcum is and does. SELcum has many drawbacks and deficiencies, including determination of recovery periods for intermittent sounds, thresholds of effective quiet at which continuous SELcum poses no risk, and other issues.
22	4	Section III, sub-section 24, first sentence	References needed to back statement up

23	4	Section III, sub-section 24, bullet-point a	Frequency-dependent sensitivity has nothing to do with SELcum
24	4	Section III, sub-section 24, bullet-point b	That is correct, because hearing recovers between sound exposures, making SELcum a largely useless metric for assessing effects of long term chronic effects of sound.
25	4	Section III, sub-section 24, bullet-point c, sentence reading ‘...duration with the same <i>duration</i> SELcum’	Second use of the word duration believed to be in error
26	4	Section III, sub-section 24, bullet-point e	As item 24.
27	4	Section III, sub-section 24, bullet-point f	It may or it may not have a cumulative effect, or it may actually have a counter-acting effect or it may have a multiplicative rather than additive effect. It is something that requires data and evidence before making decisions.
28	4	Section III, sub-section 25, second sentence	Contradicts earlier statement about SEL and intensity and is also wrong.
29	4	Section III, sub-section 25, second sentence; statement regarding pulsive or non-pulsive sounds	Wrong. Both pulsive and non-impulse sounds are scaled to a time metric in SEL.
30	4	Section III, sub-section 25, last sentence	Measures like dB peak or dB rms typically refer to pressure, since microphones and hydrophones only detect the pressure component of a signal. At close range pressure and intensity are assumed to scale proportionally, but they are two different measures of sound energy.
31	4	Section III, sub-section 26	Fast rise time has nothing to do with SEL and there is no evidence that the threshold shift due to a pulsive source is any different than for a tonal source.

CMS Family Guidelines on Environmental Impacts Assessments for Marine Noise-generating activities – Main Document, Section VI; EIA Guidelines for Seismic Surveys (Air Gun and Alternative Technologies)

#	Page #	Text from CMS	Comment
32	9	Section VI, sub-section 31, table section 1 'Description of Area', last sentence	Impossible to gauge whether wells 'may' breach
33	9	Section VI, sub-section 31, table section 2 'Description of the Equipment & Activity', second bullet-point, item d. v.	Question whether this means a source level model?
34	9	Section VI, sub-section 31, table section 2 'Description of the Equipment & Activity', second bullet-point, item d. vii to x	Question relevance of these items in terms of impact, since the streamers are passive listening equipment
35	9	Section VI, sub-section 31, table section 5 'Mitigation & Monitoring Plans'	These and other aspects of the environment not under the sole control of the action proponent should not be the responsibility of the applicant. Only the regulator can know details of who else might be working in the area and what they are doing, whereas the applicant may not be able to access the information of competitors working in the same area, military exercises, fishing, etc. Furthermore, the knowledge of what animals are present and in what numbers is the responsibility of the resource management agency and not the applicant. If every ocean user was required to generate these data then there would be large amounts of money spent on duplicative information by fisheries, offshore wind farms, shipping companies, as well as geophysical and energy companies. If one ocean user is burdened with acquiring data used by others then that unfairly penalizes one socioeconomic sector relative to others. That is why the provision of accurate, up to date environmental information is the responsibility of the resource management authority for the governing national or international body.

CMS Family Guidelines on Environmental Impacts Assessments for Marine Noise-generating activities – Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Noise-generating Activities

#	Page #	Text from CMS	Comment
1	9	Module A, Sub-section A.2.	Feel this section should be in the hearing modelling section, not the ocean physics section.

2	9	Module A, Sub-section A.2.1., paragraph 1.	Factually incorrect.
3	9	Module A, Sub-section A.2.1., paragraph 2.	Contains factual errors.
4	9	Module A, Sub-section A.2.1., paragraph 2, last sentence.	Factually incorrect.
5	9	Module A, Sub-section A.2.1., paragraph 3.	Lack of references to support statement.
6	9	Module A, Sub-section A.2.1., paragraph 4, 3 <sup>rd</sup> sentence	Incorrect and indicative of an incomplete and incorrect understanding of the physics of sound
7	9	Module A, Sub-section A.2.1., paragraph 4, last sentence, ending '...depending'.	Query on what the statement depends.
8	9	Module A, Sub-section A.2.2., second bullet-point	The opposite is true due to hearing recovery between pulses.
9	9	Module A, Sub-section A.2.2., fifth bullet-point	Reference required.
10	10	Module A, Sub-section A.2.2., last bullet-point	Not clear what this has to do with EEH, SEL.
11	10	Module A, Sub-section A.3.	Doesn't really help the applicant at all: where are they to get this modelling, how do they tell if it is 'expert' or not? This chapter is not useful for helping construct an EIA.
12	10	Module A, Sub-section A.3., first paragraph	Factually incorrect, and rise time has nothing to do with SEL-based metrics.
13	11	Module B., overarching comment	General impression that this section lacks substantive content, makes unsupported assertions, and does not help the reader at all.
14	11	Module B, paragraph 3, last sentence	Unsubstantiated assertion.
15	13	Module B, Sub-section B.1.1., paragraph 1	There are literally hundreds of references on this topic for these species. The results are far more mixed than characterized here, with many instances of no response, or even approach to sound sources. Citations for TTS include only two references for one species, when there are many more references for many more species. An incomplete analysis full of unsupported foregone political, not scientific conclusions.
16	13	Module B, Sub-section B.1.1., paragraph 3, last sentence	Speculation. Masking was not demonstrated.
17	13	Module B, Sub-section B.1.1., paragraph 4, first sentence, use of 'Spatial displacement <i>can</i> cause...'	And it can NOT cause these things, and in fact more often does NOT cause the hypothesized effects than it does.
18	13	Module B, Sub-section B.1.2., paragraph 1, first sentence	Further references recommended, considering size of group of species considered and variation among feeding specializations.
19	13	Module B, Sub-section B.1.2., paragraph 1, second sentence	Question validity of comment regarding odontocetes only occurring in highly populated

			coastal areas and those areas all being degraded. Odontocetes also occur in areas with little to no human population; locations that would not be characterised as “degraded”.
20	13	Module B, Sub-section B.1.2., paragraph 1, second sentence, use of ‘...are in the process of being fragmented’.	Unsupported assertion.
21	13	Module B, Sub-section B.1.2., paragraph 1, second sentence, use of ‘...will be disturbed by the introduction of noise’.	Unscientific and unbounded speculation and over-generalization.
22	13	Module B, Sub-section B.1.2., paragraph 1, third sentence	Query how we recognize this benchmark? When do we have "enough" population data to assess the amount of "suboptimal habitat" needed to "perform the biological tasks" that "will be disturbed by the introduction of noise?"
23	13	Module B, Sub-section B.1.2., paragraph 1, eighth sentence, use of ‘...They therefore may be more vulnerable to population level impacts...’.	Reference required.
24	13	Module B, Sub-section B.1.2., paragraph 1, eighth sentence	Further explanation needed.
25	14	Module B, Sub-section B.1.2., paragraph 1, penultimate and last sentences.	Felt that examples are random, and that they may not be relevant for a given site and activity, mixed with hypothetical scenarios unsupported by evidence or references sense.
26	14	Module B, Sub-section B.1.3., Table 2.	There are no units in this table, weighting is not considered, and the method by which SELcum is calculated is not provided. NOAA offers several options but does not provide a single numerical threshold as this table implies.
27	14	Module B, Sub-section B.1.3., paragraph 5, second sentence	Reference required.
28	14	Module B, Sub-section B.1.3., paragraph 5, last sentence	Hypothetical, not supported by follow-up testing data and thus not appropriate as a regulatory benchmark.
29	14	Module B, Sub-section B.1.3., paragraph 6	Note that while the onset for behavioural responses CAN occur at large distances, it may also not occur. It will be entirely context dependent, and vary with species and individuals. Statement is not placed in context of what that means for individuals or populations.
30	14	Module B, Sub-section B.1.4., paragraph 1, third sentence	How can decision makers adopt a “stricter position” on population structure if it is unknown? What is the default?
31	14	Module B, Sub-section B.1.4., paragraph 1, 4 <sup>th</sup> sentence	Contrary to the statement made, IAGC notes that this is done constantly, and by implication this document is recommending that it be done as well

			in a required EIA whether this information is available or not.
32	14	Module B, Sub-section B.1.4., last sentence	Unrealistic, impractical and impossible to implement.
33	16	Module B, Sub-section B.2.1., paragraph 1, second and third sentences	All of these cited reference were speculative inferences about consequences based on observed effects that were very different and much more limited in their scope. In the case of Goold and some others, even the sound exposure is unknown, and is inferred by questionable methods like assumptions about the (unmeasured) source level and (unknown) propagation loss.
34	16	Module B, Sub-section B.2.1., paragraph 3, first sentence	This is a commonly expressed political philosophy that is not only unscientific, but anti-science. Science assumes no effect until there is evidence to the contrary. The "absence of evidence is not evidence of absence" is an open door to speculations that cannot be falsified; including the assumption that a sound source MUST be causing some sort of problem even though none has yet been found.
35	17	Module B, Sub-section B.2.2., paragraph 2, last sentence	The review is incomplete for such a complex topic, and therefore of limited use to readers/ decision makers.
36	17	Module B, Sub-section B.2.3., paragraph 2	This essentially means that people cannot use the tables 2 and 3 unless they weight the received signal, which the review has not helped them be able to do.
37	17	Module B, Sub-section B.2.3., last sentence	Statement not helpful. Obviously all behavior occurs within a context and that context influences the behavior. This truism is only helpful if you can supply some specific context metrics, like effect of water depth, effect of state of health, effect of gender, age etc.
38	17	Module B, Sub-section B.2.4., paragraph 2, third sentence	Are there any references to suggest such?
39	19	Module B, Sub-section B.3.1., paragraph 1, first sentence	References cited are only a fraction and not the best references (eg references for Bahamas and Mediterranean strandings). Gas emboli are an hypothesized factor that have not yet been convincingly demonstrated or widely agreed to by the expert community. Even the original authors of the hypothesis, Fernandez and Jepson, have conceded that the presence of gas emboli are not diagnostic of sonar-related strandings, but are a general phenomenon in both live healthy animals and animals that have stranded for known, non-acoustics related reasons.
40	19	Module B, Sub-section B.3.1., paragraph 1, second sentence	IAGC believes that the statement from the given reference is not being presented accurately.



41	19	Module B, Sub-section B.3.1., paragraph 1, fourth sentence	Unwarranted speculation without evidence. It is much more plausible that the unique features of the sonar and how it is used (ship movements) create a unique response confined to these unique deep-diving species (beaked whales), and has not been seen for other species or other sound sources. Irresponsible and poorly supported speculation has no place in a risk assessment process that is supposed to be based on best available scientific information widely accepted by the expert community.
42	19	Module B, Sub-section B.3.1., paragraph 3, second sentence.	Reference required
43	19	Module B, Sub-section B.3.1., paragraph 3, third sentence	We have no information about how much populations of beaked whales may differ in their age-sex composition, or whether there may be separate areas used by breeding adults and non-breeding juveniles and adults, with or without segregation by gender or age. There are certainly many examples of such population segregation within the marine and terrestrial mammals.
44	19	Module B, Sub-section B.3.1., paragraph 3, last sentence	Reference required
45	20	Module B, Sub-section B.3.2., paragraph 1, third sentence, reference made to 'underwater explosions'	IAGC is unaware of any beaked whale strandings due to underwater explosions. Reference required.
46	20	Module B, Sub-section B.3.2., paragraph 2	This conclusion is false, since the beaked whale strandings have only occurred in proximity to a certain type of military sonar, and though this coincidence has occurred many times repeatedly, no such coincidence has been found for any other human sound source, including pile driving, shipping and seismic surveys. Extension of sonar-related beaked whale observations to other sound sources in the absence of supporting data is not only irresponsible, but runs counter to the actual available data showing no such connection over time spans and numbers of events equal to or exceeding the span of time in which multiple sonar-related strandings have been repeatedly documented.
47	20	Module B, Sub-section B.3.3., paragraph 4, last sentence	Unsupported by evidence and impracticable.
48	21	Module B, Sub-section B.3.4., paragraph 4	Who is responsible for the deployment of sensors? Onus should be on the national resource regulator to implement general ocean noise monitoring strategies where appropriate. Geophysical surveys are not the only contributors to the soundscape and should not be made financially responsible for

			national or international management of resources potentially impacted by a variety of human activities.
49	21	Module B, Sub-section B.3.4.	What types of PAM sensors are needed for beaked whales? How good are current automated detectors and where would an applicant find these? What would the acoustic criteria be for initiating mitigations?
50	22	Module B, Sub-section B.4, overarching comment	If all of these lists of sources of concern are the same for all species and includes every class of anthropogenic sound then what is the point of even providing such lists? Ditto for the "related CMS agreements" which appears to be the same list used over and over with only a few trivial additions or deletions for any circumstance. Where there are instances of one treaty being omitted or one sound source being omitted, the omissions make no sense. Why should small nearshore cetaceans in Africa not be affected while they are apparently affected everywhere else? Why is vessel traffic under 100 tonnes not of concern for some groups of animals but is for others? The whole process seems arbitrary and capricious. How were these choices made?
51	22	Module B, Sub-section B.4.1., paragraph 1, second sentence	Use of a secondary reference. Original references for mysticete hearing should be used. Speculation about hearing to 7 Hz is unsupported by anatomical or behavioral data. Presence of sound in vocalizations outside of the animal's hearing range are common, so vocal frequency range is not a perfect predictor of hearing.
52	22	Module B, Sub-section B.4.1., paragraph 1, fourth sentence	Further use of secondary references, documenting speculative effects and not necessarily demonstrated effects.
53	22	Module B, Sub-section B.4.1., paragraph 2, second sentence, use of '...strong evidence...'	Superlatives should be omitted. This reference has variously been referred to as "suggestive", strong and weak. The reference should speak for itself; a sample of one, providing data of reduced stress hormone titres during a time of reduced shipping noise (and shipping traffic), possibly indicating an effect of shipping noise on stress hormone levels. This is not "Strong" evidence of physiological impacts from noise exposure, nor is it "weak", nor is it "suggestive". It is what it is and should not be used as a platform for inserting the reviewer's opinions.
54	23	Module B, Sub-section B.4.3., Table 4	As with tables 2 and 3, units are missing, numbers do not match either the other tables or the original

			NOAA source and the application of weighting is unclearly explained and supported.
55	25	Module B, Sub-section B.5.1., paragraph 1, first sentence	Statement also true of cetaceans. What is the difference between the groups for hearing in air and why does it matter for guidance focused solely on underwater sound?
56	25	Module B, Sub-section B.5.1., paragraph 3, first sentence	Outdated reference from ice seals, with limited relevance to this document.
57	25	Module B, Sub-section B.5.1., paragraph 4, last sentence	Not clear how the cited foraging strategies affect their risk from anthropogenic noise.
58	25	Module B, Sub-section B.5.1., paragraph 5, last sentence	Speculation
59	25	Module B, Sub-section B.5.1., paragraph 6	It is equally possible, if not more possible, that no response means no masking, no behavioural disturbance and no problem.
60	25	Module B, Sub-section B.5.2., paragraph 1, second sentence	Reference required. These seals have no doubt been subjected to many forms of disturbance in their life. A single transitory noise is unlikely to have detrimental effects, particularly when placed in the context of other stressors such as chemical pollution, illegal killing and fishery bycatch, which have far more direct impacts.
61	26	Module B, Sub-section B.5.2., paragraph 1, last sentence	There are a number of plausible outcomes not listed, including the potential for fish to aggregate. If speculating, all potential outcomes should be listed.
62	26	Module B, Sub-section B.5.2., paragraph 2, last sentence	References required. One of the hallmarks of vulnerable life stages are the adaptations to reduce risk, such as suckling on land or being less likely to respond to sound during successful foraging.
63	26	Module B, Sub-section B.5.2., paragraph 3, last sentence	Does this make them more vulnerable to sound? Logic of statement is incomplete.
64	26	Module B, Sub-section B.5.2., paragraph 4, last sentence	As with 63, the logic of the statement appears incomplete. What does the information mean in the context of underwater sound and noise-generating activities?
65	26	Module B, Sub-section B.5.3., paragraph 4	The "deep sound channel" is referred to as the SOFAR channel elsewhere in the document; some editing for consistency of terminology is needed. Simple statements about the deep sound channel being a place of "higher sound levels" are inaccurate and not helpful. Nearby loud sources will not be coupled into the deep sound channel so the deep sound channel may actually be relatively quieter than less deep local conditions in some locations. What sound does get into the deep sound channel is strongly filtered: only very low frequencies couple into the deep sound channel, so odontocetes and pinnipeds are not going to hear the sounds in the deep sound channel as particularly loud because the frequencies found there are outside of those species

			ranges of best hearing. And despite the contribution of manmade sound, the main source of sound in the deep sound channel is tides, internal waves, volcanoes and earthquakes, ... and whales. At distance this will be an indistinguishable mixture of sound with identities of the sources and their range and direction impossible to determine. Data from military listening systems come from highly specialized high-gain arrays that filter sounds of interest out of background better than any animal can do. All of which is a long-winded way of saying that for this part of the document, as for most of the rest of the document, the authors clearly do not know what they are talking about.
66	26	Module B, Sub-section B.5.3., paragraph 4	Interestingly, convergence zones were not mentioned in the ocean acoustics 'basics' section, and there is no reference to help a reader define what a convergence zone is and what it means in this context. It is also not considered in the other taxonomic chapters.
67	27	Module B, Sub-section B.5.4., paragraph 2, last sentence	Gross oversimplification of the evidence followed by unsupported speculation that runs contrary to the evidence.
68	27	Module B, Sub-section B.5.5., bullet-point list	This list makes no sense. Harbor seal, gray seal and Mediterranean monk seal make sense for the region being addressed, as well, possibly, as Saaima and Caspian seals. One might add a case for vagrant walruses and ice seals (ringed, harp, hooded etc.) But what is the point of mentioning elephant seals, Australian sea lions or Hawaiian monk seals and omitting all species of fur seals, all species of sea lions and Antarctic monachine seals as well? The list is basically useless and could easily be omitted without disadvantage to the user.
69	36	Module B, Sub-section B.10.1., paragraph 1, second sentence, bullet-point d)	Reference required
70	36	Module B, Sub-section B.10.1., paragraph 1, third sentence	Reference required
71	36	Module B, Sub-section B.10.1., paragraph 1, last sentence	Reference required
72	36	Module B, Sub-section B.10.1., paragraph 2, first sentence	References required for multiple points made. First sentence is far too long and should be edited to be made more readable
73	36	Module B, Sub-section B.10.1., paragraph 2, last sentence	Reference required. Suggest Carroll et al., 2016
74	36	Module B, Sub-section B.10.1., paragraph 3, third sentence	There are other prior and more comprehensive references on fish vocal behaviour – Popper and Fay, Hawkins, etc

75	37	Module B, Sub-section B.10.1., paragraph 4, first sentence	Caveat that the statement is true unless they are herbivores, or planktivores.
76	37	Module B, Sub-section B.10.1., paragraph 4, first sentence	Gross over-simplification especially in the absence of references. Another very long sentence that requires editing.
77	37	Module B, Sub-section B.10.1., paragraph 4, second sentence	This presumes that the changes fall outside the normal resiliency and robustness to disturbance inherent in any living thing that enables it to cope with considerable environmental variability.
78	37	Module B, Sub-section B.10.1., paragraph 5, last sentence	Gross over-generalization of no useful value and a possible source of incorrect conclusions
79	37	Module B, Sub-section B.10.2., last sentence	Unconvinced that space is the issue. Cost of transport scales with body size, and at the scale of size for most fish they simply are not capable of moving far enough, fast enough to 'avoid' loud sound sources.
80	37	Module B, Sub-section B.10.3., paragraph 3, first sentence	Unnecessary use of superlatives. What are the observable and documented signs of strong vs weak impact in this context?
81	37	Module B, Sub-section B.10.3., paragraph 3, first sentence	There are some implicit assumptions in this statement about how SEL is accumulated, or is this an instantaneous, single ping metric? And has that metric been corrected for the duration and time/energy structure of the received pulse?
82	37	Module B, Sub-section B.10.3., paragraph 5, last sentence	This is only a partial list of relevant references, but even these are experimental studies where both the sound source use and the fishing were not realistic. As such they are not particularly predictive of real effects from real seismic, but are more indicative of thresholds of effect that are still much higher and longer in duration than the circumstances of real surveys interacting with real fishing activity. Real surveys, in the presence of real fishing, have occurred at the same time and place around the globe for more than 50 years without any evident impact on the fishery. This would seem to be weightier evidence for a lack of effect than a few very artificial exposure experiments with very inconsistent outcomes.
83	40	Module B, Sub-section B.11.3., paragraph 2	Speculation. Alternative outcomes of no effect are equally likely if not more likely.
84	40	Module B, Sub-section B.11.3., paragraph 3, second sentence, use of; 'sonic outbursts'	Rephrase with more common and less emotive terminology, such as sound emission
85	40	Module B, Sub-section B.11.3., paragraph 3, last sentence	Speculation. Reference required.
86	40	Module B, Sub-section B.11.4., paragraph 1, third sentence, use of; 'sonic outbursts'	As item 84

87	42	Module B, Sub-section B.12.1., paragraph 2, first sentence	Without consideration of other concurrent possibilities like ship strikes and explosions. It is interesting that these results have never been replicated anywhere by anyone else before or since this one anomalous speculative coincidence.
88	42	Module B, Sub-section B.12.1., paragraph 2, third sentence	It is interesting that this massive damage, so like barotrauma or mechanical damage from collision should be associated with a distant sound source that has never produced any effect even slightly approaching the reported effect, even in laboratory and field studies involving close proximity of the source to the animal.
89	42	Module B, Sub-section B.12.1., paragraph 2, fourth sentence	Example is from an experiment conducted in a small tank where particle motion and pressure wave effects were not discriminated.
90	42	Module B, Sub-section B.12.1., paragraph 3	All studies performed in a lab, most often with a sound that was actually not like the source of concern (airgun, boat motor) at ranges of a few cm where metrics of particle motion versus pressure were either not measured or were reported in terms of pressure effects without appropriate emphasis on the potential of particle motion being the more relevant variable.
91	43	Module B, Sub-section B.12.1., paragraph 4, fifth sentence	This statement needs to go at the beginning and/or end and this run-on paragraph needs to be broken down into smaller more coherent and logical paragraphs that follow some sort of logical order.
92	43	Module B, Sub-section B.12.2., paragraph 2	Contains a number of gross generalizations unsupported by references. Coupling of sound in the water is complicated and yields different kinds of 'ground motion'. These are well-understood physical phenomena (e.g. Schulte waves), in which the frequency of the sound, the angle of incidence, the material composition of the bottom, and other variables play a considerable role. Particle motion subsumes a number of key aspects including magnitude and direction of displacement, velocity and acceleration. It is not always clear which properties of the particle motion are most relevant to hearing or to structural damage.
93	43	Module B, Sub-section B.12.2., paragraph 3, first sentence	As noted earlier, seismic sound sources are by definition incapable of producing barotrauma, and the symptoms of the squid are definitely more consistent with barotrauma (explosives use in the same area and time as the survey) or direct injury due to collisions with vessels or equipment (not necessarily seismic vessels or equipment). In short, these references are long on speculation and short on supporting data consistent with the facts. They should not be offered as definitive scientific

			evidence of damage from sound, from any source, and remain a distant outlier among thousands of other more consistent references on the effects of sound, ranging from microscopic damage to fine hearing structures at the high end, to no response and no apparent effect at the low end. Science is based on consistently reproducible effects, and this is an unexplained outlier, not consistent with a very large quantity of similar observations of far different outcomes.
94	43	Module B, Sub-section B.12.2., paragraph 3, last sentence	Factually incorrect.
95	43	Module B, Sub-section B.12.2., paragraph 5	Speculation, unsupported by references.
96	43	Module B, Sub-section B.12.3., paragraph 1, fourth sentence	Reference required. Far-field should be defined. At more than a few hundred meters even deepwater environments see a breakdown of the scaling of pressure and particle motion. In shallower water, the plane-wave relationship between pressure and particle motion is even more quickly lost. In the near field, or less than 1/4 the wavelength of the sound frequency, the plane wave relationship of pressure to particle motion will also break down, with particle motion being the dominant component of the sound energy.
97	44	Module B, Sub-section B.12.3., paragraph 1, fifth sentence	Misleading, as these nominal point source values do not physically exist, but are back-calculated from much lower actual received levels at some distance from the source. In the case of seismic survey arrays the source would be a large array of elements many meters on a side, or in the case of explosives the sound source would be a large gas bubble more than a meter in diameter so that the nominal source level "at one meter" cannot actually physically exist, but is simply an abstracted convention for normalizing comparisons of different sound sources at a distance. The facts are that near the array or near the explosion, there is no recorded exposure within even 15-30 dB of the nominal level.
98	44	Module B, Sub-section B.12.3., paragraph 1, sixth sentence	Interesting, because the particle motion threshold reported in this paper corresponded to a free field sound pressure level of 195 dB. The extrapolation of a threshold of 160 dB SPL was done incorrectly, using a simulation of a seismic source recorded at 145 dB and then modified in frequency structure because the broadband impulse of the actual seismic sound could not be replicated by the speaker used in the experiment. All of which Dr. Soto has been told many times and has agreed is true, but nevertheless persists in using in misleading and incorrect ways.

99	44	Module B, Sub-section B.12.3., paragraph 1, eighth sentence	Reference required
100	44	Module B, Sub-section B.12.3., paragraph 1, ninth sentence	Believe the argument is weak and based on an incomplete understanding of underwater sound
101	44	Module B, Sub-section B.12.3., paragraph 1, over-arching comment	The paragraph is poorly structured and needs to be edited to be more coherent. The basic conclusion is that the evidence could be interpreted in a variety of ways depending on a variety of factors; which does not help any decision maker in assessing risk.
102	44	Module B, Sub-section B.12.4., paragraph 1, fifth sentence	The absolute maximum that two different pressure waves could increase, by being in perfect phase with each other, is 3 dB. This is an almost impossible occurrence. Summation through calculations like SEL are more complex and cannot be simply characterized as a "sum". This statement requires data and evidence. In the vast majority of circumstances there is no summing, no re-emergent "sound from the ground" and no "complex patterns of wave addition". This discussion requires greater input from a suitably qualified/ experienced acoustic oceanographer. It is too speculative and laden with technical errors at present.
103	44	Module B, Sub-section B.12.4., paragraph 1, seventh sentence	The trademark on the term Vibroseis expired almost twenty years ago. Today's alternative sources operate very differently than the Vibroseis source, but the term 'vibroseis', much like Kleenex or band-aid, has become a generic term for geophysical imaging sound sources that reduce unwanted high frequency energy and spread the sound over time so that the peak sound pressure is reduced while the total sound energy (SEL) remains much the same as a compressed air (airgun) source.
104	44	Module B, Sub-section B.12.4., paragraph 1, seventh sentence	Reference required. There is no source "currently being tested". There are several sources in various stages of development from drawings to scale models to full-sized test models. Only one has been tested for geophysical data performance. None have been tested for environmental benefit or risk (and there are risks). And none are anywhere close to being commercially available.
105	44	Module B, Sub-section B.12.4., paragraph 1, eighth sentence	Few, if any, are continuous, although the signals tend to be longer; 5-20 seconds versus 0.1-02 seconds; and with higher duty cycles (sound produced 10-50% of the time, versus less than 1% of the time for airguns),
106	44	Module B, Sub-section B.12.4., paragraph 3, first sentence	Reference required.
107	44	Module B, Sub-section B.12.4., paragraph 3, last sentence	This is likely not done because there is no documented credible evidence for effects on eggs and larvae (i.e. studies like Soto et al are neither



			credible or relevant). Second, the normal baseline survivorship values for r-selected, planktonic broadcast reproduction are only a few per cent to a fraction of one per cent. It would be difficult if not impossible for any of the hypothesized effects from sound to appreciably reduce the already low rate of larval survival or impact adult population levels and replacement rates (some expertise in mathematical population biology and fisheries stock assessment and modelling might be needed to speak to this issue more authoritatively than the current draft document).
108	46	Module C, Sub-section C.1.1., paragraph 1, third sentence	Given the very balanced and thorough evidence for and against this hypothesis that follows, this statement seems out of place and not entirely consistent with the still-limited and contradictory evidence we have at present.
109	47	Module C, Sub-section C.1.2., paragraph 1, third sentence	This is the wrong reference for the wrong conclusion. Taylor et al 2004 was an incomplete and hastily compiled list of possible sonar-related strandings that D'Amico et al and subsequent Filadelfo et al papers showed could not all have been seismic related. D'Amico et al offered natural causes, collisions, or other reasons for strandings, but did not offer any evidence for effects from other sound sources than sonars. Subsequent attempts to draw a link between seismic and strandings (Barlow and Gisiner 2009) or multi-beam sonars and strandings (Southall et al 2013, Madagascar stranding) have not led to the kinds of cumulative evidence that D'Amico et al presented for sonar, and which would be the minimum level of evidence for concluding that some other sound source was having a similar effect to that demonstrated for military mid-frequency sonars. One squid stranding, one beaked whale stranding, one melon-headed whale stranding is not evidence of a pattern of sound-related strandings, but are best characterized as odd coincidences with insufficient evidence to conclude that they were sound-related. More scientific rigor in these kinds of analyses would be beneficial.
110	47	Module C, Sub-section C.1.2., paragraph 1, last sentence	The link between behavioural disturbance due to ship noise and decompression stress is not clear. Clarify.
111	47	Module C, Sub-section C.1.2., paragraph 2, last sentence	If a link has not been demonstrated, then it is meaningless in the present context of these guidelines.
112	47	Module C, Sub-section C.1.3., paragraph 1, last sentence	Author makes a good point.

113	47	Module C, Sub-section C.1.3., paragraph 2, last sentence	Highly speculative, highly unlikely. Why not say so and acknowledge the weight of evidence for a lesser or no effect outcome? Being “precautionary” should come at the risk analysis decision stage, not in skewing the scientific evidence to lead people only toward a precautionary conclusion. Science and precaution need to be kept separate if the science is to be credible.
114	47	Module C, Sub-section C.1.4., paragraph 1, second sentence	This ignores the primary purpose of the noise being there, which is not the random desire to make noise, but to use sound for social and economic needs – national security, energy production, global commerce of food and goods, installation of offshore renewable energy infrastructure, etc. The sound cannot be moved “anywhere” driven only by minimizing the possibility of noise risk (since demonstrated risk is paltry at best). Sound sources are where they are because of a unique feature of the environment that requires them to be there. A trade-off has to be struck between one need and another, just as is the case for land use planning.
115	47	Module C, Sub-section C.1.4., paragraph 1, last sentence	On a practical basis, this would mean that given the option of conducting a sound producing activity in one area versus another with approximately equal value as a shipping route, renewables site or oil and gas exploration field, the site with the lower number of animals would be the preferred choice.
116	47	Module C, Sub-section C.1.4., paragraph 2	There is a much larger literature base on this topic. This discussion seems a little far out of range for the purported topic of the appendix.
117	48	Module C, Sub-section C.1.4., paragraph 4	Again, it would appear that the discussion has run beyond the theme of the appendix and the author's expertise. Bottom-mounted monitoring arrays of the type used by the US Navy cost close to one billion US dollars for coverage of an area under 1000 square miles. Futuristic monitoring with drones and dropped sonabuys or whatever is being suggested are fun to brainstorm about but are not viable options within today's technical means. There is a theme of "cost is no object" running through all of this discussion, in which mitigation options costing as much or more as the proposed action itself are suggested as if they were reasonable things to ask of the action proponent. By the same logic, we might ask whale watching vessels to adopt monitoring and mitigation measures equal in cost to their annual gross receipts or ask fishers to adopt bycatch reduction measures equivalent in cost to the price of the vessel and crew salaries. These are not

			practical solutions, nor do they convey a respect for the regulated party and what they do for society.
118	50	Module D	It is not clear what we are to take from this appendix, since the discussion, while quite good, offers no details, whereas previous appendices proffered very specific threshold recommendations. This is also only a partial review of a much more extensive literature.
119	54	Module E, Sub-section E.1.1., paragraph 1	This is incorrect, as a quick reading of the US Navy SURTASS LFA EIS documents and other sources would tell you. The actual issue is the need to detect quiet diesel-electric submarines at ranges that exceed the firing solution for new torpedo and missile technologies with over-the-horizon capabilities.
120	54	Module E, Sub-section E.1.1., paragraph 2, first sentence	The UK, France, Netherlands, Norway or other EU and NATO nations all possess sonars that they call LFA and which operate between 1 and 2 kHz.
121	54	Module E, Sub-section E.1.1., paragraph 2, first sentence	In these cases since the sonar signal is a tonal signal with a duration of many wavelengths, peak and rms sound pressure levels are the same.
122	54	Module E, Sub-section E.1.2., paragraph 2, first sentence	Again, the most commonly used MFA used in European navies operates at 5-7.5 kHz.
123	54	Module E, Sub-section E.1.4., paragraph 1, first sentence	Believe 'affective' should read 'effective'
124	54	Module E, Sub-section E.2., paragraph 1, second sentence	Better to describe the sound as 'emitted', rather than 'discharged'
125	54	Module E, Sub-section E.2., paragraph 1, second sentence	The source is not "at the sea surface" or all the energy would escape into the less resistant medium of the air. It is several meters, at least, below the surface.
126	54	Module E, Sub-section E.2., paragraph 1, second sentence	The sound is both reflected and refracted, and it is detected by accelerometers or geophones not hydrophones, since particle motion and its vector properties are an important part of the signal.
127	54	Module E, Sub-section E.2., paragraph 2, first sentence	Replace hydrophones with geophones
128	54	Module E, Sub-section E.2., paragraph 2, first sentence	Inadequate differentiation between source and receiver and explanation of each.
129	54	Module E, Sub-section E.2., paragraph 2, second sentence	Air guns vary in size but within a quite limited range because increasing volume produces diminishing increases in source level as volume goes up. The intensity of the source and its directivity are largely manipulated by the arrangement of multiple relatively small elements in an array. It is this array configuration, together with features like the shape of the air ports, which affects the frequency structure of the emitted signal.
130	54	Module E, Sub-section E.2., paragraph 3, first sentence	While the lowest frequencies are influenced to some extent by the volume of the air guns, the frequency

			structure of the seismic signal is more a product of array geometry.
131	54	Module E, Sub-section E.2., paragraph 3, first sentence	Statement of high frequency components up to 150 kHz is misleading and even incorrect. Yes a broadband source produces sound at many frequencies, but the amount of energy at source and how it propagates differ dramatically. Over 90% of the total pulse energy is confined to frequencies below 300 Hz. Frequencies up to 5 kHz are present but at levels 40-60 dB below the peak at about 100 Hz. Take any propagated value for the 100 Hz part of the signal, say 120 dB at 20 km, and subtract 40-60 dB. That is your received level at 1-5 kHz, very near to or below ambient levels and therefore inaudible and undetectable. At 150 kHz the source level would be 100 or more dB below the nominal source level and therefore inaudible at ranges greater than a few hundred yards ... even if it propagated like other frequencies. But at frequencies above 10 kHz the sound is increasingly absorbed by dissolved salts in the seawater, and at 150 kHz I doubt if there is any energy to speak of beyond the near-field of the array at ranges of 10 m or less. The authors also fail to address the issue of audibility. If sound were available at 150 kHz, only one European species would be likely to hear it, while all fish, seals, whales and most dolphins would not hear it even if it were available to be heard.
132	55	Module E, Sub-section E.2., paragraph 3, last sentence	Not correct. Needs input from expert in seismic sources.
133	55	Module E, Sub-section E.2., paragraph 4, first sentence	This is a nominal value in the downward direction only. The highest measurable value would be about 230-235 dB (in the downward direction) and another 10-20 dB lower in lateral directions due to interference between the array elements.
134	55	Module E, Sub-section E.2., paragraph 4, first sentence, use of; '...surveys typically run more or less continuously over many weeks'.	They are not in the same place and range over thousands of square km so that the ensonified area at any one time is quite small and the history of ensonification of a given site within that area contains peaks and valleys and should not be conveyed as if it were a continuous blanket of sound over the entire area throughout the survey.
135	55	Module E, Sub-section E.3.4., paragraph 1, first sentence	Not entirely correct. They generally have lower source levels than compressed air sources, but then they are smaller. A big array of sparkers or boomers could rival a compressed air (CA) array. The cavitation bubble produced by sparkers or boomers is smaller than the CA bubble, so tends to skew toward higher frequencies, but considerable

			energy is present below 100 Hz, so I would not characterize them as “high frequency devices”. And while they may not offer imaging to 5+ km below the seafloor, they penetrate more than soft sediment and are used quite often for imaging of shallow surface faults in areas of concern like San Francisco Bay, Puget Sound, the Mediterranean, etc.
136	55	Module E, Sub-section E.4.1., paragraph 1, first sentence, reading ‘...sound sources and can travel...’	Sentence should read ‘...sound sources and <i>the sound</i> can travel...’. It travels great distances for the same reason that LF sonars, CA sources and pile driving travels long distances - because they are high amplitude and most of the energy is in low frequencies (below 500 Hz).
137	56	Module E, Sub-section E.4.1., paragraph 1,	Redundancy in source level being detailed twice.