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Glacier Bay National Park and Preserve



Glacier Bay Watercraft Noise – Noise Characterization for Tour, Charter, Private, and Government Vessels



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Underwater acoustic noise levels of watercraft measured
under controlled conditions in lower Glacier Bay during
July and August 2003.

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ABSTRACT

Underwater sound levels of 16 vessels were measured under controlled conditions in Glacier Bay National Park and Preserve during July and August of 2003. Vessels ranged from 17 to 257 feet in length and included two small craft, a sailboat under power, one workboat, one tugboat, one fishing vessel, one research vessel, one yacht, and eight tour vessels. Sound levels associated with these vessels ranged from 153 to 180 dB re 1 microPa at 1 yard. On the average, overall sound levels were higher for the larger vessel categories. Increased vessel speeds also resulted in higher sound levels.

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PROJECT DESCRIPTION

As part of an extensive program to establish typical underwater acoustic noise levels in Glacier Bay, Alaska, the underwater noise levels emitted by 16 watercraft were measured in July and August 2003. Vessels were sized from 17 to 257 feet in length and included an open skiff, a cabin cruiser, a sailboat under power, several work boats, a tugboat, one yacht, and a number of tour vessels. Engine types ranged from a small outboard to inboard diesel power plants rated up to 900 horsepower. A complete list of the vessels tested is given in Table 1. Vessel specifications are given in Table 2. Figure 1 contains photos of the vessels that were tested. In 2000 and 2002, fourteen vessels, mostly small craft operated by the Park Service, were similarly evaluated, Kipple and Gabriele [2003].

Table 1 – List of Vessels Tested

Vessel	Date tested	Vessel type	Test speeds (kt)	Comment
Wilderness Adventurer	27 Jul 2003	Tour vessel	10	
Wilderness Explorer	28 Jul 2003	Tour vessel	9	1440 yard CPA
Sea Lion	19 Aug 2003	Tour vessel	3, 8	
Unknown	5 Aug 2003	Tugboat	Estimated 7 kt	Tug with fuel barge in tow. Range estimated at 1600 yards.
Alaskan Gyre	20 Aug 2003	Research vessel	10, 14, 20	900 yard CPA, 3 kt not useable
Yorktown Clipper	20 Aug 2003	Tour vessel	11.2	CPA range was estimated
Sea Bird	20 Aug 2003	Tour vessel	3.4, 10.7	
Snipe	21 Aug 2003	Skiff	10, 13	
Taz	21 Aug 2003	Work vessel	unknown	1000 yard CPA estimated
Alaskan Grandeur	21 Aug 2003	Yacht	8.3, 8.5	
Wilderness Discoverer	21 Aug 2003	Tour vessel	10	
Arete	22 Aug 2003	Cabin cruiser	5.4, 8.7, 13	Not same Arete as in 2000.
Keet	22 Aug 2003	Tour vessel	6, 10, 13	
Steller	25 Aug 2003	Fishing vessel	7.5, 7.6	Estimated 100 yard measurement range. Unusual vessel course.
Quintessence	28 Aug 2003	Sail boat	1.8, 5	1.8 kt not measurable
Spirit of Alaska	29 Aug 2003	Tour vessel	3.6, 7.2, 10.5	

Table 2 – Glacier Bay Watercraft Specifications

Vessel	Vessel type	Length (ft)	Engine type	HP
Snipe	Open skiff	17	2-cycle outboard	65
Arete	Cabin cruiser	26	Twin V6 gasoline	unk
Quintessence	Sail boat	30	Inboard diesel	25
Taz	Work boat	47	unk	unk
Unknown	Tugboat	unk	unk	unk
Alaskan Gyre	Research vessel	50	Diesel	480
Alaskan Grandeur	Yacht	65	Diesel	340
Steller	Fishing vessel	70	Diesel	425
Keet	Catamaran tour vessel	79	Diesel, jet propulsion	600
Wilderness Explorer	Tour vessel	104	Diesel	450
Spirit of Alaska	Tour vessel	143	Diesel	720
Sea Bird	Tour vessel	152	Diesel	800
Sea Lion	Tour vessel	152	Diesel	800
Wilderness Adventurer	Tour vessel	156	Diesel	475
Wilderness Discoverer	Tour vessel	170	Diesel	500
Yorktown Clipper	Tour vessel	257	Diesel	900

NOISE MEASUREMENT APPROACH

Underwater noise levels were measured as each vessel was operated on a constant speed, straight-line course to the west of a calibrated underwater noise measurement system located in lower Glacier Bay. A chart showing the noise measurement location is given in Fig. 2 and the hydrophone is shown in Fig. 3. The nominal distance for the closest point-of-approach (CPA) between the vessel and hydrophone was 500 yards. Actual CPA distances ranged from 396 to 553 yards, with the following exceptions: Alaskan Gyre at 895 yards, Taz estimated at 1000 yards, Wilderness Explorer at 1440 yards, and tugboat estimated at 1600 yards. Steller was also an exception, as discussed

below. Table 1 lists the test speeds for each vessel. Vessel speed and course were determined by GPS navigation. Park Service employees conducted the actual noise measurements, the vessels were operated by their normal operators, and the acoustic data were reduced and analyzed by Naval Surface Warfare Center personnel.

Issues of note from the noise measurements include:

- 1) Arete 5 kt data were not usable due to lack of data consistency.
- 2) Quintessence 1.8 kt levels were not measurable – noise levels were too low.
- 3) Taz CPA of 1000 yards was estimated and was greater than the nominal 500 yard CPA used for other vessels.
- 4) Alaskan Gyre 3 kt levels were not measurable – noise levels were too low at 800 yards. Gyre’s 900 yard CPA was greater than the nominal 500 yard CPA used for other vessels.
- 5) Steller’s course was unusual. It approached the hydrophone at close range instead of passing by at 500 yards. Its CPA was placed at 100 yards, but tracking data were insufficient to establish a reliable range. As a result, Steller noise data are especially suspect.
- 6) Wilderness Explorer’s CPA of 1440 yards was greater than the nominal 500 yard CPA used for other vessels.
- 7) An attempt was made to measure noise from Sea Lion’s bow thrusters. These data were inconsistent and are not reported.
- 8) Yortown Clipper’s CPA range was estimated.
- 9) The range for the tugboat with fuel barge in tow was estimated at 1600 yards and was greater than the nominal 500 yard CPA used for other vessels.

Typically, acoustic levels were measured from approximately 15 seconds before CPA to 15 seconds after CPA, as shown in Fig. 4, with the beam of the boat presented to the measurement hydrophone. Radio communications between the vessel under test and the noise measurement team in the shore-based laboratory were used to coordinate the

noise measurements. Water depth at the vessel location was typically about 180 feet. The hydrophone was located in a water depth of 99 feet.

Criteria were established for vessel and sea conditions during conduct of the noise measurements:

- 1) sea state 0 to 2 (i.e. no whitecaps)
- 2) no other vessels within 3 miles, and document presence of other vessels beyond a distance of 3 miles
- 3) vessels maintain steady course and engine rpm.

The noise levels in this report are given in both one-third octave and overall sound levels at a projected range of 1 yard. Measured noise levels were corrected to 1-yard source levels using a correction for spherical spreading, or

$$\text{Range correction} = 20 * \log(R)$$

where R is the range to the vessel (in yards) at the time of the measurement. For noise measurements where a noise source passes by a stationary sensor, it is common practice to use the geometric mean of the range at CPA and the range at the start of the measurement for the range correction calculation.

$$R = (R_1 * R_{CPA})^{1/2}$$

This approach was used for the measurements given in this report. No other noise propagation effects were taken into account in reporting the vessel noise levels.

In addition to measuring the noise levels from the vessels of interest, background noise levels were also measured before and after each vessel test. Measured vessel noise levels were then compared to the background levels to determine the degree of influence of background noise on the vessel noise measurements themselves. In all cases, any background noise influences on measured vessel levels were removed or corrected. As a

result, the reported (actual) vessel noise levels in some one-third octave bands may be several dB below the measured levels. For bands where background noise levels were so great that they precluded meaningful correction, no band level is reported.

DISCUSSION OF NOISE SPECTRUM

It is a common practice to quote noise levels in terms of a single number. For example, the noise level from operation of a common lawn mower may be reported as 100 dB. Usually this number represents the sum of all of the noise energy that occurs within the frequency range of human hearing. However, if more information regarding the character of the noise source is desired, the sound level should be represented in spectral form. In this case the entire frequency range covered by the measurement is divided into smaller individual frequency bands and the level for each band is established.

Ship noise signatures are commonly represented in one-third octave spectrum form. This format shows the distribution of acoustic energy that is emitted by a ship over a wide frequency spectrum by plotting noise levels for each standard one-third octave band in a level versus frequency format. This representation graphically demonstrates the amount of noise energy that is present at low, mid, and high frequencies, and serves as a tool to identify the predominant noise sources that make up a ship's total acoustic signature. An example of a one-third octave noise spectrum is shown in Fig. 5.

The noise spectrum representation is also useful as a noise source ranking tool. For example, if a noise spectrum shows that high noise energies are present near 3 kHz, this result would be important to humans because human hearing is especially sensitive to noises that occur at frequencies near 3 kHz. On the other hand, significant noise energies at 100 Hz might be less important because human hearing sensitivity at this frequency is relatively low. Use of the noise spectrum in addition to single number sound levels provides more information regarding the noise source itself and its potential effects on a creature exposed to that noise.

To supplement the approach described above, limited narrowband frequency analysis was also used to assess watercraft noise character. Compared to the one-third octave representation, narrowband frequency analysis provides more detail of a noise source's frequency characteristics because of its greater ability to resolve closely spaced frequency components. Figure 5 shows an example of a narrowband noise spectrum.

NOISE LEVELS IN WATER

When assessing the significance of underwater noise levels, it is important to recognize that in-water noise levels are measured on a different scale than in-air levels, and that they represent different sound intensities than in-air noise levels. This means that the sound intensity of a 100 dB noise in air is not equal to that of a 100 dB noise in water. In part, this effect is due to the use of different reference pressures in airborne acoustics versus underwater acoustics. This difference in scales is illustrated in Fig. 6, which shows a comparison between the underwater noise decibel scale and some familiar in-air decibel levels. Figure 6 demonstrates that the reader must resist the temptation to interpret underwater noise levels based on more familiar in-air decibel levels without accounting for the difference between the two scales.

The following information may also be useful when assessing differences in noise levels:

- 1) Humans can distinguish sound level differences of about 3 dB.
- 2) A 10 dB increase is perceived as a doubling in sound intensity.
- 3) The difference between the peak noise of a single vehicle passing by and heavy traffic is about 10 dB.

BACKGROUND INFORMATION

Typical underwater ambient noise fields in open water environments are variable in terms of noise levels and contributing noise sources. At a given time and location the observed acoustic noise may be entirely due to natural sources such as wind generated surface noise. A short time later noise from marine vessel operations may become the primary contributor of noise energy. Noise from marine life may also affect the observed noise spectrum.

Wind related noise has been studied extensively and has long been recognized as a primary source of undersea ambient noise. The noise itself is due to wind agitation of the water surface and the resulting wave, turbulence, droplet, and bubble activity. Deep ocean wind noise level and spectral dependence on sea state or wind speed has been established by a number of investigators. The widely recognized Knudsen [1948] wind noise spectra show that wind related noise levels may increase more than 20 dB when sea states progress from calm conditions to wind speeds near 30 knots. Wind related noise is typically the most pervasive source of underwater noise in ocean environments.

In the absence of oceanographic surveying, oil rig operations, etc., marine vessel noise is the primary source of manmade underwater noise and is typically due to engine, propulsion system, and propeller related noise. These mechanical systems produce narrowband and broadband noise that is characteristic of vessel and engine type. Small craft with high-speed engines and propellers generally produce higher frequency noise while large vessels can generate substantial low frequency noise because of their size and large, slow speed engines and propellers. All vessels equipped with propellers have the ability to produce propeller cavitation noise, which occurs at higher frequencies and is broadband in nature. An additional important aspect of vessel noise is that levels are typically speed dependent with noise levels increasing at higher ship speeds.

RESULTS

This report section contains the one-third octave noise spectra for the watercraft that were evaluated. It also compares the sound levels for each vessel at 10 knots and at all of the speeds that were evaluated.

The measured noise levels for each boat are given in Figs. 7 through 22. Noise levels are expressed as one-third octave band levels in dB re 1 microPascal at 1 yard. For each vessel, the one-third octave noise spectra for all test speeds are given on a single plot. In some cases, particularly at lower frequencies, noise levels for some one-third octave bands are not reported due to interference from ambient noise or system related noise.

Using the one-third octave noise spectra, the overall sound levels* for each vessel were also established. The sound levels for each vessel are compared in Fig. 23. The yellow data points indicate levels that should be viewed with caution because they were measured under unique conditions (as identified above), or because a significant portion of the sound spectrum was not measurable due to high ambient noise levels (Alaskan Grandeur). The highest reliable sound levels were associated with the Spirit of Alaska at 10.5 knots (not including the “caution” data points), and the lowest were attributed to the Sea Bird at 3.4 knots. Sound levels ranged from a low of 153 dB to a high of 180 dB. For vessels where a number of speeds were evaluated, acoustic levels increased with increasing speed. This behavior was particularly noticeable for Keet, Spirit of Alaska, Seabird, and Sea Lion.

Figure 24 shows a similar sound level comparison for 10 knots only. For vessels where 10-knot data were not available, the data for the speed closest to 10 knots was used. These speeds are indicated on the graph. Striped bars on the graph indicate levels

* The sound level is a number that represents the sum of all of the measured acoustic energy represented in a single one-third octave spectrum. It is equivalent to adding all of the one-third octave band levels in an individual one-third octave plot. As a result, the sound level is generally several dB greater than the peak one-third octave band level.

that should be viewed with caution, as per the notes on measurement conditions that were cited previously.

Sound levels were trended by vessel size to check noise dependence on vessel type. Three categories were used: small craft (Snipe, Arete, Quintessence), 50 to 100 foot vessels, and vessels over 100 feet in length. Figure 25 shows a plot of average sound level versus vessel category. The bars represent the minimum and maximum sound levels for each category. The graph shows, on the average, a trend of increasing acoustic levels with vessel size. “Caution” data points were not included in these statistics.

Summary of Results by Vessel

Snipe. Noise levels from Snipe, a 17-foot outboard powered skiff, at 10 and 13 knots were not measurable below 160 Hz due to ambient noise influence. Below 600 Hz, underwater sound levels were probably controlled by mechanical engine noise. At higher frequencies, propeller cavitation noise energy dominated the sound spectrum. Snipe, along with Keet, had the lowest true 10-knot sound level. Compared to 10 knots, Snipe exhibited slightly higher noise levels at 13 knots.

Arete. Noise levels from Arete, a 26-foot cabin cruiser, were fairly comparable at 8.7 and 13 knots. Above about 600 Hz, the sound spectrum was controlled by propeller cavitation noise energy. At lower frequencies, mechanical engine noise was dominant. The source of the elevated noise energy at 50 Hz and below could not be identified without further investigation. The noise levels measured at 5 knots were not usable because they were inconsistent between tests.

Quintessence. The sailboat Quintessence was evaluated at 5 knots under diesel power. Below 250 Hz her noise levels could not be established due to ambient noise influence. Most of the noise energy in this boat’s sound spectrum appeared to be related to mechanical diesel engine sources. At 1.8 knots, noise levels were not measurable due to ambient noise interference.

Taz. Ten-knot noise levels from the 47-foot work boat Taz were measured at an estimated range of 1000 yards. As a result they must be used with caution. Levels at frequencies below 160 Hz were not measurable due to ambient noise influence. The noise peak at 400 Hz was probably due to mechanical engine noise.

Tug/Fuel Barge. Noise levels from an unidentified tug with fuel barge in tow were estimated. The range to the tug was estimated at 1600 yards. These data should be used with caution. The 500 Hz peak in the noise spectrum was probably due to mechanical engine noise. Higher frequency energy was most likely attributable to propeller cavitation.

Alaskan Gyre. Noise levels from the research vessel Alaskan Gyre were not measurable at 3 knots due to her range, 800 yards, from the hydrophone. Her 8-knot levels were not measurable below 100 Hz due to ambient noise influence. Caution should be used when comparing Gyre's levels to those from other vessels since Gyre was measured at a range of 900 yards. The 250 Hz peak in Gyre's sound spectrum was probably due to mechanical engine/propulsion noise.

Alaskan Grandeur. Due to high ambient noise levels at lower frequencies, including some clunking noise, Alaskan Grandeur's noise levels were not measurable below 2000 Hz. It is likely that a peak in her noise spectrum would have otherwise been observed at lower frequencies. As a result, the sound levels shown for this vessel in Figs. 23 and 24 should be viewed with caution. Also, the difference between her noise levels at 8.3 and 8.5 knots would not normally be expected to be as great as that shown in Fig. 12. This difference could not be explained without further investigation.

Steller. Because of Steller's proximity to the hydrophone, unusual vessel track, and uncertain location relative to the hydrophone, her noise levels are particularly suspect. They may not be as great as is shown in Figs. 23 and 24. The peaks in the sound spectrum at lower frequencies were probably related to diesel engine noise. At higher frequencies, propeller cavitation was the suspected noise source.

Keet. The Keet, a 79-foot catamaran tour vessel exhibited one of the lower 10-knot sound levels. Below 100 Hz, Keet's levels in some frequency bands were not measurable due to low frequency ambient noise interference. Above 300 Hz, noise levels were most likely controlled by jet propulsion system noise.

Wilderness Explorer. Because Wilderness Explorer's noise levels were measured at 1440 yards, caution should be used when comparing these levels to those from other vessels. Due to this distance, and ambient noise conditions, Explorer's noise levels were not measurable below 200 Hz. Most of the energy that was measured was probably due to propeller cavitation noise.

Spirit of Alaska. Due to ambient noise limitations, sound levels in some of Spirit of Alaska's lower frequency bands were not measurable. The source of the peak in the ship's sound spectrum at 2 kHz could not be identified without further investigation, although at 10 knots, most of the energy in this frequency region was probably due to propeller cavitation. At 180 dB, Spirit of Alaska's 10-knot sound level was the highest reliable sound level measured in this project.

Sea Bird. The lowest sound level measured was from Sea Bird at 3.4 knots, although this data point should be used with care since much of the frequency spectrum was not measurable at this speed due to ambient noise limitations. At 10 knots the spectrum was ambient limited below 125 Hz. At higher frequencies the 10-knot spectrum was probably dominated by propeller cavitation noise. At 3.4 knots the noise spectrum was probably controlled by mechanical propulsion related noise.

Sea Lion. At lower frequencies, Sea Lion's noise spectrum was not measurable due to ambient noise influences. The peaks in her 4.6 and 7.8-knot spectra were probably due to mechanical engine/propulsion noise. Most of the high level energy in her 10.9-knot spectrum was probably due to propeller cavitation noise.

Wilderness Adventurer. Wilderness Adventurer exhibited one of the lower 10-knot sound levels of the larger vessels. The peak in her sound spectrum at 160 Hz was probably due to mechanical engine/propulsion noise. At higher frequencies noise levels were most likely controlled by propeller cavitation.

Wilderness Discoverer. From 60 to 500 Hz, Wilderness Discoverer's noise levels were not measurable due to ambient noise interference. For this reason her 10-knot sound level should be used with some care. But, examination of the ambient noise levels at the time of her measurement show that her highest band levels are represented in Fig. 20. Most of this spectrum was probably controlled by propeller cavitation noise.

Yorktown Clipper. The distance from Yorktown Clipper to the measurement hydrophone was estimated, so her data should be used with some care. Her 50 Hz band level was not measurable due to ambient noise interference. The peaks in the low frequency portion of her sound spectrum were probably due to mechanical engine/propulsion noise, while above 500 Hz, noise levels were likely dominated by propeller cavitation.

SUMMARY AND CONCLUSIONS

Using a bottom-mounted hydrophone in Lower Glacier Bay, the underwater noise levels of 16 vessels were established. Two of these vessels were small craft and one was a sailboat under power. Six vessels were between 50 and 100 feet in length, including one workboat, one fishing vessel, one research vessel, one tugboat, one yacht, and a catamaran tour vessel. Seven vessels, each a tour boat, were over 100 feet in length.

Overall sound levels from 153 to 180 dB re 1 microPa at 1 yard were measured. The highest levels were associated with Spirit of Alaska, a 143-foot tour boat, at 10.5 knots. The Seabird, a 152-foot tour boat, at 3.4 knots had the lowest noise levels.

Vessels were categorized by size. On the average, overall sound levels were higher for the larger vessel categories. Sound levels also increased with increasing vessel speed.

A previous report on Glacier Bay small craft sound levels, Kipple and Gabriele [2003], recommended that medium size craft noise levels should be evaluated. The current effort supplements the previous work which documented small craft and cruise ship, Kipple [2002] underwater acoustic levels. In combination, these results represent an important resource for characterizing the underwater noise environment in Glacier Bay. Also, in conjunction with the appropriate marine mammal auditory data, these noise levels constitute a necessary component for assessing the effects of vessel noise on marine mammals.

REFERENCES

- (1) Kipple, B.M., and Gabriele C., “Glacier Bay Watercraft Noise”, Naval Surface Warfare Center Technical Report NSWCCD-71-TR-2003/522 (2003).
- (2) Knudsen, V.O., et. al., “Underwater Ambient Noise”, Journal of Marine Research, 7:410 (1948).
- (3) Kipple, B.M., “Southeast Alaska Cruise Ship Underwater Acoustic Noise”, Naval Surface Warfare Center Technical Report NSWCCD-71-TR-2002/574 (2002).

FIGURES



Snipe



Arete



Quintessence

Fig. 1 Vessel Photos



Taz



Alaskan Gyre



Alaskan Grandeur

Fig. 1 Vessel Photos (cont'd)



Steller



Keet



Wilderness Explorer

Fig. 1 Vessel Photos (cont'd)



Spirit of Alaska



Sea Bird



Sea Lion

Fig. 1 Vessel Photos (cont'd)



Wilderness Adventurer

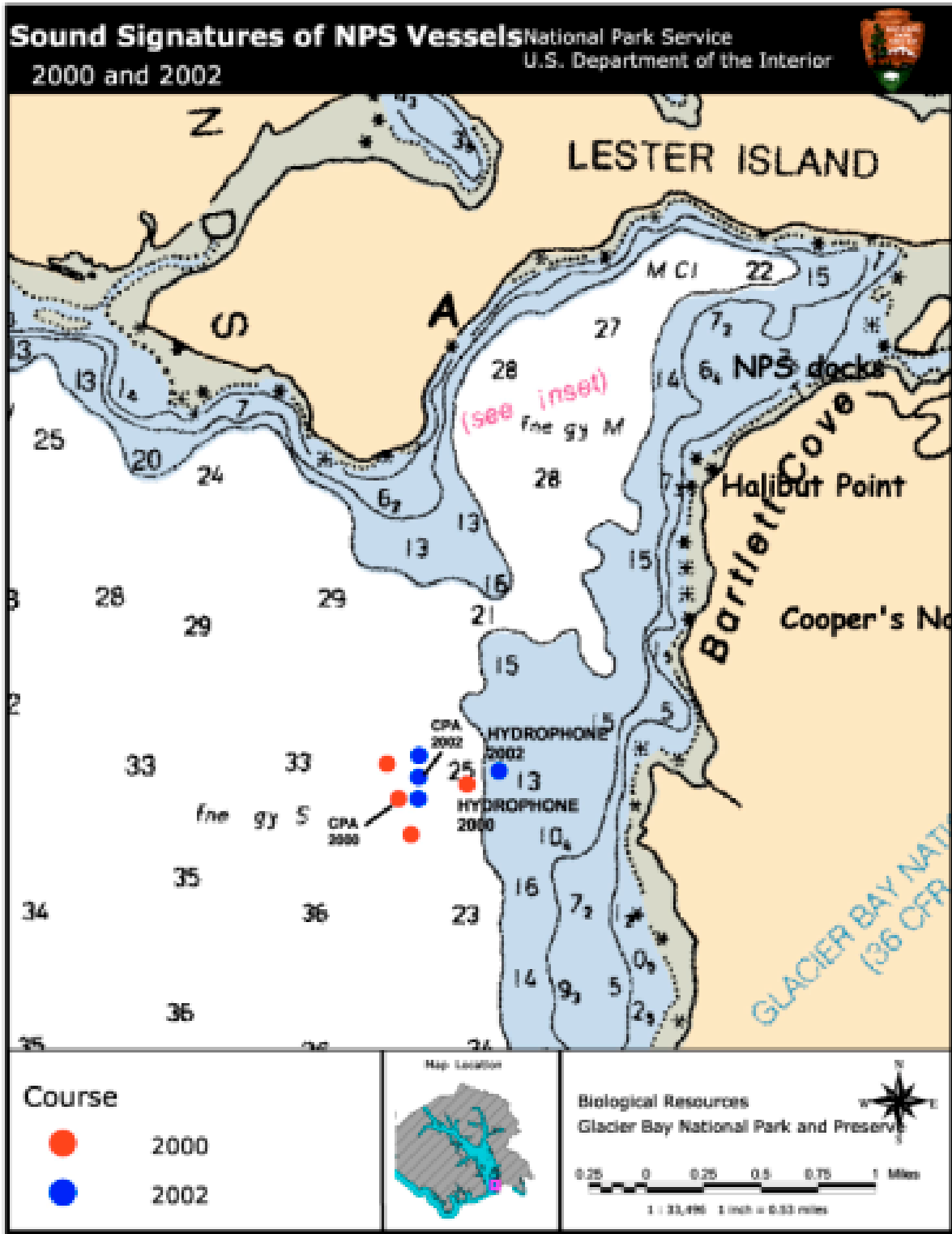


Wilderness Discoverer



Yorktown Clipper

Fig. 1 Vessel Photos (cont'd)



(The 2003 vessel noise measurements were performed at the same location used in 2002.)

Fig. 2 Noise Measurement Location in Lower Glacier Bay



Fig. 3 Noise Measurement Hydrophone

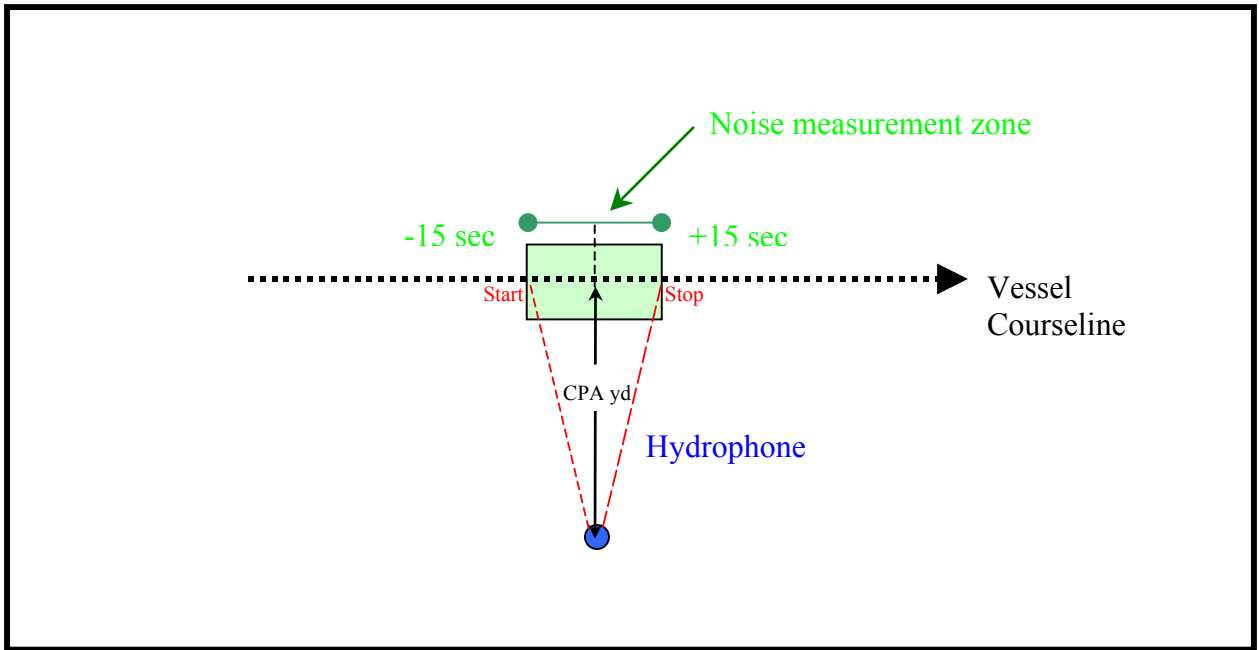
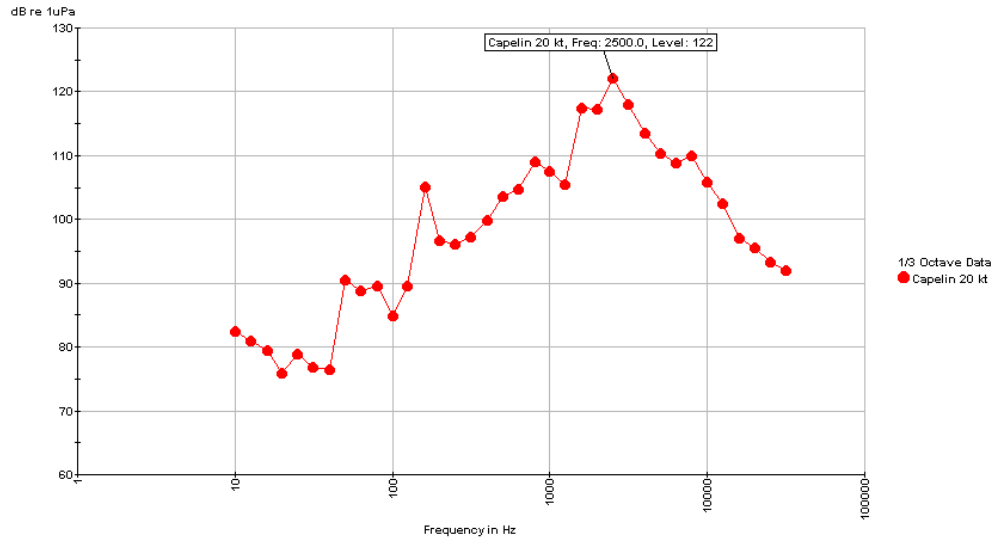
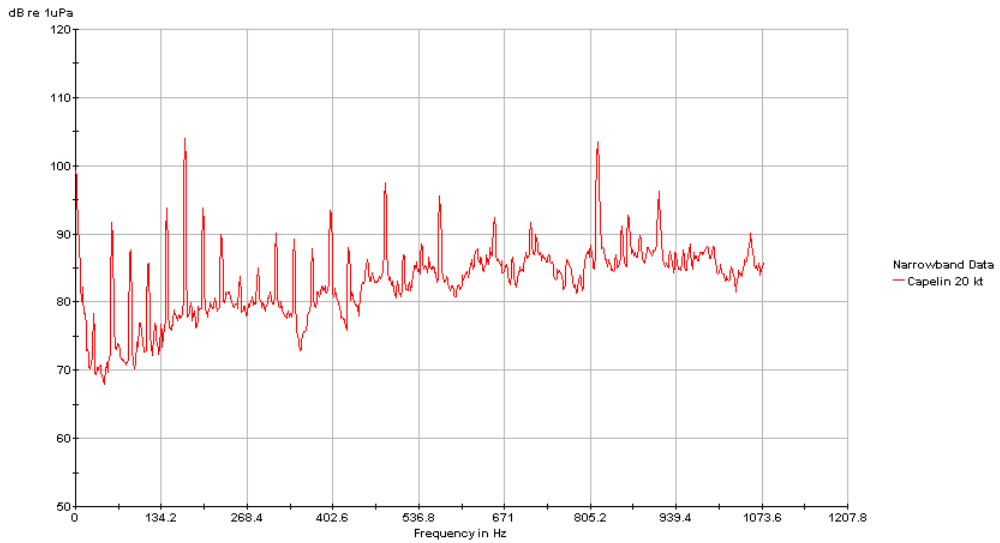


Fig. 4 Noise Measurement Geometry

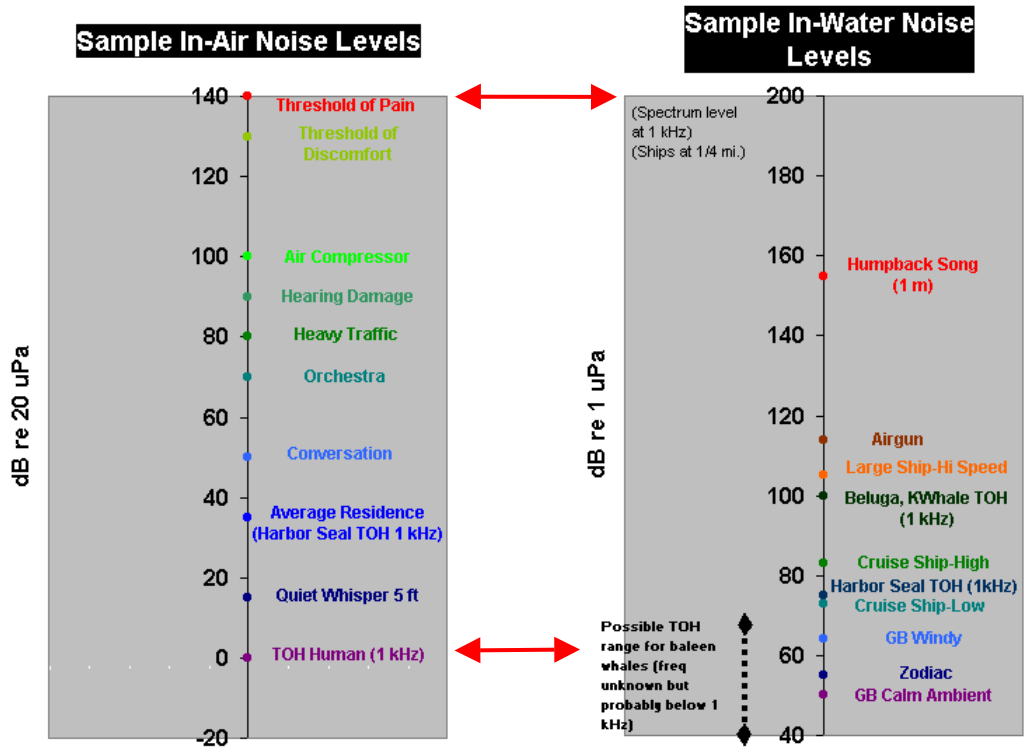


Representative One-Third Octave Plot



Representative Narrowband Plot

Fig. 5 Representative One-Third Octave and Narrowband Noise Spectra



(TOH = threshold of hearing)

Fig. 6 Sample In-Water and In-Air Noise Scales

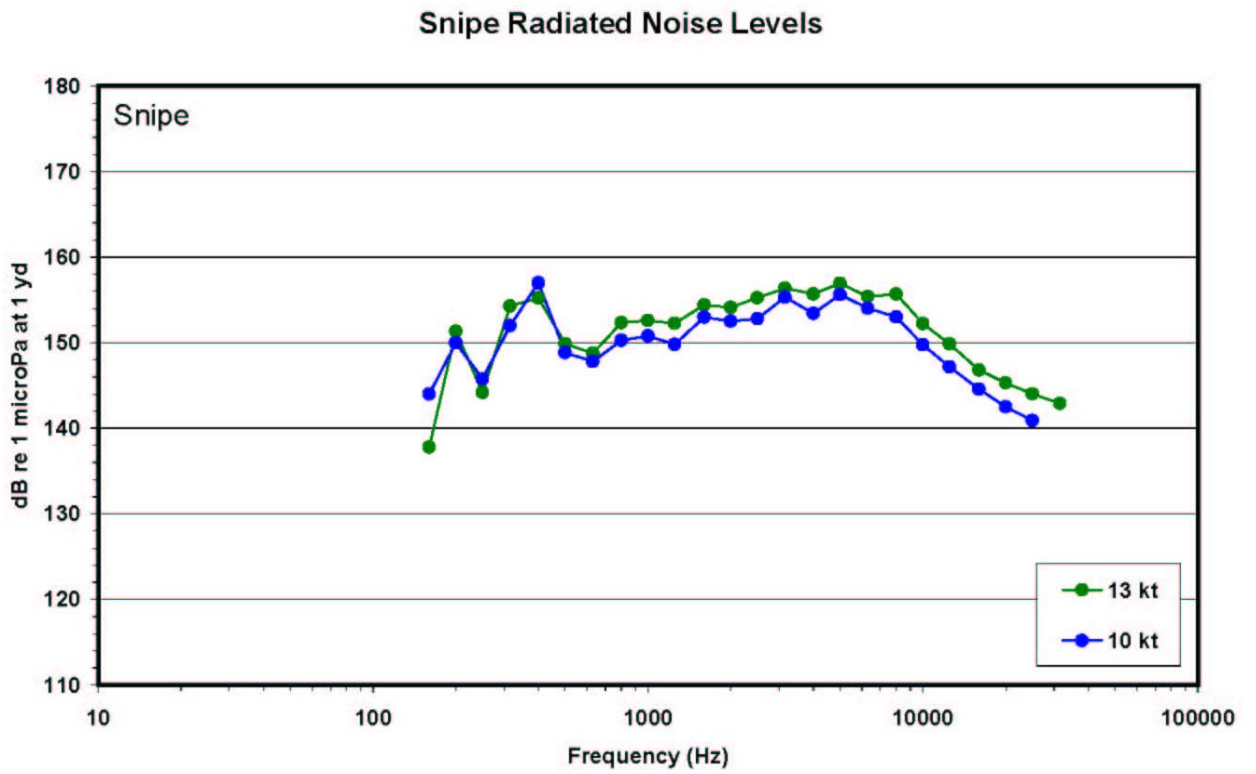


Fig. 7 Snipe Radiated Noise

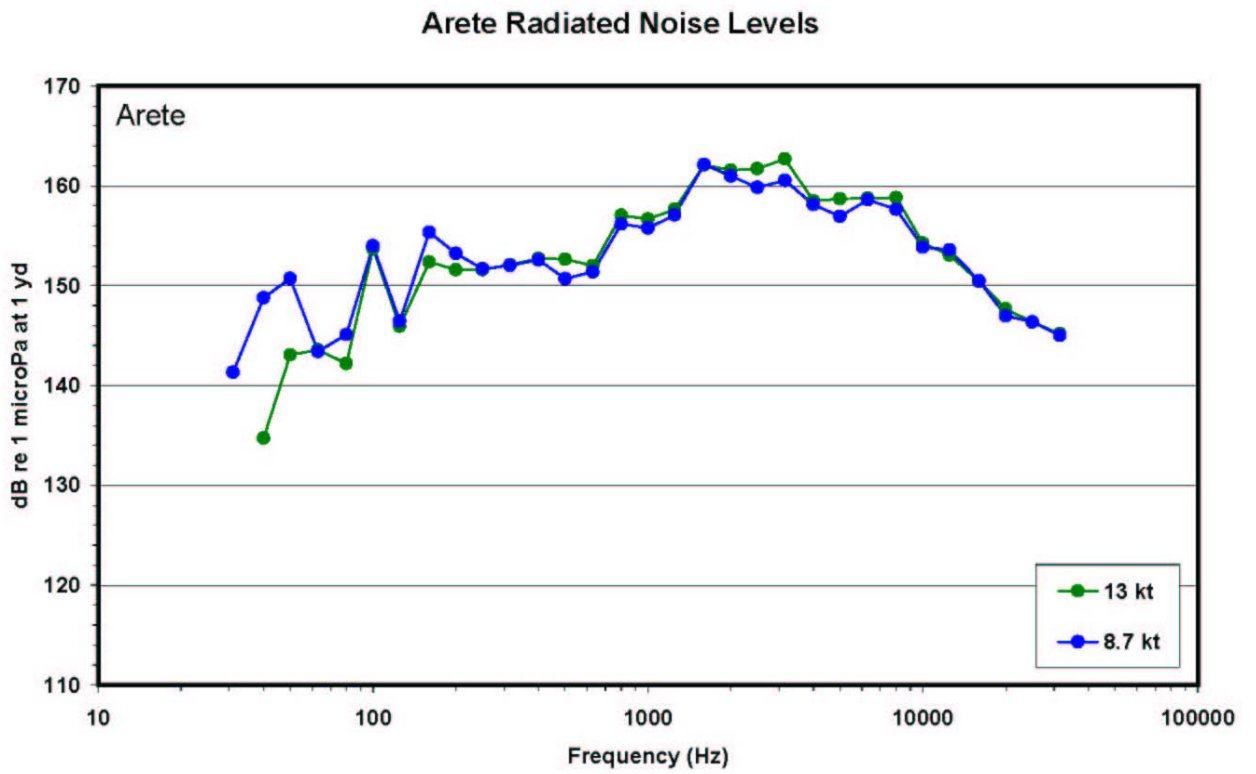


Fig. 8 Arete Radiated Noise

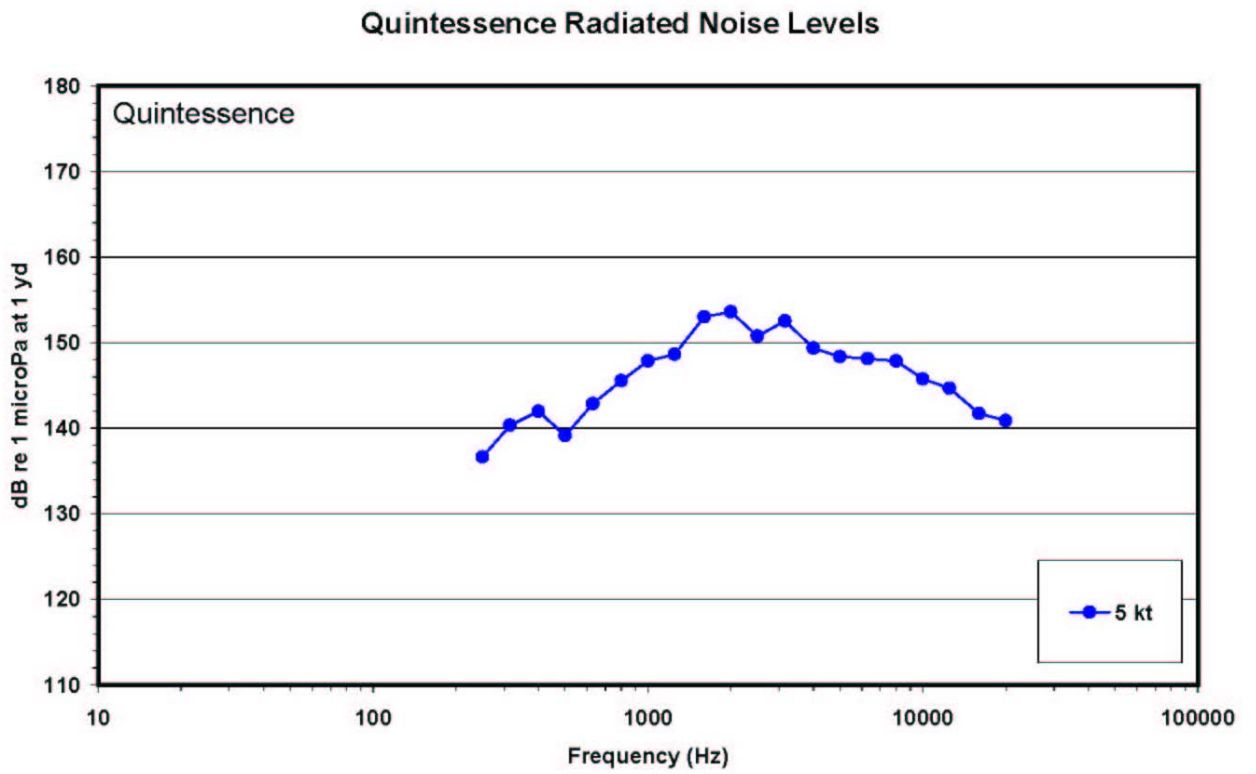
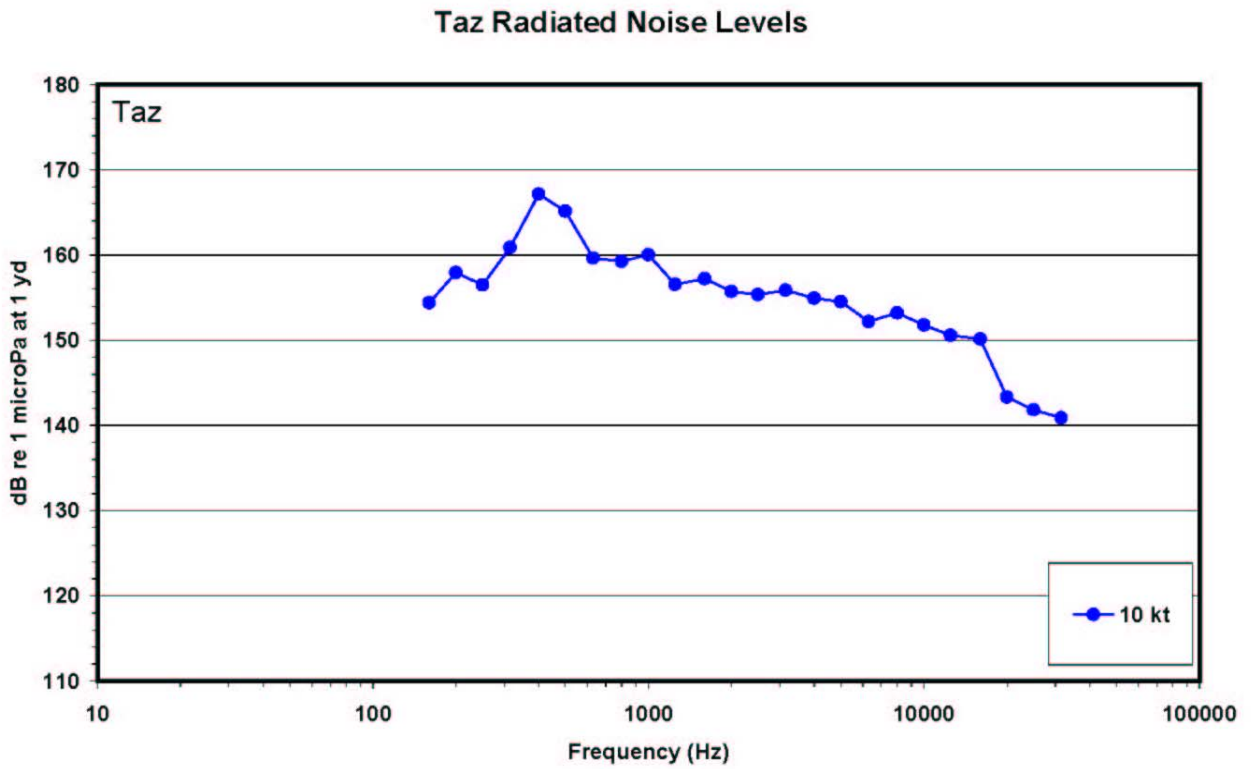


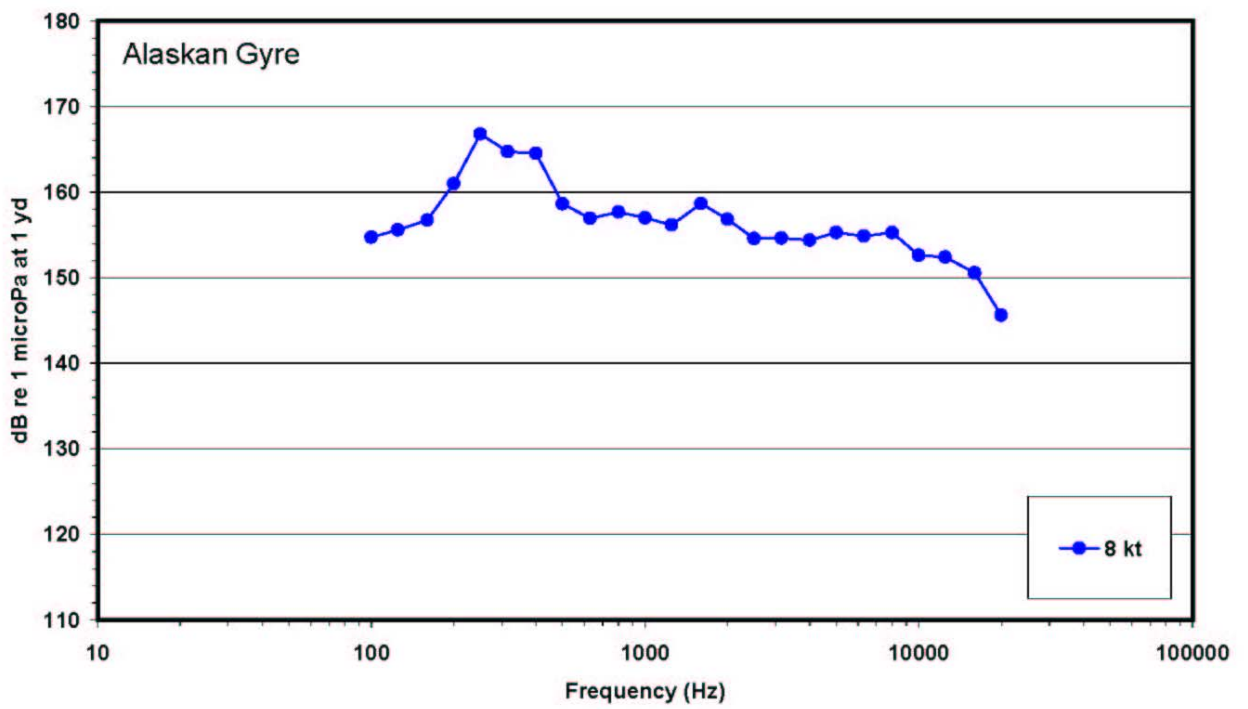
Fig. 9 Quintessence Radiated Noise



(Use Taz data with caution)

Fig. 10 Taz Radiated Noise

Alaskan Gyre Radiated Noise Levels



(Use Alaskan Gyre data with caution)

Fig. 11 Alaskan Gyre Radiated Noise

Alaskan Grandeur Radiated Noise Levels

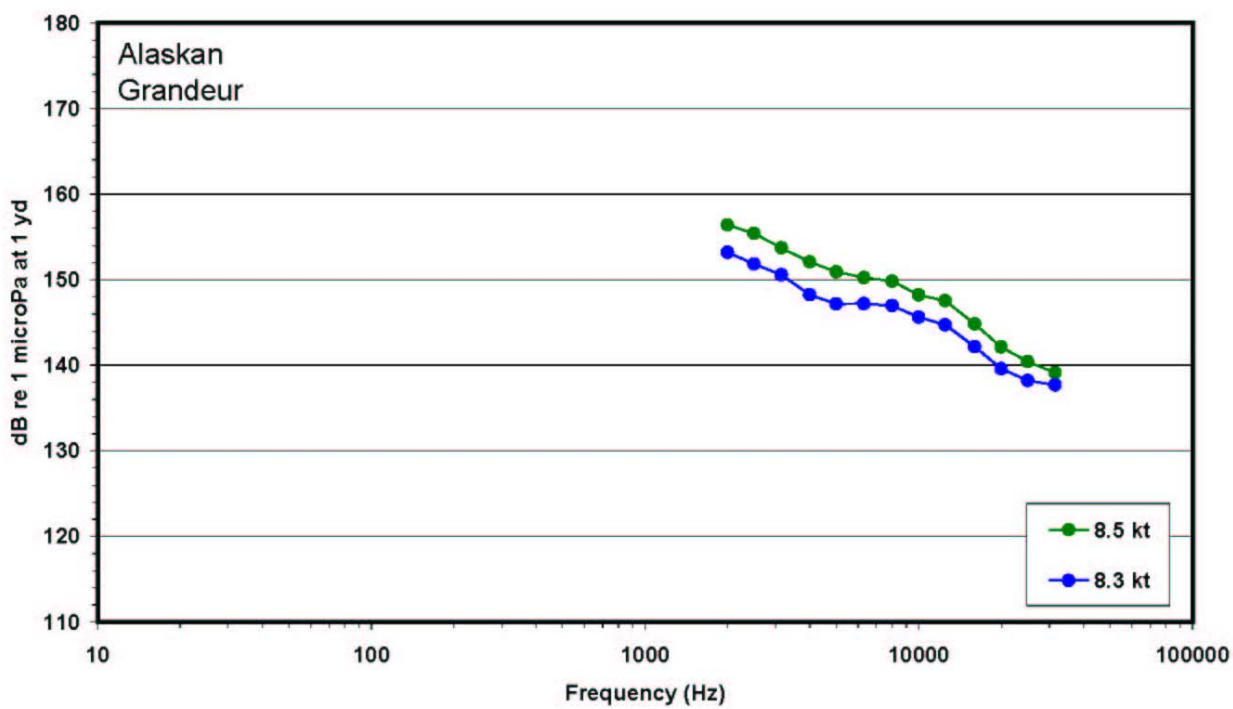
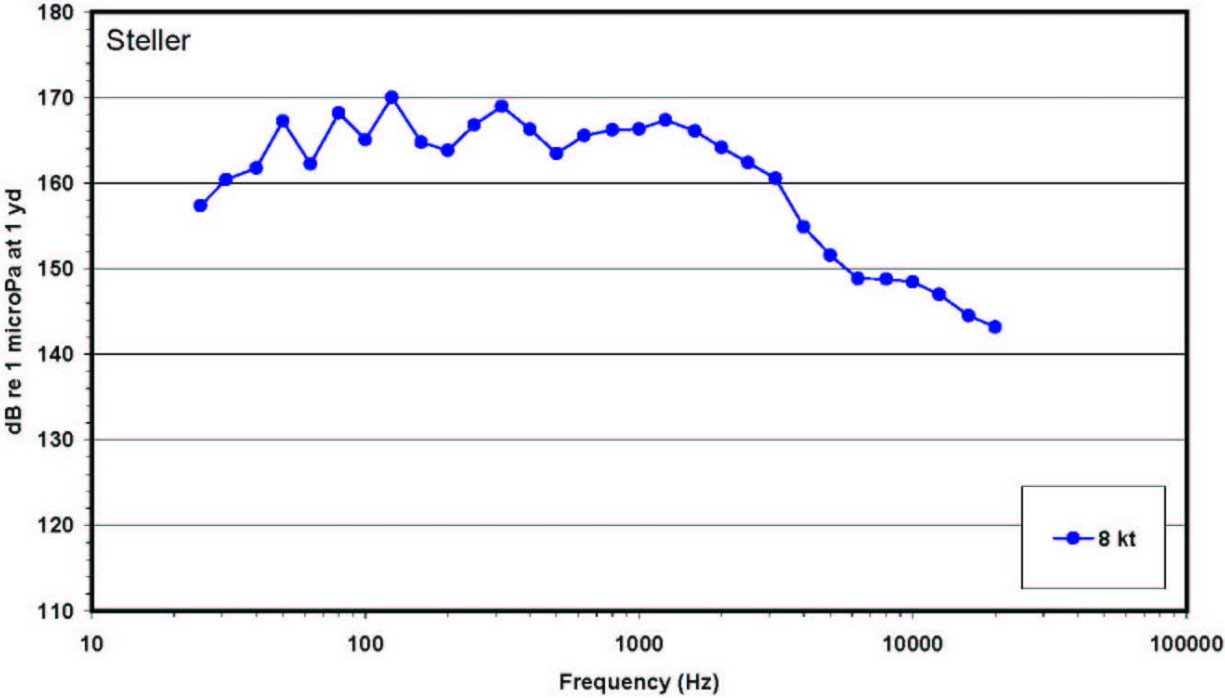


Fig. 12 Alaskan Grandeur Radiated Noise

Steller Radiated Noise Levels



(Use Steller data with caution)

Fig. 13 Steller Radiated Noise

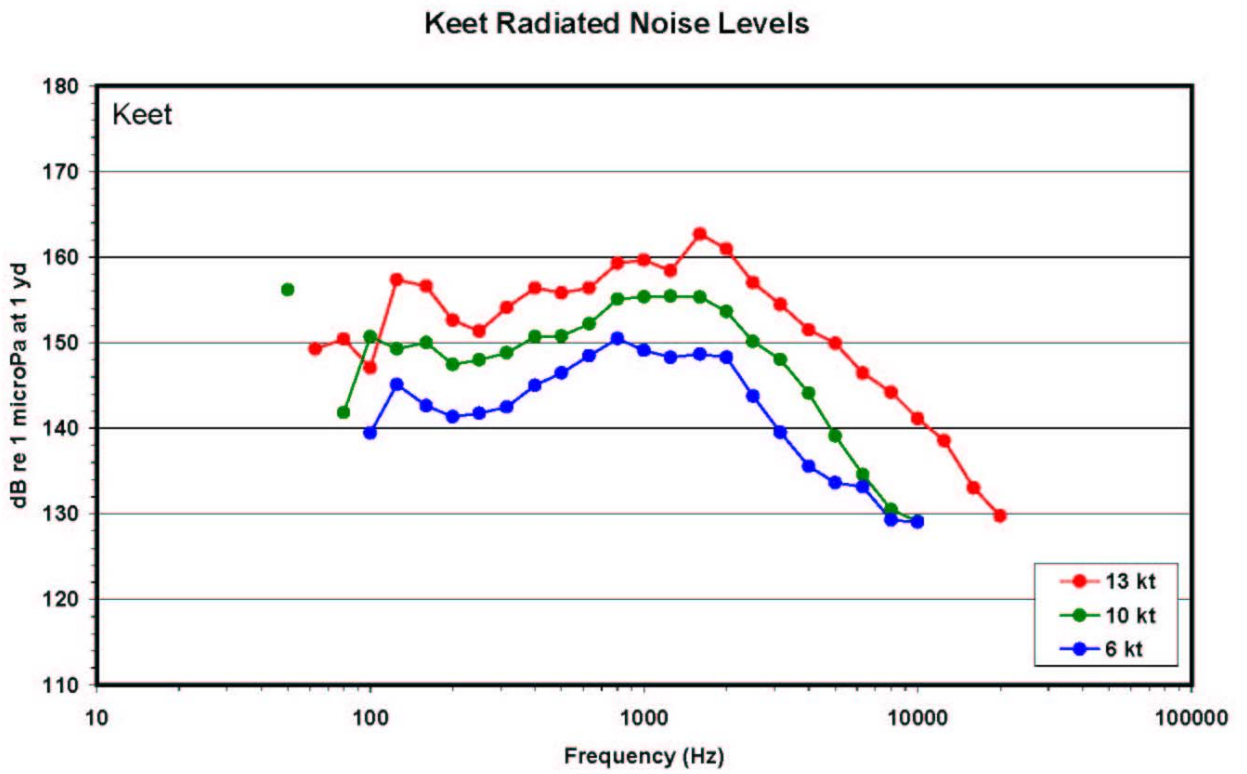
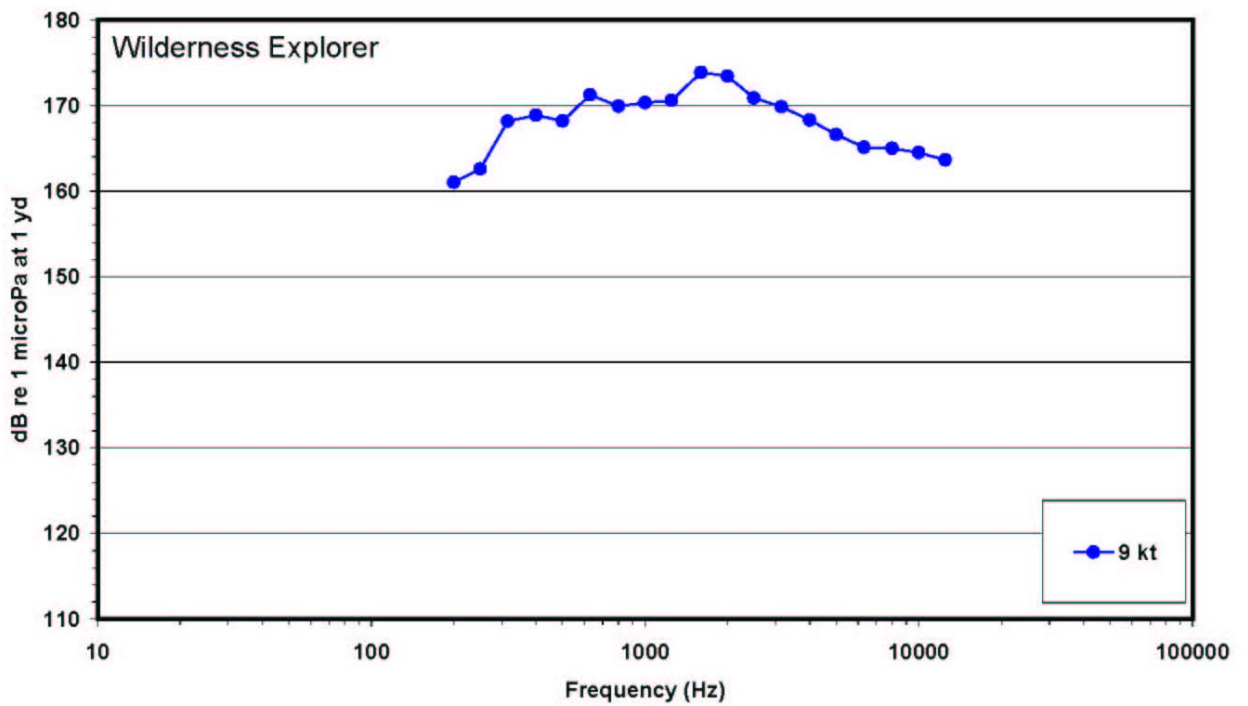


Fig. 14 Keet Radiated Noise

Wilderness Explorer Radiated Noise Levels



(Use Wilderness Explorer data with caution)

Fig. 15 Wilderness Explorer Radiated Noise

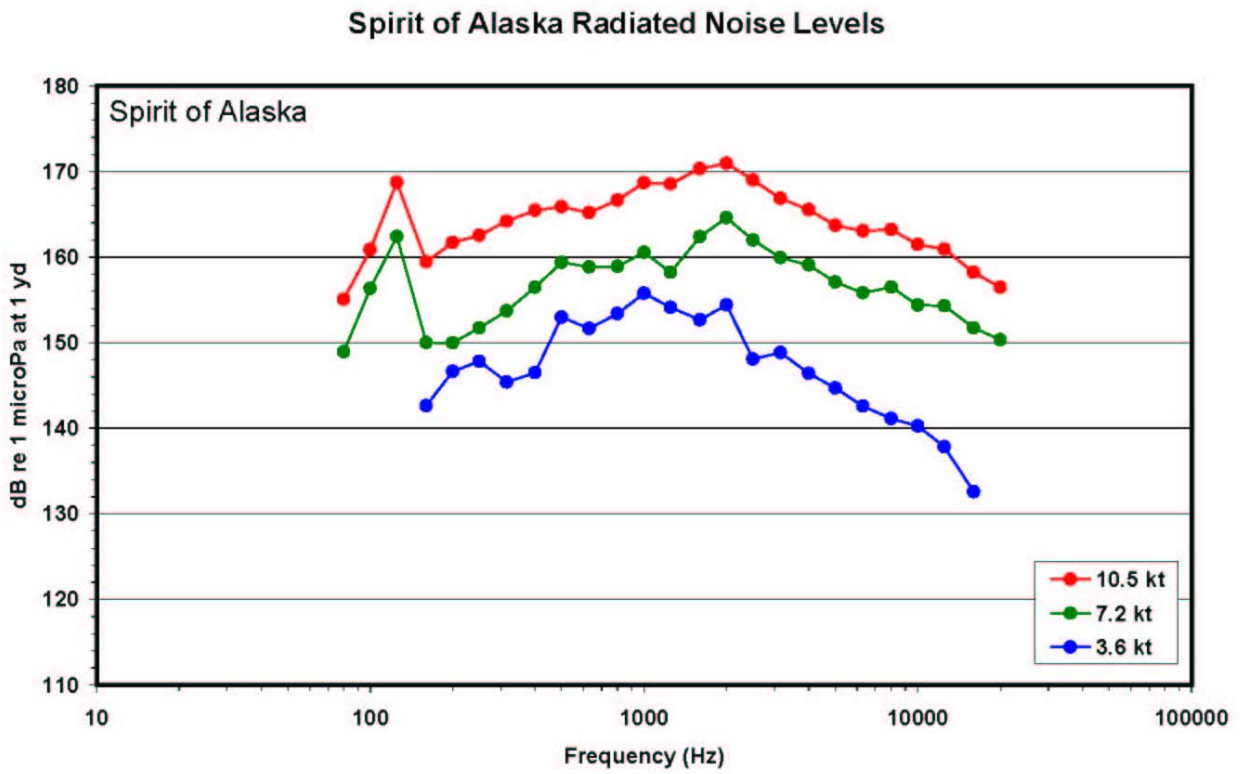


Fig. 16 Spirit of Alaska Radiated Noise

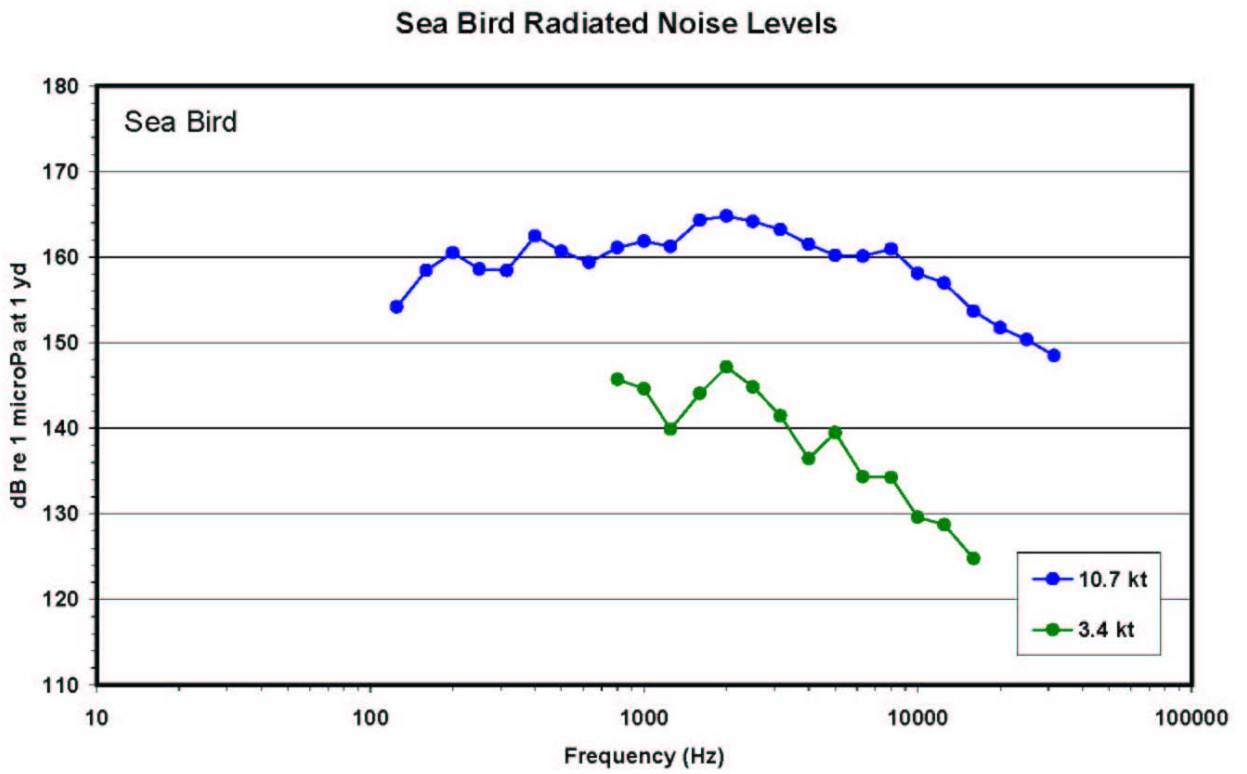


Fig. 17 Sea Bird Radiated Noise

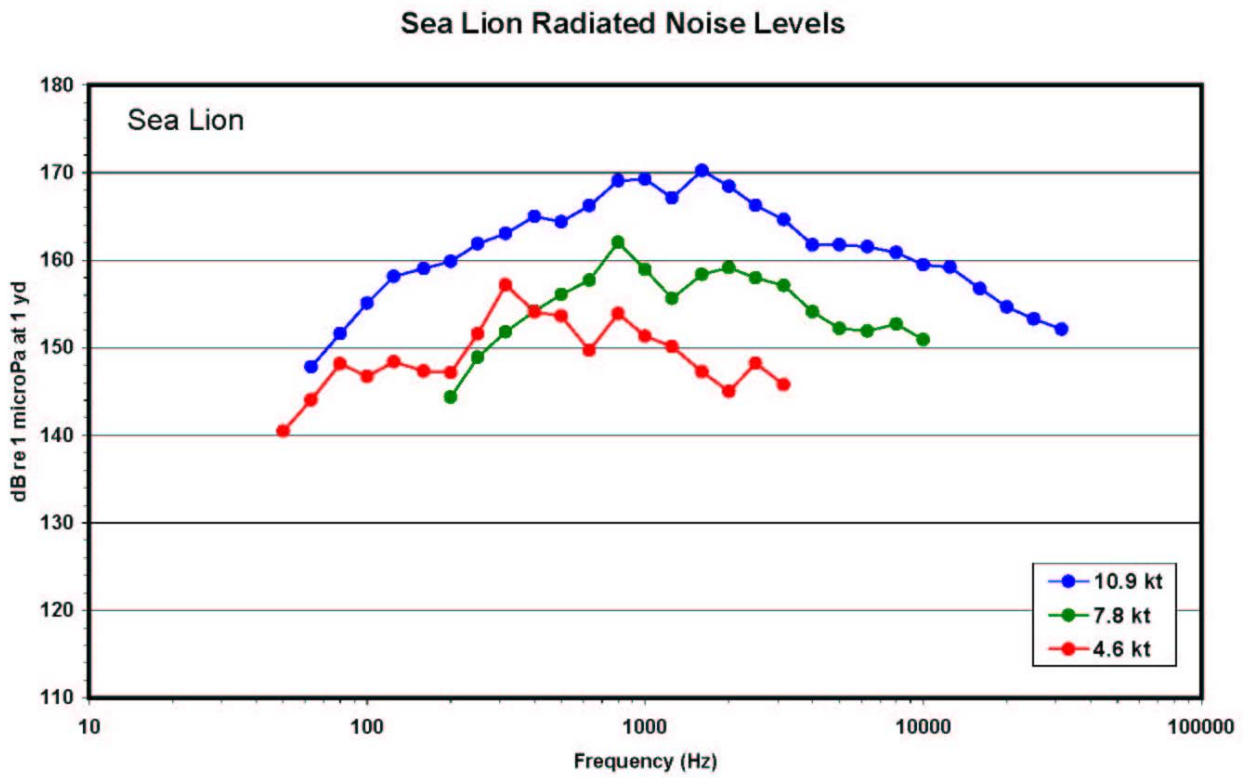


Fig. 18 Sea Lion Radiated Noise

Wilderness Adventurer Radiated Noise Levels

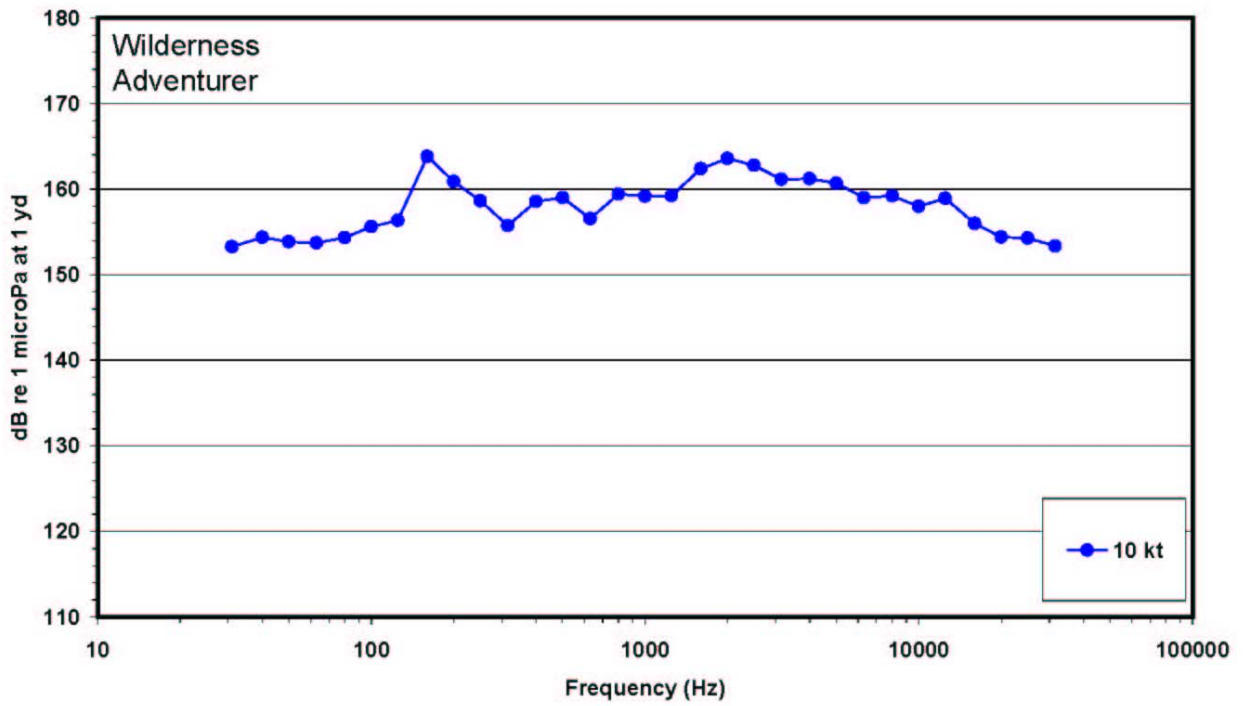


Fig. 19 Wilderness Adventurer Radiated Noise

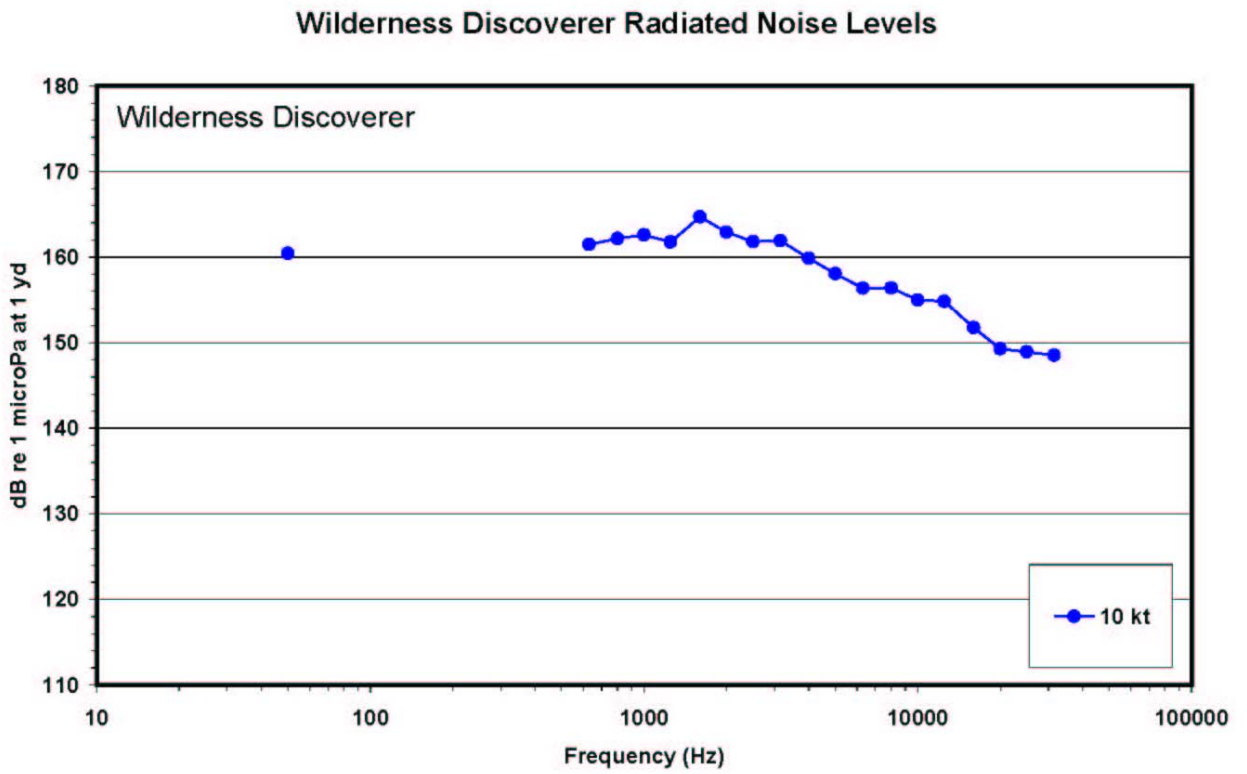


Fig. 20 Wilderness Discoverer Radiated Noise

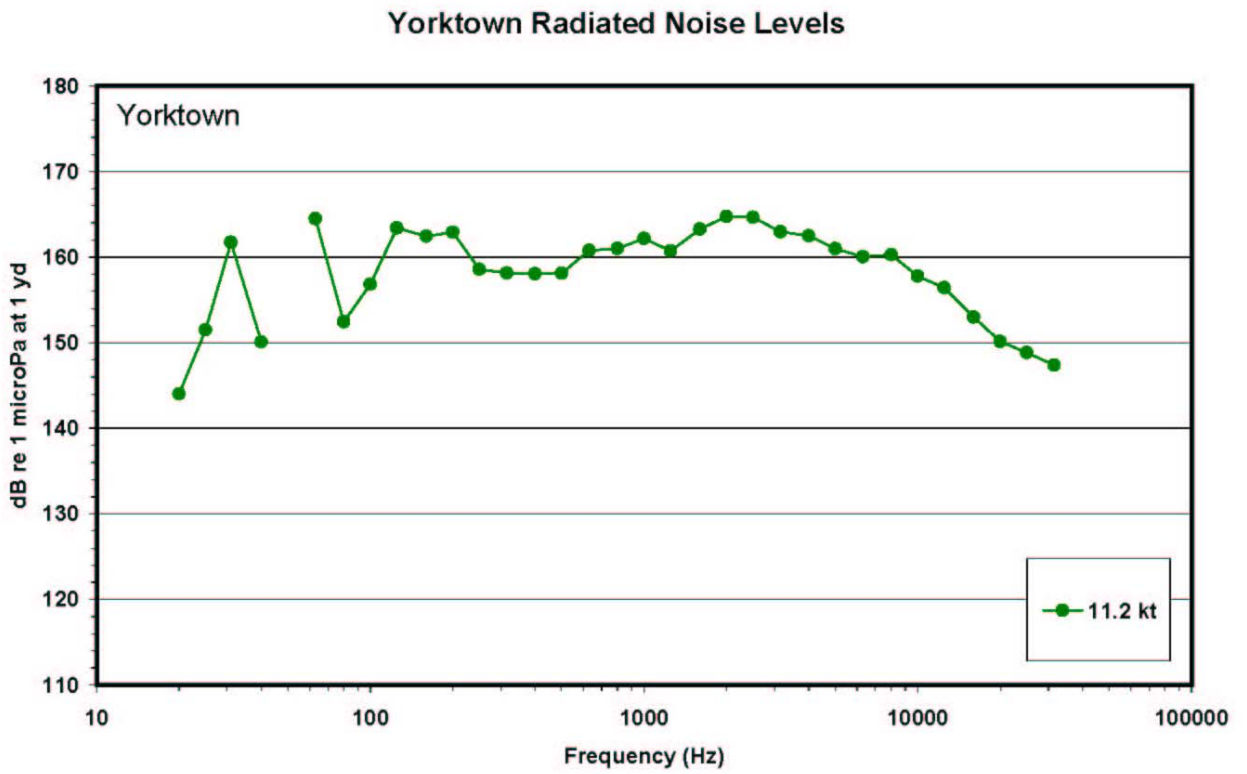
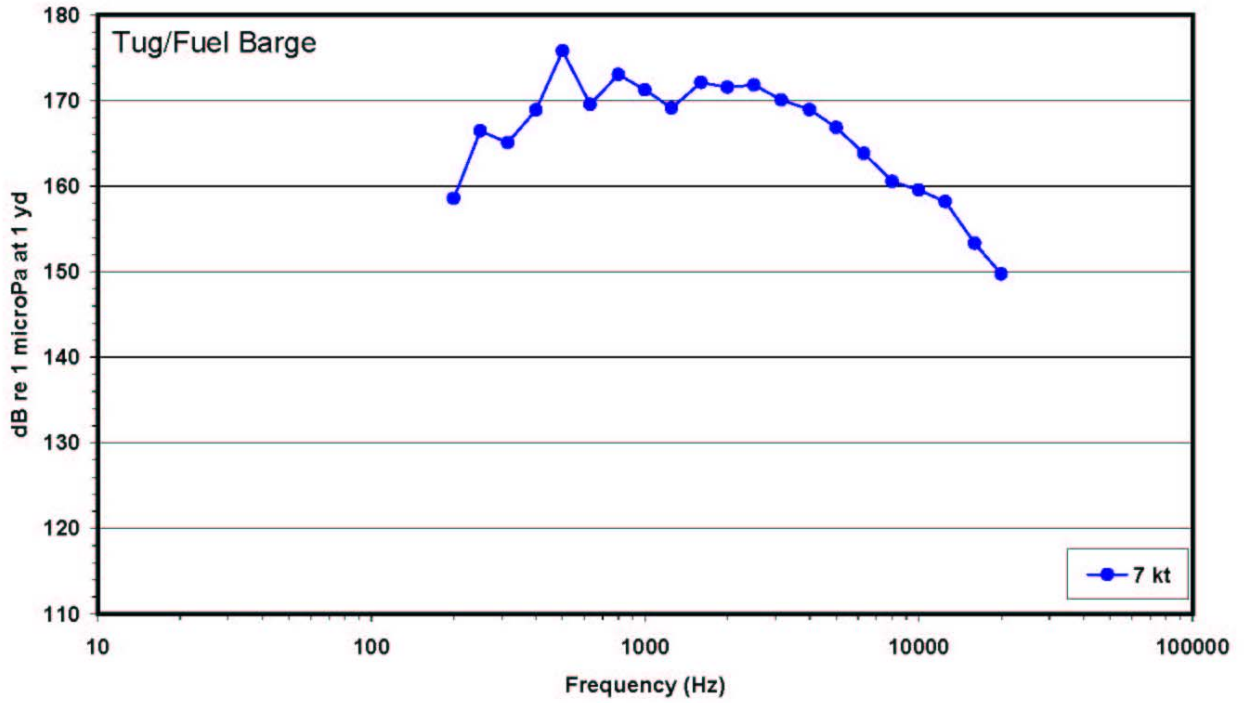


Fig. 21 Yorktown Clipper Radiated Noise

Tug with Fuel Barge in Tow Radiated Noise Levels



(Use Tug with Fuel Barge data with caution)

Fig. 22 Tug with Fuel Barge Radiated Noise

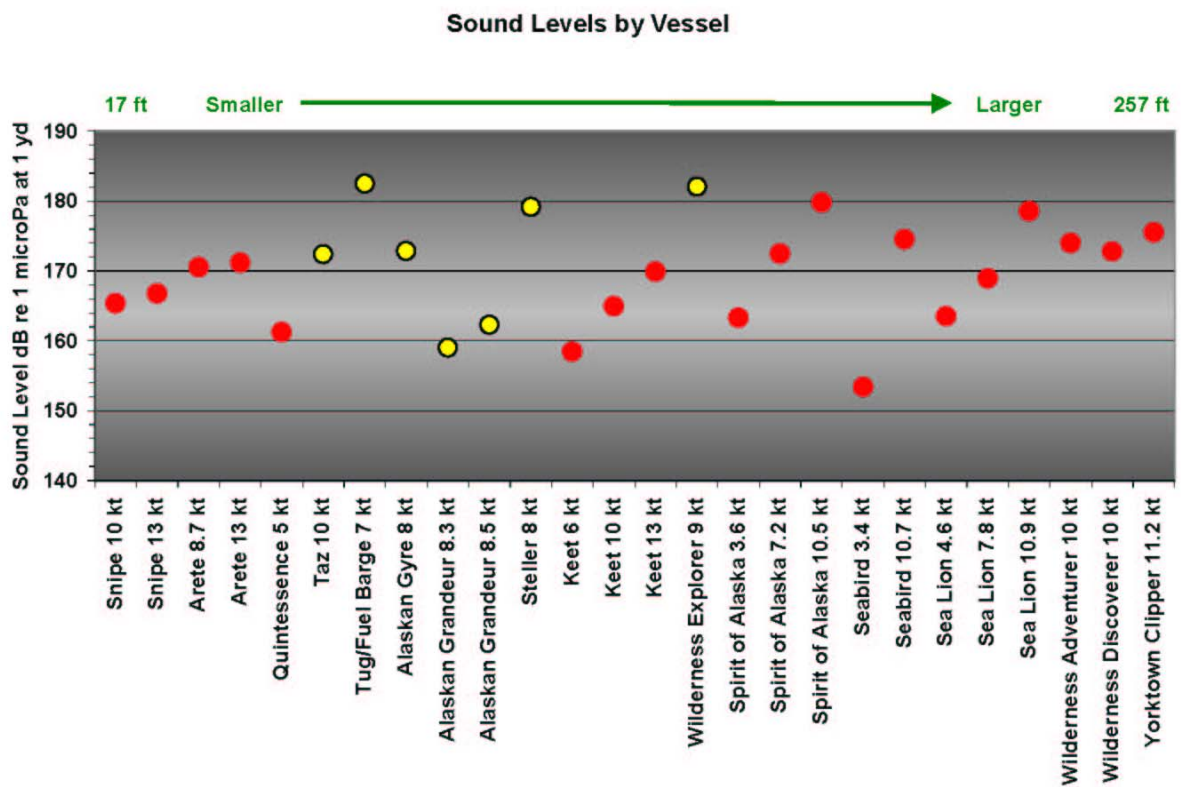


Fig. 23 Vessel Sound Levels

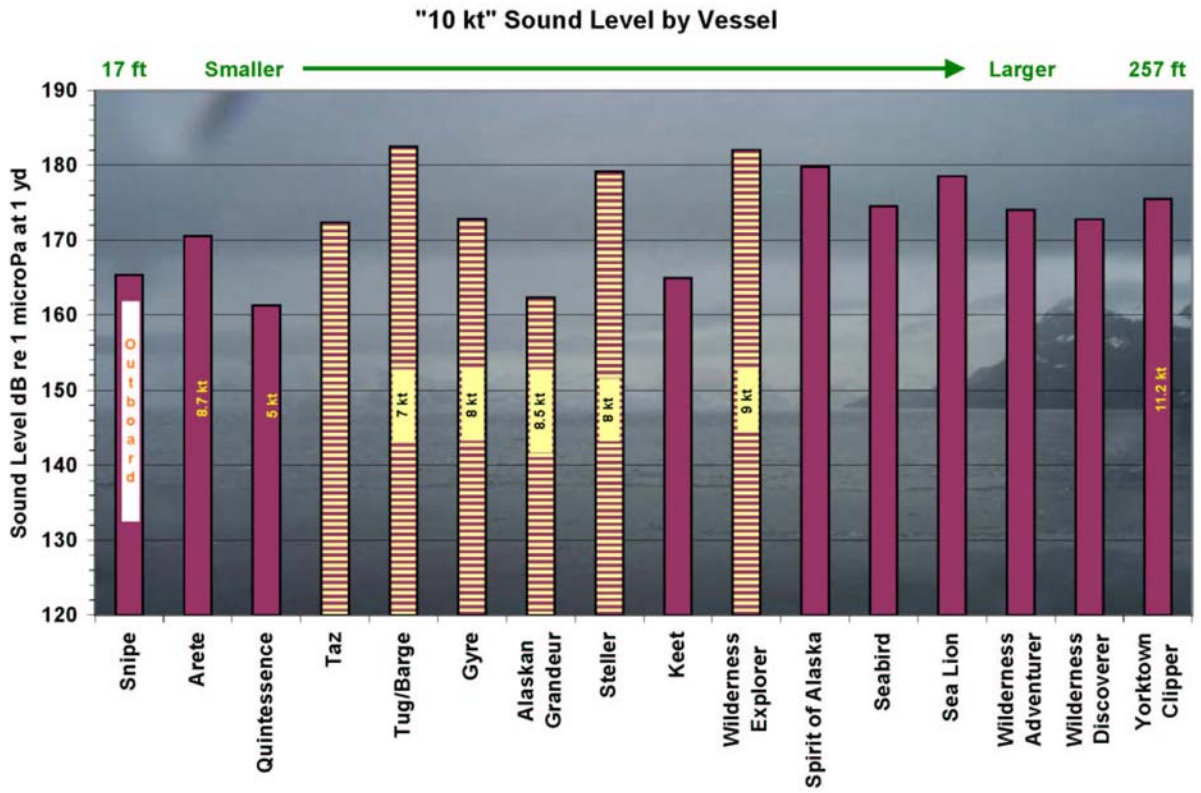


Fig. 24 "10-Knot" Sound Levels



Fig. 25 “10-Knot” Sound Level by Vessel Category

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