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State University of New York at Plattsburgh
Auditory Research Laboratories

Report No. ARL 86-2

The Effects of Blast Trauma (Impulse Noise) on Hearing: A Parametric Study

Final Report
Part 2

Roger P. Hamernik
William A. Ahroon
George A. Turrentine

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ABSTRACT

There are three broad goals to this project. The first and primary goal is to begin the systematic development of a data base from which one could estimate the hazards to hearing resulting from exposure to blast waves or other high level impulse noise transients. To achieve this primary objective the following two objectives must first be achieved: (1) to develop a methodology to efficiently acquire data on a large number of experimental animals that have been exposed to a variety of blast wave configurations. This includes audiometric, histological and acoustic variables; (2) to develop a set of blast wave simulation devices which can reliably generate blast waves with a variable distribution of spectral energy in a laboratory environment. This report will describe progress that was achieved on each of these objectives. Before the project termination, data acquisition was completed on 70 chinchillas that were exposed to one of a series of very low frequency (125 Hz) energy-content blast wave exposure paradigms. This data represents part of the first of four phases of a parametric study that was designed to estimate the contributions of individual blast wave exposure variables on the production of hearing loss. Hearing function was measured using the auditory evoked potential (AEP) technique. The evaluation of hearing consisted of pre- and postexposure measurements of pure tone thresholds and tuning curves (masked thresholds). Quantitative and qualitative data on each experimental cochlea was obtained from the traditional surface preparation technique. The objective of this approach was to correlate the exposure variables with functional and morphological indices of trauma. The blast waves used in this first study were generated using a conventional compressed air-driven shock tube. The following blast wave parameters were studied:

1. Intensity of the blast wave. The intensity was characterized by the peak sound pressure level of the initial positive over pressure, and by the total energy (J/m^2) of the exposure. Three intensities were used; 150, 155, and 160 dB peak SPL.

2. Inter-stimulus interval (ISI) i.e., the effects of repetition rate. Rates of 1/m, 10/m, and 1/10m were used.

3. Total number of impulses (N), where N = 1, 10 and 100.

The original goals of the project were not completed because the principal investigator moved from the University of Texas at Dallas to the State University of New York at Plattsburgh. Of the 21 groups specified in the original project, 13 were completed before moving. This report includes the raw data collected for those 13 groups. The remaining eight groups will be completed at the State University of New York at Plattsburgh (DAMD17-86-C-6172) and a final summary report will contain a detailed analysis of the data from all 21 groups.

Keywords: physiological effects; stress physiology; hearing; blast waves; exposure physiology; tables, data; (KT)

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Appendix

Individual and Group Statistics from:

The Effects of Blast Trauma (Impulse Noise) on Hearing: A Parametric Study

Part 2

Summary Data for the Group Exposed to:

155 dB, 100X, 10/M

Animal #		
1880	-	Completed the Entire Protocol
1922	-	Completed the Entire Protocol
1927	-	Completed the Entire Protocol
1945	-	Completed the Entire Protocol
1949	-	Completed the Entire Protocol
1953	-	Completed the Entire Protocol

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155 dB 100X 10/M

PRE-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1880	10.8	5.8	15.8	7.5	0.8	9.2	*****
1922	14.2	2.5	15.8	2.5	7.5	14.2	*****
1927	9.2	9.2	17.5	17.5	27.5	17.5	*****
1945	19.2	7.5	7.5	5.8	19.2	10.8	*****
1949	4.2	-0.8	9.2	14.2	30.8	35.8	*****
1953	12 5	5.8	7.5	-2.5	10.8	10.8	*****
Mean	11.7	5.0	12.2	7.5	16.1	16.4	*****
S.D.	5.0	3.6	4.6	7.4	11.8	10.0	*****

POST-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1880	44.2	54.2	57.5	49.2	57.5	75.8	*****
1922	4.2	5.8	17.5	-5.5	15.8	22.5	*****
1927	25.8	12.5	20.8	5.8	19.2	20.8	*****
1945	19.2	9.2	12.5	4.2	24.2	5.8	*****
1949	40.8	42.5	49.2	37.5	44.2	42.5	*****
1953	27.5	37.5	42.5	2.5	22.5	25.8	*****
Mean	26.9	26.9	33.3	15.6	30.6	32.2	*****
S.D.	14.6	20.3	18.8	22.1	16.5	24.4	*****

PERMANENT THRESHOLD SHIFT (dB)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1880	33.3	48.3	41.7	41.7	56.7	66.7	*****
1922	-10.0	3.3	1.7	-8.0	8.3	8.3	*****
1927	16.7	3.3	3.3	-11.7	-8.3	3.3	*****
1945	0.0	1.7	5.0	-1.7	5.0	-5.0	*****
1949	36.7	43.3	40.0	23.3	13.3	6.7	*****
1953	15.0	31.7	35.0	5.0	11.7	15.0	*****
Mean	15.3	21.9	21.1	8.1	14.4	15.8	*****
S.D.	18.2	21.7	19.6	20.6	22.1	25.8	*****

155 dB 100X 10/M

TEMPORARY THRESHOLD SHIFT (dB)

Frequency 0.5 kHz

Animal\Hr	0	2	8	24	240	Max
1880	76.7	66.7	56.7	61.7	41.7	76.7
1922	48.3	23.3	23.3	13.3	8.3	48.3
1927	38.3	33.3	33.3	33.3	18.3	38.3
1945	13.3	23.3	28.3	8.3	8.3	28.3
1949	78.3	78.3	78.3	78.3	43.3	78.3
1953	60.0	65.0	70.0	55.0	*****	70.0
Mean	52.5	48.3	48.3	41.7	24.0	56.7
S.D.	24.7	24.5	23.2	28.0	17.4	21.2

Frequency 2.0 kHz

Animal\Hr	0	2	8	24	240	Max
1880	71.7	72.2*	71.7	71.7	51.7	72.2
1922	46.7	21.7	21.7	6.7	6.7	46.7
1927	25.0	15.0	10.0	10.0	5.0	25.0
1945	30.0	40.0	50.0	15.0	10.0	50.0
1949	73.3	78.3	78.3	73.3	48.3	78.3
1953	70.0	75.0	80.0	65.0	*****	80.0
Mean	52.8	50.4	52.0	40.3	24.3	58.7
S.D.	21.9	28.5	30.2	32.8	23.5	21.8

Frequency 8.0 kHz

Animal\Hr	0	2	8	24	240	Max
1880	86.7	81.7	81.7	81.7	56.7	86.7
1922	75.0	45.0	45.0	15.0	5.0	75.0
1927	35.0	15.0	-10.0	-5.0	-5.0	35.0
1945	68.3	68.3	68.3	28.3	3.3	68.3
1949	51.7	56.7	56.7	56.7	16.7	56.7
1953	76.7	76.7	76.7	46.7	*****	76.7
Mean	65.6	57.2	53.1	37.2	15.3	66.4
S.D.	18.9	24.6	33.7	31.0	24.4	18.3

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 10/M

Probe Frequency: 0.5 kHz

Masker (kHz):		0.150	0.200	0.300	0.400	0.520	0.600	0.650	0.750	1.300	2.200
Animal (Q-10 dB)						Pre-Exposure					
1880	(1.73)	67.5	67.5	57.5	42.5	32.5	27.5	32.5	32.5	72.5	87.5
1922	(1.49)	72.5	67.5	57.5	47.5	37.5	42.5	42.5	47.5	72.5	82.5
1927	(3.92)	62.5	62.5	47.5	37.5	27.5	12.5	17.5	27.5	62.5	82.5
1945	(5.36)	72.5	67.5	52.5	42.5	37.5	27.5	42.5	42.5	67.5	77.5
1949	(1.98)	62.5	62.5	47.5	32.5	17.5	17.5	17.5	37.5	67.5	82.5
1953	(1.48)	72.5	62.5	47.5	37.5	32.5	32.5	37.5	47.5	67.5	82.5
Mean	(2.66)	68.3	65.0	51.7	40.0	30.8	26.7	31.7	39.2	68.3	82.5
S.D.	(1.61)	4.9	2.7	4.9	5.2	7.5	10.7	11.6	8.2	3.8	3.2
Animal (Q-10 dB)						Post-Exposure					
1880	(0.50)	77.5	72.5	67.5	67.5	67.5	72.5	72.5	77.5	77.5	82.5
1922	(2.69)	67.5	52.5	52.5	37.5	27.5	27.5	22.5	42.5	57.5	77.5
1927	(0.84)	77.5	72.5	62.5	47.5	47.5	47.5	32.5	37.5	37.5	77.5
1945	(2.84)	67.5	57.5	47.5	42.5	32.5	27.5	22.5	32.5	37.5	47.5
1949	(1.25)	77.5	72.5	72.5	67.5	62.5	62.5	62.5	77.5	77.5	82.5
1953	(5.65)	72.5	72.5	67.5	57.5	57.5	57.5	47.5	62.5	77.5	82.5
Mean	(2.30)	73.3	66.7	61.7	53.3	49.2	49.2	43.3	55.0	60.8	75.0
S.D.	(1.90)	4.9	9.2	9.7	12.8	16.3	18.6	21.1	20.2	19.7	13.7

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 10/M

Probe Frequency: 1.0 kHz

Masker (kHz):		0.150	0.200	0.400	0.550	0.800	1.050	1.300	1.700	1.900	2.500
Animal (Q-10 dB)						Pre-Exposure					
1880	(3.16)	67.5	72.5	57.5	42.5	22.5	42.5	37.5	67.5	77.5	87.5
1922	(2.24)	72.5	77.5	52.5	47.5	22.5	17.5	32.5	47.5	47.5	82.5
1927	(1.26)	77.5	77.5	62.5	42.5	22.5	27.5	32.5	67.5	77.5	82.5
1945	(1.84)	77.5	77.5	57.5	52.5	32.5	22.5	27.5	52.5	52.5	67.5
1949	(2.10)	72.5	77.5	57.5	47.5	27.5	17.5	27.5	57.5	77.5	82.5
1953	(2.24)	82.5	77.5	57.5	52.5	27.5	22.5	37.5	47.5	67.5	82.5
Mean	(2.14)	75.0	76.7	57.5	47.5	25.8	25.0	32.5	56.7	66.7	80.8
S.D.	(0.62)	5.2	2.0	3.2	4.5	4.1	9.4	4.5	9.2	13.6	6.8
Animal (Q-10 dB)						Post-Exposure					
1880	(6.25)	82.5	82.5	77.5	82.5	77.5	47.5	77.5	87.5	77.5	82.5
1922	(1.18)	67.5	62.5	52.5	37.5	22.5	22.5	32.5	52.5	57.5	72.5
1927	(2.55)	82.5	77.5	62.5	47.5	42.5	32.5	47.5	72.5	72.5	82.5
1945	(0.92)	72.5	72.5	67.5	52.5	27.5	27.5	27.5	42.5	62.5	72.5
1949	(2.46)	82.5	82.5	77.5	57.5	47.5	77.5	67.5	67.5	72.5	72.5
1953	(0.92)	77.5	77.5	67.5	57.5	47.5	47.5	52.5	67.5	67.5	72.5
Mean	(2.38)	77.5	75.8	67.5	55.8	44.2	42.5	50.8	65.0	68.3	75.8
S.D.	(2.04)	6.3	7.5	9.5	15.1	19.4	20.0	19.4	15.7	7.4	5.2

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 10/M

Probe Frequency: 2.0 kHz

Masker (kHz):		0.300	0.750	0.900	1.300	1.700	2.050	2.200	3.000	3.500	4.000
Animal (Q-10 dB)					Pre-Exposure						
1880	(1.78)	77.5	47.5	42.5	57.5	42.5	42.5	47.5	57.5	82.5	82.5
1922	(1.02)	77.5	47.5	37.5	52.5	32.5	32.5	37.5	37.5	52.5	77.5
1927	(0.62)	67.5	37.5	27.5	32.5	32.5	32.5	37.5	42.5	57.5	82.5
1945	(1.52)	77.5	42.5	42.5	32.5	27.5	32.5	37.5	42.5	67.5	82.5
1949	(2.17)	77.5	52.5	37.5	57.5	27.5	22.5	27.5	37.5	47.5	82.5
1953	(1.58)	62.5	57.5	37.5	37.5	32.5	22.5	27.5	32.5	57.5	82.5
Mean	(1.45)	73.3	47.5	37.5	45.0	32.5	30.8	35.8	41.7	60.8	81.7
S.D.	(0.55)	6.6	7.1	5.5	12.1	5.5	7.5	7.5	8.6	12.5	2.0
Animal (Q-10 dB)					Post-Exposure						
1880	(2.31)	77.5	77.5	77.5	77.5	77.5	82.5	82.5	72.5	82.5	82.5
1922	(4.09)	67.5	42.5	42.5	42.5	32.5	22.5	32.5	27.5	37.5	47.5
1927	(5.24)	67.5	37.5	37.5	37.5	32.5	17.5	27.5	37.5	47.5	77.5
1945	(2.28)	77.5	47.5	37.5	32.5	27.5	22.5	32.5	42.5	62.5	82.5
1949	(1.89)	67.5	57.5	52.5	57.5	47.5	47.5	57.5	52.5	47.5	62.5
1953	(6.00)	77.5	67.5	57.5	52.5	62.5	52.5	57.5	47.5	32.5	52.5
Mean	(3.64)	72.5	55.0	50.8	50.0	46.7	40.8	48.3	46.7	51.7	67.5
S.D.	(1.74)	5.5	15.4	15.4	16.4	19.9	25.0	21.3	15.3	18.3	15.5

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 10/M

Probe Frequency: 4.0 kHz

Masker (kHz):		0.450	1.300	2.200	3.000	3.500	4.100	4.500	5.000	5.600	6.000
Animal (Q-10 dB)						Pre-Exposure					
1880	(4.76)	82.5	62.5	62.5	37.5	32.5	22.5	37.5	42.5	57.5	72.5
1922	(5.06)	82.5	52.5	62.5	42.5	22.5	7.5	17.5	27.5	37.5	47.5
1927	(3.49)	77.5	57.5	62.5	47.5	32.5	27.5	37.5	47.5	62.5	82.5
1945	(2.78)	77.5	47.5	62.5	42.5	22.5	22.5	32.5	47.5	67.5	77.5
1949	(4.10)	77.5	52.5	82.5	57.5	47.5	37.5	47.5	82.5	77.5	87.5
1953	(3.49)	72.5	52.5	52.5	32.5	17.5	12.5	22.5	37.5	57.5	67.5
Mean	(3.95)	78.3	54.2	64.2	43.3	29.2	21.7	32.5	47.5	60.0	72.5
S.D.	(0.86)	3.8	5.2	9.8	8.6	10.8	10.7	11.0	18.7	13.3	14.1
Animal (Q-10 dB)						Post-Exposure					
1880	(6.19)	62.5	72.5	82.5	52.5	77.5	77.5	87.5	62.5	82.5	82.5
1922	(6.77)	77.5	67.5	62.5	47.5	32.5	17.5	37.5	37.5	32.5	57.5
1927	(3.18)	77.5	57.5	62.5	32.5	22.5	22.5	*****	22.5	57.5	77.5
1945	(3.32)	77.5	52.5	57.5	42.5	22.5	27.5	37.5	57.5	67.5	67.5
1949	(4.76)	82.5	57.5	67.5	52.5	47.5	37.5	52.5	62.5	72.5	72.5
1953	(5.62)	82.5	77.5	62.5	57.5	22.5	12.5	42.5	67.5	77.5	82.5
Mean	(4.97)	80.0	64.2	65.8	47.5	37.5	32.5	51.5	51.7	65.0	73.3
S.D.	(1.49)	2.7	9.8	8.8	8.9	21.9	23.7	21.0	17.7	18.1	9.7

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 10/M

Probe Frequency: 8.0 kHz

Masker (kHz):		0.450	1.300	2.500	5.900	7.000	8.100	9.300	11.000	12.700	14.000
Animal (Q-10 dB)					**Pre-Exposure**						
1880	(5.29)	87.5	82.5	77.5	52.5	32.5	17.5	32.5	47.5	77.5	87.5
1922	(5.19)	77.5	57.5	47.5	32.5	12.5	2.5	27.5	57.5	72.5	82.5
1927	(1.35)	87.5	67.5	67.5	47.5	42.5	42.5	42.5	67.5	77.5	82.5
1945	(3.86)	82.5	62.5	57.5	37.5	27.5	42.5	32.5	57.5	[illegible].5	82.5
1949	(4.31)	82.5	62.5	62.5	47.5	42.5	32.5	47.5	67.5	67.5	82.5
1953	(1.03)	67.5	57.5	52.5	32.5	22.5	27.5	27.5	27.5	32.5	47.5
Mean	(3.50)	80.8	65.0	60.8	41.7	30.0	27.5	35.0	54.2	65.0	77.5
S.D.	(1.87)	7.5	9.4	10.8	8.6	11.7	15.5	8.2	15.1	17.0	14.8
Animal (Q-10 dB)					**Post-Exposure**						
1880	(*****)	87.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5
1922	(3.02)	82.5	62.5	57.5	42.5	27.5	27.5	52.5	67.5	77.5	82.5
1927	(2.75)	77.5	57.5	57.5	42.5	32.5	22.5	22.5	47.5	72.5	82.5
1945	(1.17)	82.5	62.5	57.5	37.5	37.5	37.5	52.5	57.5	77.5	77.5
1949	(2.03)	82.5	62.5	62.5	57.5	47.5	47.5	42.5	52.5	77.5	82.5
1953	(3.18)	82.5	67.5	57.5	37.5	27.5	37.5	47.5	67.5	82.5	82.5
Mean	(2.43)	82.5	65.8	62.5	50.0	42.5	42.5	50.0	62.5	78.3	81.7
S.D.	(0.83)	3.2	8.8	10.0	17.5	21.0	21.4	19.4	12.6	3.8	2.0

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 10/M

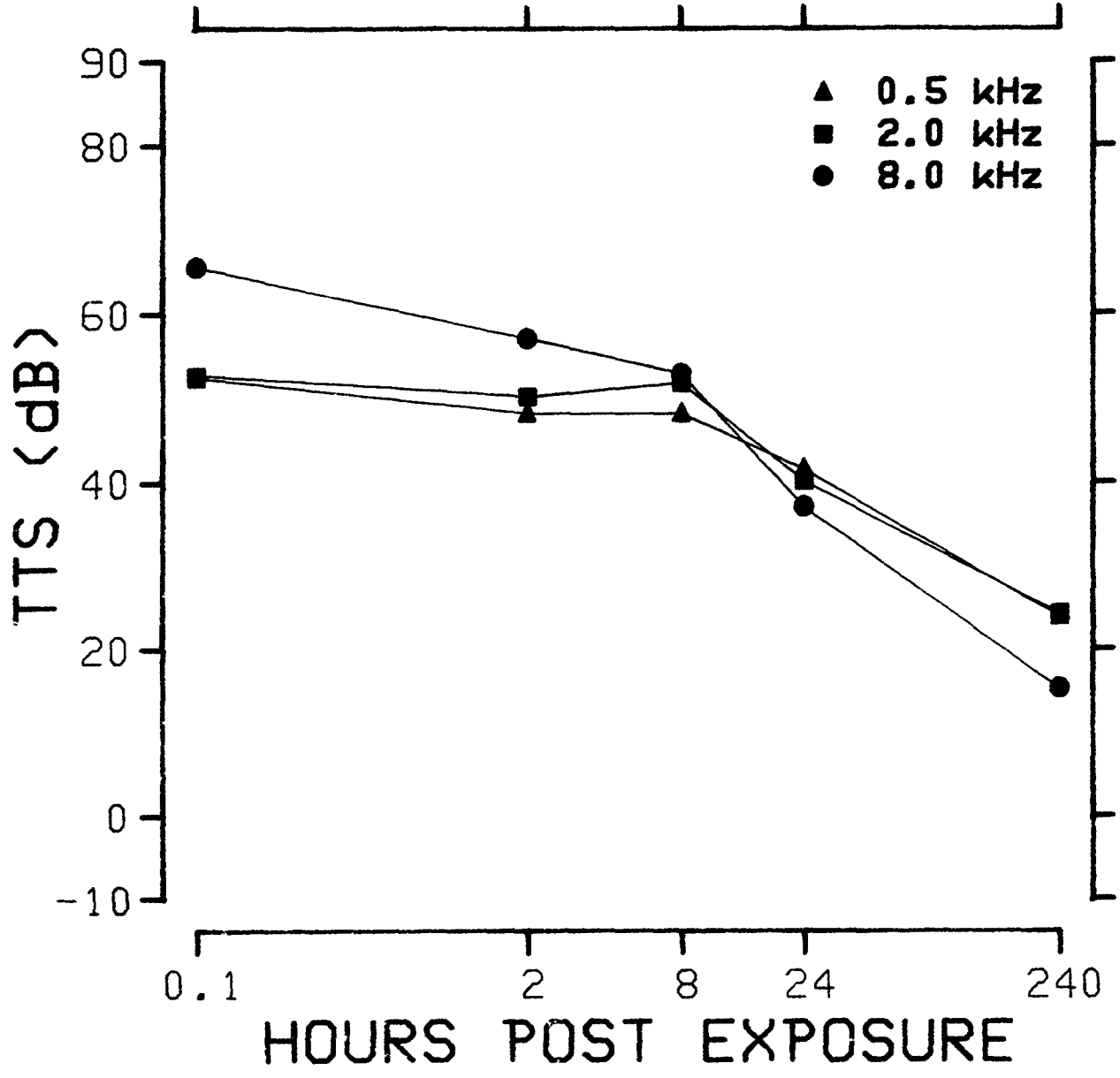
Probe Frequency: 11.2 kHz

Masker (kHz):		1.000	4.000	7.000	9.000	11.000	11.500	12.000	13.000	14.500	16.000
Animal (Q-10 dB)					Pre-Exposure						
1880	(10.55)	90.0*	52.5	47.5	62.5	32.5	47.5	42.5	42.5	77.5	72.5
1922	(5.95)	72.5	42.5	47.5	42.5	17.5	17.5	27.5	37.5	57.5	77.5
1927	(5.75)	62.5	47.5	47.5	47.5	47.5	37.5	42.5	47.5	62.5	72.5
1945	(4.24)	82.5	42.5	57.5	52.5	37.5	32.5	32.5	42.5	57.5	72.5
1949	(0.97)	62.5	62.5	47.5	47.5	47.5	47.5	57.5	52.5	67.5	77.5
1953	(11.48)	67.5	42.5	47.5	47.5	27.5	17.5	27.5	27.5	52.5	52.5
Mean	(6.49)	72.9	48.3	49.2	50.0	35.0	33.3	38.3	41.7	62.5	70.8
S.D.	(3.94)	11.2	8.0	4.1	6.9	11.7	13.6	11.6	8.6	8.9	9.3
Animal (Q-10 dB)					Post-Exposure						
1880	(1.40)	82.5	82.5	72.5	82.5	87.5	87.5	87.5	87.5	77.5	77.5
1922	(5.75)	67.5	47.5	47.5	57.5	37.5	27.5	32.5	37.5	72.5	72.5
1927	(9.50)	57.5	47.5	47.5	32.5	32.5	37.5	27.5	40.5	57.5	57.5
1945	(3.26)	57.5	32.5	32.5	32.5	17.5	17.5	17.5	27.5	47.5	42.5
1949	(0.70)	62.5	52.5	47.5	52.5	47.5	47.5	57.5	47.5	62.5	67.5
1952	(3.30)	57.5	47.5	42.5	42.5	17.5	17.5	17.5	17.5	47.5	62.5
Mean	(3.99)	64.2	51.7	48.3	50.0	40.0	39.2	40.0	43.0	60.8	63.3
S.D.	(3.23)	9.8	16.6	13.2	18.9	26.0	26.4	27.5	24.2	12.5	12.4

The Group Mean Recovery Curves

Measured at Three Test Frequencies

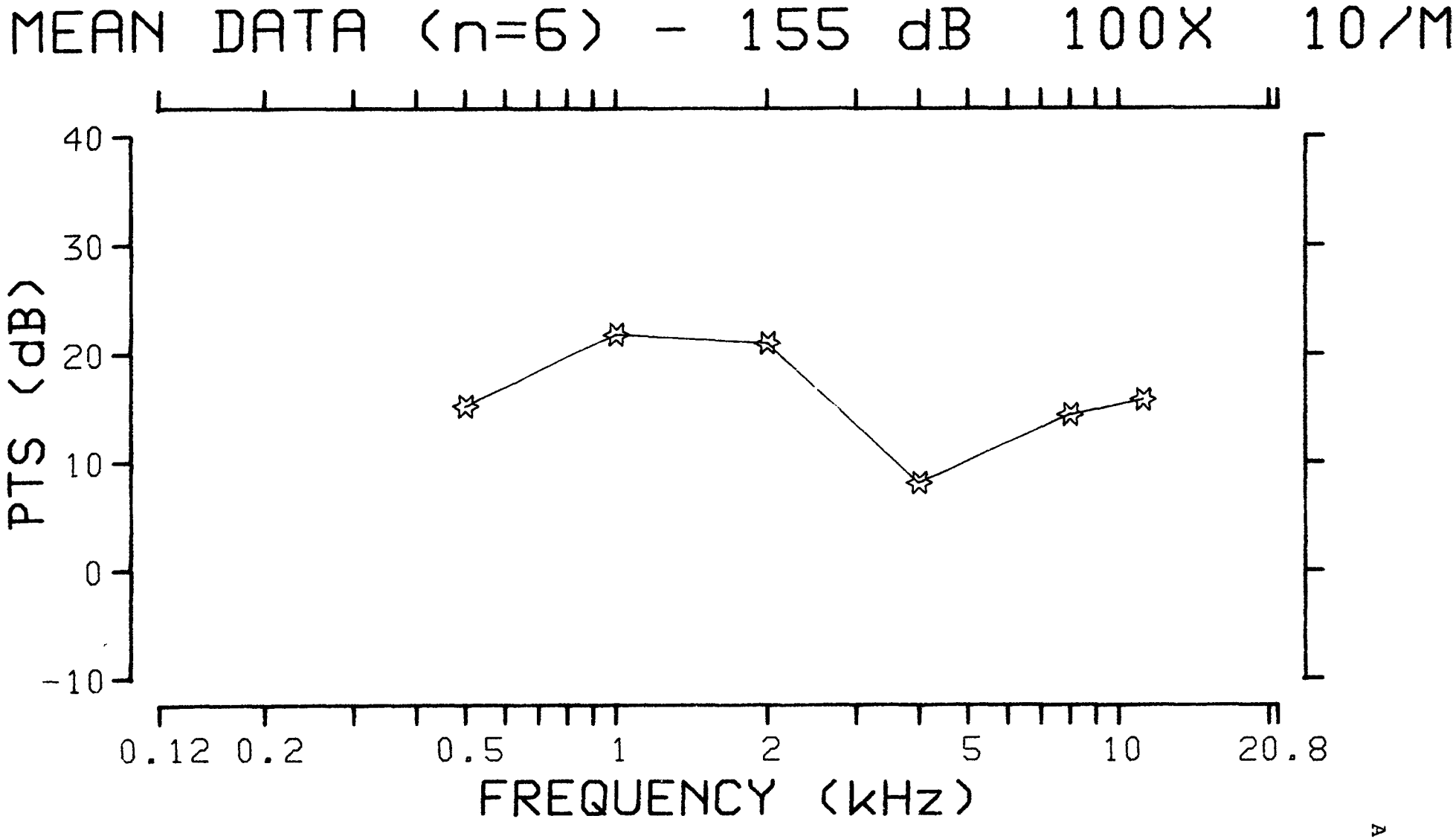
MEAN DATA (n=6) - 155 dB 100X 10/M



A249

The Group Mean Permanent Threshold Shift (PTS)

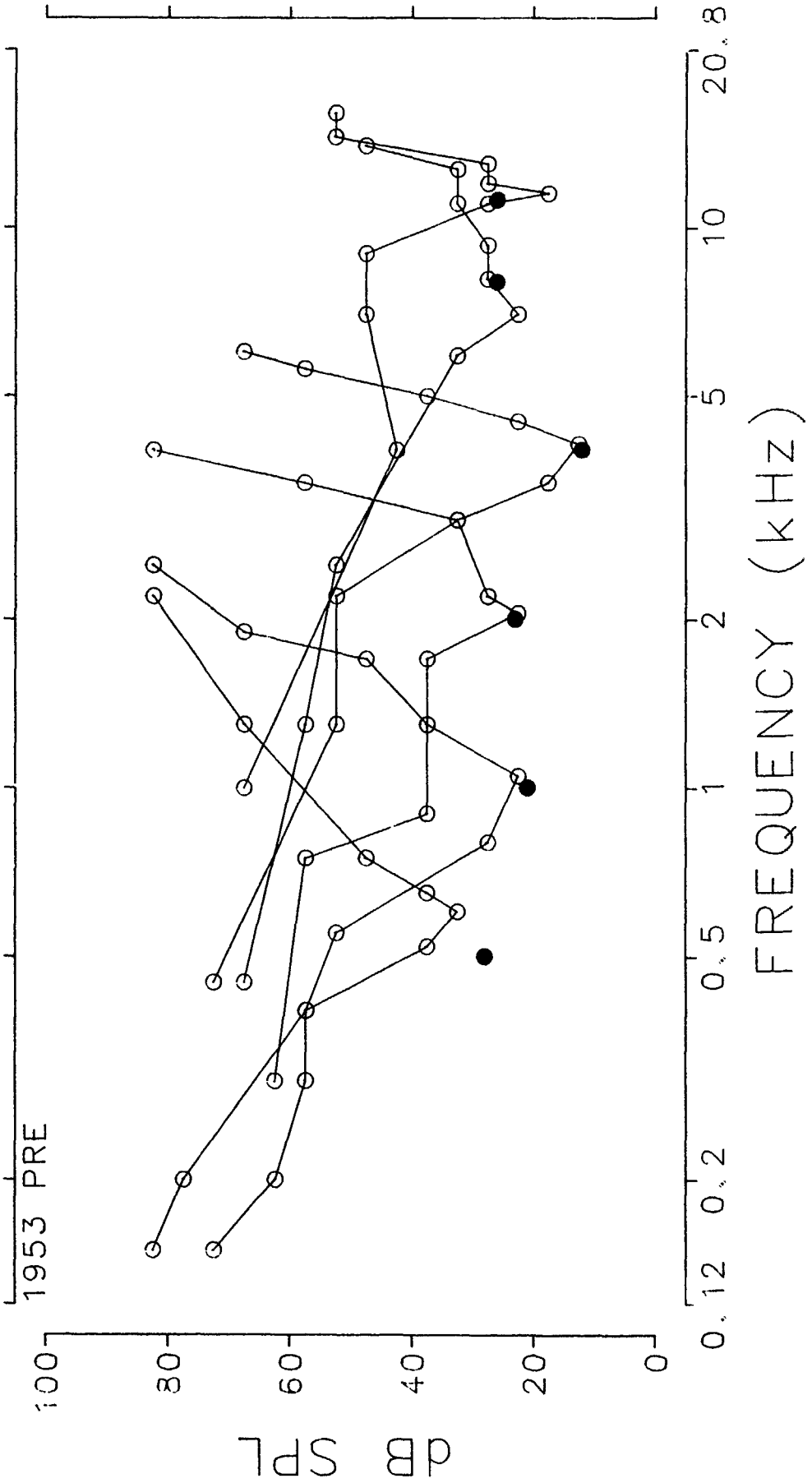
for all Test Frequencies

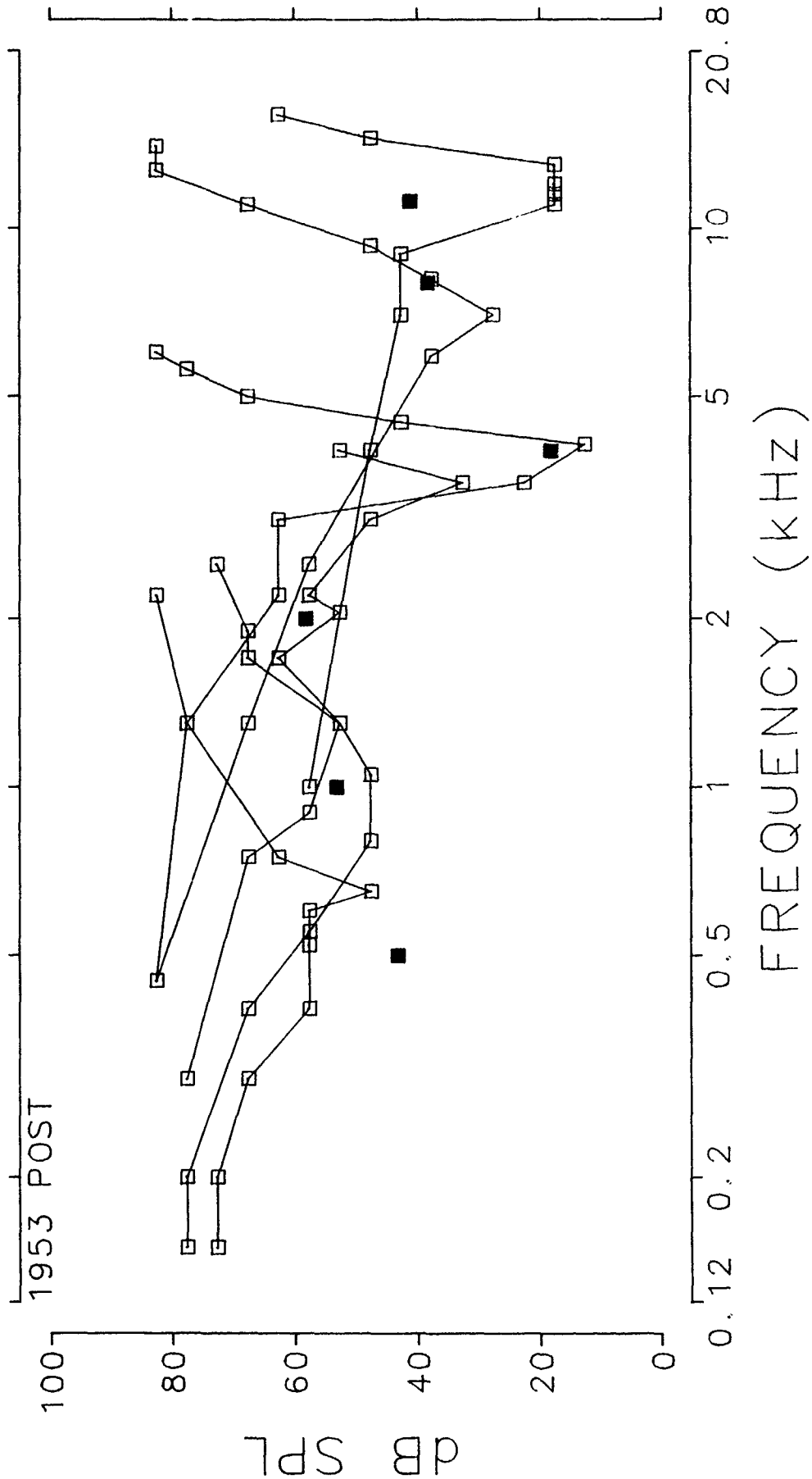

MEAN DATA (n=6) - 155 dB 100X 10/M
PTS (dB)
40
30
20
10
0
-10
0.12 0.2 0.5 1 2 5 10 20.8
FREQUENCY (kHz)

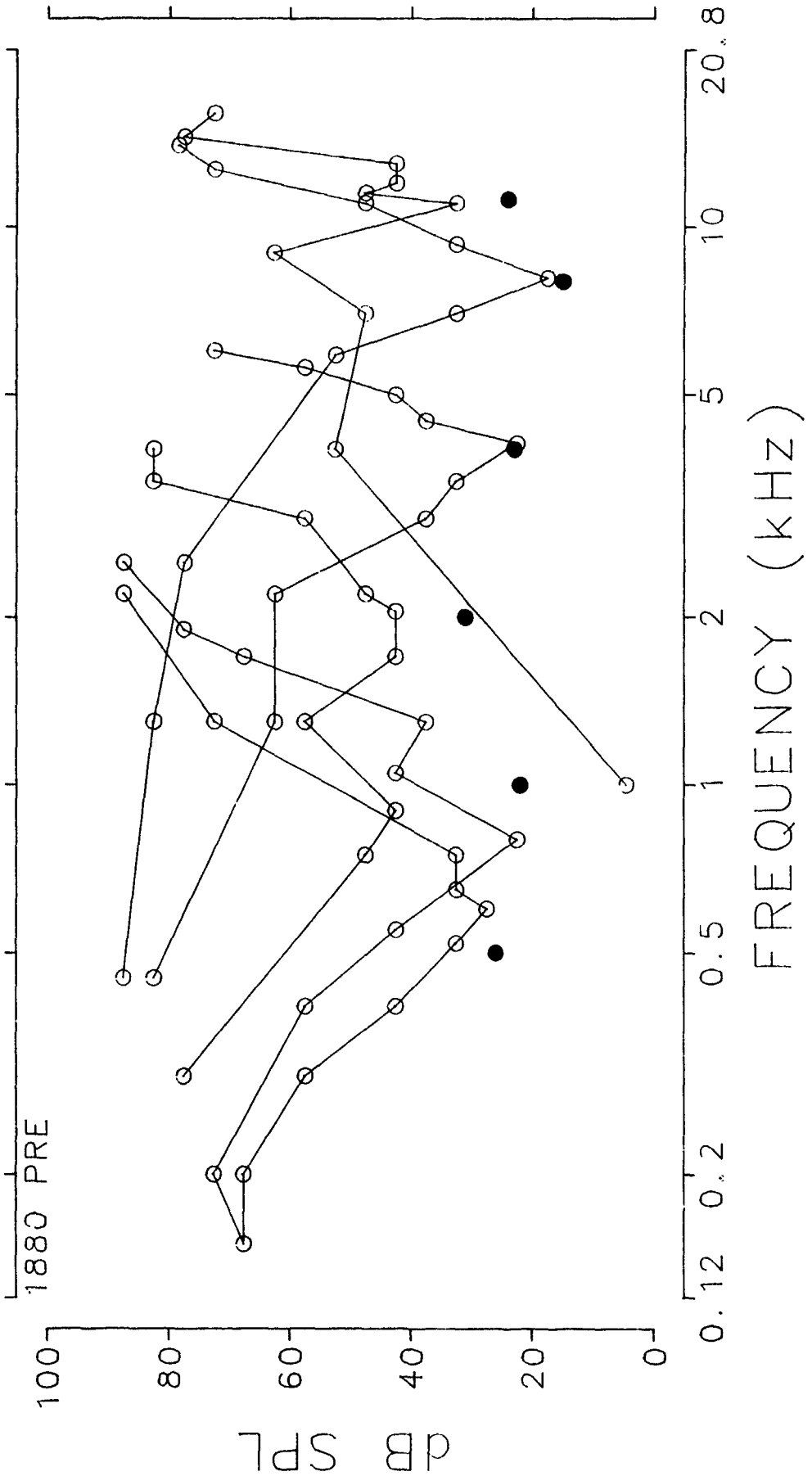
A251

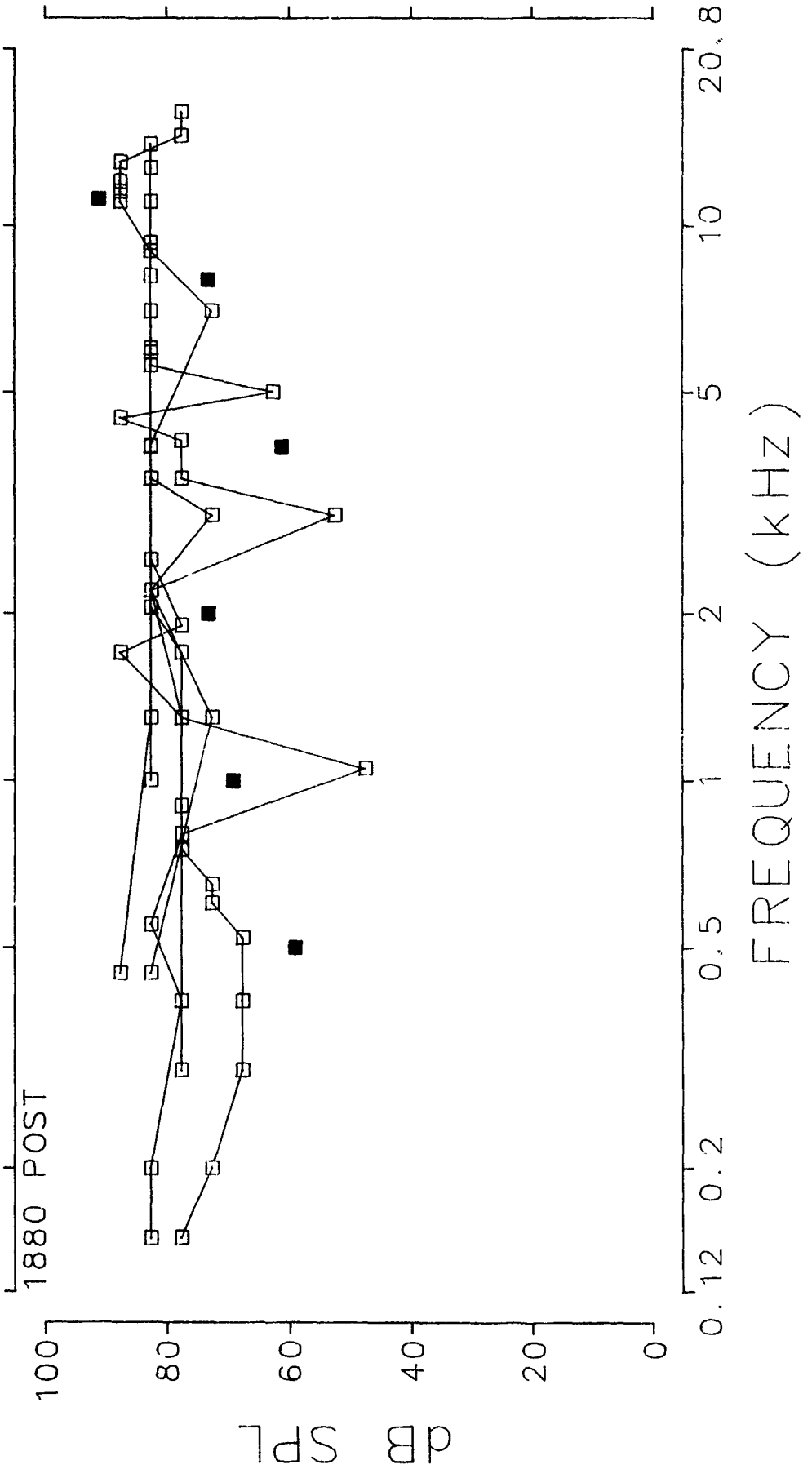
The Pre and Postexposure Tuning Curves for Individual Animals in this Exposure Group.

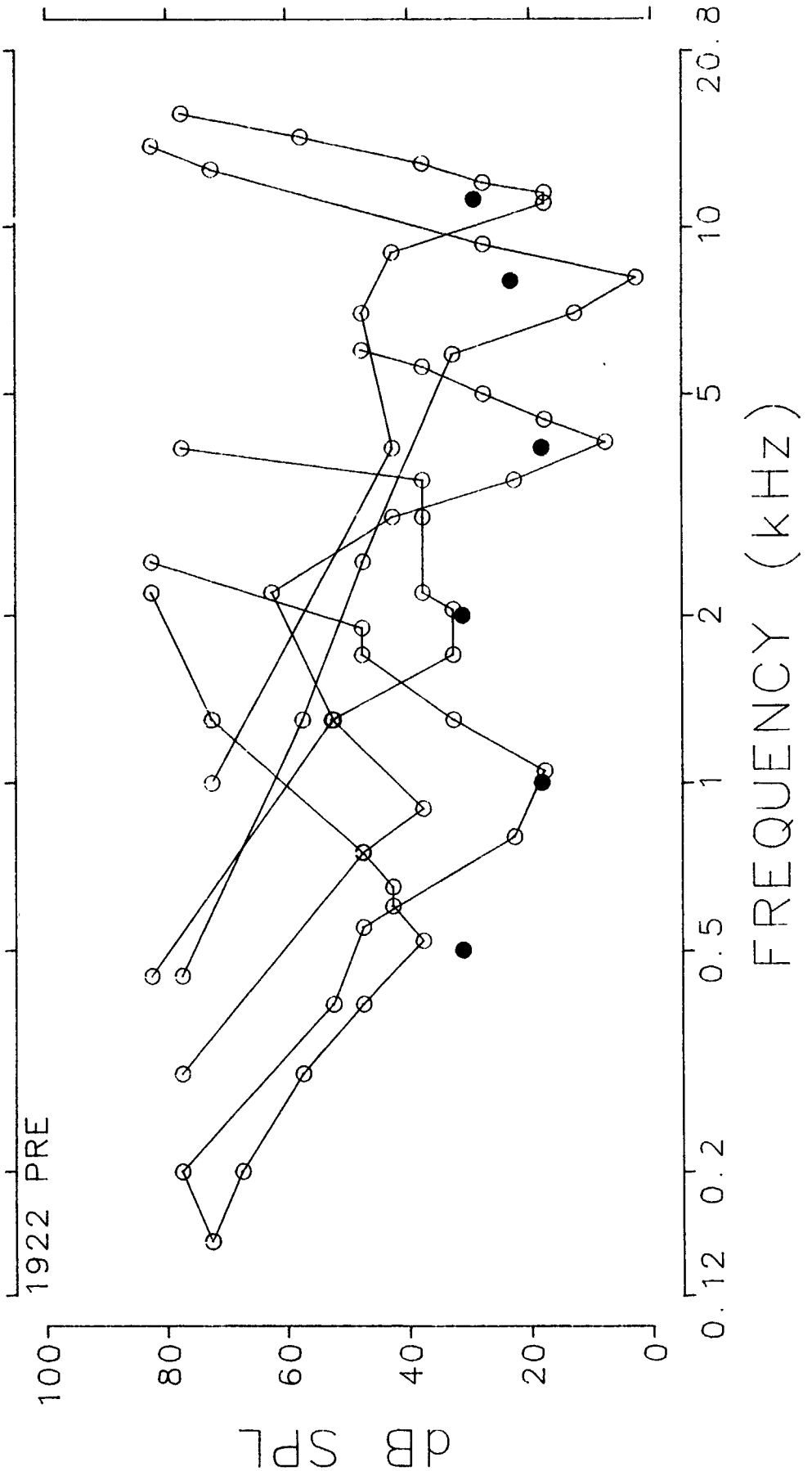
The solid symbol represents the threshold of the probe tone.

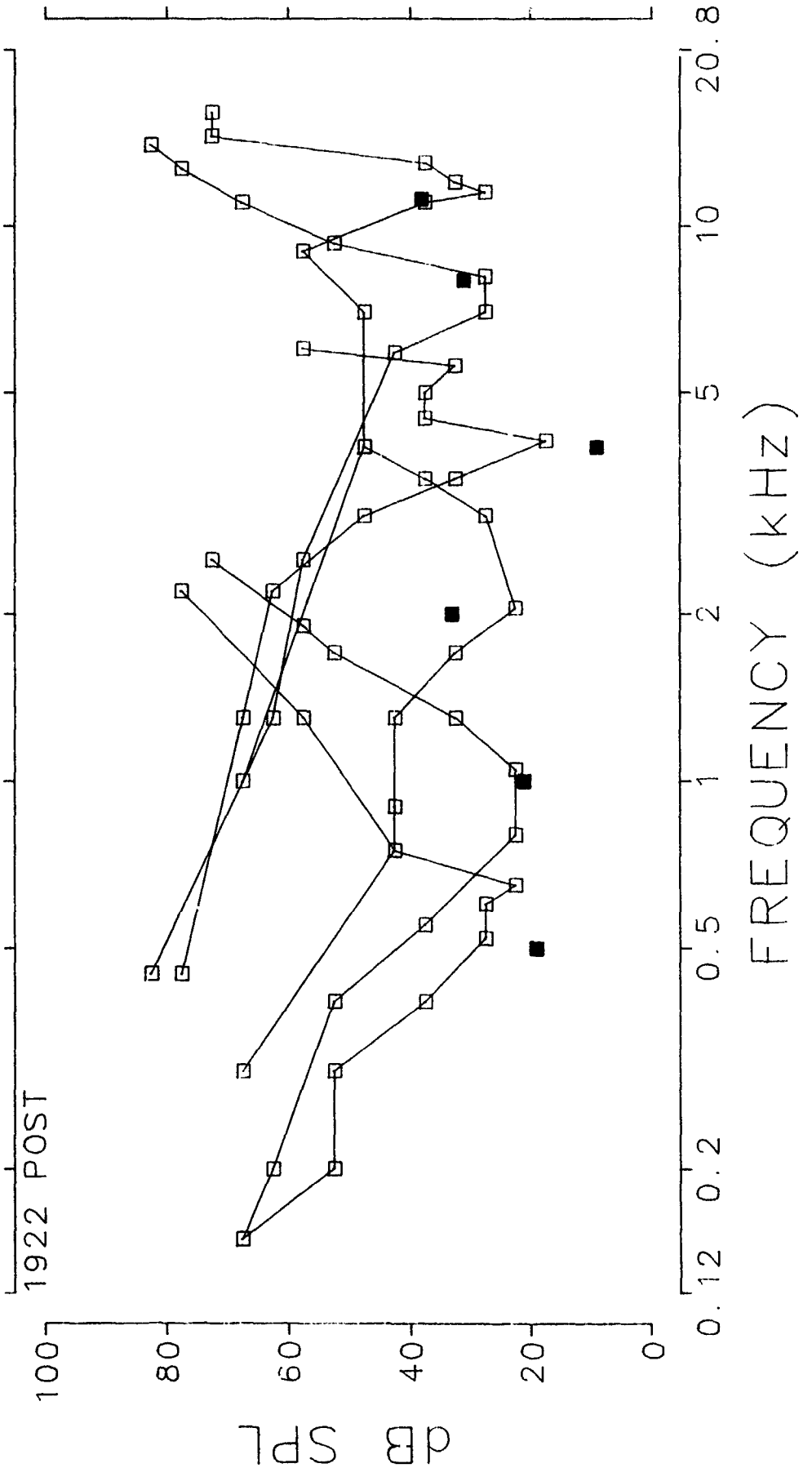

1953 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

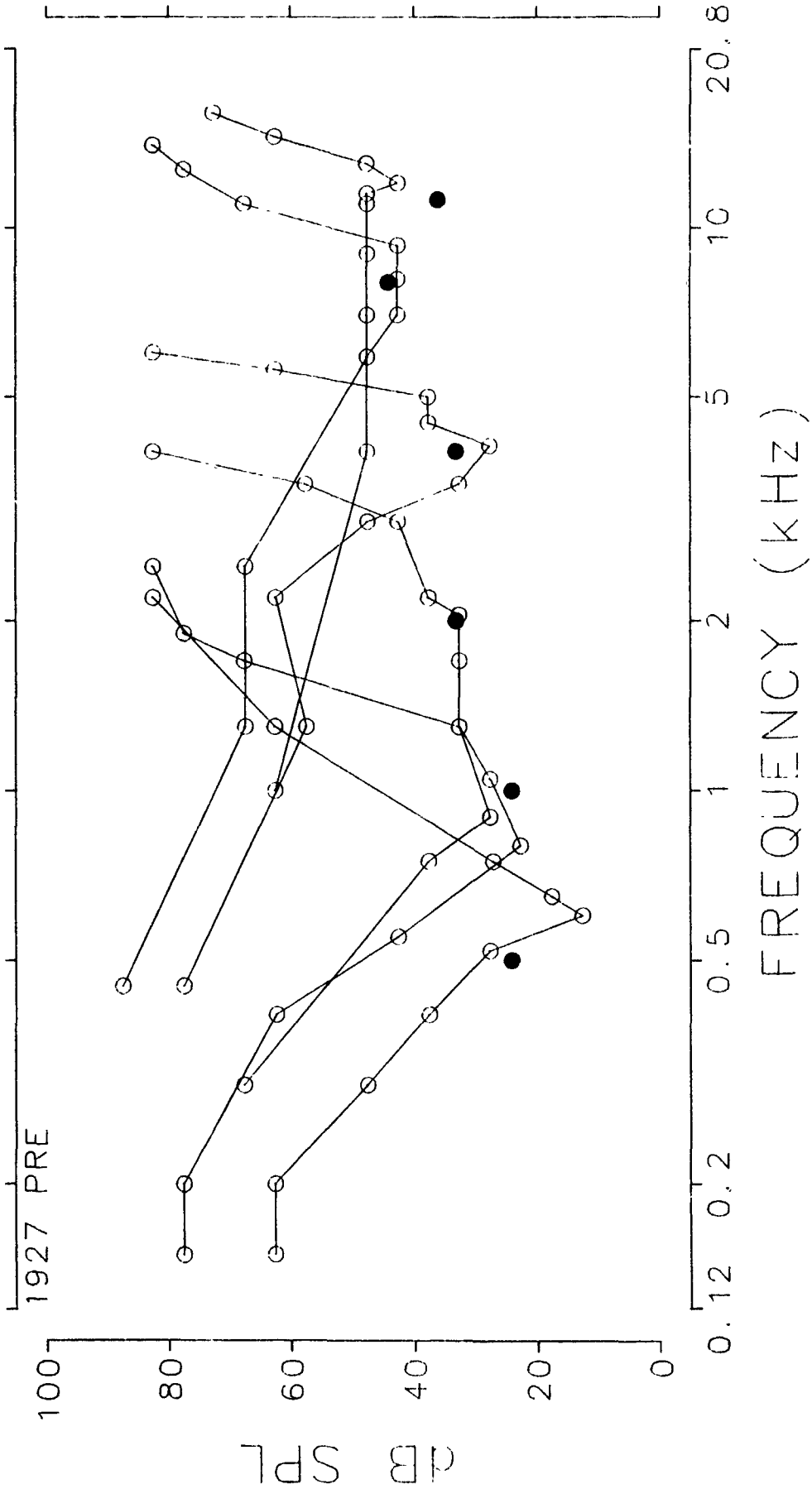

1953 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

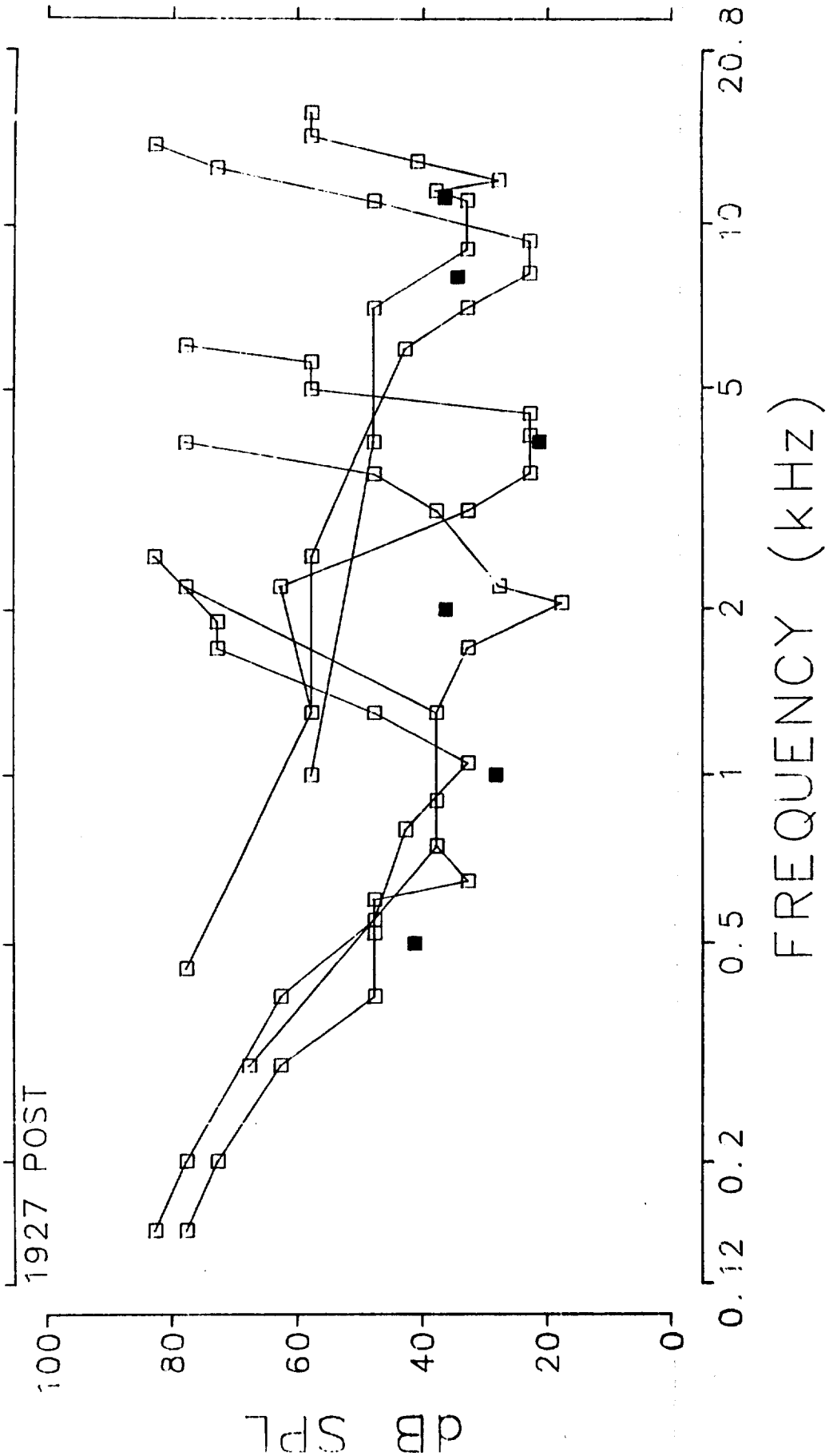

1880 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

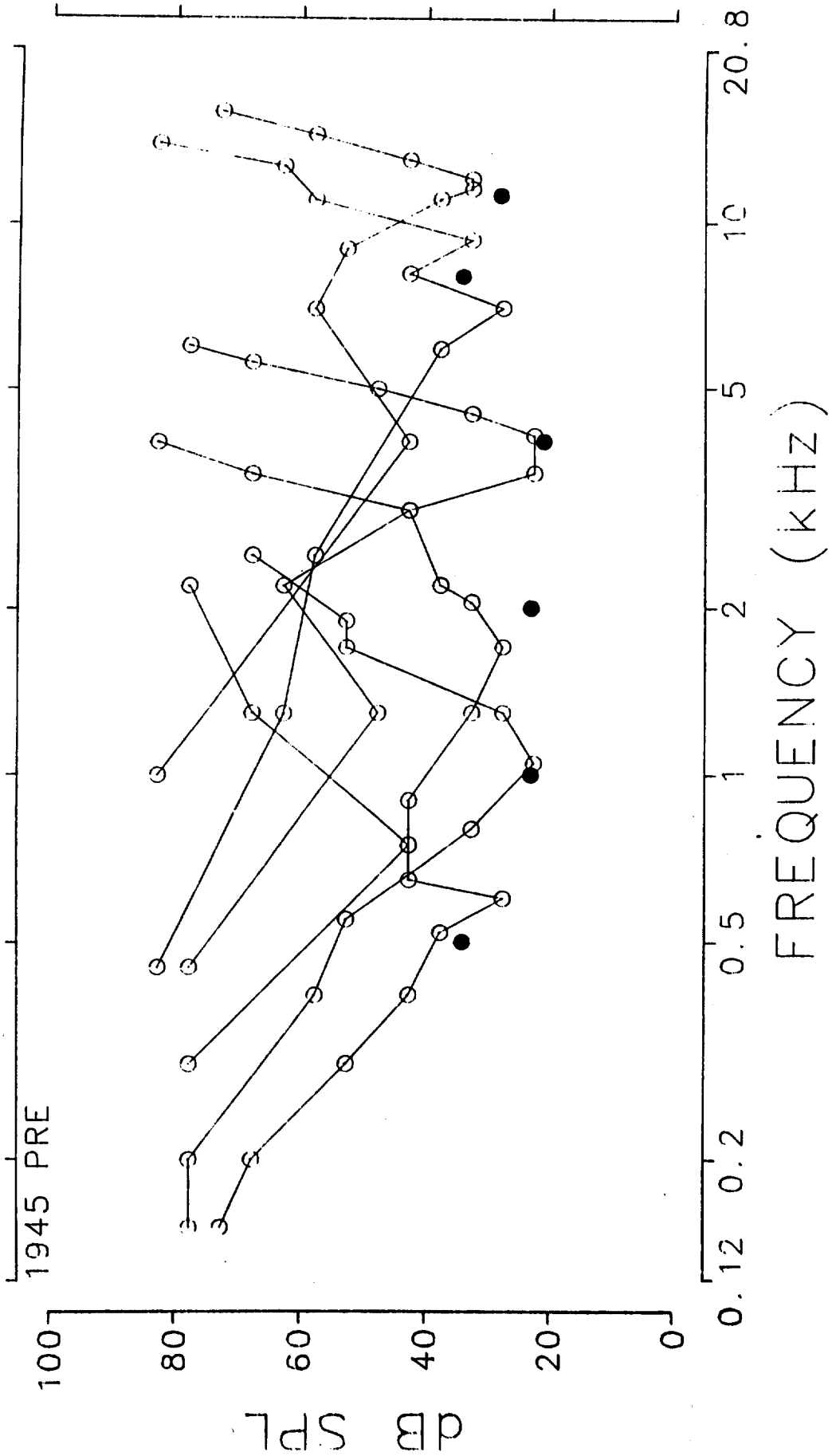

1880 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

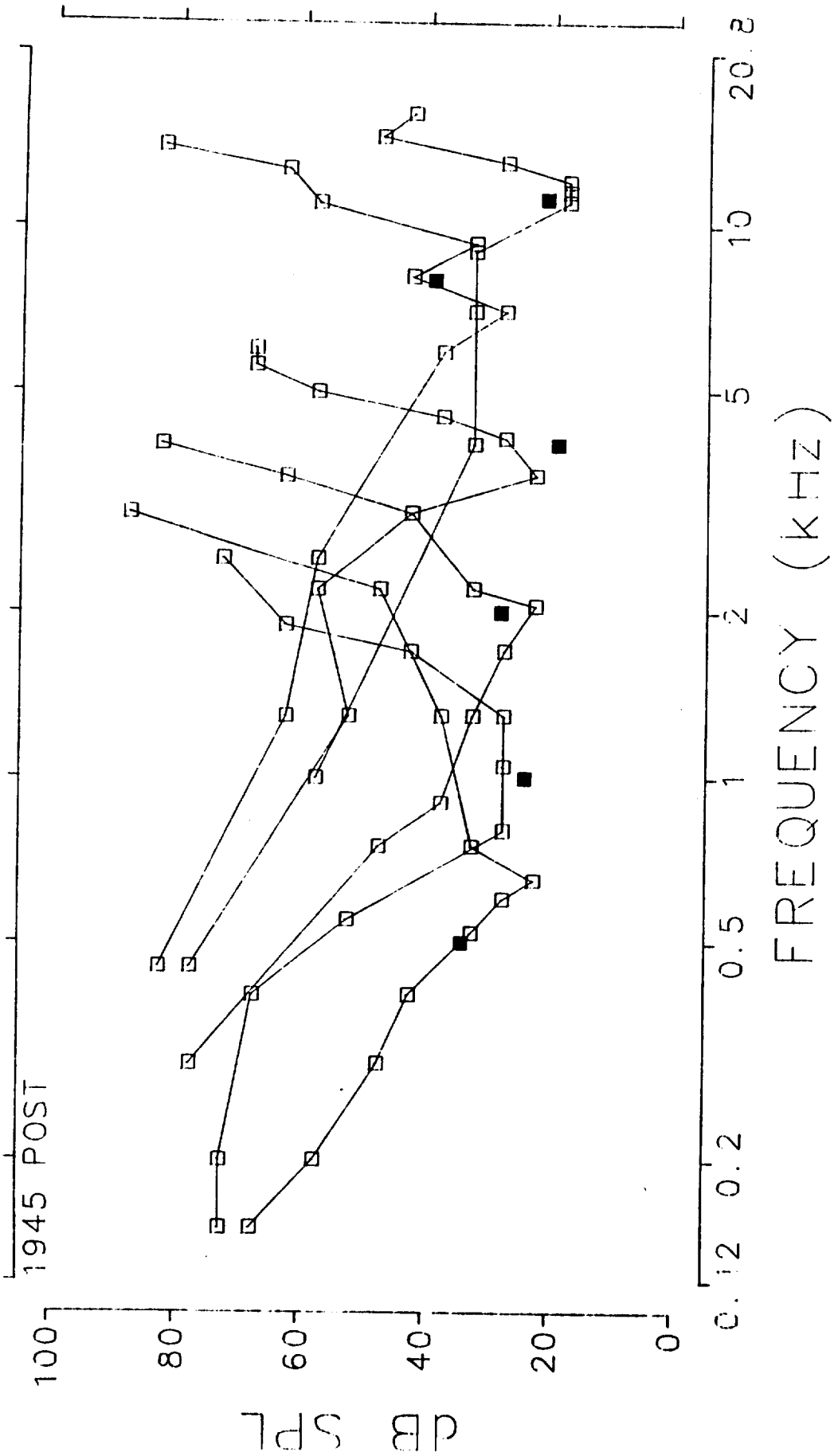

1922 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

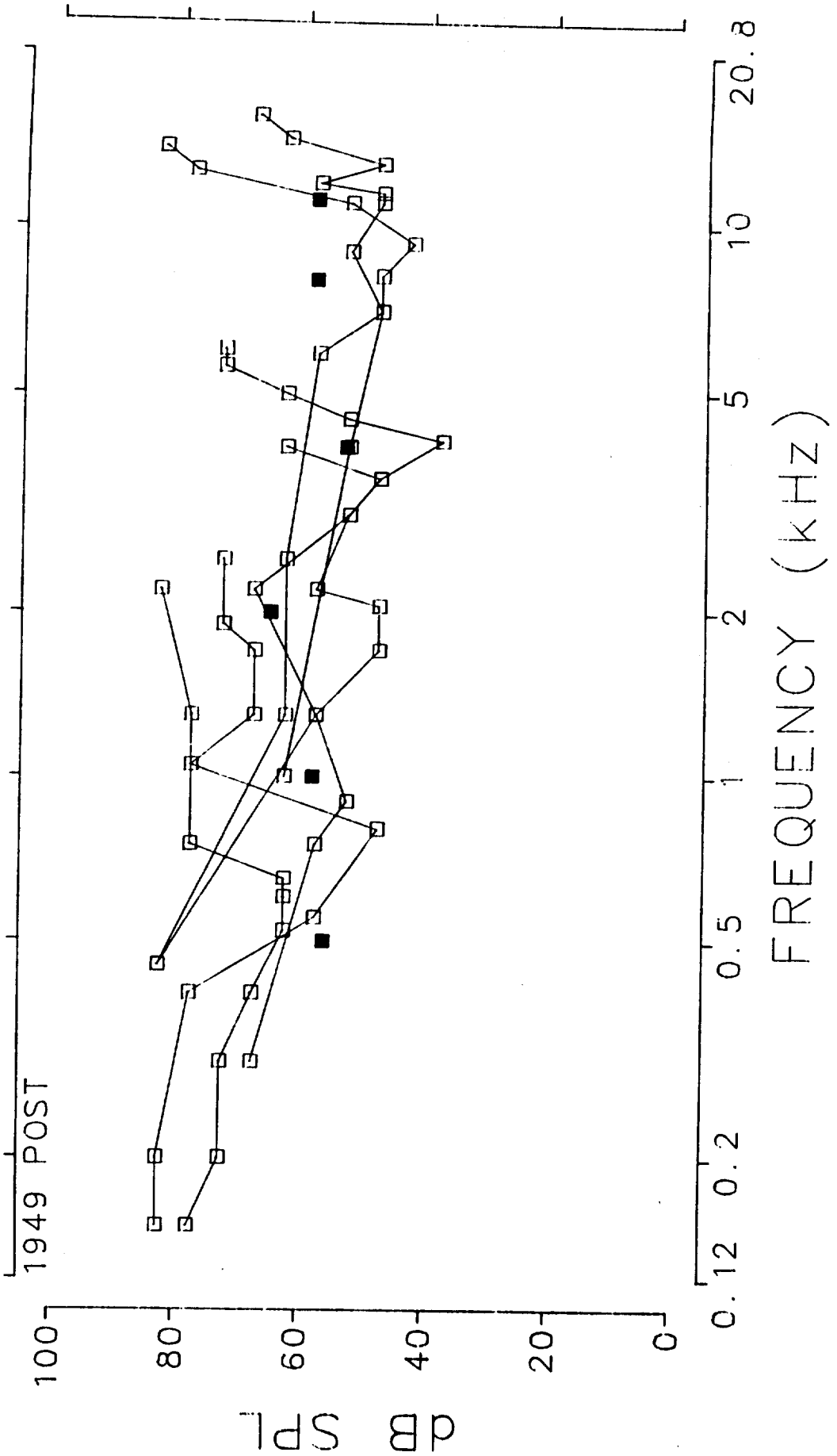

1922 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

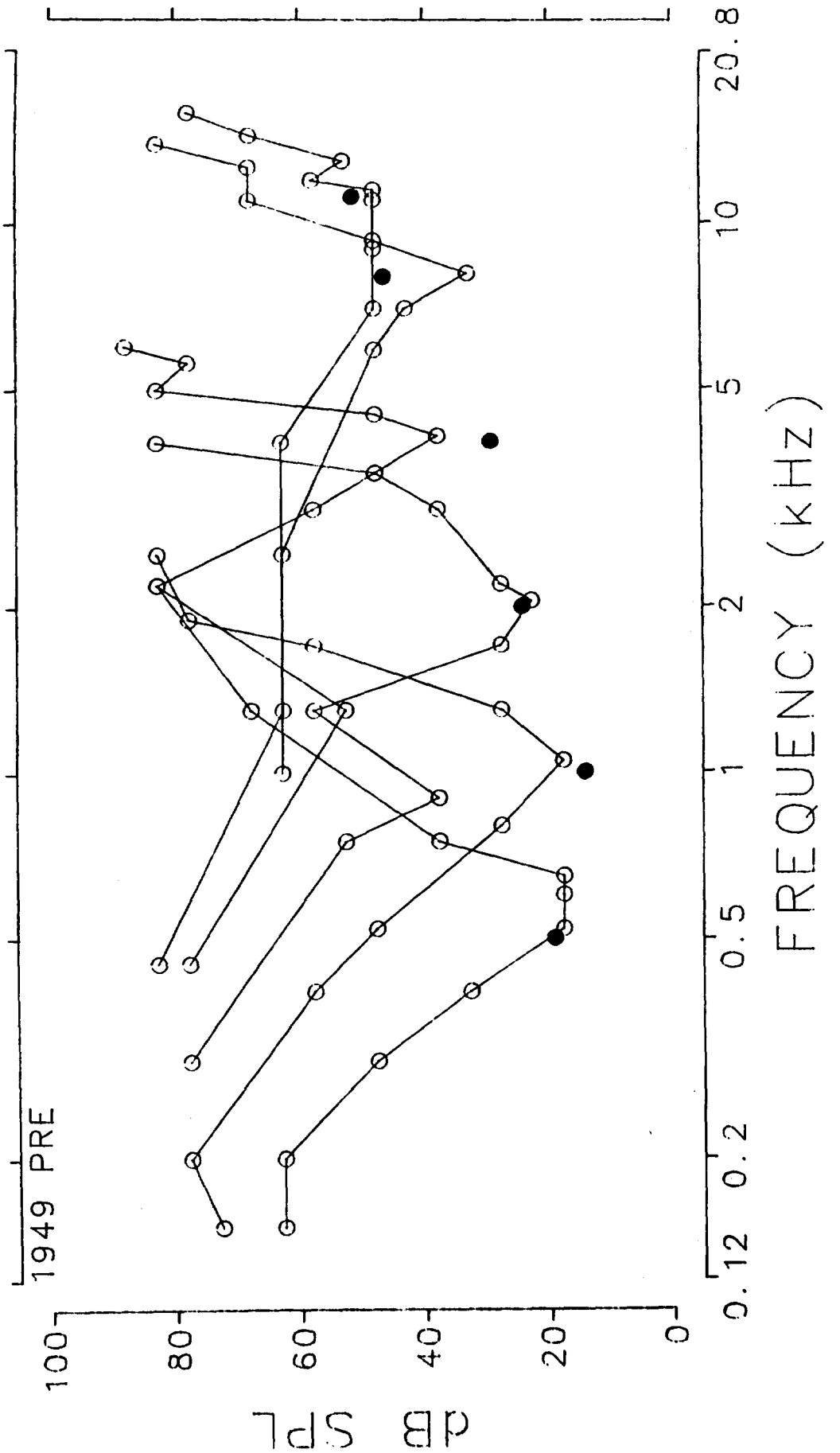

1927 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1927 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)


1945 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1945 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20
FREQUENCY (KHZ)


1949 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1949 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

SHOCK TUBE EXPOSURE
155 dB, 100X, 10/MIN

TOTAL NUMBER OF COCHLEAR SENSORY CELLS MISSING

ANIMAL NUMBER	INNER HAIR CELLS	1ST ROW OUTER HAIR CELLS	2ND ROW OUTER HAIR CELLS	3RD ROW OUTER HAIR CELLS	TOTAL OUTER HAIR CELLS
R1880R	108	2235	2146	1696	6077
R1922R	27	104	134	142	380
R1927R	56	586	517	495	1598
R1945R	68	85	122	163	370
R1949R	138	1342	1521	1412	4275
R1953R	116	551	682	975	2208
GROUP MEAN	86				2485
S.D.	42				2275

TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND LENGTHS OF THE COCHLEA CENTERED AT THE FREQUENCIES INDICATED

	OCTAVE BAND CENTER FREQUENCY	INNER HAIR CELLS	OUTER HAIR CELLS
GROUP MEANS			
	0.125 kHz	2.8	64.8
	0.25 kHz	4.8	139.2
	0.5 kHz	7.0	348.2
	1 kHz	38.0	459.2
	2 kHz	5.5	414.8
	4 kHz	9.0	366.8
	8 kHz	14.3	440.5
	16 kHz	4.0	242.0
STANDARD DEVIATIONS			
	0.125 kHz	2.4	24.1
	0.25 kHz	6.0	141.2
	0.5 kHz	9.8	301.2
	1 kHz	42.5	493.5
	2 kHz	8.1	467.4
	4 kHz	12.9	463.7
	8 kHz	22.7	390.9
	16 kHz	3.8	364.7

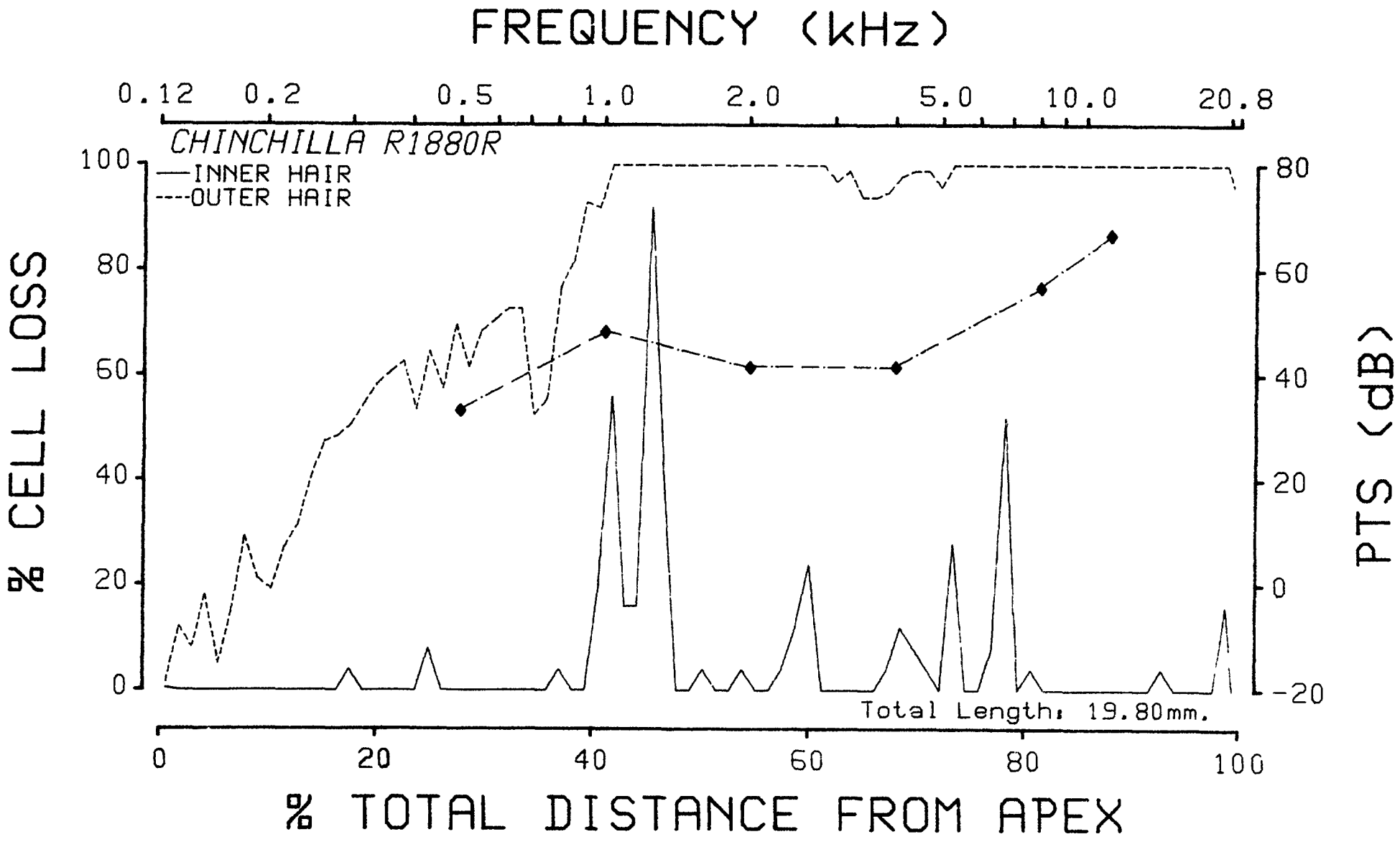
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1880R							
0.125 kHz	1	8	18	48	74	0	1
0.25 kHz	1	252	132	33	417	0	0
0.5 kHz	2	327	314	43	684	5	5
1 kHz	57	302	334	250	886	112	120
2 kHz	12	341	341	341	1023	10	61
4 kHz	14	339	341	314	994	29	54
8 kHz	16	341	341	341	1023	44	114
16 kHz	5	310	310	310	930	2	11
TOTALS	108	2235	2146	1696	6077	202	366
CHINCHILLA R1922R							
0.125 kHz	7	2	14	25	41	0	4
0.25 kHz	16	40	44	48	132	22	26
0.5 kHz	4	29	38	33	100	7	26
1 kHz	0	3	5	3	11	0	0
2 kHz	0	0	2	2	4	0	0
4 kHz	0	1	1	0	2	0	0
8 kHz	0	28	26	27	81	0	0
16 kHz	0	0	4	4	8	0	0
TOTALS	27	104	134	142	380	29	56
CHINCHILLA R1927R							
0.125 kHz	4	24	24	49	97	0	0
0.25 kHz	2	52	13	16	81	1	0
0.5 kHz	27	262	253	232	747	62	72
1 kHz	1	11	11	6	28	1	0
2 kHz	0	33	19	15	67	0	3
4 kHz	6	28	15	12	55	0	0
8 kHz	5	68	47	26	141	1	0
16 kHz	11	106	133	138	377	0	0
TOTALS	56	586	517	495	1598	65	75

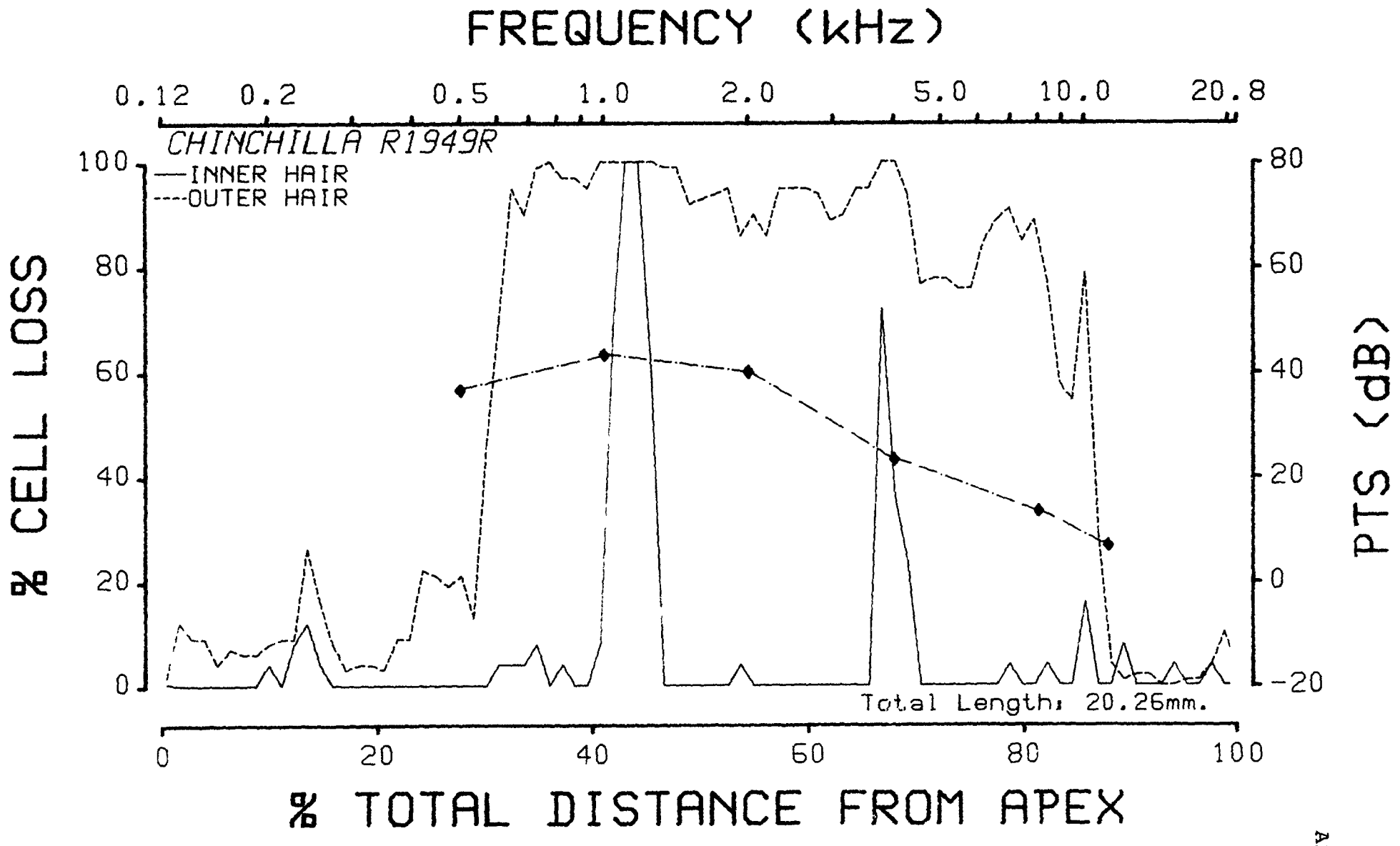
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1945R							
0.125 kHz	1	4	6	26	36	2	1
0.25 kHz	0	3	3	11	17	1	0
0.5 kHz	4	1	17	14	32	0	0
1 kHz	0	3	19	7	29	0	0
2 kHz	1	1	7	15	23	0	0
4 kHz	1	2	0	6	8	0	0
8 kHz	59	65	65	73	203	21	23
16 kHz	2	6	5	11	22	0	2
TOTALS	68	85	122	163	370	24	26
CHINCHILLA R1949R							
0.125 kHz	1	6	11	41	58	0	1
0.25 kHz	7	29	25	45	99	5	8
0.5 kHz	2	132	94	90	316	5	62
1 kHz	84	368	367	358	1093	183	194
2 kHz	1	330	332	281	943	5	22
4 kHz	33	277	335	305	917	83	86
8 kHz	6	195	341	285	821	7	4
16 kHz	4	3	15	7	25	0	0
TOTALS	138	1342	1521	1412	4275	288	377
CHINCHILLA R1953R							
0.125 kHz	3	6	28	49	83	0	1
0.25 kHz	3	16	15	58	89	2	1
0.5 kHz	3	67	73	70	210	0	1
1 kHz	86	223	238	247	708	171	122
2 kHz	19	127	139	163	429	28	22
4 kHz	0	38	72	115	225	1	2
8 kHz	0	64	100	210	374	0	6
16 kHz	2	10	17	63	90	0	0
TOTALS	116	551	682	975	2208	202	155

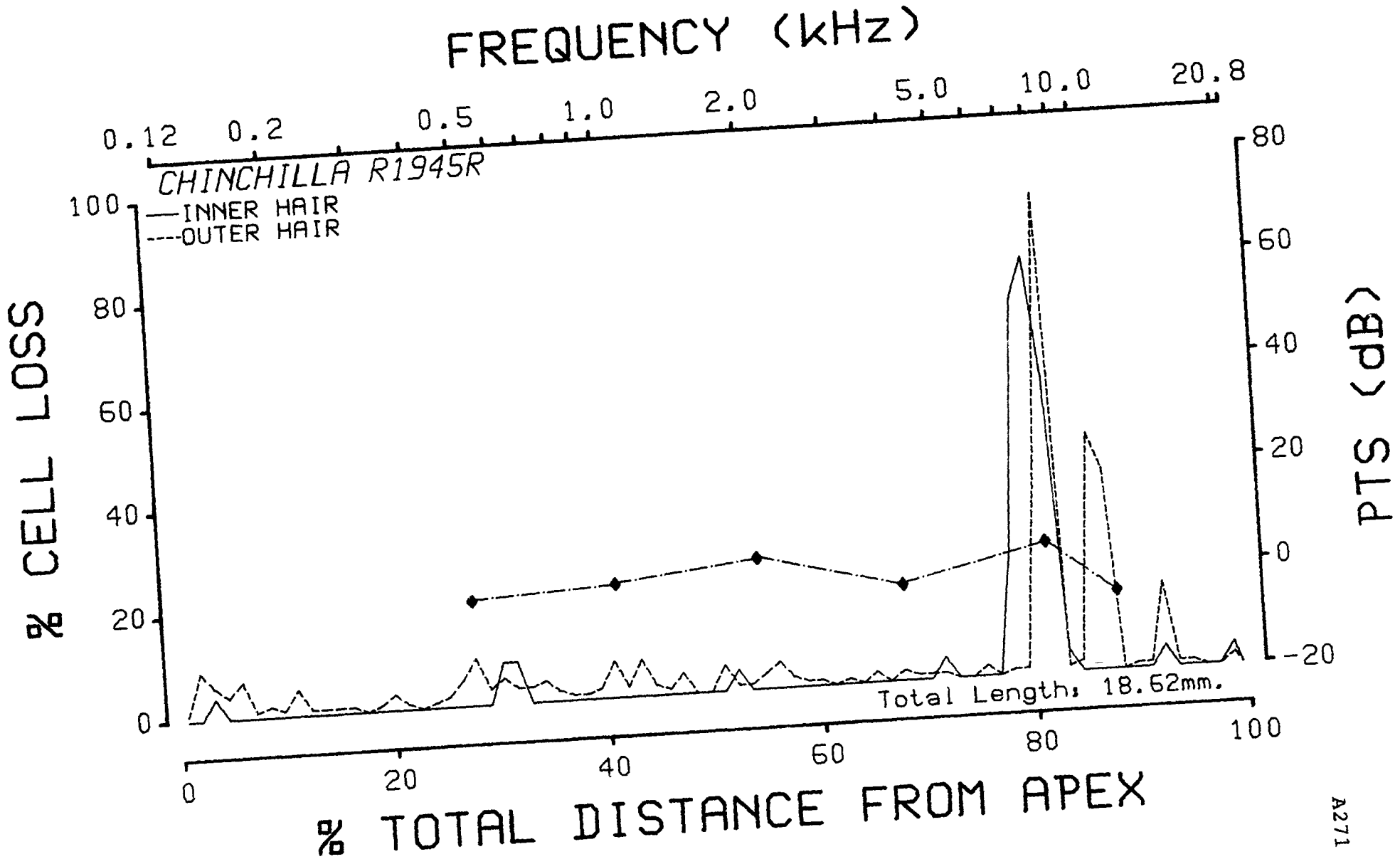
Cochleograms and PTS Audiograms for Individual Animals

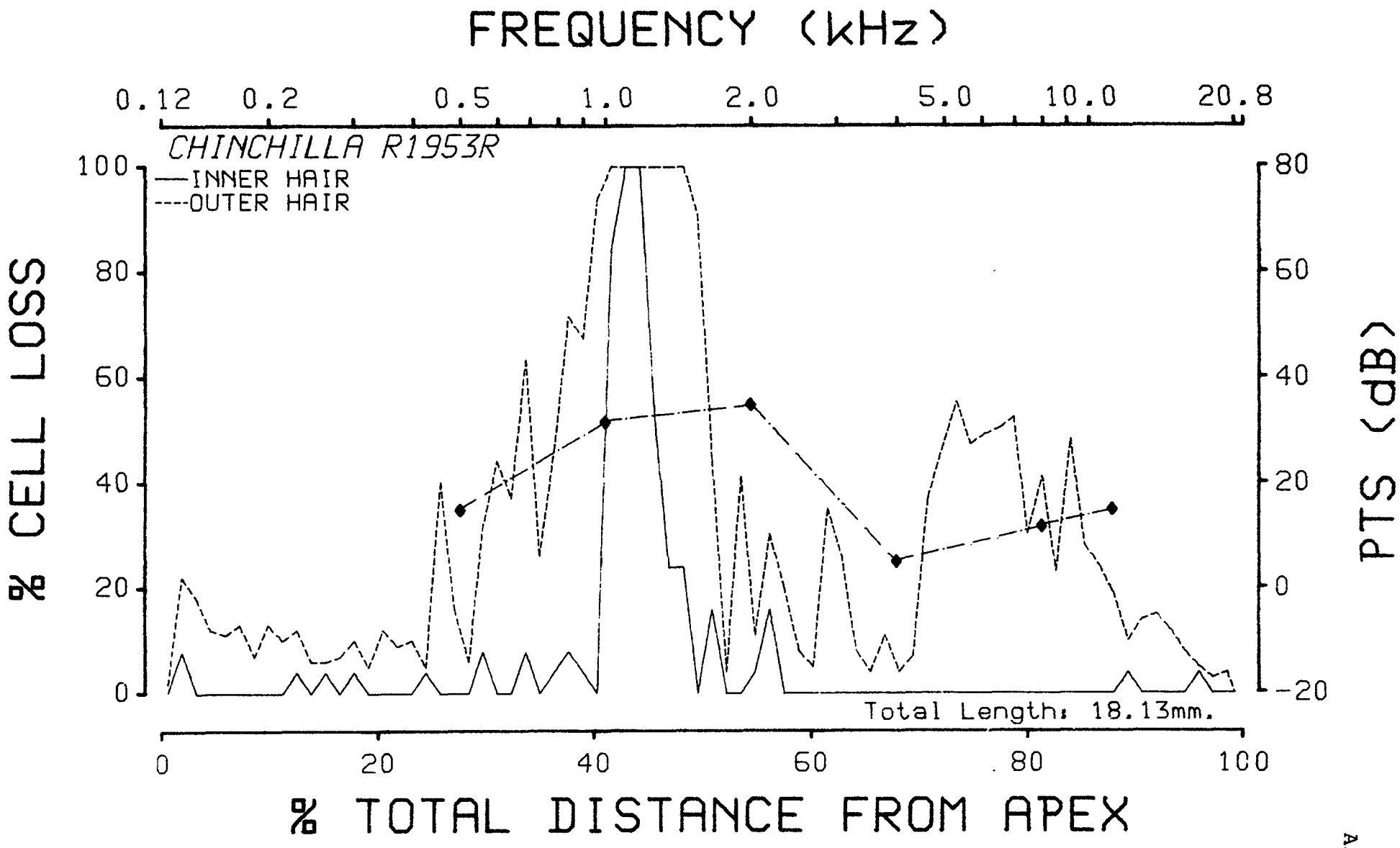

FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1880R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.80mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A269

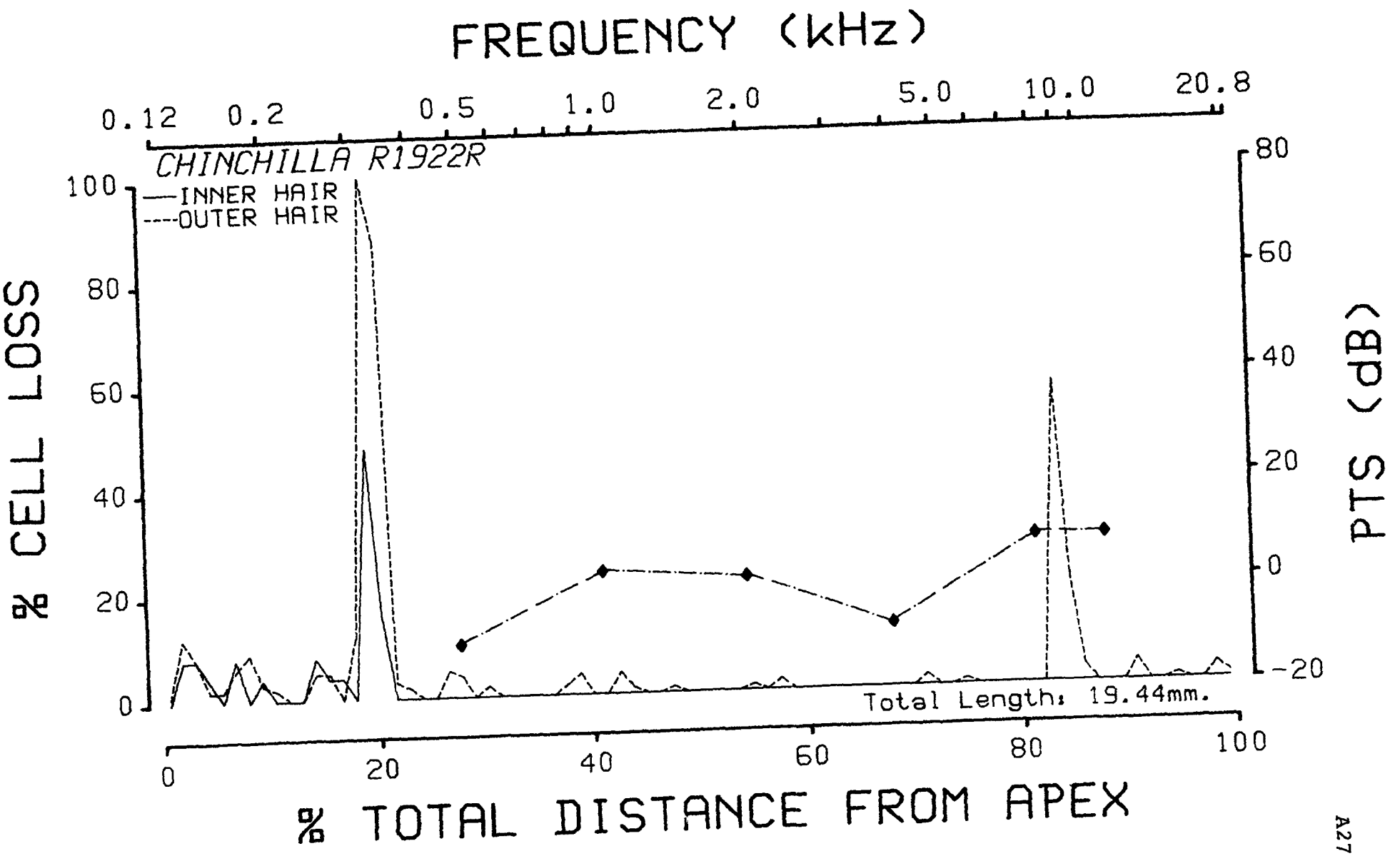

FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1949R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 20.26mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

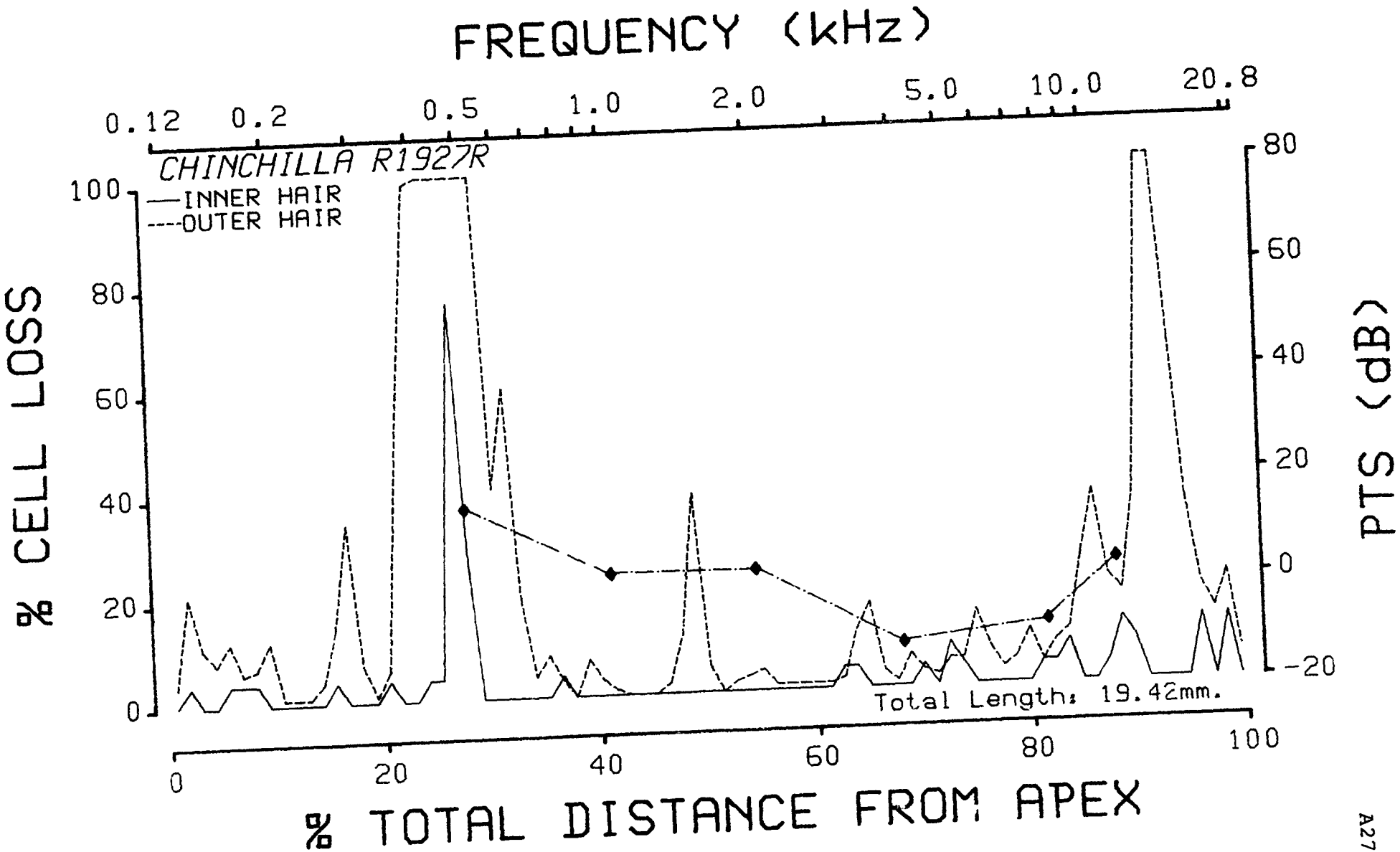
A270


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1945R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.62mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1953R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.13mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A272


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1922R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.44mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1927R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.42mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A274

Summary Data for the Group Exposed to:

155 dB, 100X, 1/M

Animal #		
1746	-	Completed the Entire Protocol
1826	-	Completed the Entire Protocol
1854	-	No postexposure Tuning Curve Collected
1866	-	Completed the Entire Protocol
1868	-	Completed the Entire Protocol
1887	-	Completed the Entire Protocol

155 dB 100X 1/M

PRE-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1746	17.5	12.5	15.8	4.2	25.8	27.5	*****
1826	15.8	9.2	17.5	10.8	27.5	20.8	*****
1854	20.8	10.8	14.2	9.2	19.2	20.8	*****
1866	15.8	5.8	14.2	7.5	19.2	19.2	*****
1868	10.8	4.2	4.2	-1.7	20.8	17.5	*****
1887	15.8	9.2	17.5	0.0	5.8	12.5	*****
Mean	16.1	8.6	13.9	5.0	19.7	19.7	*****
S.D.	3.2	3.1	5.0	5.1	7.7	4.9	*****

POST-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1746	30.8	39.2	40.8	24.2	35.8	35.8	*****
1826	39.2	32.5	37.5	22.5	37.5	35.8	*****
1854	19.2	14.2	19.2	17.5	14.2	27.5	*****
1866	14.2	7.5	9.2	5.0	2.5	12.5	*****
1868	20.8	22.5	20.8	-5.8	27.5	9.2	*****
1887	24.2	35.8	34.2	14.2	25.8	17.5	*****
Mean	24.7	25.3	26.9	12.9	23.9	23.1	*****
S.D.	9.0	12.7	12.4	11.4	13.4	11.7	*****

PERMANENT THRESHOLD SHIFT (dB)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1746	13.3	26.7	25.0	20.0	10.0	8.3	*****
1826	23.3	23.3	20.0	11.7	10.0	15.0	*****
1854	-1.7	3.3	5.0	8.3	-5.0	6.7	*****
1866	-1.7	1.7	-5.0	-2.5	-16.7	-6.7	*****
1868	10.0	18.3	16.7	-4.2	6.7	-8.3	*****
1887	8.3	26.7	16.7	14.2	20.0	5.0	*****
Mean	8.6	16.7	13.1	7.9	4.2	3.3	*****
S.D.	9.5	11.4	11.0	9.5	13.0	9.1	*****

155 dB 100X 1/M

TEMPORARY THRESHOLD SHIFT (dB)

Frequency 0.5 kHz

Animal\Hr	0	2	8	24	240	Max
1746	70.0	65.0	35.0	65.0	15.0	70.0
1826	66.7	61.7	41.7	41.7	31.7	66.7
1854	41.7	31.7	16.7	21.7	1.7	41.7
1866	-3.3	-8.3	-3.3	-3.3	-3.3	-3.3
1868	66.7	66.7	66.7	31.7	16.7	66.7
1887	56.7	61.7	36.7	21.7	11.7	61.7
Mean	49.7	46.4	32.2	29.7	12.2	50.6
S.D.	28.0	29.8	23.7	22.9	12.3	28.3

Frequency 2.0 kHz

Animal\Hr	0	2	8	24	240	Max
1746	71.7	71.7	51.7	46.7	21.7	71.7
1826	65.0	65.0	50.0	45.0	30.0	65.0
1854	68.3	63.3	58.3	43.3	18.3	68.3
1866	-1.7	-6.7	-6.7	-1.7	-6.7	-1.7
1868	68.3	78.3	73.3	63.3	33.3	78.3
1887	70.0	70.0	45.0	35.0	15.0	70.0
Mean	56.9	56.9	45.3	38.6	18.6	58.6
S.D.	28.8	31.6	27.3	21.8	14.2	29.9

Frequency 8.0 kHz

Animal\Hr	0	2	8	24	240	Max
1746	61.7	61.7	41.7	41.7	21.7	61.7
1826	60.0	60.0	55.0	25.0	20.0	60.0
1854	68.3	68.3	63.3	38.3	-1.7	68.3
1866	13.3	-6.7	3.3	-6.7	-11.7	13.3
1868	66.7	66.7	66.7	56.7	-3.3	66.7
1887	75.7	81.7	26.7	21.7	6.7	81.7
Mean	57.0	55.3	42.8	29.4	5.3	58.6
S.D.	22.2	31.3	24.3	21.7	13.4	23.5

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/M

Probe Frequency: 0.5 kHz

Masker (kHz):		0.150	0.200	0.300	0.400	0.520	0.600	0.650	0.750	1.300	2.200
Animal (Q-10 dB)						Pre-Exposure					
1746	(3.11)	62.5	52.5	42.5	37.5	27.5	22.5	32.5	32.5	62.5	82.5
1826	(1.49)	62.5	57.5	47.5	32.5	22.5	22.5	27.5	32.5	52.5	82.5
1854	(3.37)	62.5	57.5	52.5	42.5	37.5	27.5	32.5	42.5	77.5	87.5
1866	(2.62)	62.5	67.5	52.5	42.5	37.5	27.5	27.5	37.5	67.5	87.5
1868	(1.29)	52.5	52.5	42.5	32.5	27.5	27.5	27.5	37.5	67.5	82.5
1897	(2.62)	62.5	62.5	52.5	37.5	37.5	27.5	27.5	37.5	77.5	87.5
Mean	(2.42)	60.8	58.3	48.3	37.5	31.7	25.8	29.2	36.7	67.5	85.0
S.D.	(0.85)	4.1	5.8	4.9	4.5	6.6	2.6	2.6	3.8	9.5	2.7
Animal (Q-10 dB)						Post-Exposure					
1746	(4.65)	62.5	62.5	57.5	47.5	47.5	37.5	47.5	52.5	67.5	82.5
1826	(1.55)	67.5	67.5	62.5	47.5	47.5	42.5	42.5	52.5	57.5	82.5
1854	(2.62)	62.5	62.5	52.5	42.5	47.5	37.5	37.5	47.5	67.5	82.5
1866	(1.49)	57.5	57.5	47.5	37.5	27.5	22.5	27.5	27.5	47.5	67.5
1868	(1.57)	62.5	62.5	52.5	47.5	47.5	42.5	47.5	62.5	77.5	87.5
1887	(1.35)	67.5	62.5	57.5	42.5	37.5	37.5	37.5	47.5	77.5	82.5
Mean	(2.21)	63.3	62.5	55.0	44.2	42.5	36.7	40.0	48.3	65.8	80.8
S.D.	(1.28)	3.8	3.2	5.2	4.1	8.4	7.4	7.6	11.6	11.7	6.8

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/M

Probe Frequency: 1.0 kHz

Masker (kHz):		0.150	0.200	0.400	0.550	0.800	1.050	1.300	1.700	1.900	2.500
Animal (Q-10 dB)						Pre-Exposure					
1746	(1.67)	72.5	72.5	57.5	42.5	17.5	22.5	32.5	42.5	52.5	82.5
1826	(2.08)	82.5	72.5	52.5	37.5	22.5	17.5	32.5	42.5	52.5	82.5
1854	(1.84)	82.5	72.5	57.5	52.5	32.5	27.5	37.5	57.5	67.5	87.5
1866	(1.26)	72.5	77.5	57.5	47.5	27.5	27.5	37.5	52.5	62.5	72.5
1868	(1.84)	72.5	72.5	52.5	47.5	27.5	22.5	32.5	52.5	67.5	77.5
1887	(2.08)	77.5	77.5	47.5	37.5	22.5	17.5	32.5	47.5	57.5	82.5
Mean	(1.79)	76.7	74.2	54.2	44.2	25.0	22.5	34.2	49.2	60.0	80.8
S.D.	(0.31)	4.9	2.6	4.1	6.1	5.2	4.5	2.6	6.1	6.9	5.2
Animal (Q-10 dB)						Post-Exposure					
1746	(1.07)	82.5	77.5	67.5	57.5	47.5	47.5	57.5	62.5	67.5	72.5
1826	(2.70)	72.5	72.5	57.5	52.5	32.5	47.5	57.5	52.5	52.5	47.5
1854	(*****)	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
1866	(2.08)	72.5	72.5	57.5	42.5	27.5	22.5	37.5	47.5	67.5	77.5
1868	(0.57)	82.5	82.5	67.5	62.5	52.5	47.5	47.5	47.5	47.5	57.5
1887	(1.07)	77.5	77.5	67.5	57.5	47.5	47.5	57.5	57.5	67.5	67.5
Mean	(1.50)	77.5	76.5	63.5	54.5	41.5	42.5	51.5	53.5	60.5	64.5
S.D.	(0.87)	5.0	4.2	5.5	7.6	10.8	11.2	8.9	6.5	9.7	12.0

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/M

Probe Frequency: 2.0 kHz

Masker (kHz):		0.300	0.750	0.900	1.300	1.700	2.050	2.200	3.000	3.500	4.000
Animal (Q-10 dB)						Pre-Exposure					
1746	(1.45)	72.5	62.5	37.5	47.5	27.5	22.5	27.5	32.5	52.5	62.5
1826	(1.00)	82 5	47.5	42.5	32.5	37.5	32.5	42.5	42.5	57.5	82.5
1854	(1.58)	87.5	47.5	37.5	32.5	32.5	27.5	37.5	42.5	67.5	87.5
1866	(2.87)	77.5	42.5	37.5	47.5	37.5	32.5	42.5	47.5	67.5	87.5
1868	(2.87)	82.5	47.5	32.5	37.5	27.5	22.5	32.5	37.5	42.5	57.5
1887	(1.26)	77.5	42.5	37.5	37.5	37.5	27.5	32.5	27.5	42.5	57.5
Mean	(1.84)	80.0	48.3	37.5	39.2	33.3	27.5	35.8	38.3	55.0	72.5
S.D.	(0.82)	5.2	7.4	3.2	6.8	4.9	4.5	6.1	7.4	11.3	14.8
Animal (Q-10 dB)						Post-Exposure					
1746	(3.50)	72.5	57.5	47.5	47.5	37.5	47.5	42.5	42.5	32.5	42.5
1826	(2.63)	77.5	52.5	47.5	47.5	57.5	57.5	57.5	42.5	47.5	77.5
1854	(*****)	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
1866	(2.28)	77.5	42.5	32.5	32.5	27.5	22.5	32.5	37.5	62.5	87.5
1868	(4.09)	72.5	47.5	42.5	42.5	42.5	32.5	42.5	32.5	67.5	82.5
1887	(2.28)	77.5	52.5	47.5	52.5	47.5	42.5	52.5	42.5	57.5	67.5
Mean	(2.96)	75.5	50.5	43.5	44.5	42.5	40.5	45.5	39.5	53.5	71.5
S.D.	(0.81)	2.7	5.7	6.5	7.6	11.2	13.5	9.7	4.5	13.9	17.8

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/M

Probe Frequency: 4.0 kHz

Masker (kHz):		0.450	1.300	2.200	3.000	3.500	4.100	4.500	5.000	5.600	6.000
Animal (Q-10 dB)						Pre-Exposure					
1746	(2.33)	77.5	47.5	52.5	27.5	12.5	12.5	17.5	32.5	37.5	42.5
1826	(3.12)	72.5	52.5	42.5	32.5	12.5	12.5	27.5	42.5	42.5	47.5
1854	(3.65)	82.5	52.5	57.5	37.5	27.5	22.5	37.5	57.5	77.5	77.5
1866	(2.91)	62.5	47.5	47.5	37.5	22.5	22.5	37.5	47.5	52.5	62.5
1868	(4.10)	72.5	47.5	52.5	37.5	22.5	12.5	22.5	47.5	72.5	87.5
1887	(3.26)	82.5	47.5	52.5	22.5	12.5	7.5	17.5	37.5	42.5	42.5
Mean	(3.23)	75.0	49.2	50.8	32.5	18.3	15.0	26.7	44.2	54.2	60.0
S.D.	(0.61)	7.6	2.6	5.2	6.3	6.6	6.1	9.2	8.8	16.9	19.2
Animal (Q-10 dB)						Post-Exposure					
1746	(2.89)	82.5	57.5	57.5	42.5	32.5	27.5	32.5	47.5	62.5	72.5
1826	(2.70)	62.5	47.5	52.5	32.5	22.5	27.5	37.5	52.5	52.5	57.5
1854	(*****)	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
1866	(2.33)	72.5	52.5	57.5	37.5	27.5	32.5	37.5	52.5	67.5	77.5
1868	(4.76)	72.5	47.5	47.5	27.5	12.5	2.5	17.5	27.5	57.5	57.5
1887	(3.95)	72.5	52.5	62.5	42.5	27.5	22.5	37.5	42.5	67.5	87.5
Mean	(3.33)	72.5	51.5	55.5	36.5	24.5	22.5	32.5	44.5	61.5	70.5
S.D.	(1.00)	7.1	4.2	5.7	6.5	7.6	11.7	8.7	10.4	6.5	13.0

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/M

Probe Frequency: 8.0 kHz

Masker (kHz):		0.450	1.300	2.500	5.900	7.000	8.100	9.300	11.000	12.700	14.000
Animal (Q-10 dB)					Pre-Exposure						
1746	(4.31)	67.5	52.5	42.5	32.5	17.5	7.5	22.5	32.5	42.5	47.5
1826	(2.79)	67.5	67.5	62.5	47.5	32.5	32.5	27.5	52.5	77.5	87.5
1854	(3.60)	87.5	62.5	62.5	52.5	42.5	37.5	57.5	67.5	77.5	87.5
1866	(3.18)	77.5	62.5	52.5	37.5	27.5	37.5	47.5	62.5	72.5	87.5
1868	(9.63)	67.5	52.5	52.5	47.5	42.5	17.5	47.5	67.5	77.5	87.5
1887	(2.38)	77.5	57.5	47.5	37.5	17.5	12.5	12.5	32.5	32.5	37.5
Mean	(4.31)	74.2	59.2	53.3	42.5	30.0	24.2	35.8	52.5	63.3	72.5
S.D.	(2.69)	8.2	6.1	8.0	7.7	11.3	13.3	17.5	16.4	20.4	23.5
Animal (Q-10 dB)					Post-Exposure						
1746	(3.78)	82.5	52.5	37.5	32.5	17.5	27.5	32.5	42.5	47.5	52.5
1826	(4.04)	77.5	57.5	62.5	47.5	42.5	37.5	27.5	42.5	57.5	82.5
1854	(*****)	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
1866	(2.52)	72.5	57.5	52.5	32.5	22.5	27.5	37.5	67.5	77.5	82.5
1868	(7.52)	82.5	52.5	52.5	47.5	37.5	22.5	57.5	77.5	82.5	82.5
1887	(2.58)	82.5	57.5	57.5	47.5	37.5	32.5	37.5	67.5	77.5	82.5
Mean	(4.09)	79.5	55.5	52.5	41.5	31.5	29.5	38.5	59.5	66.5	76.5
S.D.	(2.04)	4.5	2.7	9.4	8.2	10.8	5.7	11.4	16.0	15.2	13.4

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/M

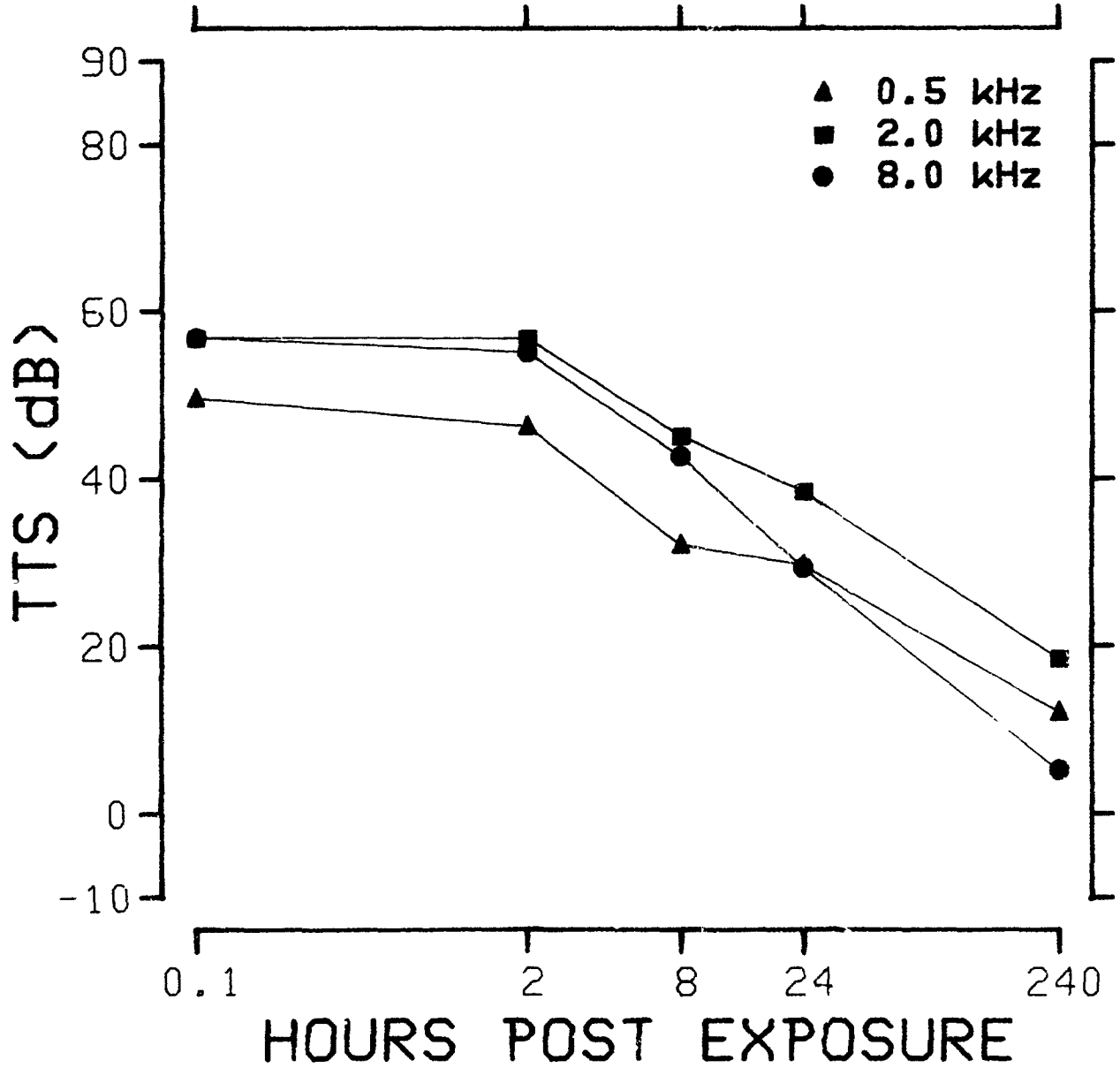
Probe Frequency: 11.2 kHz

Masker (kHz):		1.000	4.000	7.000	9.000	11.000	11.500	12.000	13.000	14.500	16.000
Animal (Q-10 dB)						Pre-Exposure					
1746	(2.20)	67.5	52.5	47.5	42.5	37.5	37.5	47.5	47.5	62.5	77.5
1826	(1.13)	62.5	47.5	27.5	27.5	27.5	37.5	37.5	42.5	52.5	47.5
1854	(5.35)	67.5	47.5	52.5	57.5	47.5	42.5	37.5	42.5	72.5	87.5
1866	(8.99)	57.5	47.5	47.5	57.5	62.5	52.5	37.5	47.5	82.5	77.5
1868	(11.48)	67.5	52.5	52.5	37.5	32.5	22.5	32.5	42.5	67.5	72.5
1887	(6.42)	67.5	47.5	47.5	52.5	22.5	22.5	32.5	37.5	67.5	72.5
Mean	(5.93)	65.0	49.2	45.8	45.8	38.3	35.8	37.5	43.3	67.5	72.5
S.D.	(3.94)	4.2	2.6	9.3	12.1	14.6	11.7	5.5	3.8	10.0	13.4
Animal (Q-10 dB)						Post-Exposure					
1746	(2.05)	62.5	47.5	47.5	32.5	37.5	37.5	42.5	42.5	57.5	62.5
1826	(3.67)	67.5	47.5	42.5	42.5	32.5	32.5	42.5	42.5	52.5	72.5
1854	(*****)	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
1866	(1.33)	62.5	42.5	37.5	37.5	37.5	32.5	32.5	47.5	72.5	72.5
1868	(3.75)	52.5	42.5	47.5	47.5	32.5	37.5	22.5	22.5	27.5	47.5
1887	(5.60)	72.5	57.5	62.5	42.5	32.5	27.5	37.5	52.5	77.5	87.5
Mean	(3.28)	63.5	47.5	47.5	40.5	34.5	33.5	35.5	41.5	57.5	68.5
S.D.	(1.67)	7.4	6.1	9.4	5.7	2.7	4.2	8.4	11.4	19.7	14.7

The oup Mean Recovery Curves

Measured at Three Test Frequencies

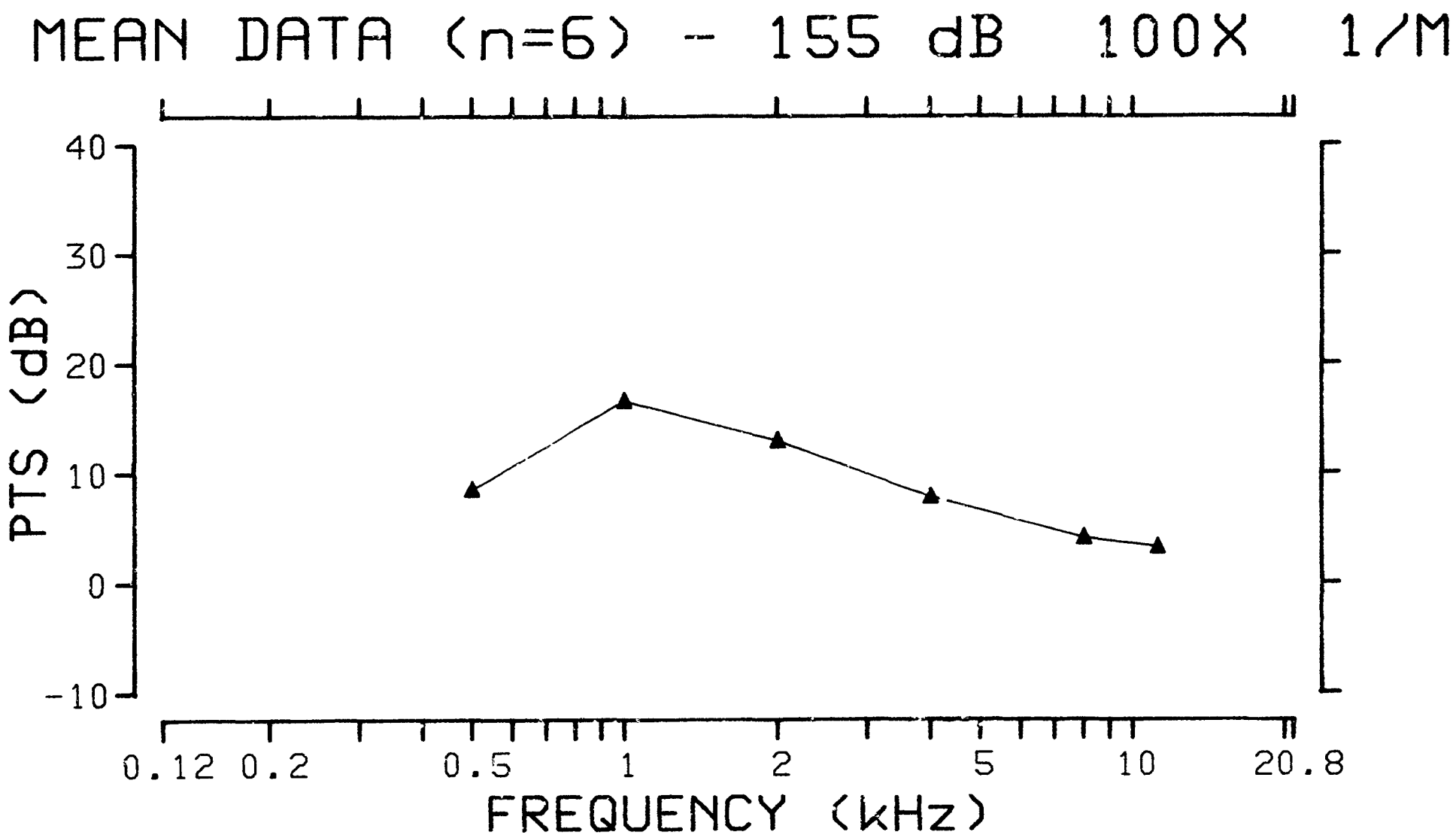
MEAN DATA (n=6) - 155 dB 100X 1/M



A285

The Group Mean Permanent Threshold Shift (PTS)

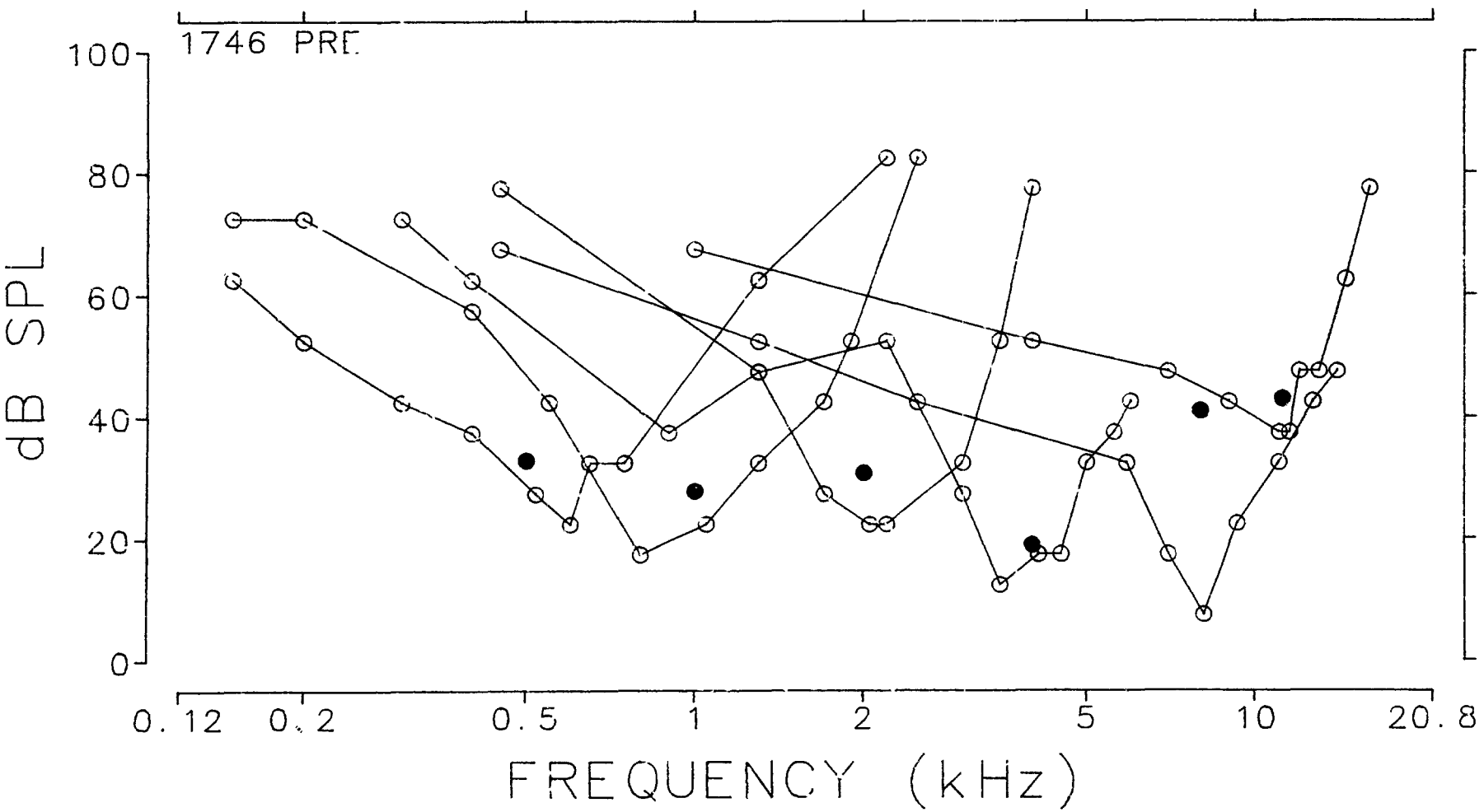
for all Test Frequencies


MEAN DATA (n=6) - 155 dB 100X 1/M
PTS (dB)
40
30
20
10
0
-10
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

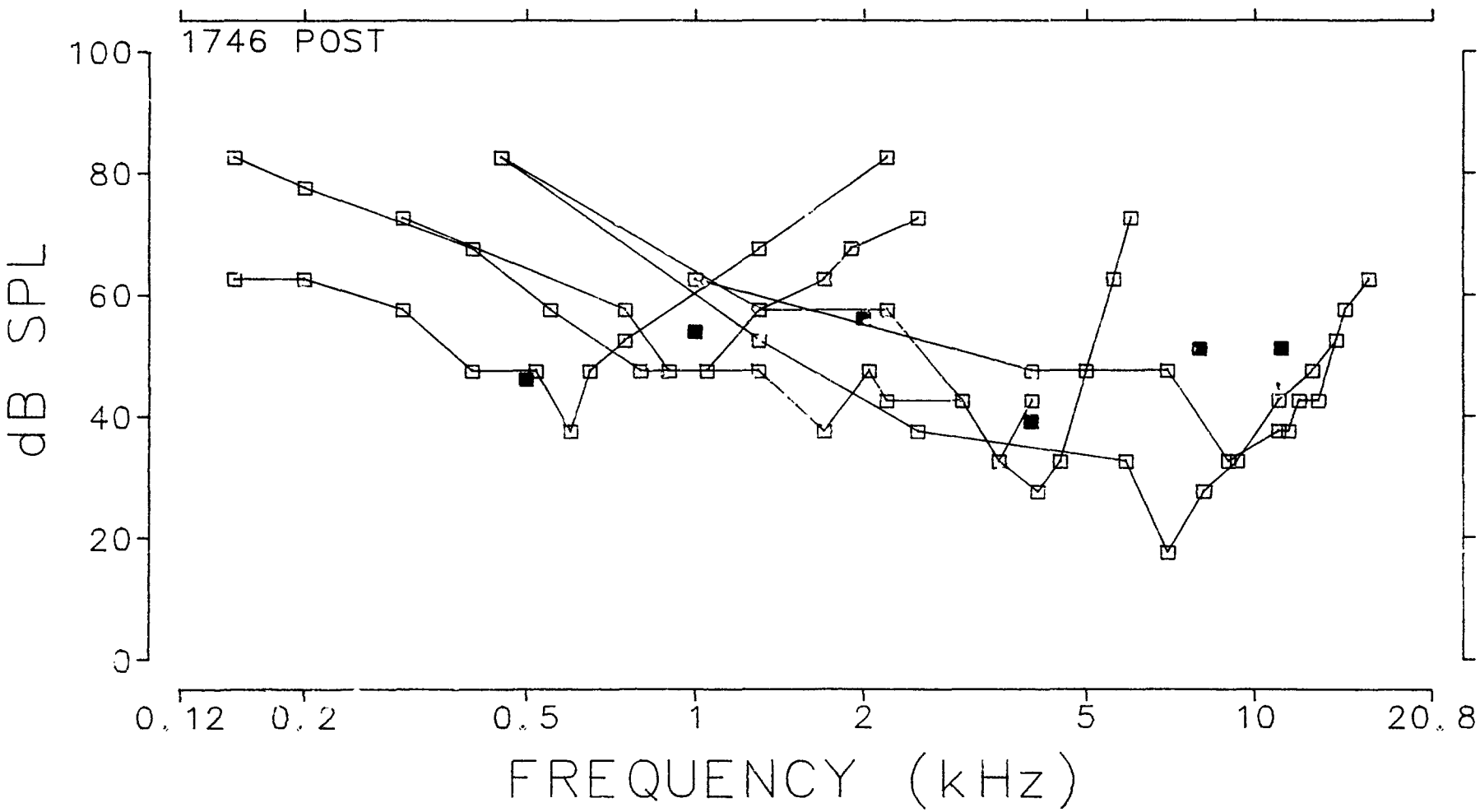
A287

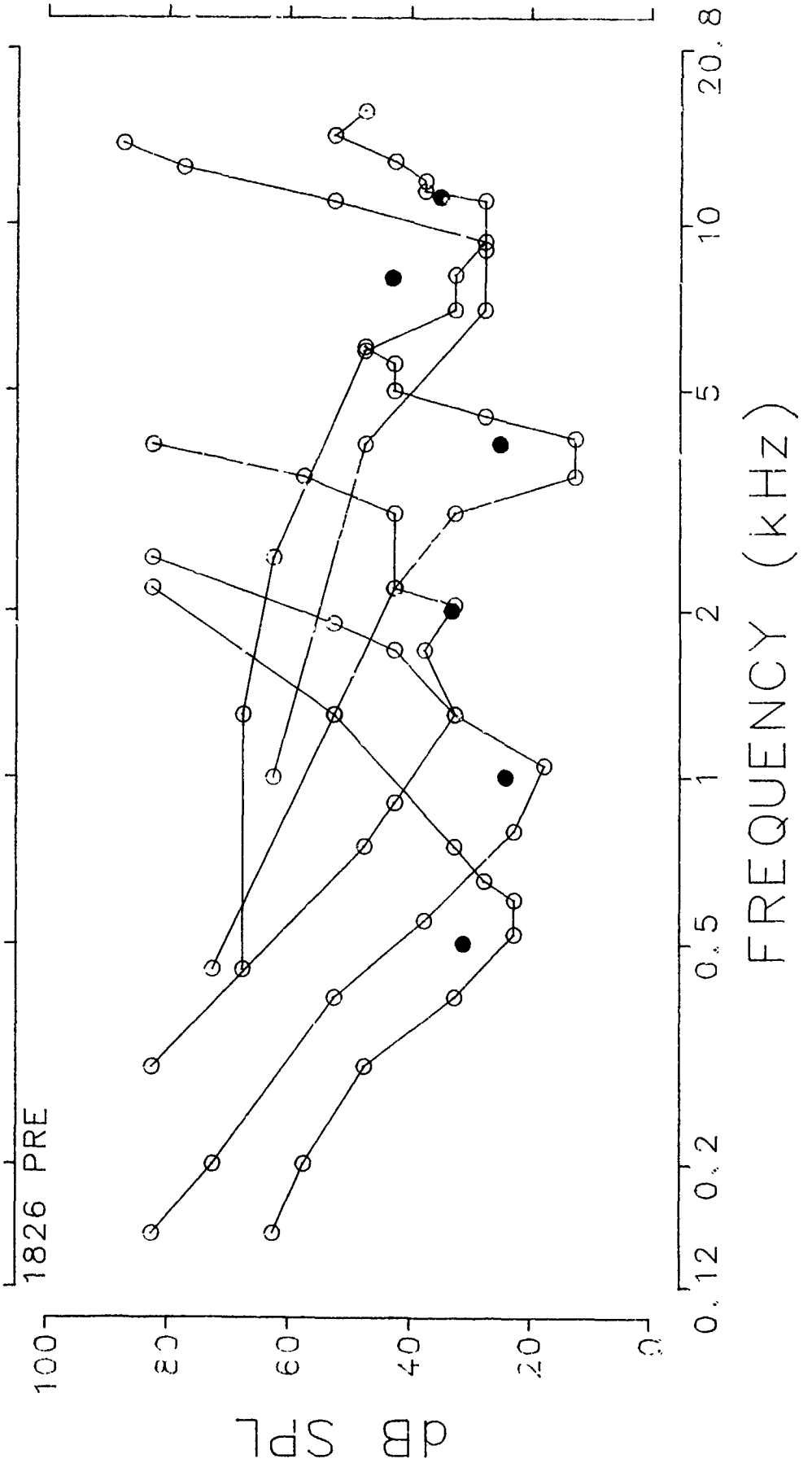
The Pre and Postexposure Tuning Curves for
Individual Animals in this Exposure Group.

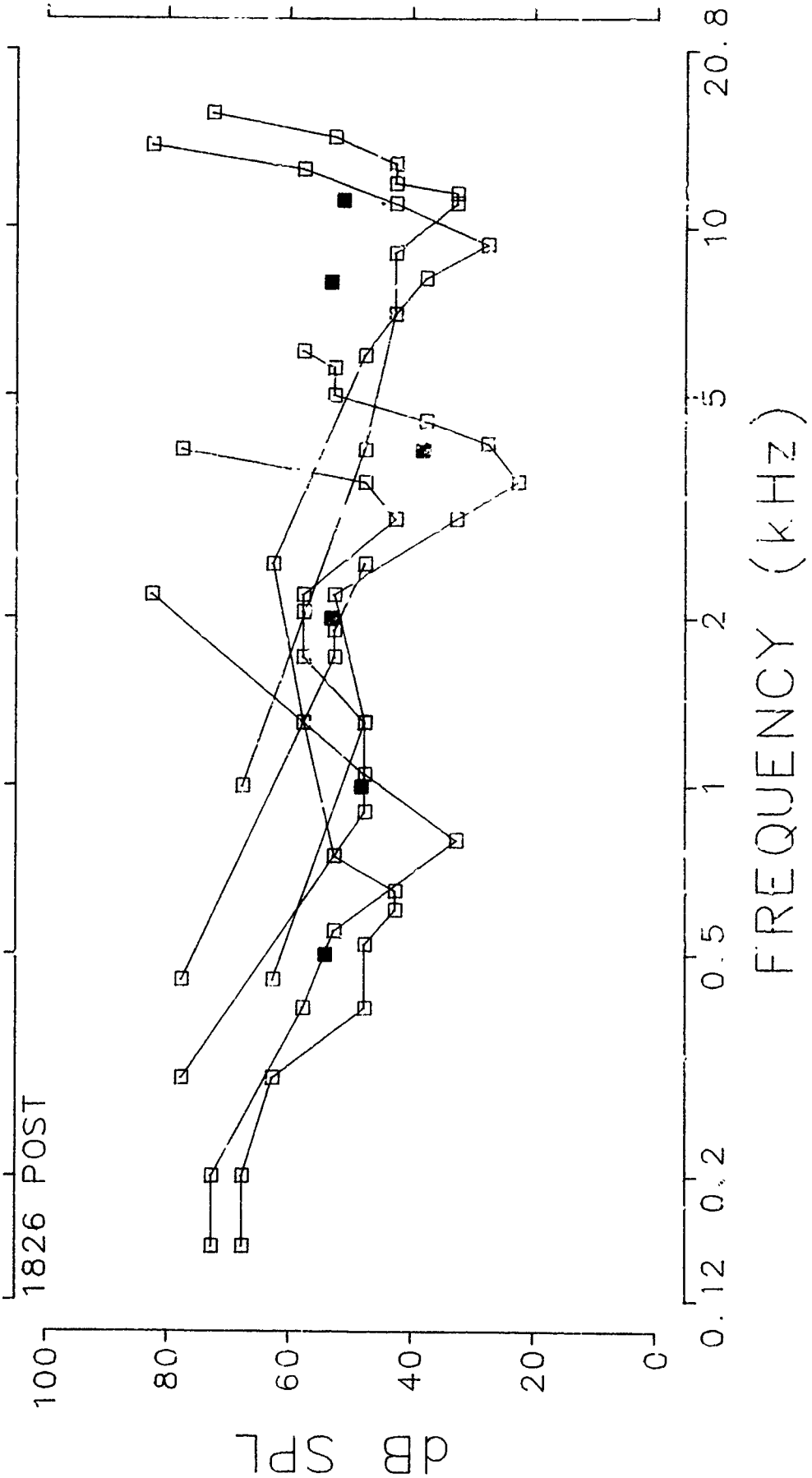
The solid symbol represents the threshold of the probe tone.

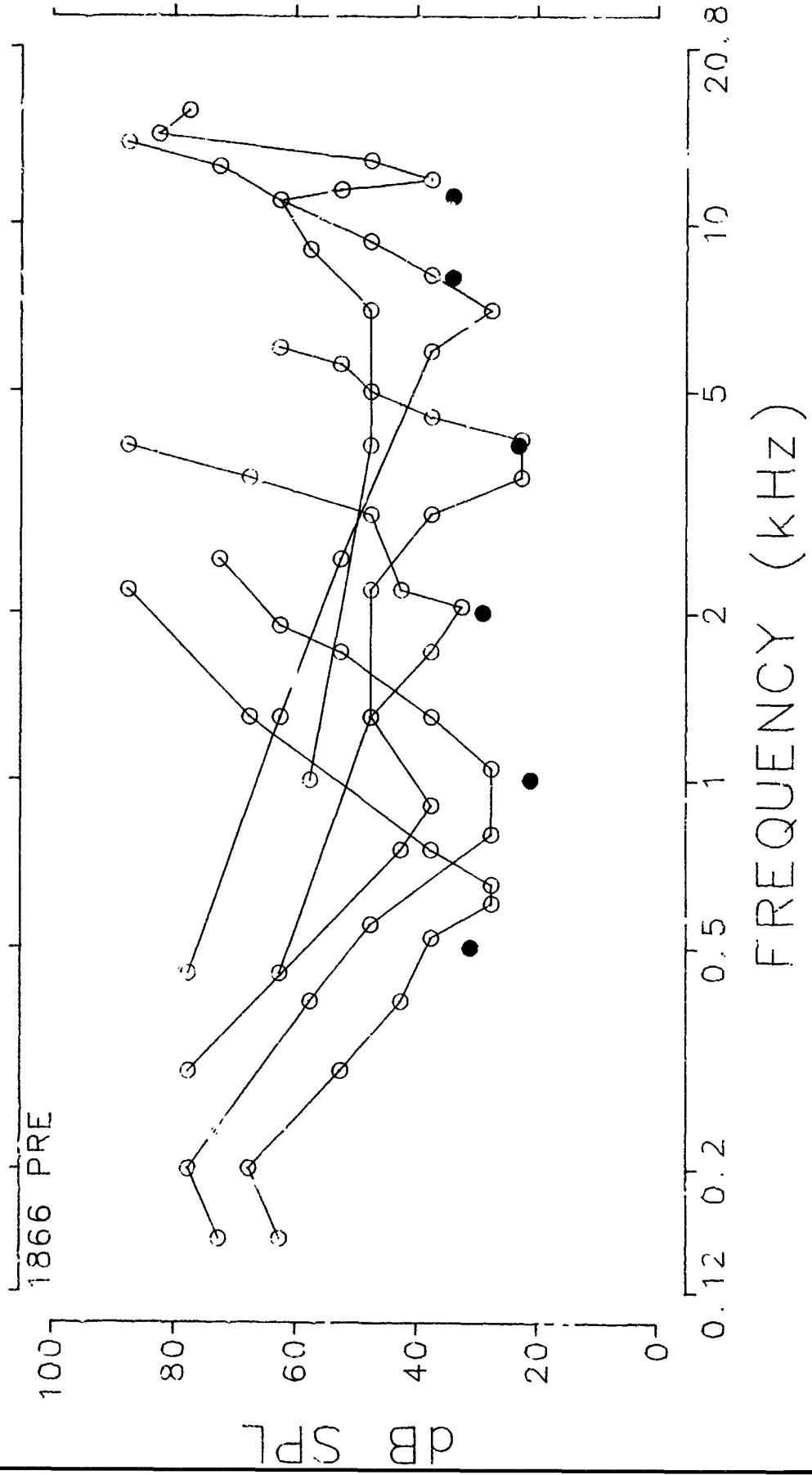

1746 PRE
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

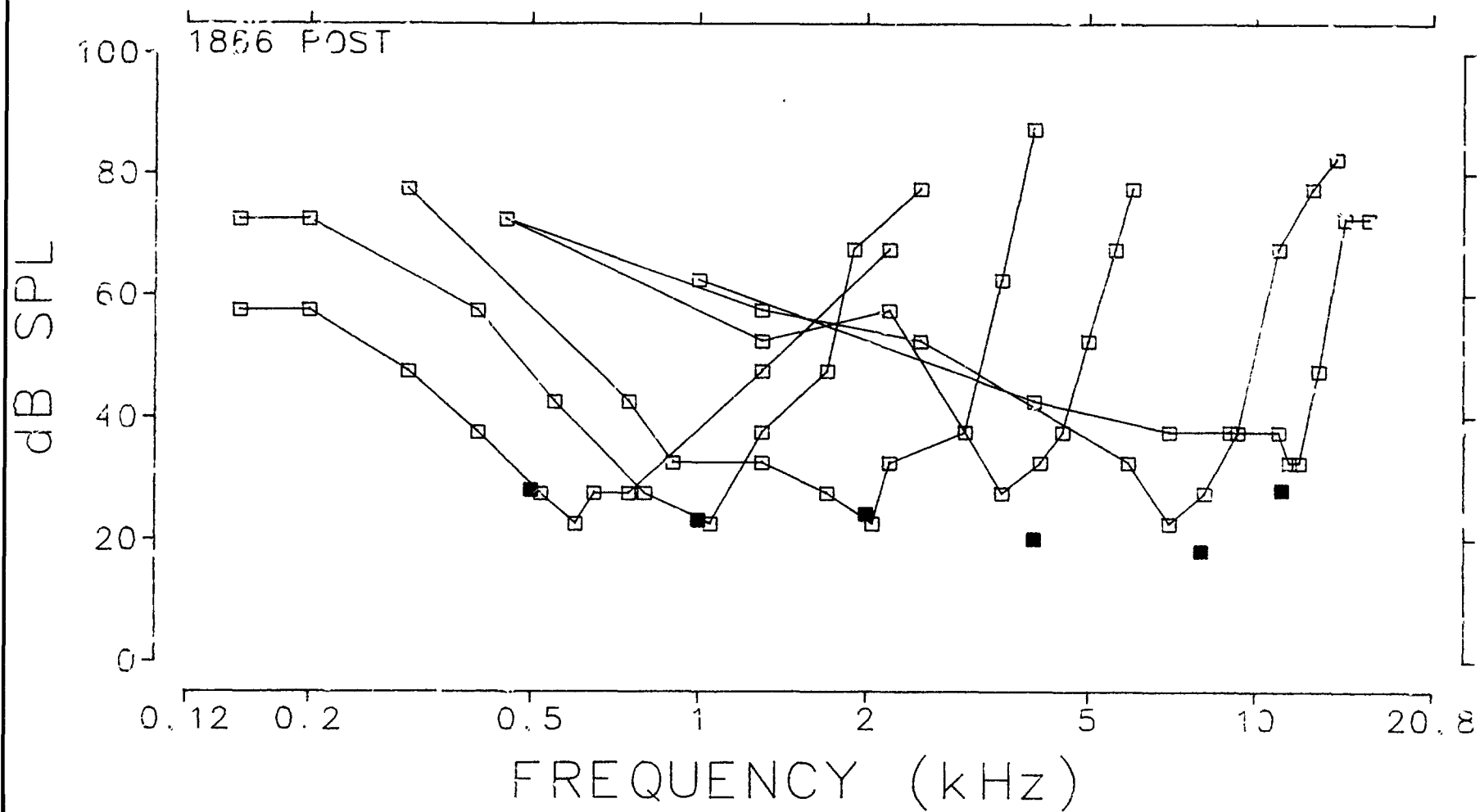
A289

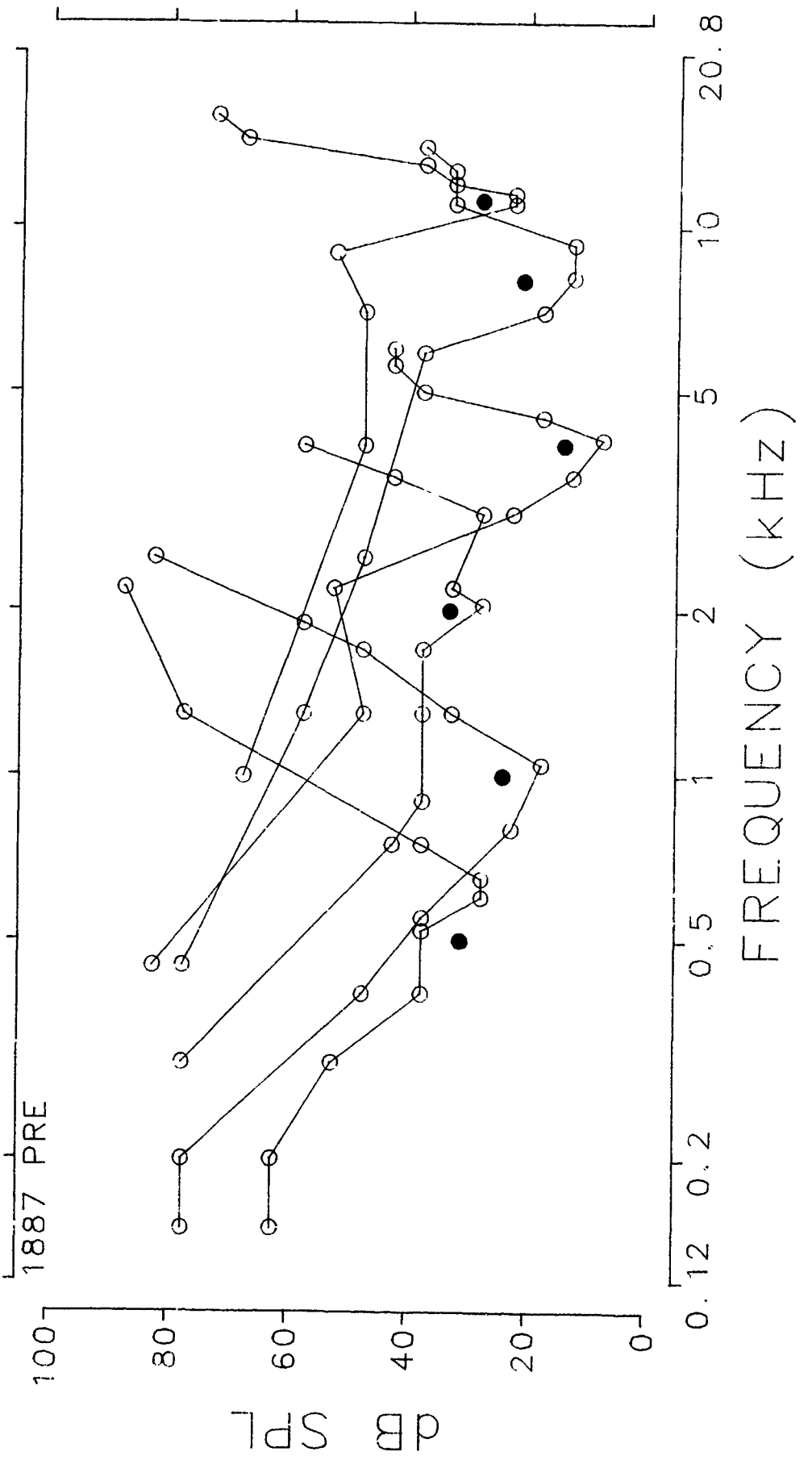

1746 POST
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

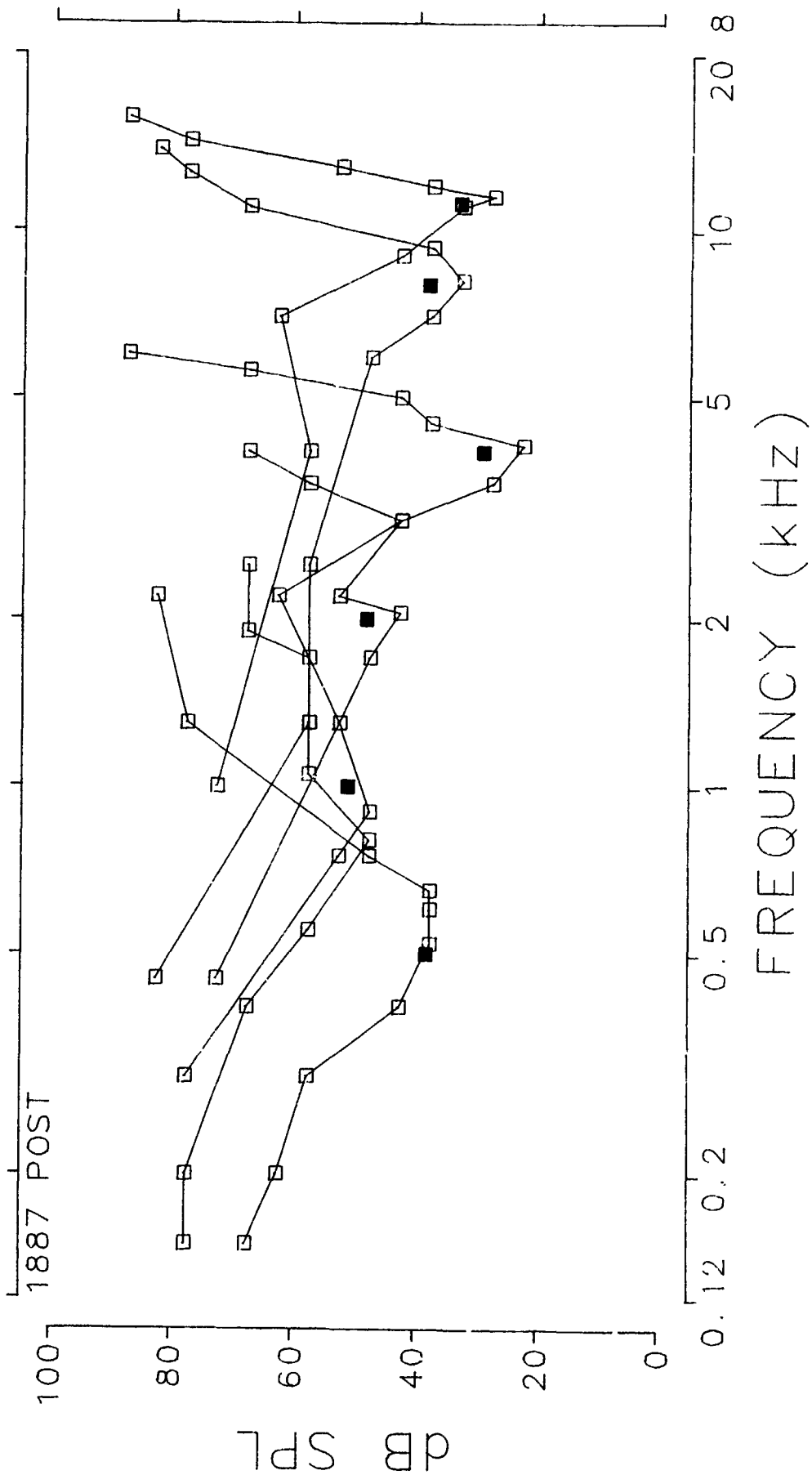

1826 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

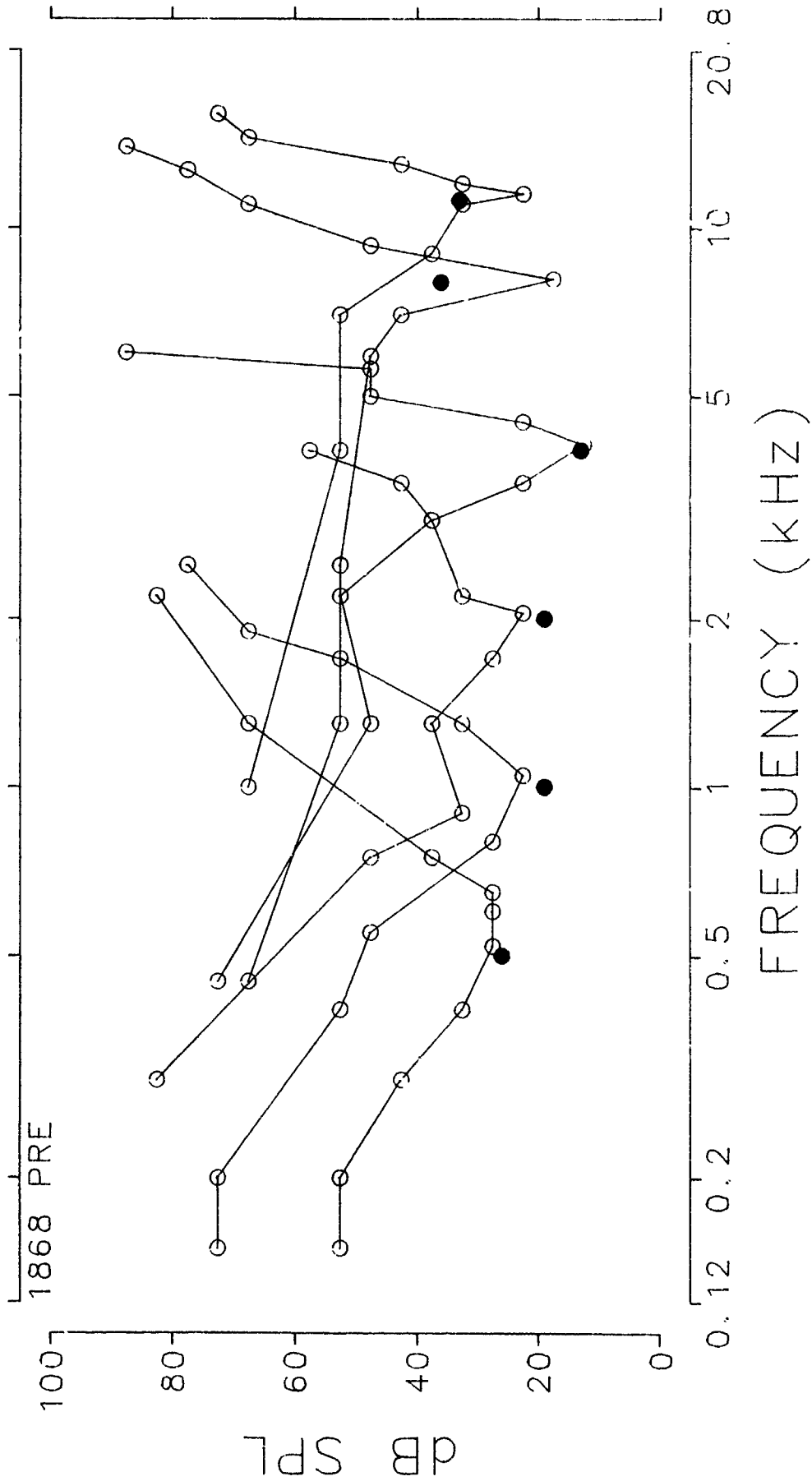

1826 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

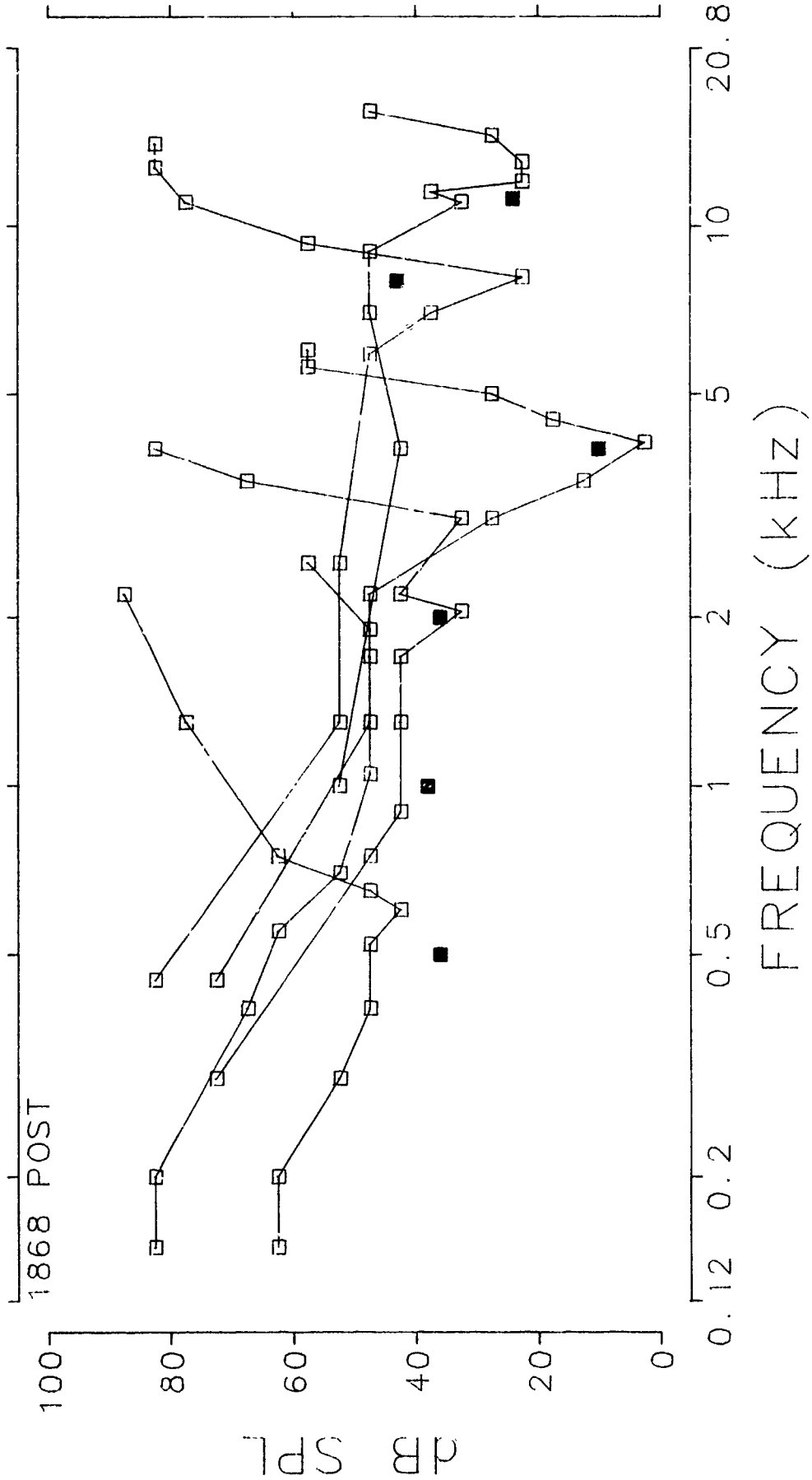

1866 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1866 POST
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1887 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1887 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20
8
FREQUENCY (kHz)


1868 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1868 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

SHOCK TUBE EXPOSURE
155 dB, 100X, 1/MIN

TOTAL NUMBER OF COCHLEAR SENSORY CELLS MISSING

ANIMAL NUMBER	INNER HAIR CELLS	1ST ROW OUTER HAIR CELLS	2ND ROW OUTER HAIR CELLS	3RD ROW OUTER HAIR CELLS	TOTAL OUTER HAIR CELLS
R1746R	15	282	299	155	736
R1826R	28	785	739	443	1967
R1854R	19	172	153	188	513
R1866R	20	24	29	26	79
R1868R	115	629	819	495	1943
R1887R	12	501	577	347	1425
GROUP MEAN	35				1111
.D.	40				786

TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND LENGTHS OF THE COCHLEA CENTERED AT THE FREQUENCIES INDICATED

	OCTAVE BAND CENTER FREQUENCY	INNER HAIR CELLS	OUTER HAIR CELLS
GROUP MEANS			
	0.125 kHz	1.7	66.2
	0.25 kHz	2.8	57.2
	0.5 kHz	3.5	108.0
	1 kHz	13.8	430.5
	2 kHz	3.8	321.3
	4 kHz	4.3	84.7
	8 kHz	3.5	22.7
	16 kHz	1.2	19.5
STANDARD DEVIATIONS			
	0.125 kHz	1.6	34.0
	0.25 kHz	3.1	55.3
	0.5 kHz	2.4	106.0
	1 kHz	29.5	367.0
	2 kHz	6.5	264.1
	4 kHz	3.7	77.2
	8 kHz	4.7	37.0
	16 kHz	1.6	22.4

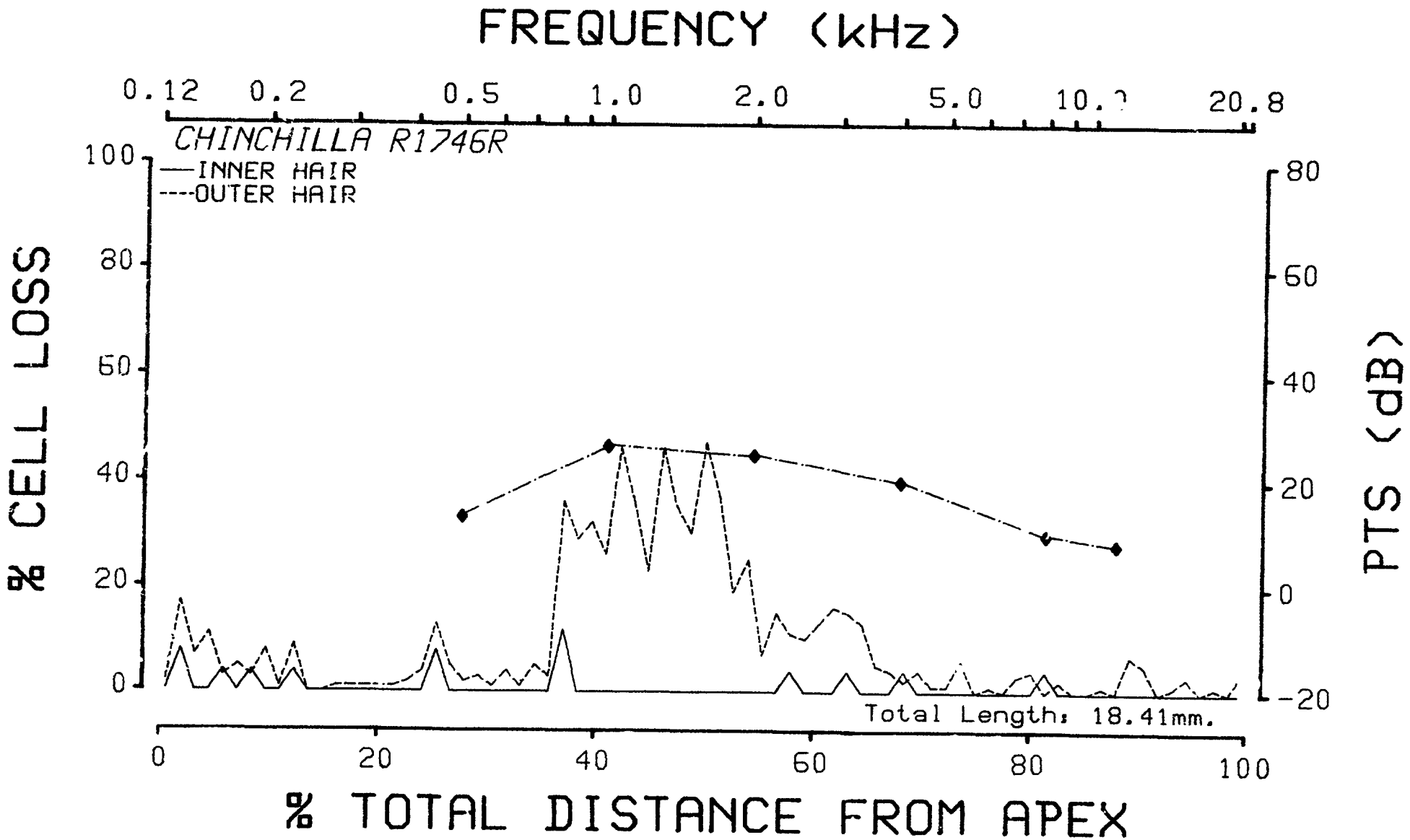
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1746R							
0.125 kHz	4	5	12	43	60	0	1
0.25 kHz	2	4	10	15	29	2	2
0.5 kHz	2	11	10	16	37	1	2
1 kHz	3	126	114	30	270	2	7
2 kHz	1	104	101	25	230	0	2
4 kHz	2	27	43	10	80	1	3
8 kHz	1	2	1	8	11	0	0
16 kHz	0	2	7	8	17	0	0
TOTALS	15	282	299	155	736	6	17
CHINCHILLA R1826R							
0.125 kHz	1	9	36	40	85	0	2
0.25 kHz	1	8	11	25	44	0	0
0.5 kHz	6	91	44	9	144	1	0
1 kHz	4	320	289	55	664	1	8
2 kHz	3	247	241	259	747	41	22
4 kHz	11	92	85	36	213	9	8
8 kHz	1	0	4	2	6	0	0
16 kHz	1	18	29	17	64	1	4
TOTALS	28	785	739	443	1967	53	44
CHINCHILLA R1854R							
0.125 kHz	2	10	10	29	49	0	1
0.25 kHz	2	7	7	10	24	3	3
0.5 kHz	1	11	8	5	24	0	4
1 kHz	0	38	22	7	67	0	15
2 kHz	1	34	32	47	113	0	5
4 kHz	4	42	39	53	134	1	3
8 kHz	9	30	34	34	98	6	8
16 kHz	0	0	1	3	4	0	0
TOTALS	19	172	153	188	513	10	39

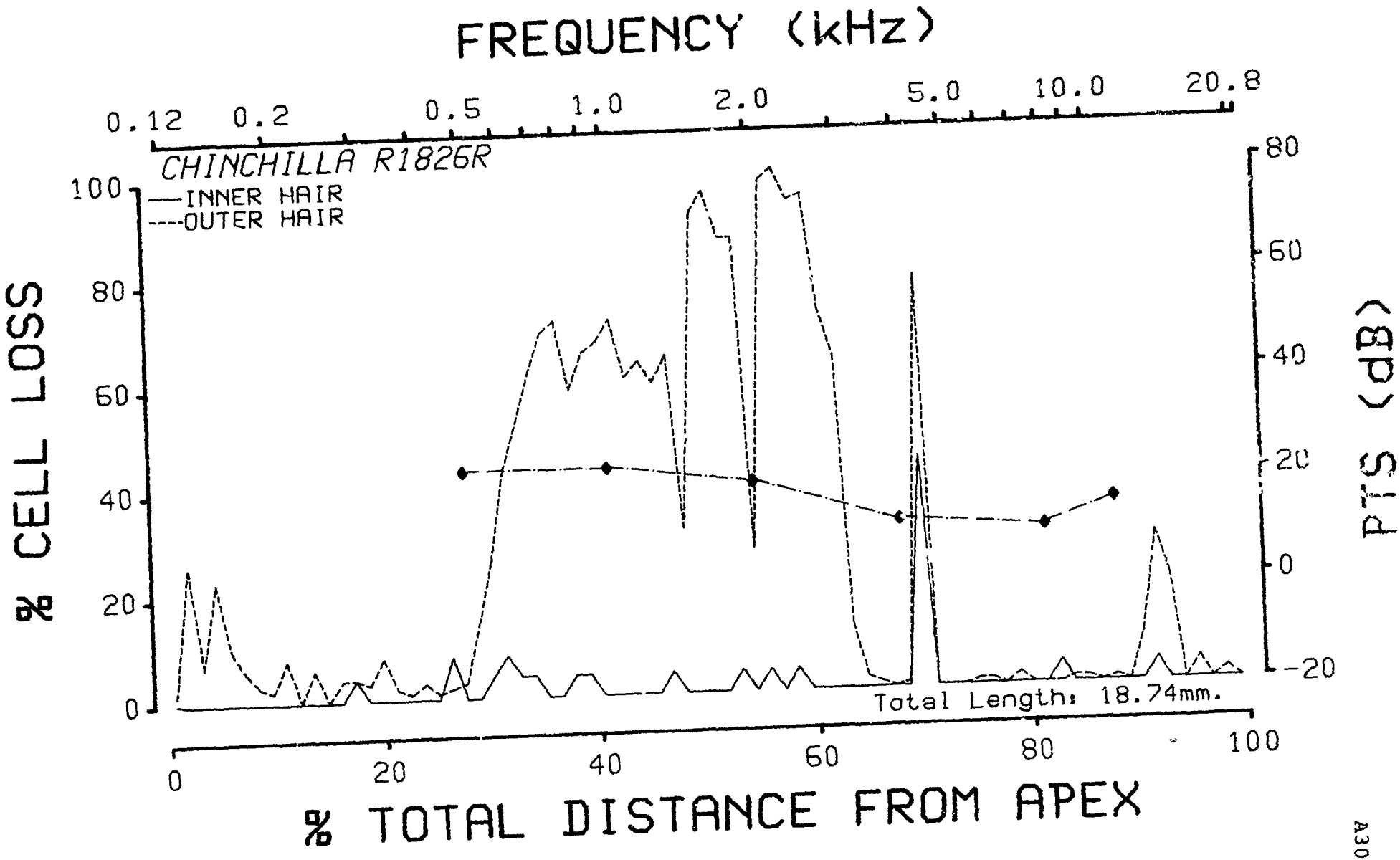
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1866R							
0.125 kHz	3	4	5	8	17	0	3
0.25 kHz	9	11	8	4	23	0	0
0.5 kHz	6	1	7	1	9	0	0
1 kHz	2	2	2	4	8	0	0
2 kHz	0	2	2	4	8	0	0
4 kHz	0	1	1	1	3	0	0
8 kHz	0	2	2	1	5	0	0
16 kHz	0	1	2	3	6	0	0
TOTALS	20	24	29	26	79	0	3
CHINCHILLA R1868R							
0.125 kHz	0	16	38	64	118	0	0
0.25 kHz	1	61	48	58	167	0	0
0.5 kHz	5	122	134	29	285	0	2
1 kHz	74	321	337	248	906	162	140
2 kHz	17	95	232	83	410	4	15
4 kHz	5	5	26	4	35	0	0
8 kHz	10	4	1	6	11	0	0
16 kHz	2	4	3	3	10	0	0
TOTALS	115	629	819	495	1943	166	157
CHINCHILLA R1887R							
0.125 kHz	0	9	24	35	68	1	0
0.25 kHz	2	11	5	40	56	0	0
0.5 kHz	1	88	48	13	149	0	1
1 kHz	0	247	295	126	668	0	1
2 kHz	1	132	168	120	420	1	11
4 kHz	4	8	27	8	43	0	0
8 kHz	0	0	4	1	5	0	0
16 kHz	4	6	6	4	16	0	1
TOTALS	12	501	577	347	1425	2	14

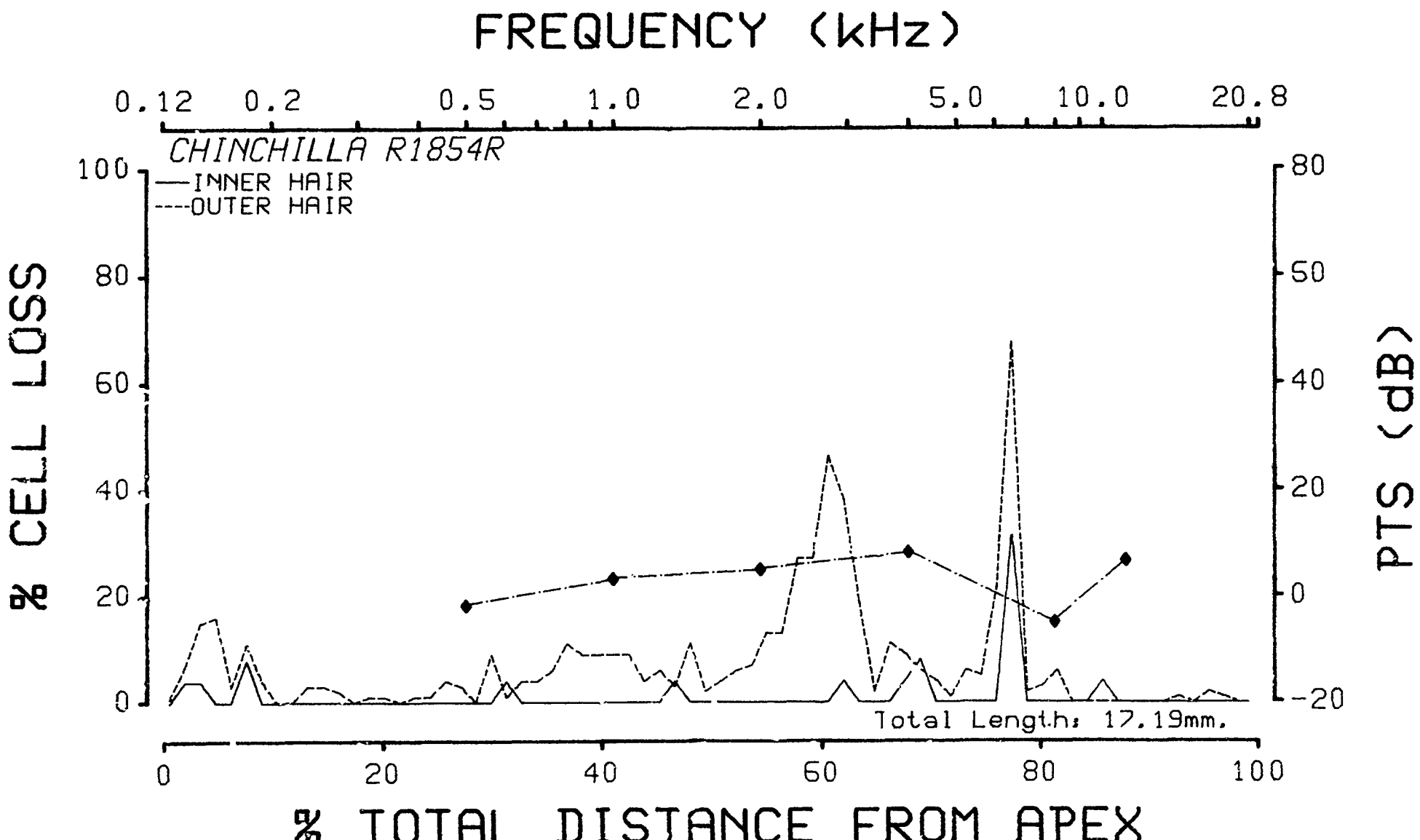
Cochleograms and PTS Audiograms for Individual Animals


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1746R
INNER HAIR
OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.41mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

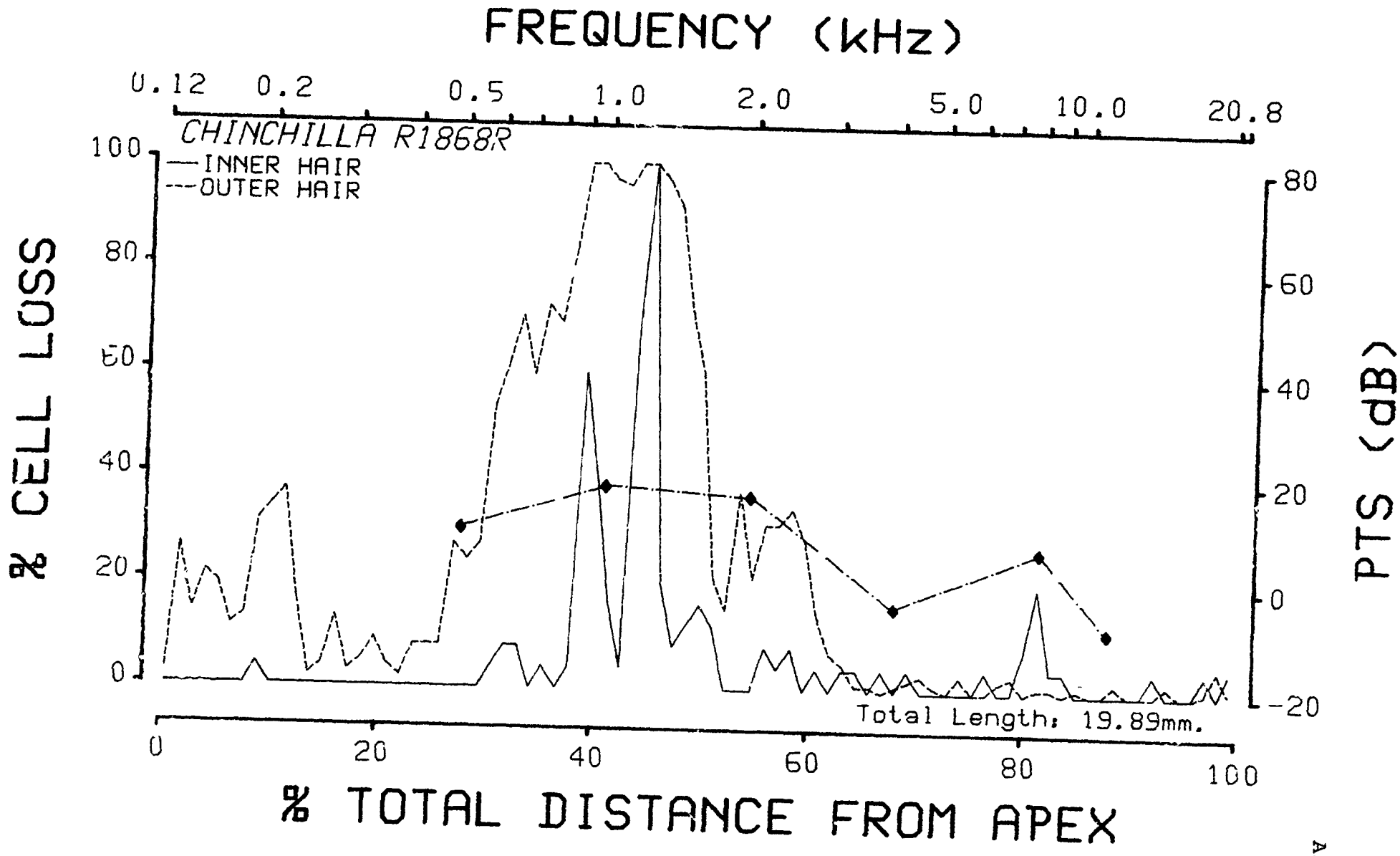
A303


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1826R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.74mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

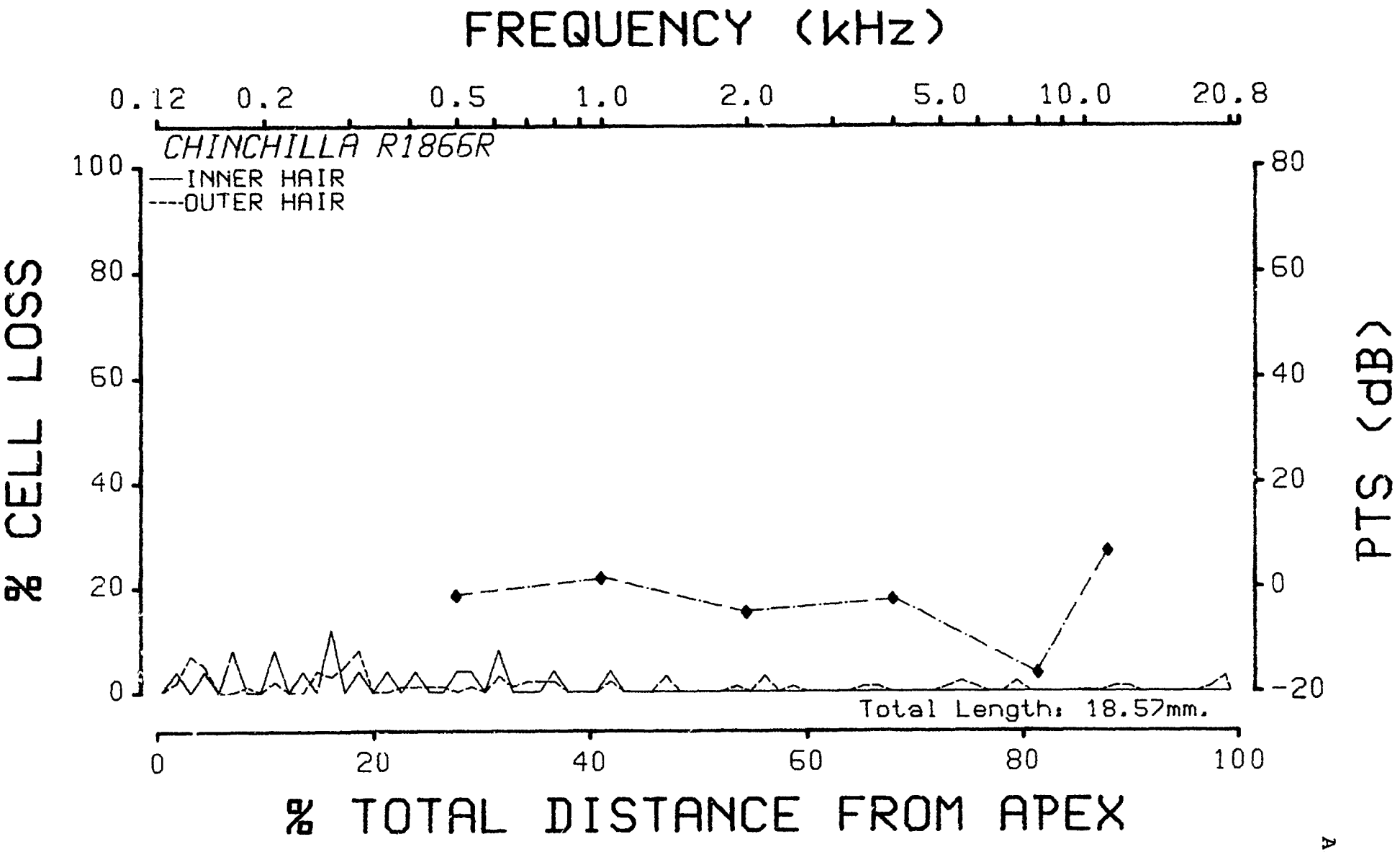
A304


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1854R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
50
40
20
0
-20
Total Length: 17.19mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

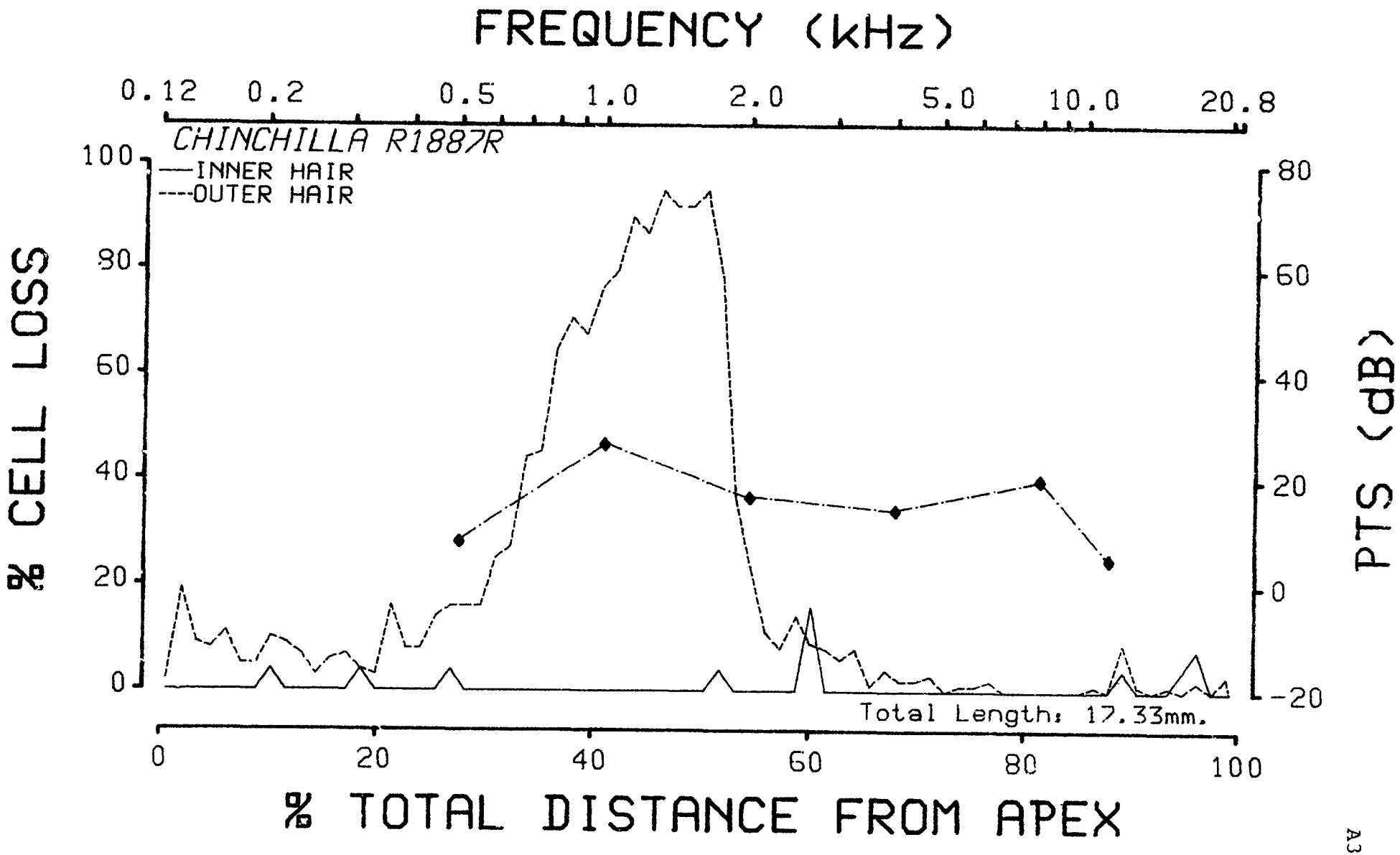
A305


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1868R
—INNER HAIR
---OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.89mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A306


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1866R
INNER HAIR
OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.57mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A307


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1887R
INNER HAIR
OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 17.33mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A308

Summary Data for the Group Exposed to:

155 dB, 100X, 1/10M

Animal #		
1914	-	Completed the Entire Protocol
1917	-	Completed the Entire Protocol
1970	-	Completed the Entire Protocol
1999	-	Completed the Entire Protocol
2066	-	Completed the Entire Protocol

155 dB 100X 1/10M

PRE-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1914	19.2	9.2	14.2	-0.8	12.5	5.8	*****
1917	10.8	12.5	14.2	-7.5	2.5	2.5	*****
1970	2.5	-5.8	0.8	-0.8	4.2	12.5	*****
1999	7.5	0.8	9.2	-6.7	10.8	14.2	30.0
2066	7.5	9.2	9.2	0.8	4.2	17.5	*****
Mean	9.5	5.2	9.5	-3.0	6.8	10.5	30.0
S.D.	6.2	7.5	5.4	3.8	4.5	6.2	*****

POST-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1914	35.8	37.5	39.2	20.8	17.5	24.2	*****
1917	17.5	12.5	10.8	-6.7	2.5	10.8	*****
1970	9.2	4.2	9.2	-6.7	14.2	24.2	*****
1999	32.5	22.5	47.5	69.2	80.8	85.8	*****
2066	4.2	5.8	5.8	-0.8	5.8	14.2	*****
Mean	19.8	16.5	22.5	15.2	24.2	31.8	*****
S.D.	14.0	13.8	19.3	32.2	32.3	30.8	*****

PERMANENT THRESHOLD SHIFT (dB)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1914	16.7	28.3	25.0	21.7	5.0	18.3	*****
1917	6.7	0.0	-3.3	0.8	0.0	8.3	*****
1970	6.7	10.0	8.3	-5.8	10.0	11.7	*****
1999	25.0	21.7	38.3	75.8	70.0	71.7	*****
2066	-3.3	-3.3	-3.3	-1.7	1.7	-3.3	*****
Mean	10.3	11.3	13.0	18.2	17.3	21.3	*****
S.D.	10.8	13.6	18.3	33.9	29.7	29.2	*****

155 dB 100X 1/10M

TEMPORARY THRESHOLD SHIFT (dB)

Frequency 0.5 kHz

Animal\Hr	0	2	8	24	240	Max
1914	63.3	63.3	48.3	38.3	18.3	63.3
1917	36.7	31.7	31.7	6.7	6.7	36.7
1970	25.0	15.0	10.0	5.0	-5.0	25.0
1999	45.0	40.0	20.0	20.0	5.0	45.0
2066	25.0	5.0	5.0	20.0	5.0	25.0
Mean	39.0	31.0	23.0	18.0	6.0	39.0
S.D.	16.0	22.7	17.5	13.4	8.3	16.0

Frequency 2.0 kHz

Animal\Hr	0	2	8	24	240	Max
1914	63.3	63.3	53.3	43.3	33.3	63.3
1917	53.3	43.3	33.3	8.3	-1.7	53.3
1970	36.7	21.7	11.7	11.7	1.7	36.7
1999	53.3	43.3	28.3	18.3	-1.7	53.3
2066	43.3	13.3	3.3	23.3	-1.7	43.3
Mean	50.0	37.0	26.0	21.0	6.0	50.0
S.D.	10.3	19.8	19.5	13.8	15.4	10.3

Frequency 8.0 kHz

Animal\Hr	0	2	8	24	240	Max
1914	75.0	70.0	70.0	40.0	15.0	75.0
1917	60.0	50.0	20.0	-5.0	5.0	60.0
1970	53.3	23.3	8.3	-1.7	13.3	53.3
1999	36.7	36.7	36.7	16.7	6.7	36.7
2066	53.3	23.3	3.3	48.3	3.3	53.3
Mean	55.7	40.7	27.7	19.7	8.7	55.7
S.D.	13.8	19.8	26.9	24.0	5.2	13.8

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/10M

Probe Frequency: 0.5 kHz

Masker (kHz):		0.150	0.200	0.300	0.400	0.520	0.600	0.650	0.750	1.300	2.200
Animal (Q-10 dB)						Pre-Exposure					
1914	(2.32)	62.5	62.5	57.5	42.5	32.5	27.5	27.5	42.5	57.5	82.5
1917	(2.62)	72.5	67.5	52.5	37.5	37.5	27.5	32.5	37.5	77.5	87.5
1970	(4.64)	77.5	62.5	42.5	37.5	27.5	17.5	12.5	32.5	52.5	77.5
1999	(3.30)	67.5	67.5	52.5	42.5	27.5	32.5	22.5	27.5	72.5	82.5
2066	(1.13)	62.5	62.5	52.5	42.5	32.5	27.5	27.5	32.5	42.5	82.5
Mean	(2.80)	68.5	64.5	51.5	40.5	31.5	26.5	24.5	34.5	60.5	82.5
S.D.	(1.29)	6.5	2.7	5.5	2.7	4.2	5.5	7.6	5.7	14.4	3.5
Animal (Q-10 dB)						Post-Exposure					
1914	(1.49)	67.5	67.5	62.5	57.5	52.5	57.5	62.5	62.5	72.5	82.5
1917	(3.37)	52.5	52.5	42.5	32.5	27.5	17.5	22.5	32.5	72.5	82.5
1970	(1.01)	77.5	72.5	57.5	47.5	42.5	42.5	42.5	47.5	67.5	82.5
1999	(4.65)	67.5	67.5	62.5	57.5	57.5	47.5	57.5	52.5	87.5	82.5
2066	(2.93)	62.5	62.5	52.5	37.5	27.5	32.5	22.5	27.5	57.5	82.5
Mean	(2.69)	65.5	64.5	55.5	46.5	41.5	39.5	41.5	44.5	71.5	82.5
S.D.	(1.47)	9.1	7.6	8.4	11.4	13.9	15.2	18.8	14.4	10.8	0.0

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/10M

Probe Frequency: 1.. kHz

Masker (kHz):		0.150	0.200	0.400	0.550	0.800	1.050	1.300	1.700	1.900	2.500
Animal (Q-10 dB)						Pre-Exposure					
1914	(0.97)	72.5	72.5	52.5	47.5	27.5	27.5	32.5	42.5	47.5	82.5
1917	(1.21)	72.5	67.5	57.5	47.5	37.5	37.5	52.5	82.5	72.5	82.5
1970	(2.46)	67.5	72.5	52.5	42.5	17.5	12.5	32.5	52.5	47.5	67.5
1999	(2.22)	72.5	72.5	57.5	52.5	37.5	17.5	22.5	42.5	52.5	82.5
2066	(3.13)	82.5	82.5	62.5	52.5	42.5	27.5	42.5	62.5	77.5	82.5
Mean	(2.00)	73.5	73.5	56.5	48.5	32.5	24.5	36.5	56.5	59.5	79.5
S.D.	(0.90)	5.5	5.5	4.2	4.2	10.0	9.7	11.4	16.7	14.4	6.7
Animal (Q-10 dB)						Post-Exposure					
1914	(3.05)	82.5	82.5	77.5	67.5	62.5	52.5	77.5	82.5	77.5	82.5
1917	(1.59)	67.5	67.5	42.5	37.5	22.5	27.5	42.5	82.5	77.5	82.5
1970	(1.18)	67.5	67.5	52.5	42.5	27.5	27.5	37.5	57.5	77.5	82.5
1999	(1.72)	67.5	72.5	57.5	57.5	47.5	42.5	37.5	52.5	64.5	67.5
2066	(1.87)	77.5	77.5	57.5	47.5	32.5	22.5	27.5	57.5	72.5	87.5
Mean	(1.88)	72.5	73.5	57.5	50.5	38.5	34.5	44.5	66.5	73.9	80.5
S.D.	(0.70)	7.1	6.5	12.7	12.0	16.4	12.5	19.2	14.7	5.7	7.6

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/10M

Probe Frequency: 2.0 kHz

Masker (kHz):		0.300	0.750	0.900	1.300	1.700	2.050	2.200	3.000	3.500	4.000
Animal (Q-10 dB)						Pre-Exposure					
1914	(2.28)	77.5	57.5	42.5	37.5	32.5	27.5	37.5	37.5	52.5	82.5
1917	(1.31)	67.5	52.5	47.5	42.5	37.5	42.5	47.5	42.5	62.5	77.5
1970	(1.42)	77.5	42.5	27.5	37.5	22.5	17.5	22.5	27.5	42.5	57.5
1999	(5.24)	77.5	52.5	42.5	42.5	32.5	17.5	27.5	42.5	47.5	82.5
2066	(4.57)	72.5	47.5	32.5	37.5	27.5	17.5	32.5	27.5	32.5	72.5
Mean	(2.96)	74.5	50.5	38.5	39.5	30.5	24.5	33.5	35.5	47.5	74.5
S.D.	(1.83)	4.5	5.7	8.2	2.7	5.7	11.0	9.6	7.6	11.2	10.4
Animal (Q-10 dB)						Post-Exposure					
1914	(4.16)	77.5	67.5	52.5	62.5	67.5	57.5	67.5	52.5	37.5	47.5
1917	(3.46)	57.5	32.5	12.5	32.5	32.5	22.5	32.5	52.5	72.5	82.5
1970	(6.14)	67.5	47.5	42.5	42.5	42.5	22.5	32.5	37.5	57.5	82.5
1999	(2.16)	72.5	42.5	52.5	52.5	57.5	62.5	67.5	77.5	77.5	82.5
2066	(4.23)	67.5	32.5	32.5	22.5	22.5	22.5	12.5	32.5	32.5	87.5
Mean	(4.03)	68.5	44.5	38.5	42.5	44.5	37.5	42.5	50.5	55.5	76.5
S.D.	(1.44)	7.4	14.4	16.7	15.8	18.2	20.6	24.2	17.5	20.2	16.4

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/10M

Probe Frequency: 4.0 kHz

Masker (kHz):		0.450	1.300	2.200	3.000	3.500	4.100	4.500	5.000	5.600	6.000
Animal (Q-10 dB)						Pre-Exposure					
1914	(2.70)	62.5	32.5	42.5	22.5	12.5	12.5	32.5	37.5	52.5	52.5
1917	(4.22)	67.5	57.5	57.5	32.5	27.5	12.5	17.5	32.5	57.5	87.5
1970	(4.76)	72.5	57.5	52.5	37.5	27.5	17.5	32.5	47.5	57.5	82.5
1999	(5.06)	72.5	47.5	47.5	32.5	22.5	7.5	17.5	32.5	27.5	37.5
2066	(3.71)	77.5	67.5	52.5	52.5	27.5	22.5	32.5	37.5	72.5	87.5
Mean	(4.09)	70.5	52.5	50.5	35.5	23.5	14.5	26.5	37.5	53.5	69.5
S.D.	(0.93)	5.7	13.2	5.7	11.0	6.5	5.7	8.2	6.1	16.4	23.1
Animal (Q-10 dB)						Post-Exposure					
1914	(*****)	62.5	42.5	52.5	37.5	32.5	37.5	32.5	32.5	32.5	22.5
1917	(3.95)	57.5	42.5	47.5	32.5	17.5	12.5	27.5	32.5	52.5	62.5
1970	(2.33)	67.5	47.5	47.5	32.5	17.5	17.5	22.5	37.5	42.5	52.5
1999	(*****)	52.5	77.5	82.5	87.5	87.5	82.5	82.5	82.5	82.5	87.5
2066	(2.33)	77.5	47.5	52.5	47.5	27.5	27.5	32.5	42.5	77.5	87.5
Mean	(2.87)	63.5	51.5	56.5	47.5	36.5	35.5	39.5	45.5	57.5	62.5
S.D.	(0.94)	9.6	14.7	14.7	23.2	29.2	28.0	24.4	21.1	21.8	27.2

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/10M

Probe Frequency: 8.0 kHz

Masker (kHz):		0.450	1.300	2.500	5.900	7.000	8.100	9.300	11.000	12.700	14.000
Animal (Q-10 dB)						Pre-Exposure					
1914	(3.57)	72.5	57.5	42.5	22.5	7.5	2.5	17.5	12.5	17.5	42.5
1917	(1.48)	72.5	57.5	17.5	7.5	7.5	2.5	12.5	22.5	67.5	82.5
1970	(2.88)	72.5	52.5	52.5	32.5	17.5	22.5	32.5	67.5	67.5	62.5
1999	(7.83)	77.5	47.5	47.5	27.5	12.5	-2.5	37.5	67.5	77.5	82.5
2066	(6.09)	82.5	67.5	47.5	42.5	37.5	22.5	42.5	57.5	82.5	82.5
Mean	(4.37)	75.5	56.5	41.5	26.5	16.5	9.5	28.5	45.5	62.5	70.5
S.D.	(2.55)	4.5	7.4	13.9	12.9	12.4	12.0	12.9	26.1	26.0	17.9
Animal (Q-10 dB)						Post-Exposure					
1914	(2.35)	82.5	52.5	52.5	32.5	22.5	22.5	37.5	67.5	82.5	82.5
1917	(4.18)	62.5	47.5	42.5	32.5	12.5	22.5	22.5	37.5	52.5	62.5
1970	(4.61)	77.5	52.5	52.5	27.5	17.5	42.5	27.5	42.5	52.5	82.5
1999	(5.66)	67.5	82.5	82.5	82.5	82.5	82.5	65.0	82.5	82.5	82.5
2066	(2.03)	77.5	47.5	57.5	42.5	27.5	27.5	32.5	52.5	67.5	87.5
Mean	(3.77)	73.5	56.5	57.5	43.5	32.5	39.5	37.0	56.5	67.5	79.5
S.D.	(1.54)	8.2	14.7	15.0	22.5	28.5	25.4	16.6	18.5	15.0	9.7

MASKED THRESHOLDS (dB SPL) Group: 155 dB 100X 1/10M

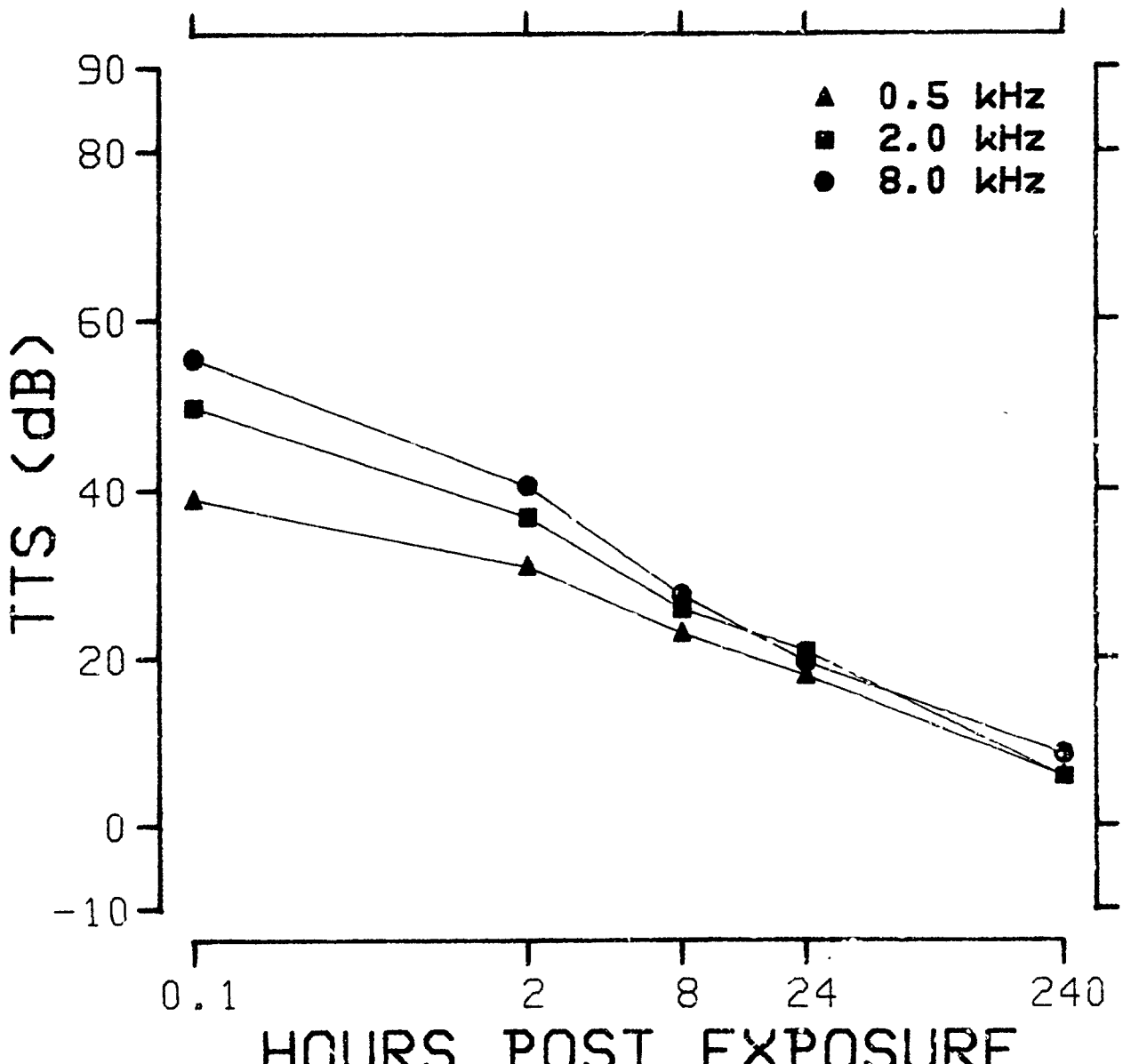
Probe Frequency: 11.2 kHz

Masker (kHz):		1.000	4.000	7.000	9.000	11.000	11.500	12.000	13.000	14.500	16.000
Animal (Q-10 dB)						Pre-Exposure					
1914	(3.72)	62.5	47.5	47.5	37.5	42.5	37.5	37.5	32.5	42.5	62.5
1917	(5.98)	62.5	42.5	47.5	52.5	27.5	22.5	22.5	42.5	57.5	67.5
1970	(1.93)	57.5	47.5	32.5	32.5	27.5	37.5	37.5	32.5	47.5	47.5
1999	(4.53)	57.5	37.5	27.5	37.5	27.5	22.5	27.5	37.5	67.5	72.5
2066	(13.82)	82.5	52.5	42.5	62.5	32.5	22.5	37.5	37.5	72.5	77.5
Mean	(5.99)	64.5	45.5	39.5	44.5	31.5	28.5	32.5	36.5	57.5	65.5
S.D.	(4.61)	10.4	5.7	9.1	12.5	6.5	8.2	7.1	4.2	12.7	11.5
Animal (Q-10 dB)						Post-Exposure					
1914	(0.60)	62.5	37.5	37.5	47.5	42.5	42.5	37.5	47.5	47.5	72.5
1917	(1.93)	57.5	47.5	32.5	27.5	27.5	27.5	27.5	22.5	42.5	72.5
1970	(3.72)	62.5	47.5	47.5	47.5	47.5	42.5	42.5	37.5	47.5	72.5
1999	(*****)	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	87.5
2066	(8.40)	57.5	57.5	52.5	57.5	27.5	32.5	57.5	67.5	77.5	87.5
Mean	(3.66)	64.5	54.5	50.5	52.5	45.5	45.5	49.5	51.5	59.5	78.5
S.D.	(3.41)	10.4	17.2	19.6	20.0	22.5	21.7	21.4	23.8	18.9	8.2

The Group Mean Recovery Curves

Measured at Three Test Frequencies

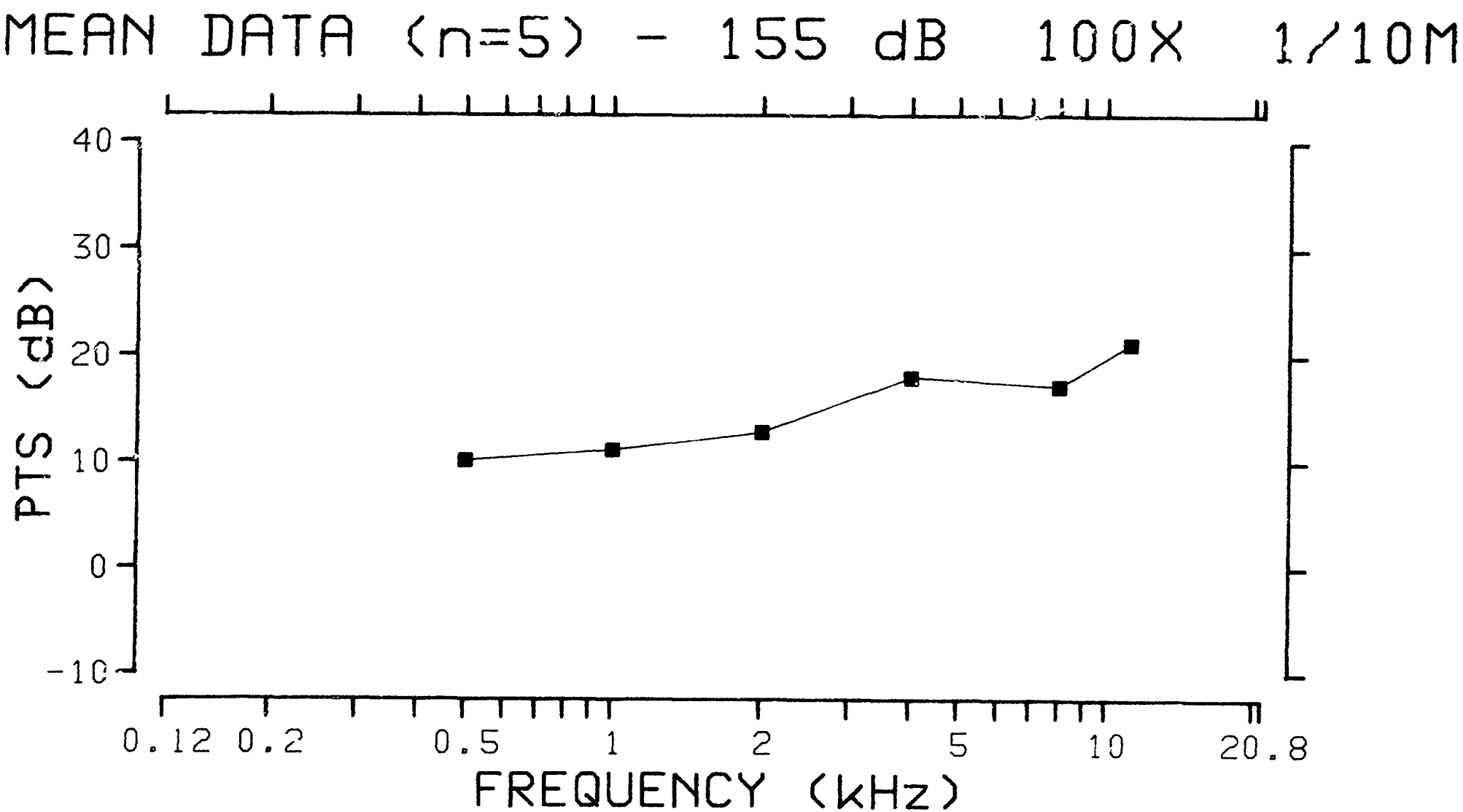
MEAN DATA (n=5) - 155 dB 100X 1/10M



A319

The Group Mean Permanent Threshold Shift (PTS)

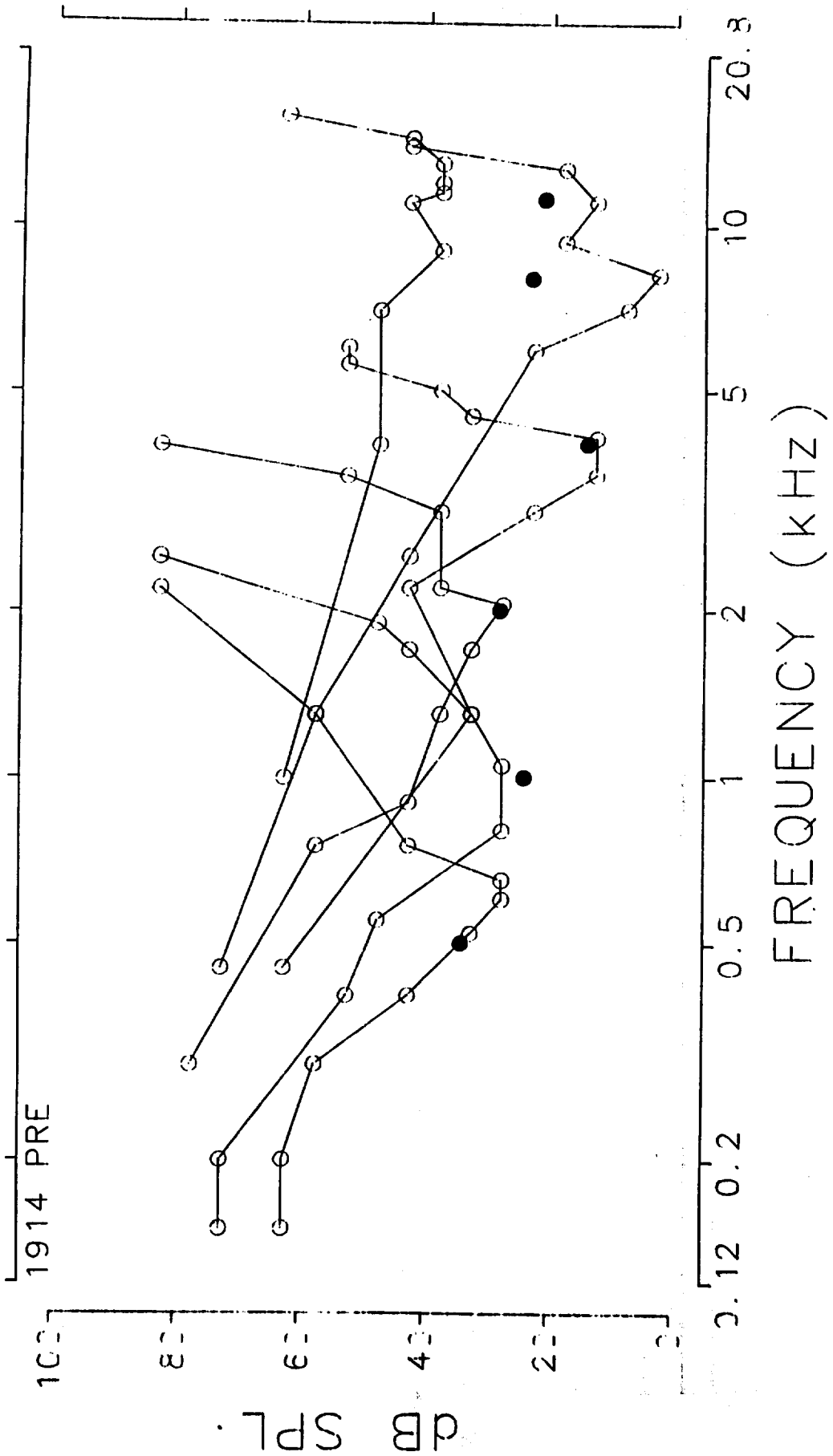
for all Test Frequencies

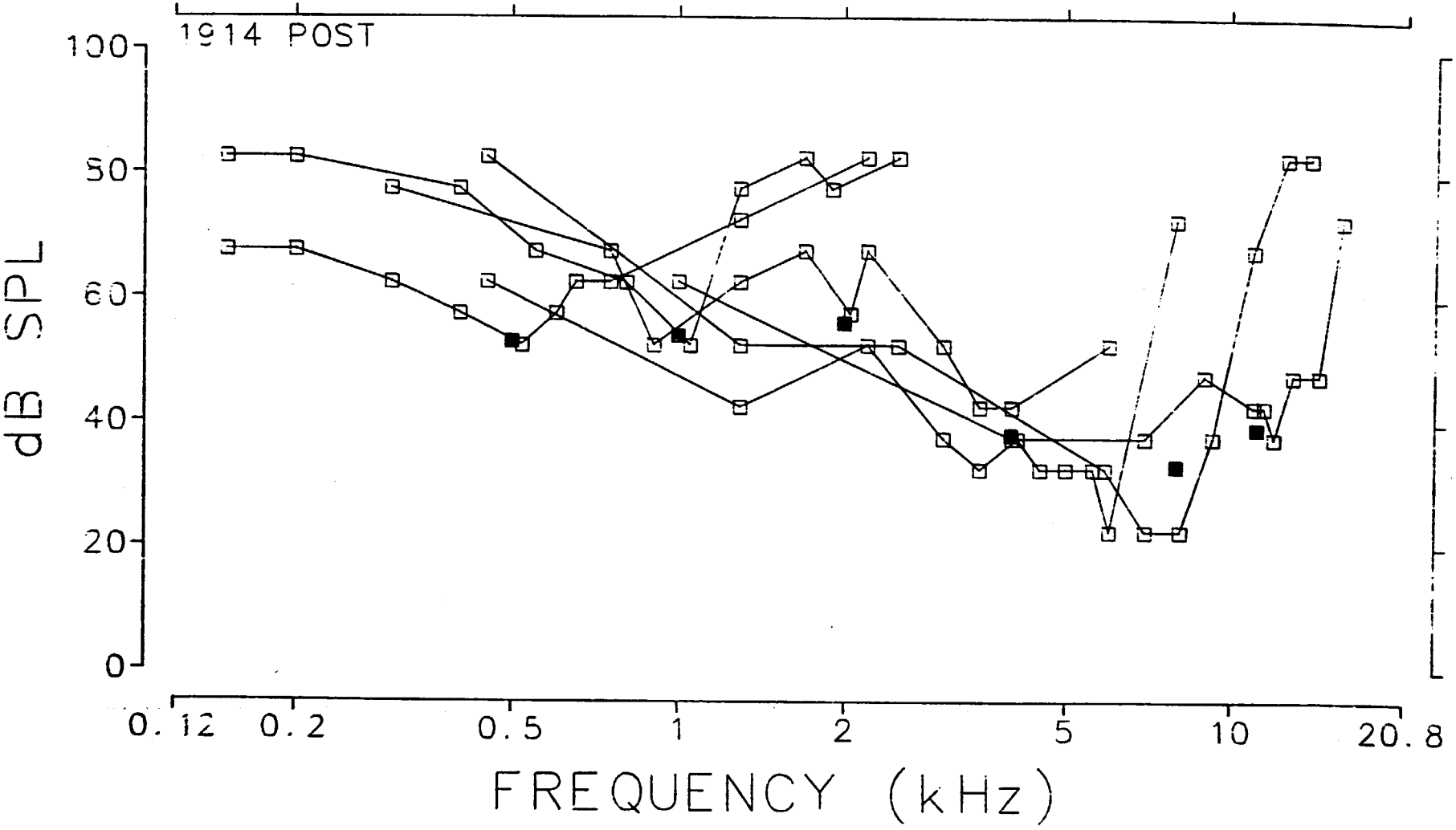

MEAN DATA (n=5) - 155 dB 100X 1/10M
PTS (dB)
40
30
20
10
0
-10
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

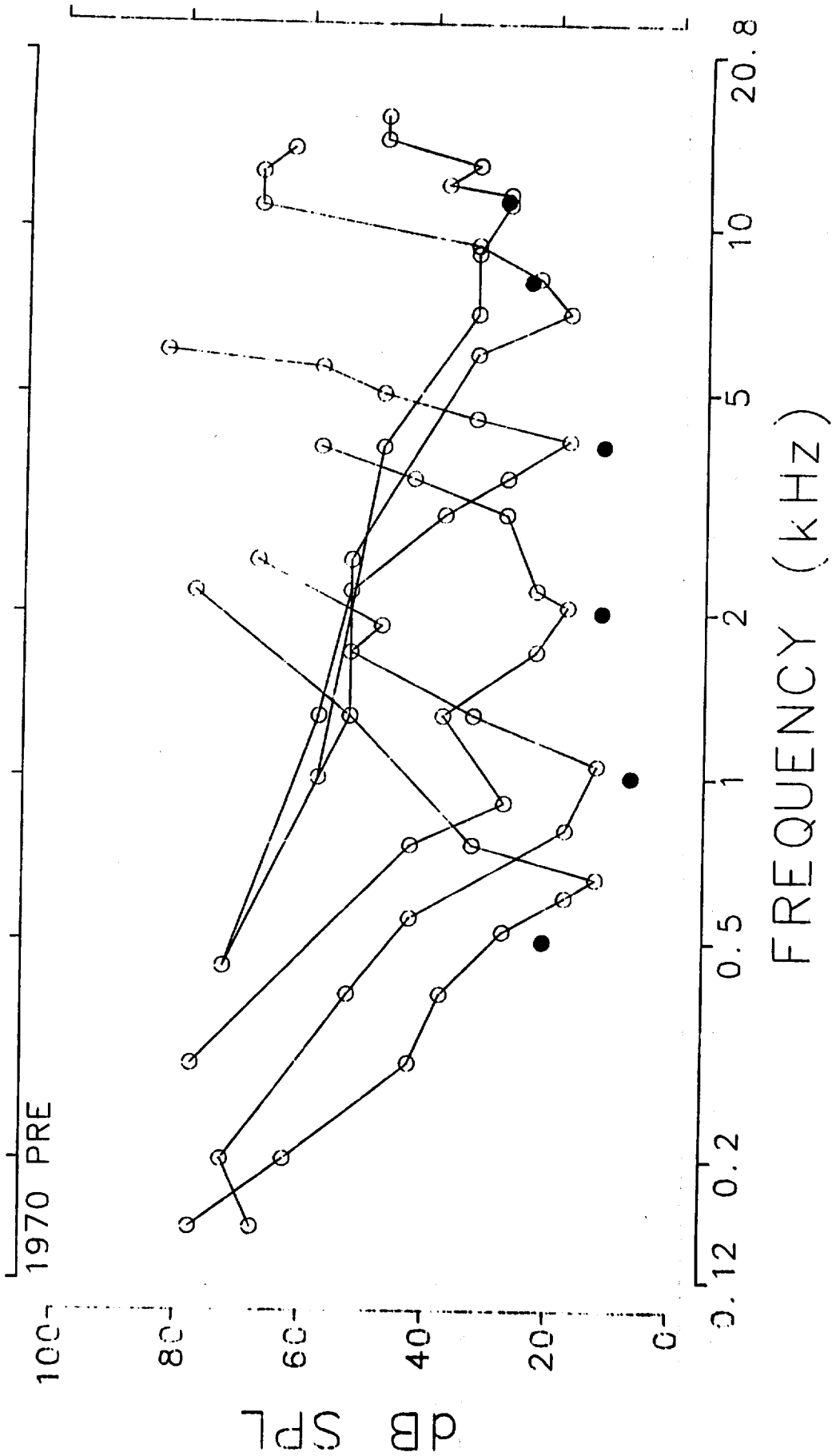
A321

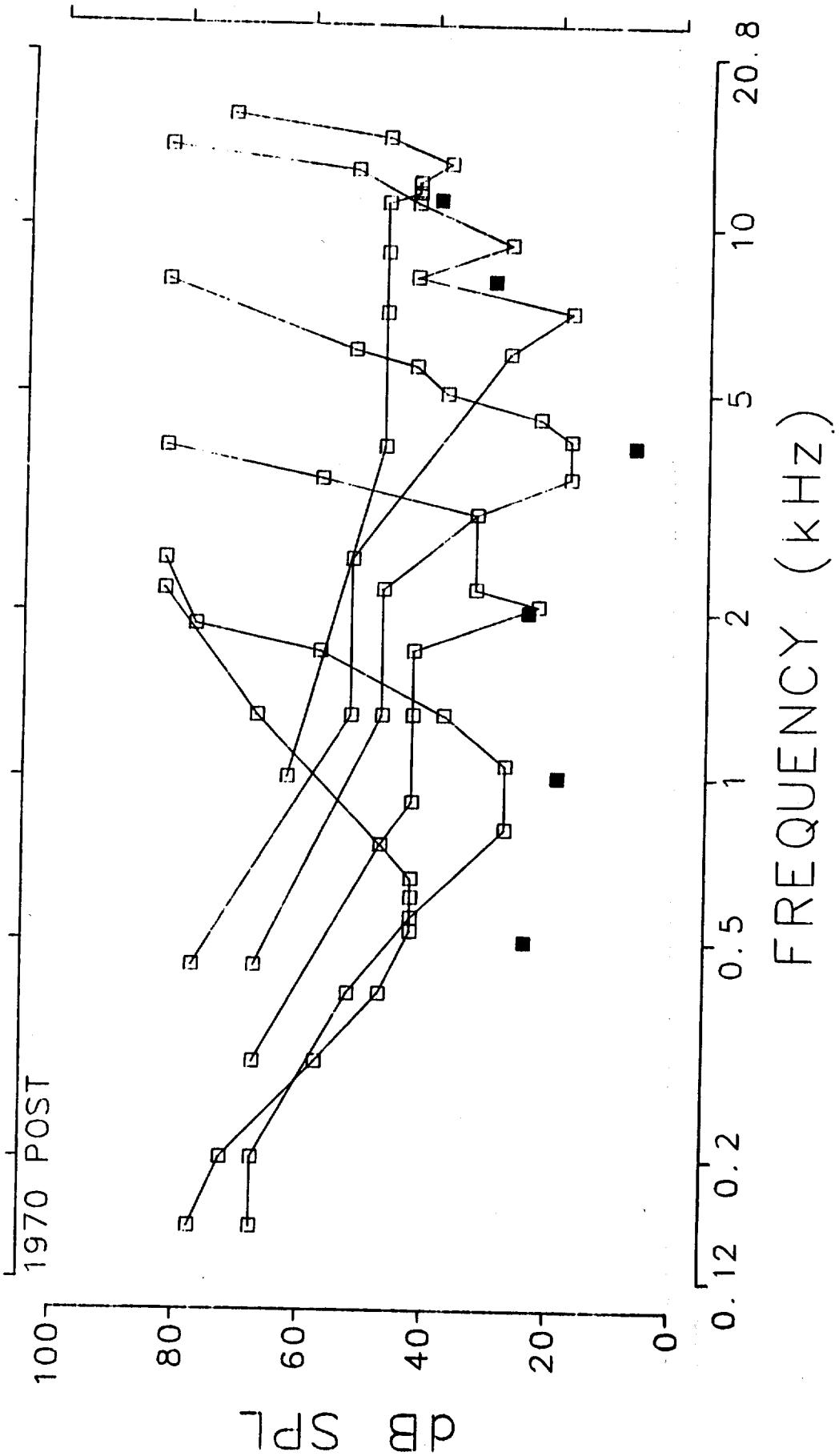
The Pre and Postexposure Tuning Curves for
Individual Animals in this Exposure Group.

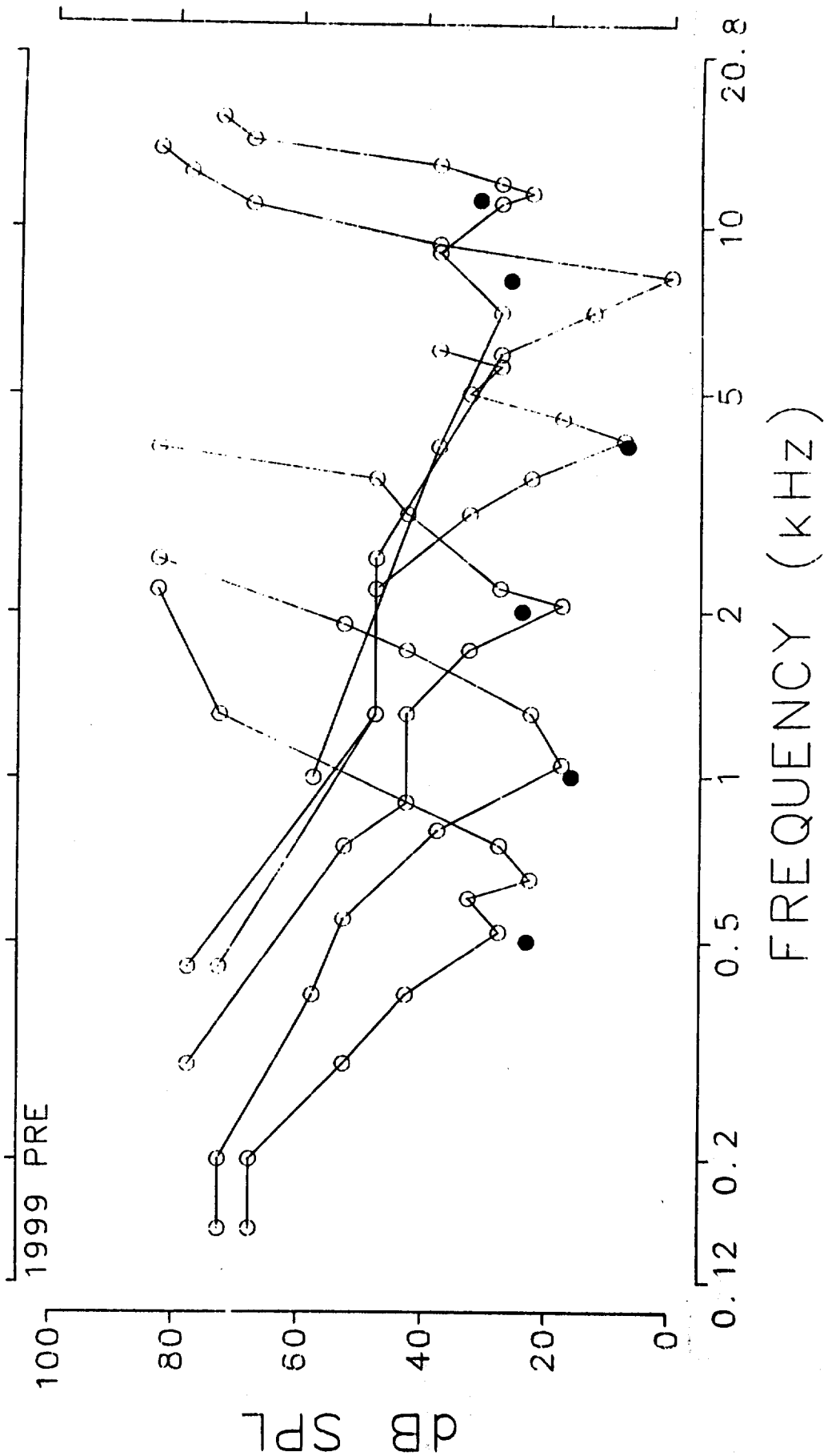
The solid symbol represents the threshold of the probe tone.

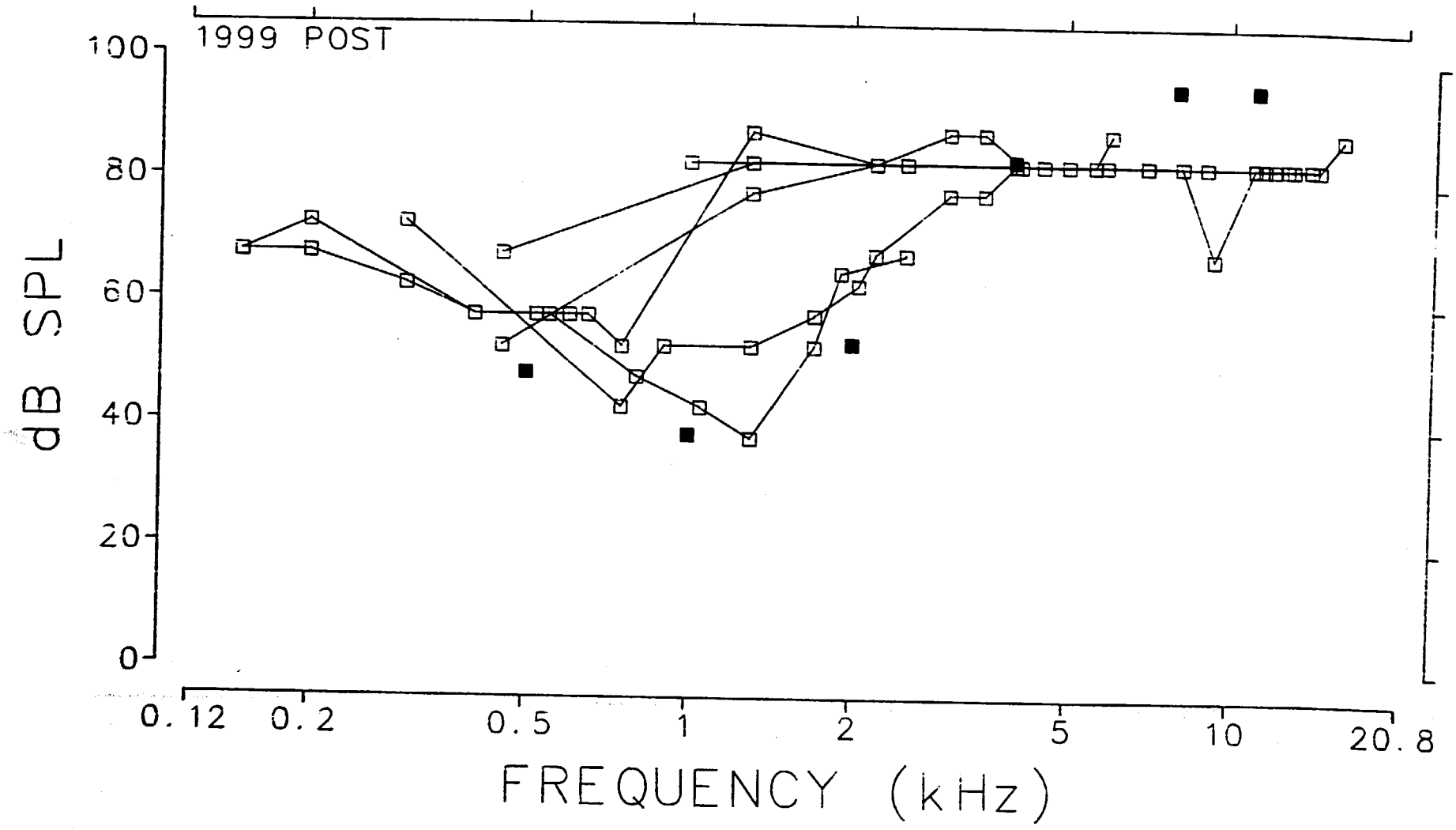

1914 PRE
dB SPL
FREQUENCY (kHz)
0.12
0.2
0.5
1
2
5
10
20

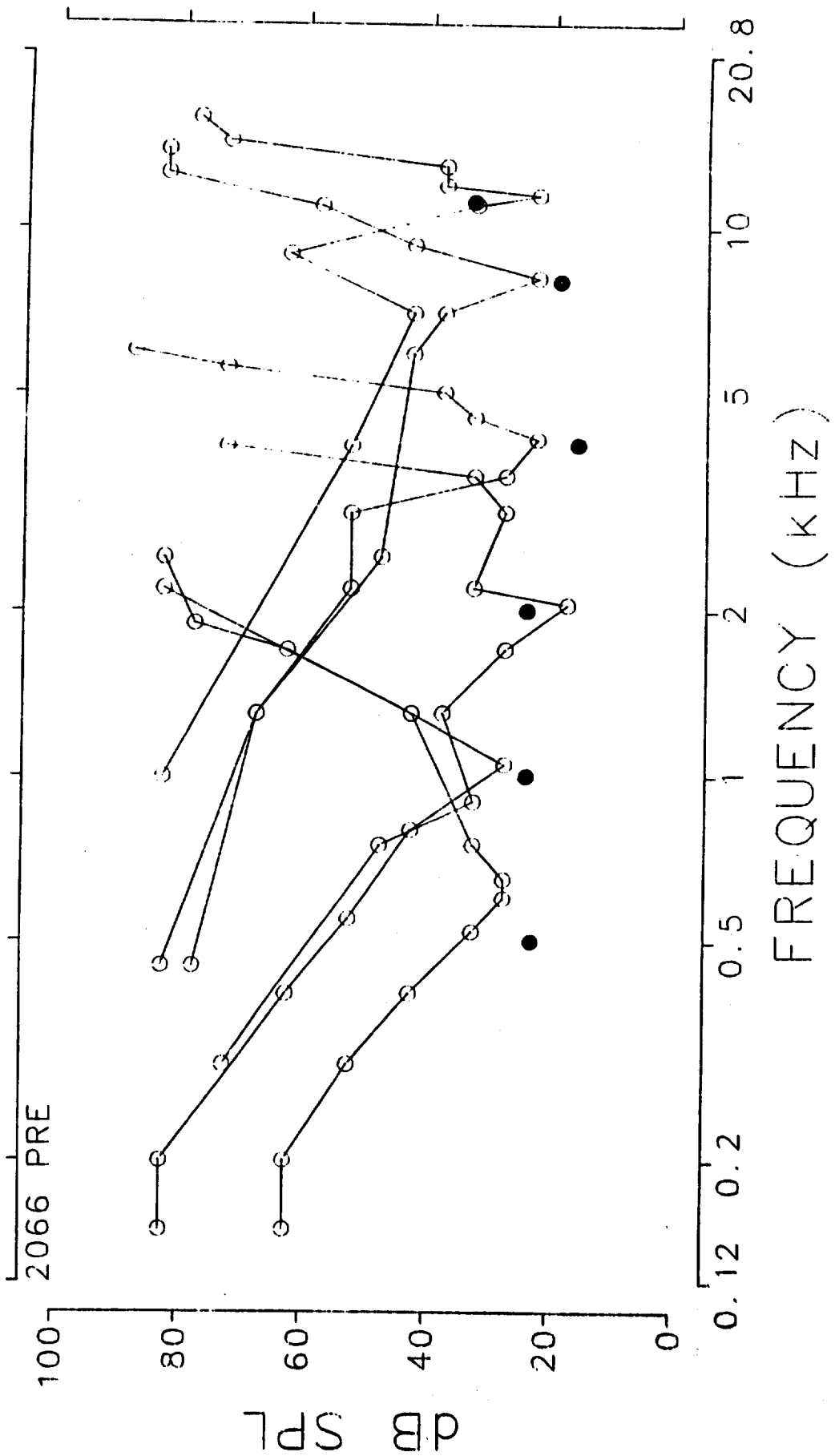

1914 POST
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

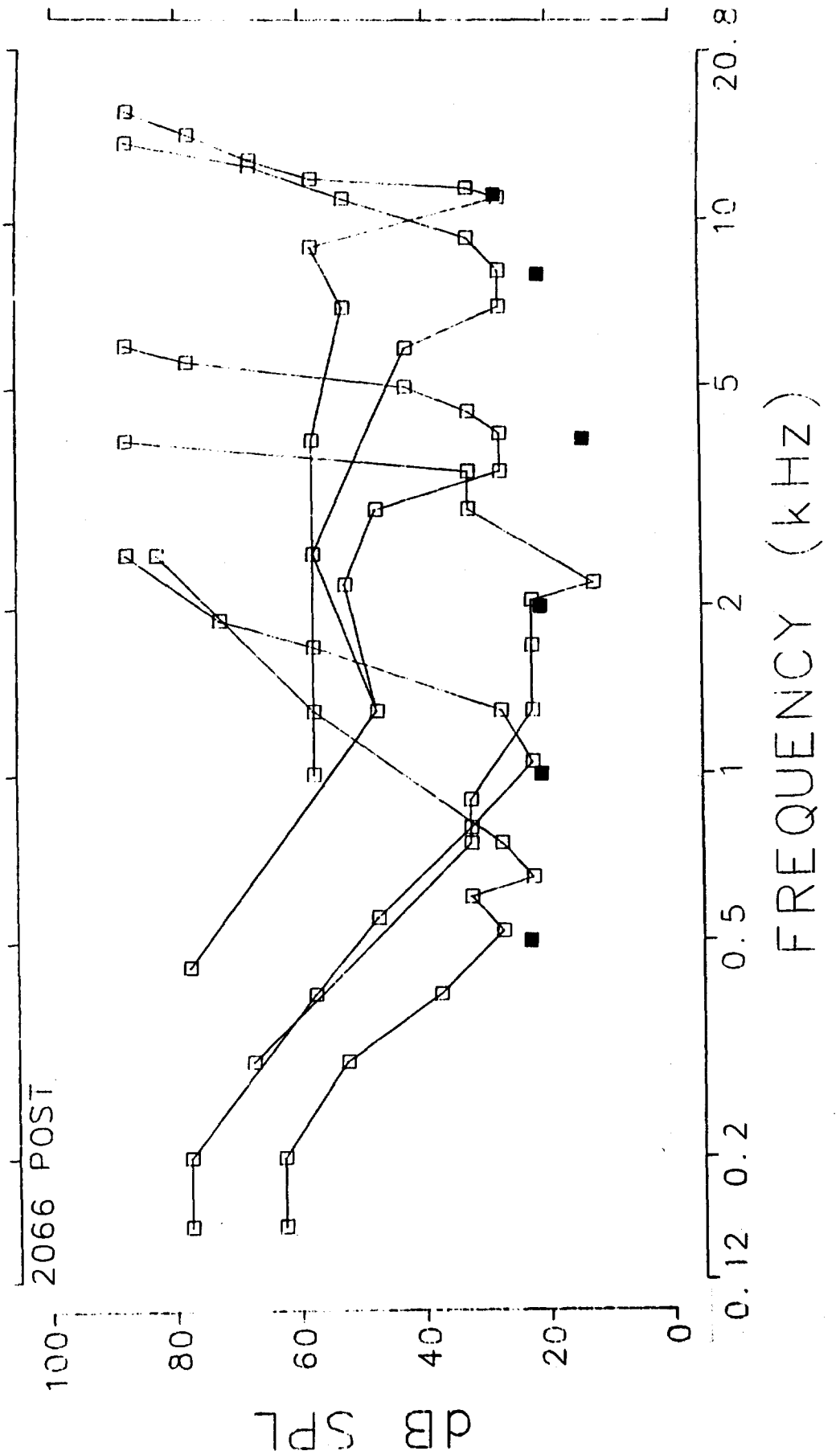

1970 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

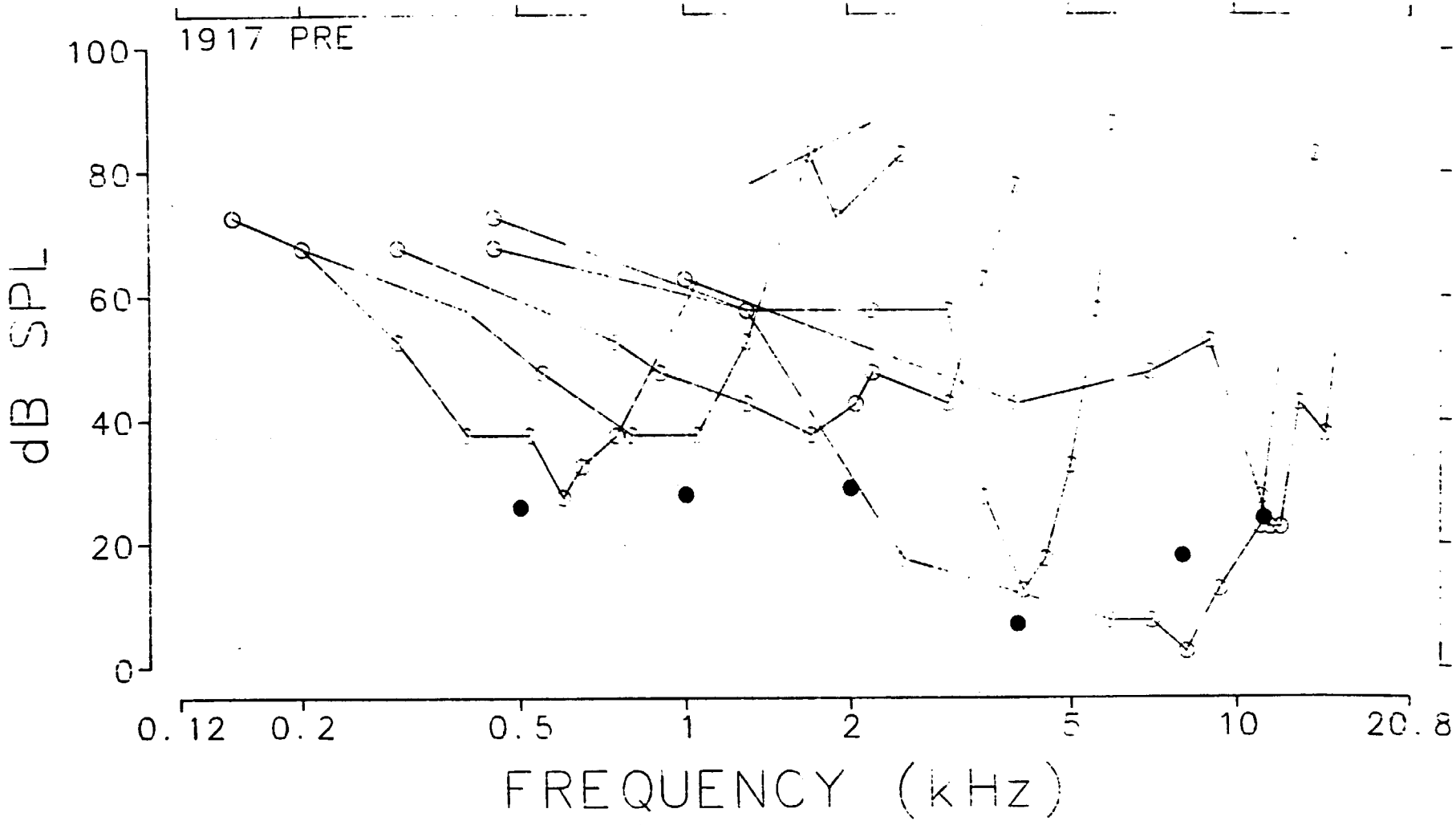

1970 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

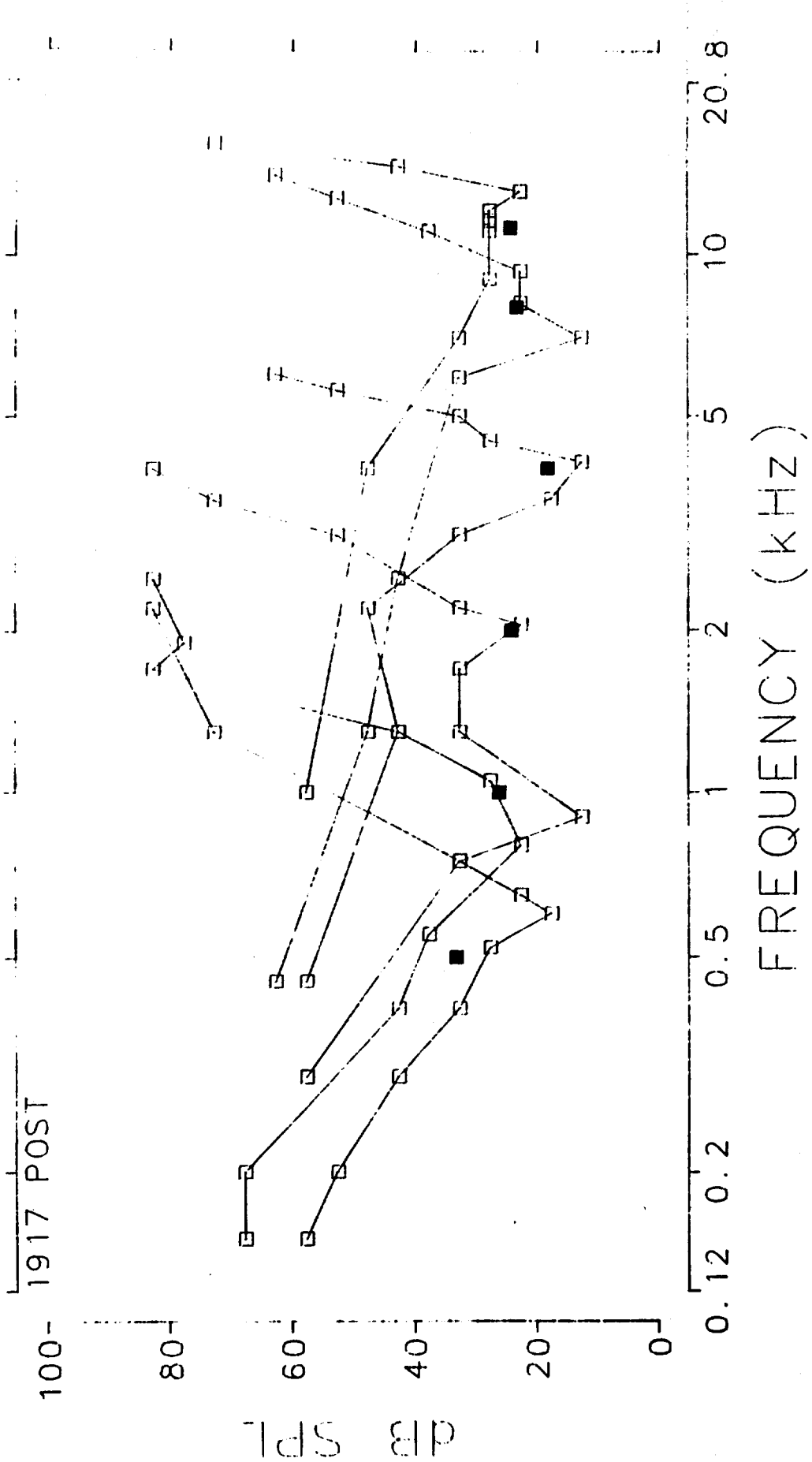

1999 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1999 POST
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


2066 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


2066 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.0
FREQUENCY (kHZ)


1917 PRE
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1917 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

SHOCK TUBE EXPOSURE
155 dB, 100X, 1/10 MIN

TOTAL NUMBER OF COCHLEAR SENSORY CELLS MISSING

ANIMAL NUMBER	INNER HAIR CELLS	1ST ROW OUTER HAIR CELLS	2ND ROW OUTER HAIR CELLS	3RD ROW OUTER HAIR CELLS	TOTAL OUTER HAIR CELLS
R1914R	235	1072	1026	811	2909
R1917R	15	175	151	193	519
R1970R	19	66	62	104	232
R1999R	194	881	904	862	2647
R2066R	4	31	26	43	100
GROUP MEAN	93				1281
S.D.	112				1378

TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND LENGTHS OF THE COCHLEA CENTERED AT THE FREQUENCIES INDICATED

	OCTAVE BAND CENTER FREQUENCY	INNER HAIR CELLS	OUTER HAIR CELLS
GROUP MEANS			
	0.125 kHz	2.0	71.4
	0.25 kHz	1.6	48.0
	0.5 kHz	.4	43.6
	1 kHz	5.2	190.2
	2 kHz	19.8	222.8
	4 kHz	28.4	255.6
	8 kHz	29.2	241.8
	16 kHz	6.2	194.2
STANDARD DEVIATIONS			
	0.125 kHz	2.0	51.8
	0.25 kHz	.9	28.5
	0.5 kHz	.9	25.2
	1 kHz	5.3	238.8
	2 kHz	38.8	389.8
	4 kHz	59.1	386.2
	8 kHz	63.1	442.4
	16 kHz	10.6	411.4

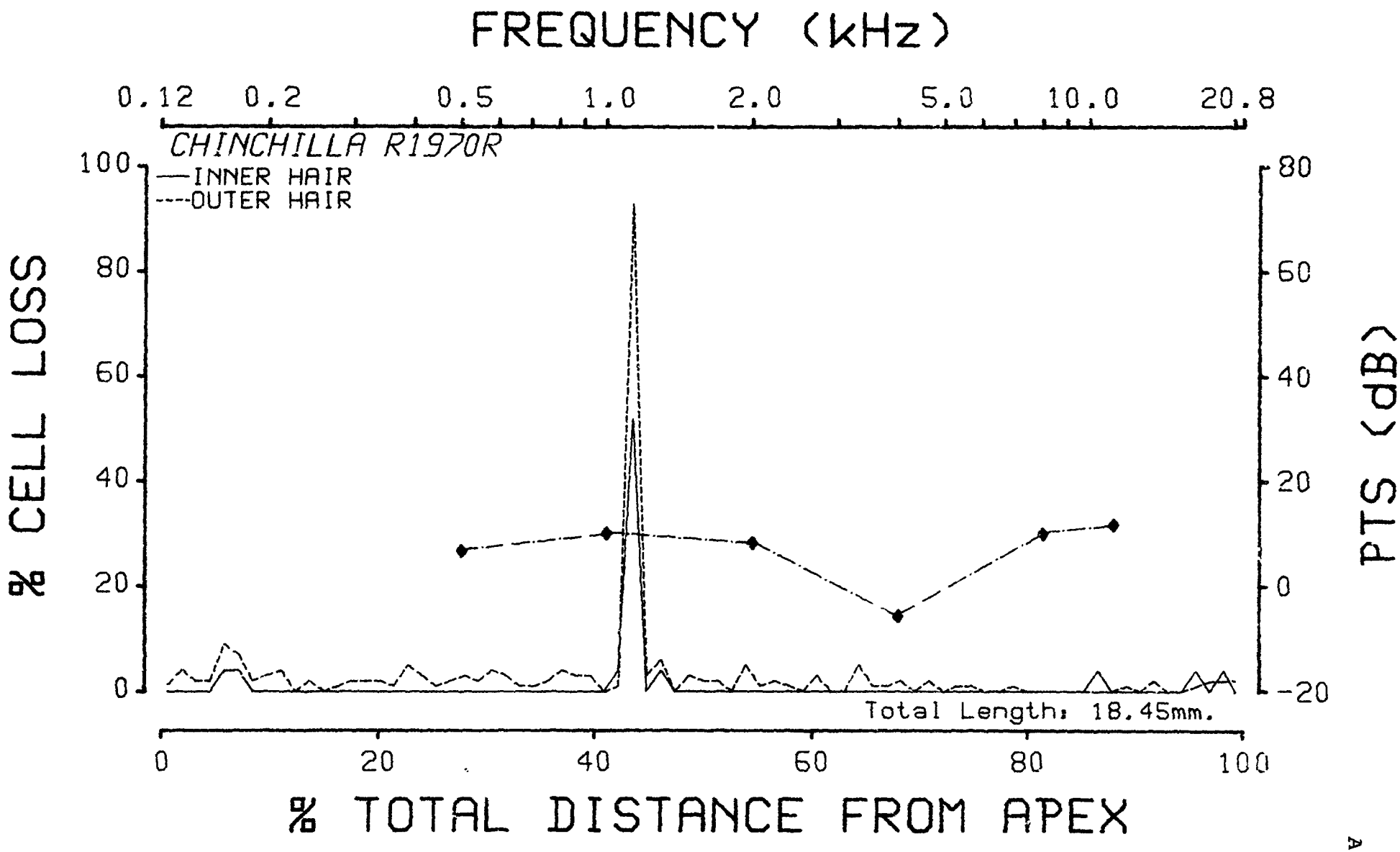
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1914R							
0.125 kHz	0	51	50	55	156	0	3
0.25 kHz	3	14	23	23	60	2	0
0.5 kHz	0	30	22	20	72	0	3
1 kHz	4	262	246	102	610	11	47
2 kHz	89	310	308	297	915	168	134
4 kHz	134	310	305	294	909	275	190
8 kHz	2	86	66	17	169	2	10
16 kHz	3	9	6	3	18	0	1
TOTALS	235	1072	1076	811	2909	458	388
CHINCHILLA R1917R							
0.125 kHz	5	12	19	34	65	0	6
0.25 kHz	1	15	10	59	84	0	1
0.5 kHz	2	23	14	19	56	4	6
1 kHz	3	63	48	20	131	3	14
2 kHz	3	37	44	48	129	6	6
4 kHz	0	20	13	9	42	1	1
8 kHz	0	3	2	2	7	0	0
16 kHz	1	2	1	2	5	0	0
TOTALS	15	175	151	193	519	14	34
CHINCHILLA R1970R							
0.125 kHz	1	9	3	18	30	0	0
0.25 kHz	1	2	1	20	23	0	0
0.5 kHz	0	3	12	12	27	0	0
1 kHz	14	38	36	35	109	27	13
2 kHz	0	6	3	7	16	0	0
4 kHz	0	3	5	7	15	0	0
8 kHz	1	1	1	0	2	0	0
16 kHz	2	2	1	5	8	0	0
TOTALS	19	66	62	104	232	27	13

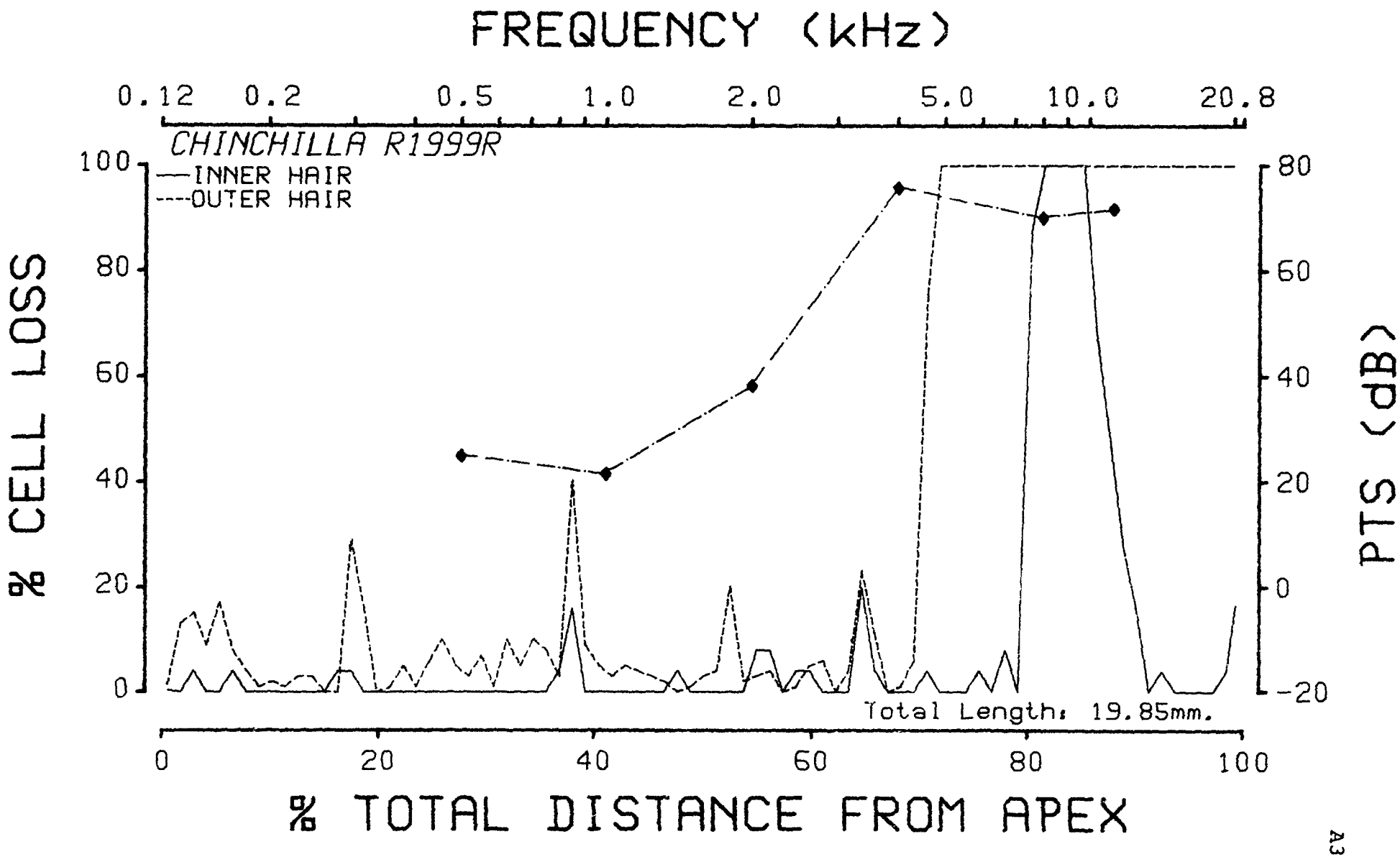
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1999R							
0.125 kHz	3	13	28	36	77	0	1
0.25 kHz	2	37	13	8	58	5	3
0.5 kHz	0	14	33	7	54	0	0
1 kHz	5	24	43	21	88	6	5
2 kHz	7	17	10	16	43	0	1
4 kHz	7	103	104	101	308	6	5
8 kHz	142	341	341	341	1023	193	6
16 kHz	25	310	310	310	930	3	8
TOTALS	194	881	904	862	2647	213	29
CHINCHILLA R2066R							
0.125 kHz	1	4	8	17	29	0	0
0.25 kHz	1	4	2	9	15	0	0
0.5 kHz	0	3	1	5	9	0	0
1 kHz	0	7	1	5	13	0	0
2 kHz	0	4	4	3	11	0	0
4 kHz	1	3	0	1	4	0	0
8 kHz	1	1	6	1	8	0	0
16 kHz	0	4	4	2	10	0	0
TOTALS	4	31	26	43	100	0	0

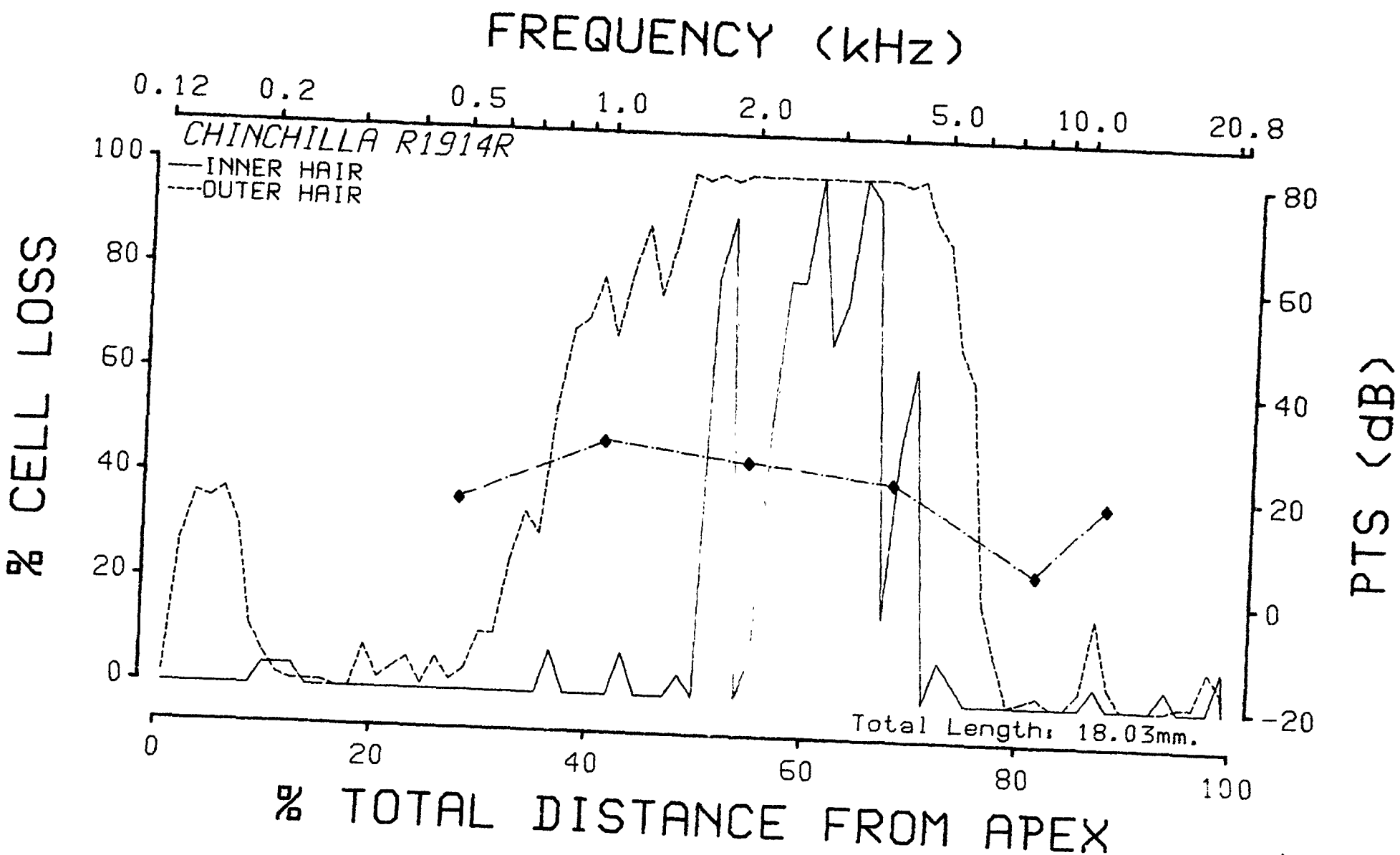
Cochleograms and PTS Audiograms for Individual Animals


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1970R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.45mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

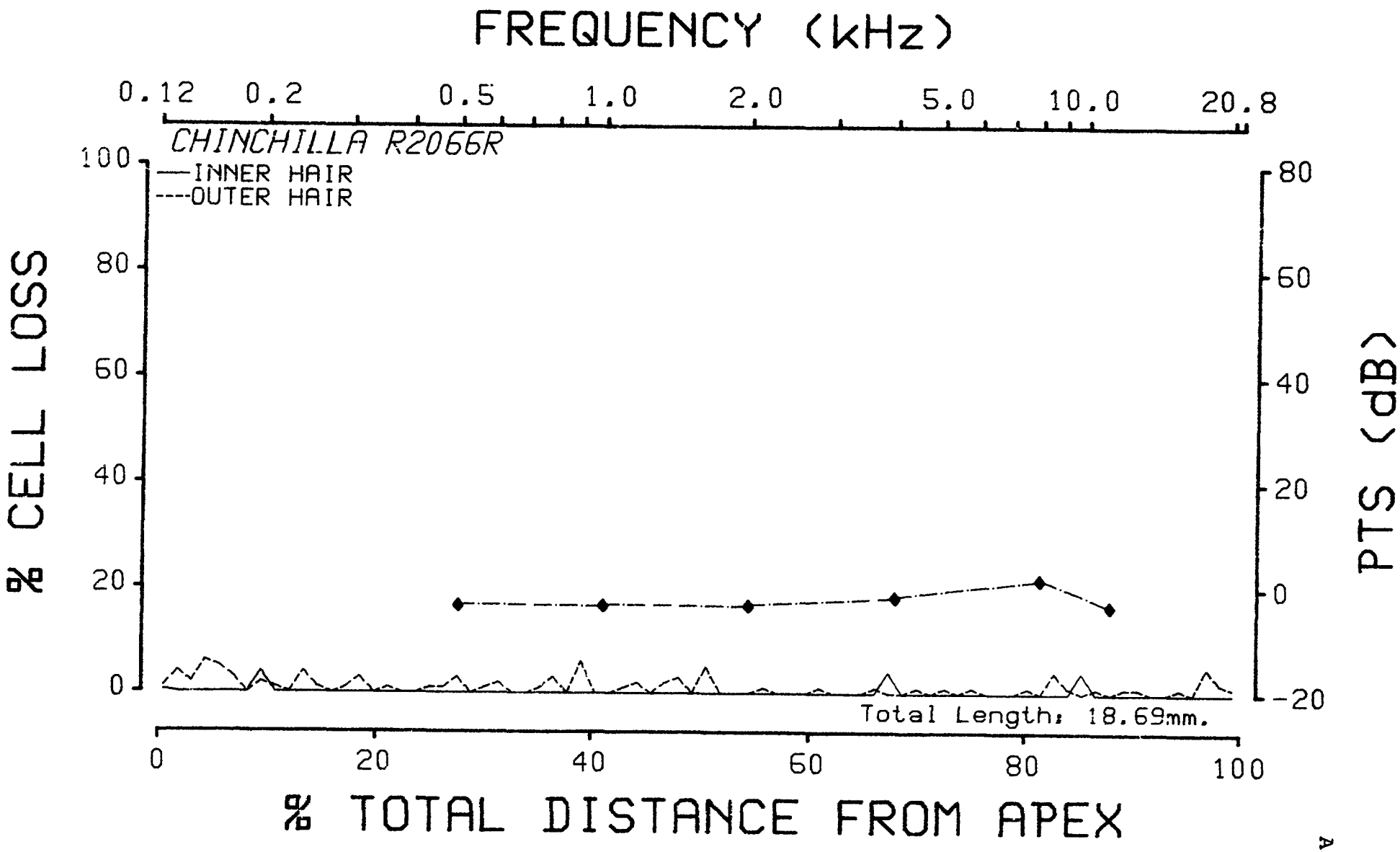
A337


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1999R
INNER HAIR
OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.85mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

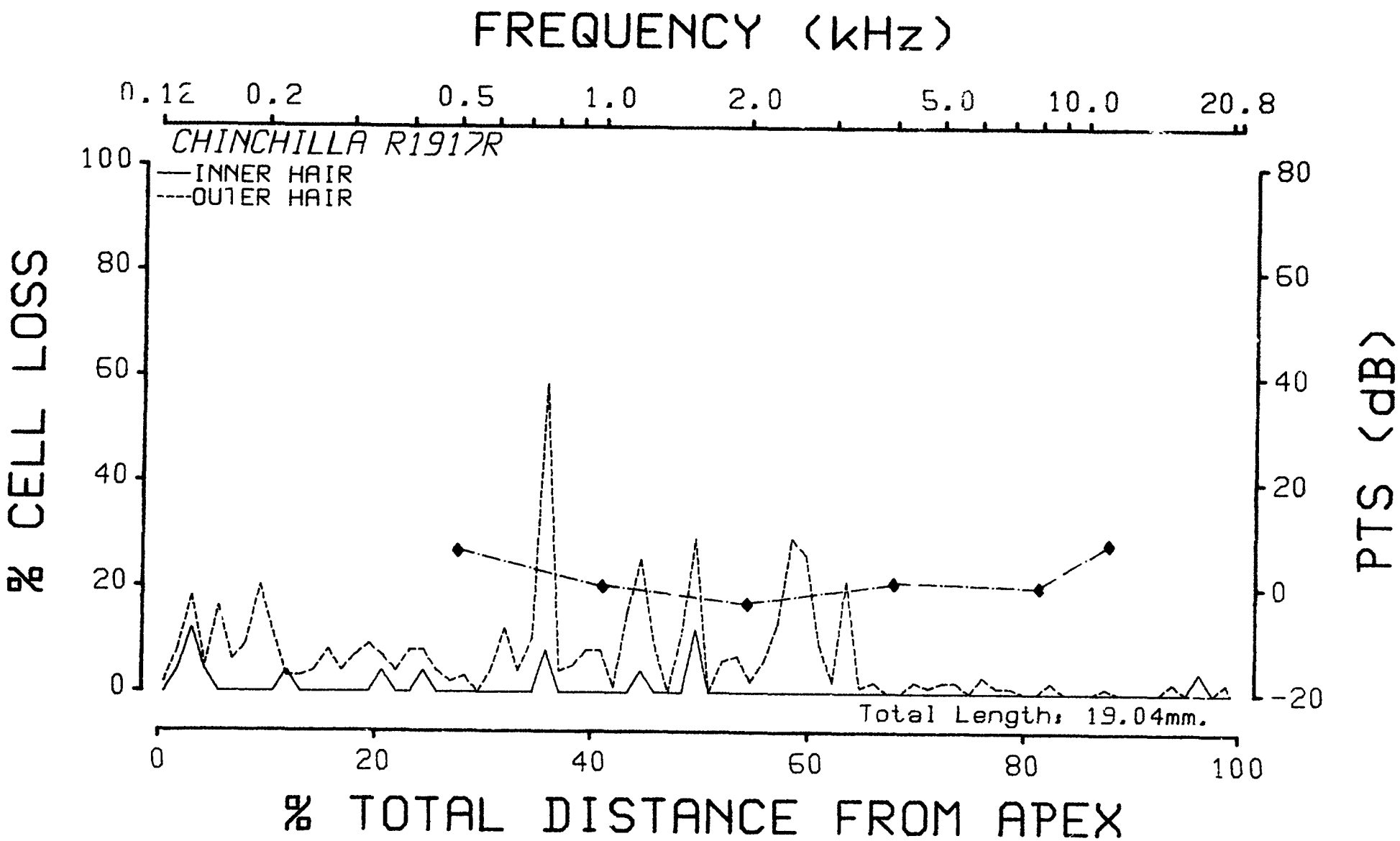
A338


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1914R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.03mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A339


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R2066R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.69mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A340


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1917R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.04mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A341

Summary Data for the Group Exposed to:

160 dB, 1X

Animal #		
1973	-	Completed the Entire Protocol
1843	-	Completed the Entire Protocol
2013	-	Completed the Entire Protocol
2035	-	Completed the Entire Protocol
2057	-	Completed the Entire Protocol
1972	-	No Histology Available

160 dB 1X

PRE-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1843	29.2	19.2	17.5	-2.5	29.2	35.8	50.8
1972	32.5	17.5	19.2	15.8	24.2	31.2	*****
1973	23.8	14.2	21.3	14.2	30.8	26.3	*****
2013	19.2	13.8	14.2	12.5	20.8	19.2	*****
2035	25.8	14.2	22.5	16.3	29.2	32.5	*****
2057	22.5	15.8	22.5	17.5	42.5	29.2	*****
Mean	25.5	15.8	19.5	12.3	29.4	29.0	50.8
S.D.	4.8	2.2	3.3	7.4	7.4	5.8	*****

POST-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1843	17.5	9.2	14.2	0.8	27.5	35.8	40.8
1972	30.0	19.2	22.5	14.2	37.5	43.7	*****
1973	19.2	14.2	17.5	15.8	40.0	35.0	*****
2013	17.5	12.5	19.2	19.2	25.8	19.2	*****
2035	29.2	17.5	22.5	20.8	35.8	35.8	*****
2057	20.8	12.5	20.8	12.5	34.2	24.2	*****
Mean	22.4	14.2	19.5	13.9	33.5	32.3	40.8
S.D.	5.7	3.7	3.2	7.1	5.6	9.0	*****

PERMANENT THRESHOLD SHIFT (dB)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1843	-11.7	-10.0	-3.3	3.3	-1.7	0.0	-10.0
1972	-2.5	1.7	3.3	-1.7	13.3	12.5	*****
1973	-4.6	0.0	-3.7	1.7	9.2	8.7	*****
2013	-1.7	-1.2	5.0	6.7	5.0	0.0	*****
2035	3.3	3.3	0.0	4.6	6.7	3.3	*****
2057	-1.7	-3.3	-1.7	-5.0	-8.3	-5.0	*****
Mean	-3.1	-1.6	-0.1	1.6	4.0	3.3	-10.0
S.D.	4.9	4.7	3.6	4.3	7.8	6.4	*****

160 dB 1X

TEMPORARY THRESHOLD SHIFT (dB)

Frequency 0.5 kHz

Animal\Hr	0	2	8	24	240	Max
1843	3.3	-11.7	-6.7	-16.7	-16.7	3.3
1972	0.0	0.0	20.0	5.0	5.0	20.0
1973	-1.2	-1.2	-1.2	-6.2	-1.2	-1.2
2013	8.3	3.3	3.3	-1.7	-1.7	8.3
2035	-3.3	-3.3	1.7	-3.3	-3.3	1.7
2057	0.0	0.0	0.0	0.0	-5.0	0.0
Mean	1.2	-2.2	2.8	-3.8	-3.8	5.3
S.D.	4.1	5.1	9.1	7.3	7.2	7.9

Frequency 2.0 kHz

Animal\Hr	0	2	8	24	240	Max
1843	5.0	0.0	0.0	-10.0	0.0	5.0
1972	8.3	8.3	13.3	3.3	3.3	13.3
1973	6.2	1.2	-3.7	-3.7	-3.7	6.2
2013	8.3	8.3	3.3	3.3	-1.7	8.3
2035	5.0	5.0	0.0	0.0	0.0	5.0
2057	5.0	0.0	0.0	0.0	0.0	5.0
Mean	6.3	3.8	2.2	-1.2	-0.3	7.2
S.D.	1.6	4.0	5.9	5.1	2.3	3.3

Frequency 8.0 kHz

Animal\Hr	0	2	8	24	240	Max
1843	3.3	-6.7	-6.7	-6.7	3.3	3.3
1972	13.3	23.3	23.3	13.3	13.3	23.3
1973	6.7	1.7	1.7	-3.3	-3.3	6.7
2013	1.7	-3.3	6.7	1.7	1.7	6.7
2035	-1.7	3.3	3.3	3.3	8.3	8.3
2057	-5.0	-15.0	0.0	-5.0	-15.0	0.0
Mean	3.1	0.6	4.7	0.6	1.4	8.1
S.D.	6.4	12.9	10.1	7.3	9.9	8.1

MASKED THRESHOLDS (dB SPL) Group: 160 dB 1X

Probe Frequency: 0.5 kHz

Masker (kHz):		0.150	0.200	0.300	0.400	0.520	0.600	0.650	0.750	1.300	2.200
Animal (Q-10 dB)						Pre-Exposure					
1843	(1.19)	72.5	62.5	62.5	47.5	37.5	37.5	37.5	42.5	67.5	95.0*
1972	(1.12)	72.5	72.5	57.5	42.5	27.5	32.5	32.5	32.5	47.5	82.5
1973	(1.78)	72.5	62.5	47.5	47.5	37.5	37.5	32.5	37.5	67.5	87.5
2013	(2.62)	77.5	67.5	52.5	47.5	42.5	32.5	37.5	42.5	72.5	82.5
2035	(1.57)	67.5	62.5	47.5	42.5	32.5	27.5	27.5	32.5	57.5	77.5
2057	(2.22)	67.5	62.5	52.5	42.5	32.5	32.5	27.5	37.5	47.5	72.5
Mean	(1.75)	71.7	65.0	53.3	45.0	35.0	33.3	32.5	37.5	60.0	82.9
S.D.	(0.59)	3.8	4.2	5.8	2.7	5.2	3.8	4.5	4.5	10.8	7.8
Animal (Q-10 dB)						Post-Exposure					
1843	(2.05)	67.5	62.5	37.5	42.5	32.5	27.5	27.5	37.5	52.5	95.0*
1972	(1.20)	72.5	72.5	52.5	52.5	32.5	27.5	27.5	27.5	47.5	77.5
1973	(1.49)	67.5	62.5	52.5	37.5	27.5	27.5	27.5	37.5	67.5	82.5
2013	(2.62)	67.5	62.5	52.5	47.5	42.5	32.5	37.5	42.5	67.5	87.5
2035	(1.89)	67.5	62.5	47.5	47.5	37.5	27.5	27.5	32.5	57.5	87.5
2057	(1.01)	67.5	62.5	47.5	37.5	32.5	32.5	32.5	37.5	57.5	72.5
Mean	(1.71)	68.3	64.2	48.3	44.2	34.2	29.2	30.0	35.8	58.3	83.8
S.D.	(0.60)	2.0	4.1	5.8	6.1	5.2	2.6	4.2	5.2	8.0	8.0

MASKED THRESHOLDS (dB SPL) Group: 160 dB 1X

Probe Frequency: 1.0 kHz

Masker (kHz):		0.150	0.200	0.400	0.550	0.800	1.050	1.300	1.700	1.900	2.500
Animal (Q-10 dB)						Pre-Exposure					
1843	(1.31)	77.5	77.5	52.5	52.5	27.5	27.5	37.5	42.5	52.5	95.0*
1972	(1.54)	77.5	72.5	57.5	42.5	27.5	22.5	27.5	47.5	52.5	77.5
1973	(1.84)	77.5	72.5	57.5	42.5	32.5	22.5	27.5	52.5	52.5	87.5
2013	(1.92)	82.5	77.5	57.5	42.5	32.5	27.5	42.5	67.5	72.5	97.5
2035	(1.58)	72.5	72.5	47.5	42.5	27.5	22.5	27.5	52.5	57.5	95.0*
2057	(2.55)	72.5	72.5	52.5	42.5	32.5	22.5	37.5	47.5	52.5	67.5
Mean	(1.79)	76.7	74.2	54.2	44.2	30.0	24.2	33.3	51.7	56.7	86.7
S.D.	(0.44)	3.8	2.6	4.1	4.1	2.7	2.6	6.6	8.6	8.0	11.9
Animal (Q-10 dB)						Post-Exposure					
1843	(1.26)	72.5	67.5	47.5	32.5	12.5	17.5	22.5	37.5	57.5	95.0*
1972	(1.39)	82.5	72.5	57.5	42.5	32.5	27.5	27.5	57.5	52.5	82.5
1973	(2.10)	77.5	77.5	57.5	42.5	32.5	22.5	32.5	47.5	52.5	95.0*
2013	(1.61)	77.5	77.5	67.5	57.5	42.5	37.5	42.5	72.5	82.5	97.5
2035	(1.92)	72.5	72.5	52.5	37.5	27.5	22.5	37.5	52.5	52.5	77.5
2057	(1.18)	77.5	72.5	47.5	37.5	22.5	22.5	32.5	52.5	52.5	62.5
Mean	(1.57)	76.7	73.3	55.0	41.7	28.3	25.0	32.5	53.3	58.3	85.0
S.D.	(0.37)	3.8	3.8	7.6	8.6	10.2	6.9	7.1	11.6	12.0	13.6

MASKED THRESHOLDS (dB SPL) Group: 160 dB 1X

Probe Frequency: 2.0 kHz

Masker (kHz):		0.300	0.750	0.900	1.300	1.700	2.050	2.200	3.000	3.500	4.000
Animal (Q-10 dB)						Pre-Exposure					
1843	(3.86)	67.5	47.5	42.5	37.5	37.5	22.5	27.5	52.5	77.5	95.0*
1972	(7.27)	67.5	42.5	42.5	27.5	32.5	12.5	27.5	42.5	42.5	87.5
1973	(5.24)	72.5	47.5	42.5	42.5	42.5	27.5	37.5	42.5	42.5	95.5
2013	(6.14)	77.5	47.5	37.5	37.5	42.5	22.5	32.5	42.5	67.5	77.5
2035	(5.24)	67.5	52.5	47.5	37.5	37.5	22.5	32.5	37.5	47.5	82.5
2057	(2.28)	77.5	47.5	47.5	42.5	37.5	32.5	42.5	42.5	42.5	95.0*
Mean	(5.01)	71.7	47.5	43.3	37.5	38.3	23.3	33.3	43.3	53.3	88.8
S.D.	(1.75)	4.9	3.2	3.8	5.5	3.8	6.6	5.8	4.9	15.3	7.6
Animal (Q-10 dB)						Post-Exposure					
1843	(6.45)	67.5	52.5	42.5	42.5	37.5	32.5	17.5	47.5	72.5	82.5
1972	(2.70)	67.5	57.5	47.5	32.5	37.5	22.5	27.5	37.5	47.5	87.5
1973	(5.24)	67.5	47.5	42.5	32.5	42.5	27.5	37.5	42.5	42.5	67.5
2013	(7.27)	72.5	47.5	42.5	37.5	52.5	32.5	47.5	62.5	95.0*	97.5
2035	(4.57)	67.5	52.5	42.5	22.5	27.5	17.5	32.5	37.5	37.5	62.5
2057	(5.24)	72.5	42.5	47.5	47.5	47.5	32.5	42.5	42.5	57.5	95.0*
Mean	(5.25)	69.2	50.0	44.2	35.8	40.8	27.5	34.2	45.0	58.8	82.1
S.D.	(1.58)	2.6	5.2	2.6	8.8	8.8	6.3	10.8	9.4	21.7	14.4

MASKED THRESHOLDS (dB SPL) Group: 160 dB 1X

Probe Frequency: 4.0 kHz

Masker (kHz):		0.450	1.300	2.200	3.000	3.500	4.100	4.500	5.000	5.600	6.000
Animal (Q-10 dB)						Pre-Exposure					
1843	(7.14)	72.5	52.5	47.5	37.5	27.5	7.5	22.5	37.5	62.5	67.5
1972	(3.95)	72.5	47.5	57.5	37.5	22.5	17.5	32.5	47.5	62.5	72.5
1973	(2.61)	77.5	57.5	57.5	47.5	32.5	32.5	42.5	72.5	77.5	82.5
2013	(2.59)	72.5	57.5	57.5	37.5	37.5	32.5	47.5	67.5	62.5	72.5
2035	(3.49)	72.5	57.5	57.5	42.5	27.5	22.5	32.5	57.5	57.5	87.5
2057	(2.73)	77.5	57.5	52.5	42.5	37.5	32.5	42.5	57.5	67.5	82.5
Mean	(3.75)	74.2	55.0	55.0	40.8	30.8	24.2	36.7	56.7	65.0	77.5
S.D.	(1.75)	2.6	4.2	4.2	4.1	6.1	10.3	9.2	12.8	6.9	7.7
Animal (Q-10 dB)						Post-Exposure					
1843	(10.07)	72.5	57.5	62.5	57.5	47.5	22.5	47.5	57.5	85.0*	72.5
1972	(2.89)	77.5	57.5	62.5	47.5	32.5	27.5	32.5	42.5	62.5	87.5
1973	(3.49)	72.5	57.5	52.5	47.5	32.5	27.5	37.5	62.5	72.5	82.5
2013	(3.01)	77.5	57.5	67.5	47.5	42.5	37.5	52.5	77.5	82.5	77.5
2035	(2.82)	67.5	52.5	52.5	42.5	32.5	27.5	27.5	52.5	57.5	77.5
2057	(1.81)	77.5	52.5	47.5	37.5	32.5	32.5	42.5	52.5	67.5	67.5
Mean	(4.02)	74.2	55.8	57.5	46.7	36.7	29.2	40.0	57.5	71.3	77.5
S.D.	(3.02)	4.1	2.6	7.7	6.6	6.6	5.2	9.4	11.8	10.9	7.1

MASKED THRESHOLDS (dB SPL) Group: 160 dB 1X

Probe Frequency: 8.0 kHz

Masker (kHz):		0.450	1.300	2.500	5.900	7.000	8.100	9.300	11.000	12.700	14.000
Animal (Q-10 dB)						Pre-Exposure					
1843	(3.12)	95.0*	62.5	62.5	67.5	47.5	42.5	52.5	67.5	82.5	95.0*
1972	(3.00)	72.5	52.5	57.5	47.5	37.5	27.5	32.5	52.5	62.5	77.5
1973	(0.99)	85.0*	57.5	62.5	47.5	52.5	47.5	57.5	67.5	77.5	82.5
2013	(0.77)	82.5	67.5	62.5	52.5	57.5	52.5	57.5	67.5	92.5	97.5
2035	(3.45)	77.5	62.5	57.5	47.5	47.5	32.5	37.5	57.5	72.5	85.0*
2057	(1.43)	87.5	72.5	67.5	52.5	52.5	47.5	47.5	67.5	85.0*	95.0*
Mean	(2.13)	83.3	62.5	61.7	52.5	49.2	41.7	47.5	63.3	78.8	88.8
S.D.	(1.19)	7.9	7.1	3.8	7.7	6.8	9.7	10.5	6.6	10.5	8.2
Animal (Q-10 dB)						Post-Exposure					
1843	(1.47)	77.5	57.5	67.5	52.5	47.5	42.5	47.5	47.5	67.5	72.5
1972	(2.38)	77.5	57.5	62.5	52.5	42.5	37.5	37.5	67.5	77.5	87.5
1973	(1.88)	87.5	67.5	72.5	52.5	47.5	47.5	77.5	92.5	97.5	97.5
2013	(2.06)	82.5	62.5	67.5	52.5	47.5	42.5	42.5	72.5	95.0*	97.5
2035	(2.91)	85.0*	62.5	67.5	47.5	42.5	37.5	57.5	75.0*	85.0*	95.0*
2057	(2.02)	87.5	67.5	67.5	47.5	60.0	47.5	52.5	75.5	90.0*	95.0*
Mean	(2.12)	82.9	62.5	67.5	50.8	47.9	42.5	52.5	71.8	85.4	90.8
S.D.	(0.49)	4.6	4.5	3.2	2.6	6.4	4.5	14.1	14.6	11.3	9.7

MASKED THRESHOLDS (dB SPL) Group: 160 dB 1X

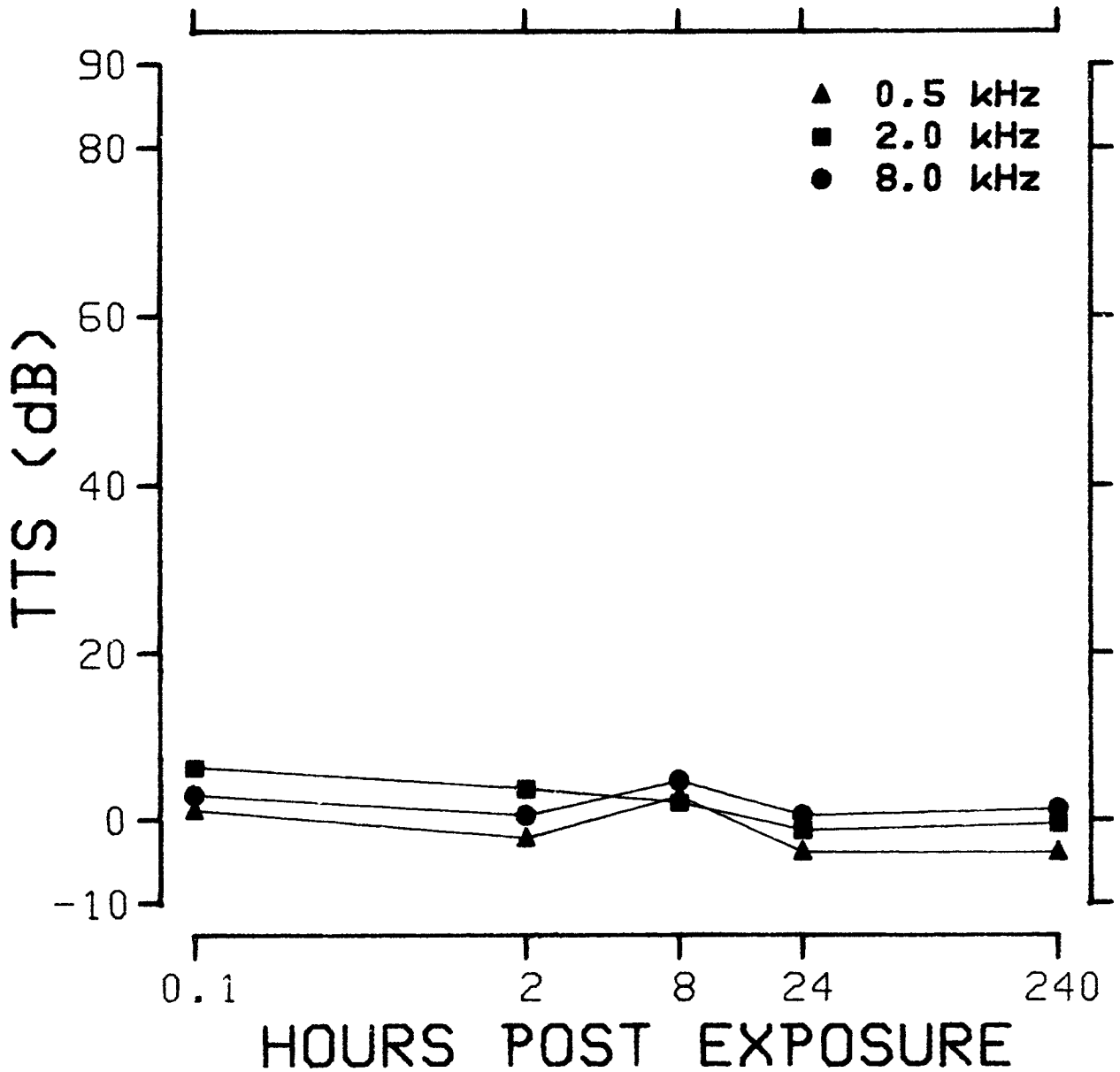
Probe Frequency: 11.2 kHz

Masker (kHz):		1.000	4.000	7.000	9.000	11.000	11.500	12.000	13.000	14.500	16.000
Animal (Q-10 dB)						Pre-Exposure					
1843	(4.24)	72.5	57.5	67.5	57.5	42.5	37.5	37.5	47.5	62.5	87.5
1972	(4.02)	77.5	52.5	62.5	62.5	42.5	37.5	32.5	32.5	47.5	72.5
1973	(3.86)	72.5	57.5	62.5	52.5	42.5	32.5	32.5	32.5	47.5	67.5
2013	(13.72)	77.5	62.5	62.5	47.5	42.5	27.5	37.5	47.5	72.5	72.5
2035	(3.84)	72.5	52.5	62.5	47.5	32.5	32.5	32.5	52.5	57.5	77.5
2057	(5.36)	67.5	57.5	67.5	52.5	32.5	37.5	42.5	57.5	62.5	82.5
Mean	(5.84)	73.3	56.7	64.2	53.3	39.2	34.2	35.8	45.0	58.3	76.7
S.D.	(3.90)	3.8	3.8	2.6	5.8	5.2	4.1	4.1	10.4	9.7	7.4
Animal (Q-10 dB)						Post-Exposure					
1843	(5.00)	77.5	52.5	72.5	62.5	32.5	37.5	37.5	47.5	62.5	87.5
1972	(6.89)	72.5	57.5	47.5	47.5	32.5	55.0	52.5	52.5	67.5	77.5
1973	(2.53)	62.5	52.5	57.5	37.5	37.5	47.5	37.5	42.5	57.5	95.0*
2013	(4.20)	72.5	57.5	67.5	47.5	32.5	32.5	37.5	57.5	67.5	82.5
2035	(11.48)	72.5	57.5	67.5	57.5	42.5	32.5	42.5	52.5	67.5	87.5
2057	(9.08)	67.5	57.5	62.5	57.5	27.5	37.5	42.5	52.5	67.5	77.5
Mean	(6.53)	70.8	55.8	62.5	51.7	34.2	40.4	41.7	50.8	65.0	84.6
S.D.	(3.31)	5.2	2.6	8.9	9.2	5.2	9.0	5.8	5.2	4.2	6.8

The Group Mean Recovery Curves

Measured at Three Test Frequencies

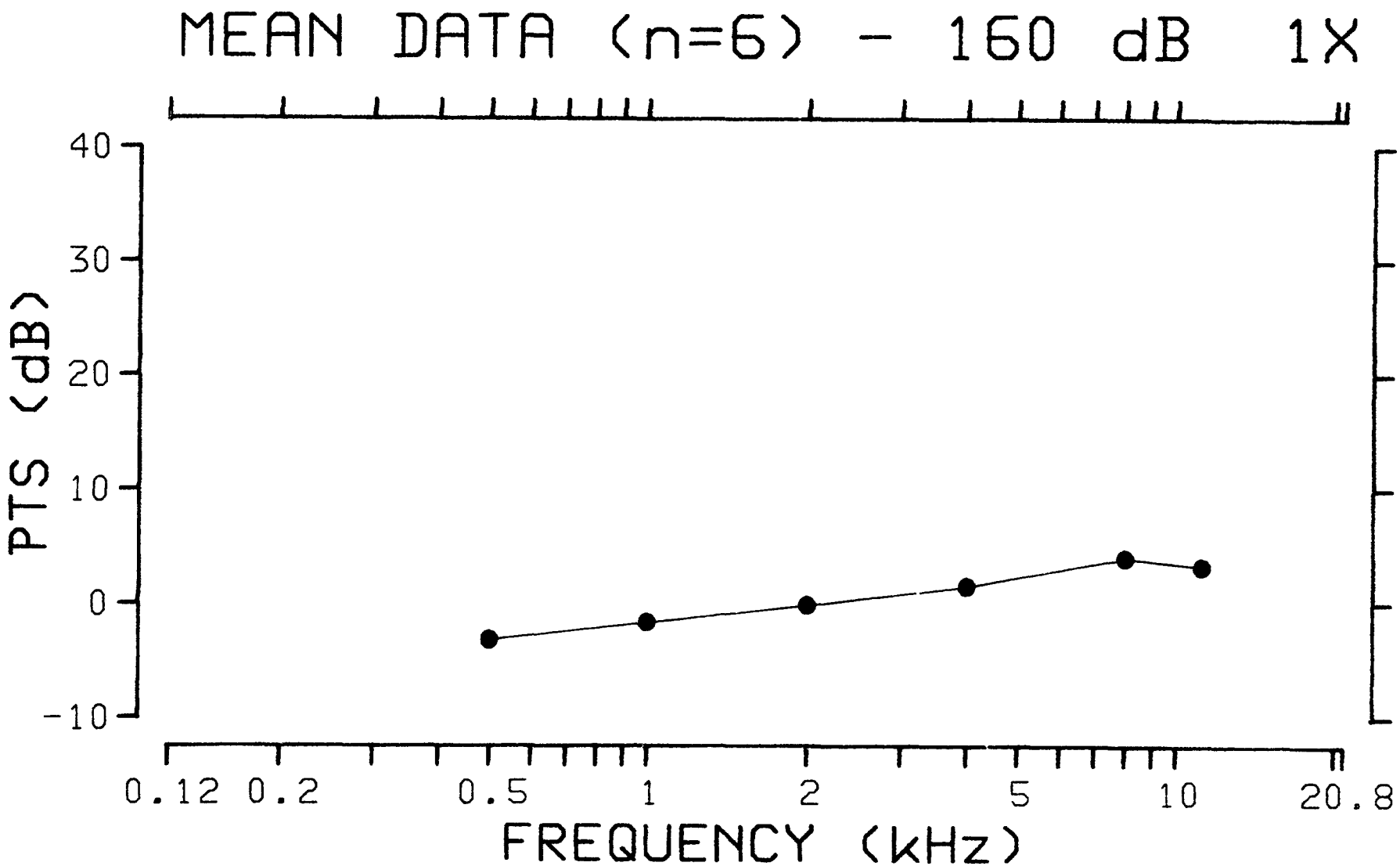
MEAN DATA (n=6) - 160 dB 1X



A352

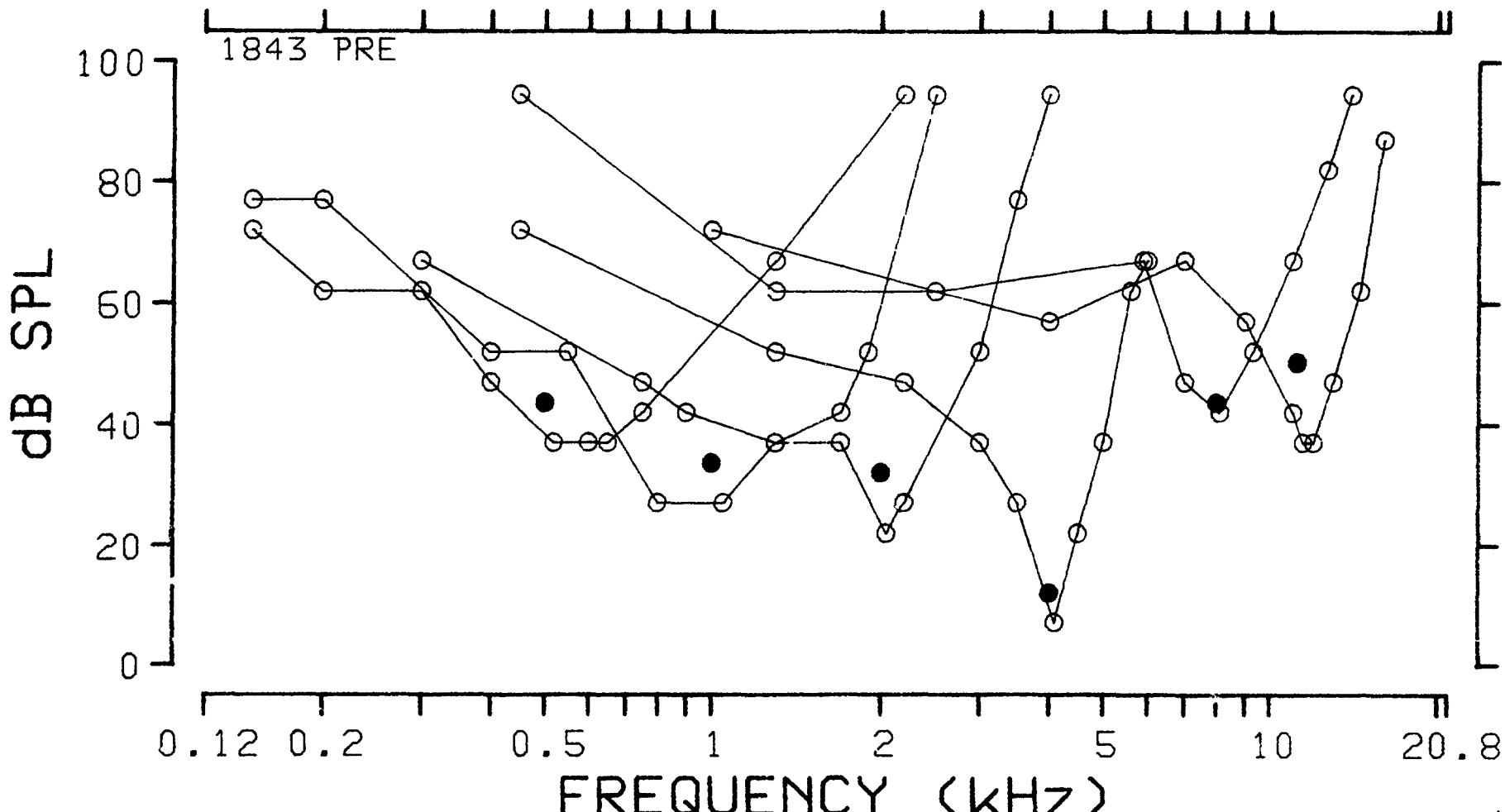
The Group Mean Permanent Threshold Shift (PTS)

for all Test Frequencies

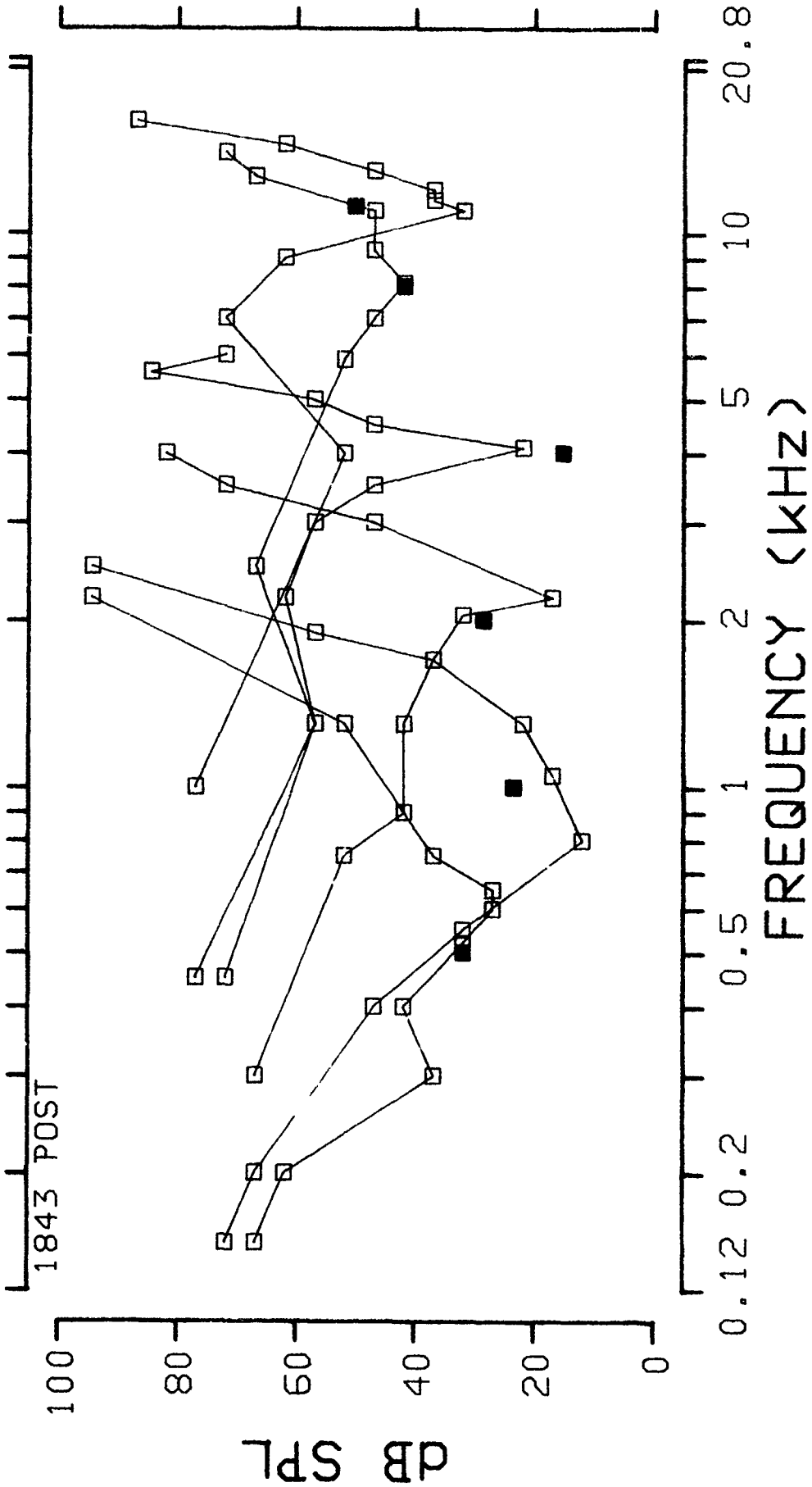

MEAN DATA (n=6) - 160 dB 1X
PTS (dB)
40
30
20
10
0
-10
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

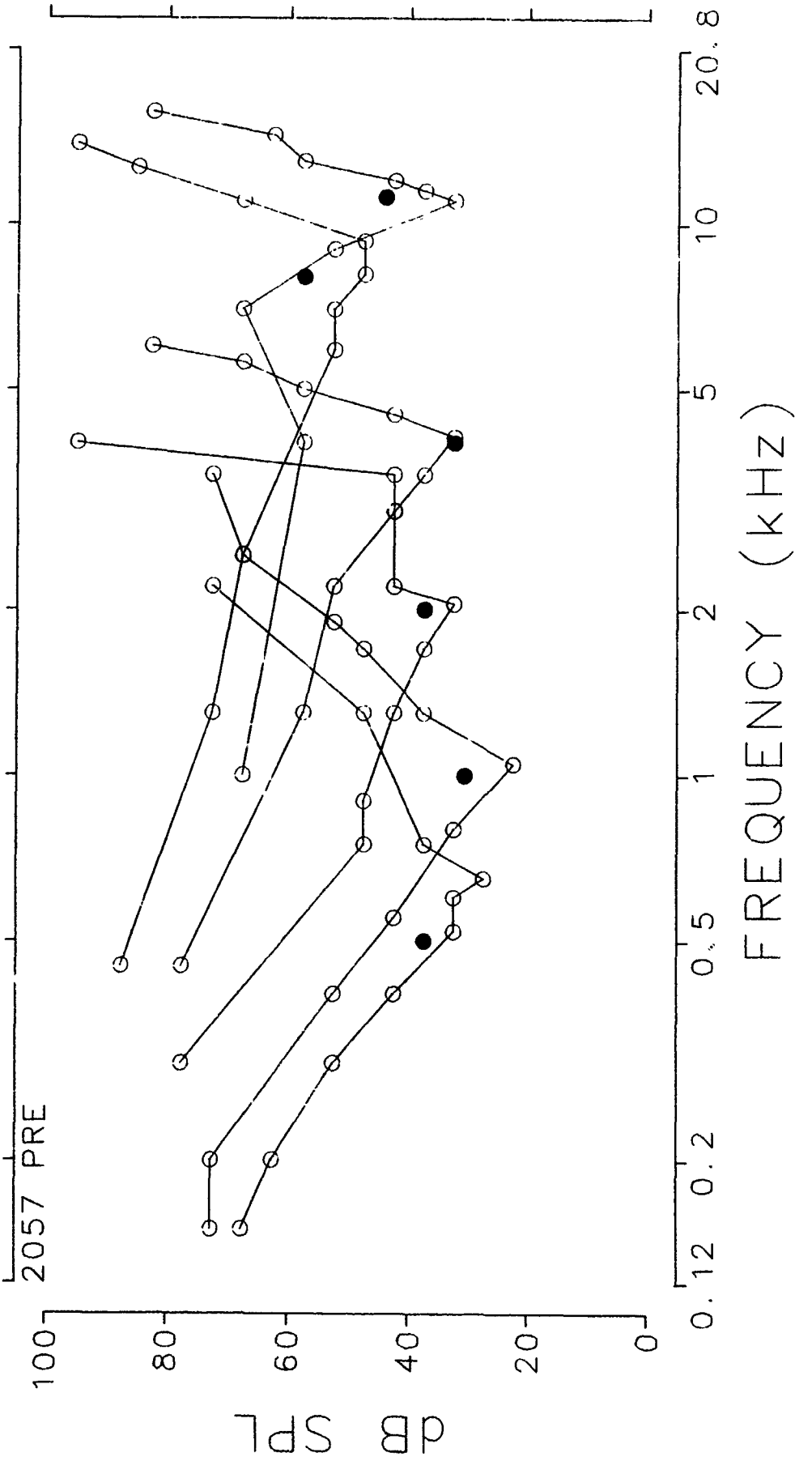
The Pre and Postexposure Tuning Curves for
Individual Animals in this Exposure Group.

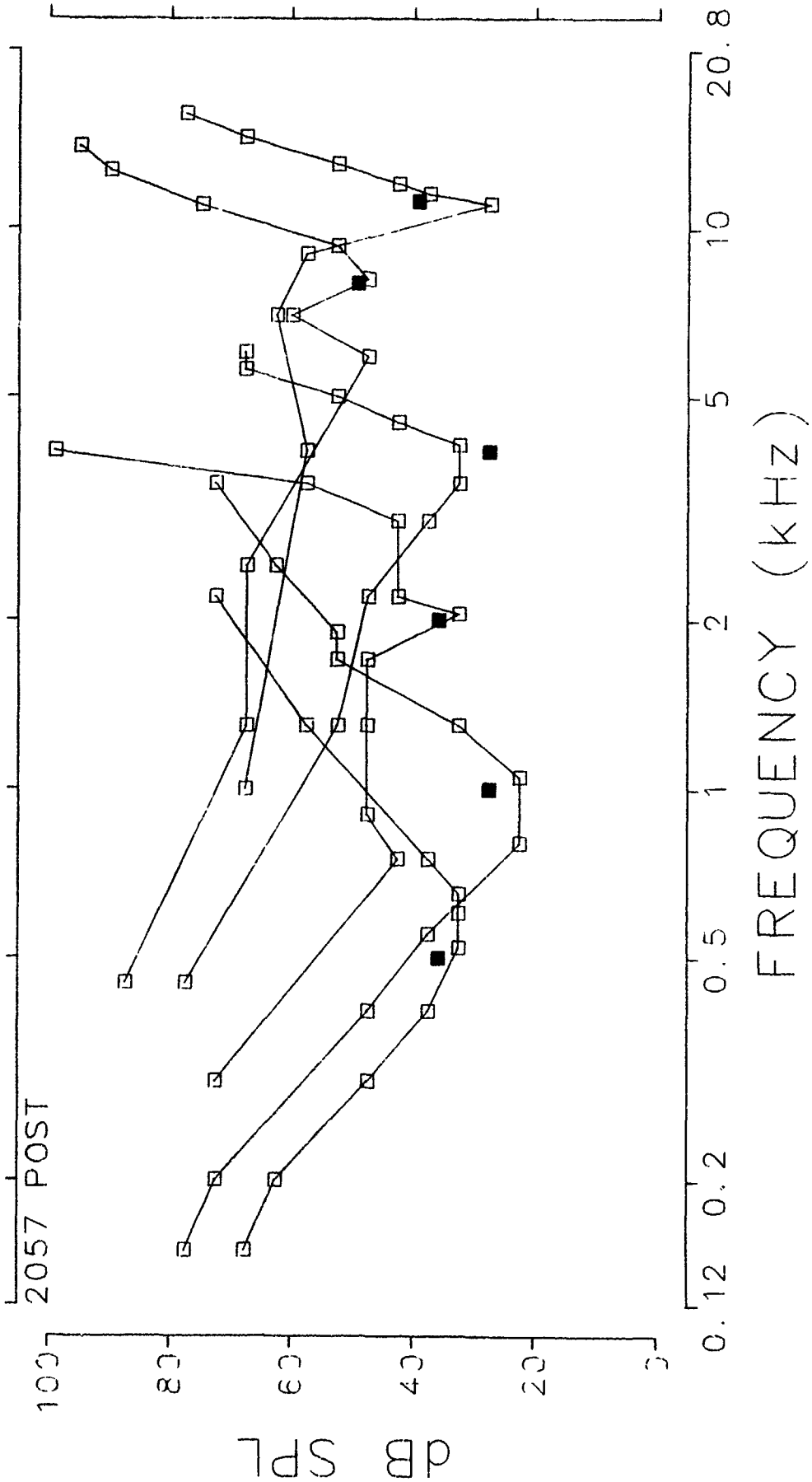
The solid symbol represents the threshold of the probe tone.

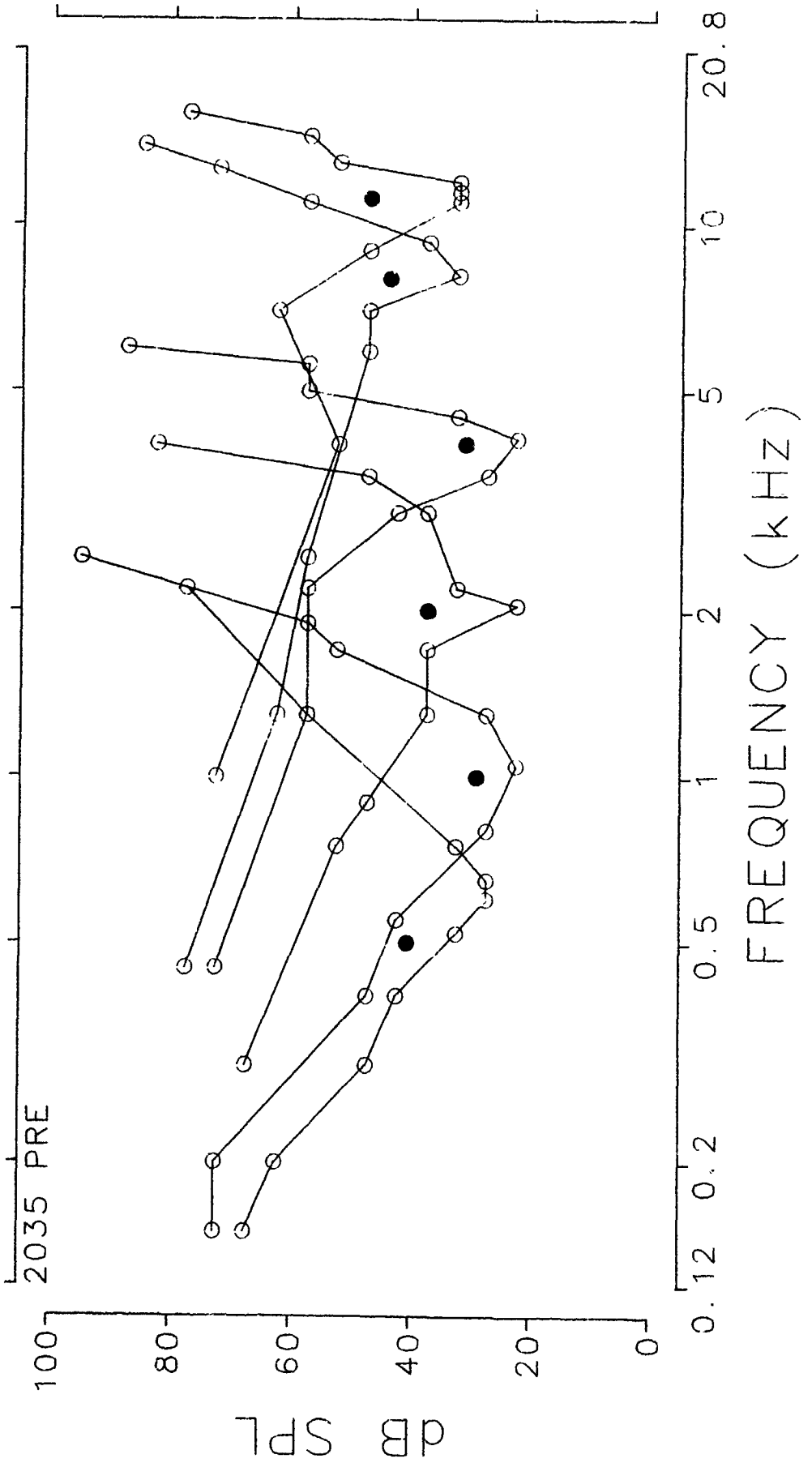

1843 PRE
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

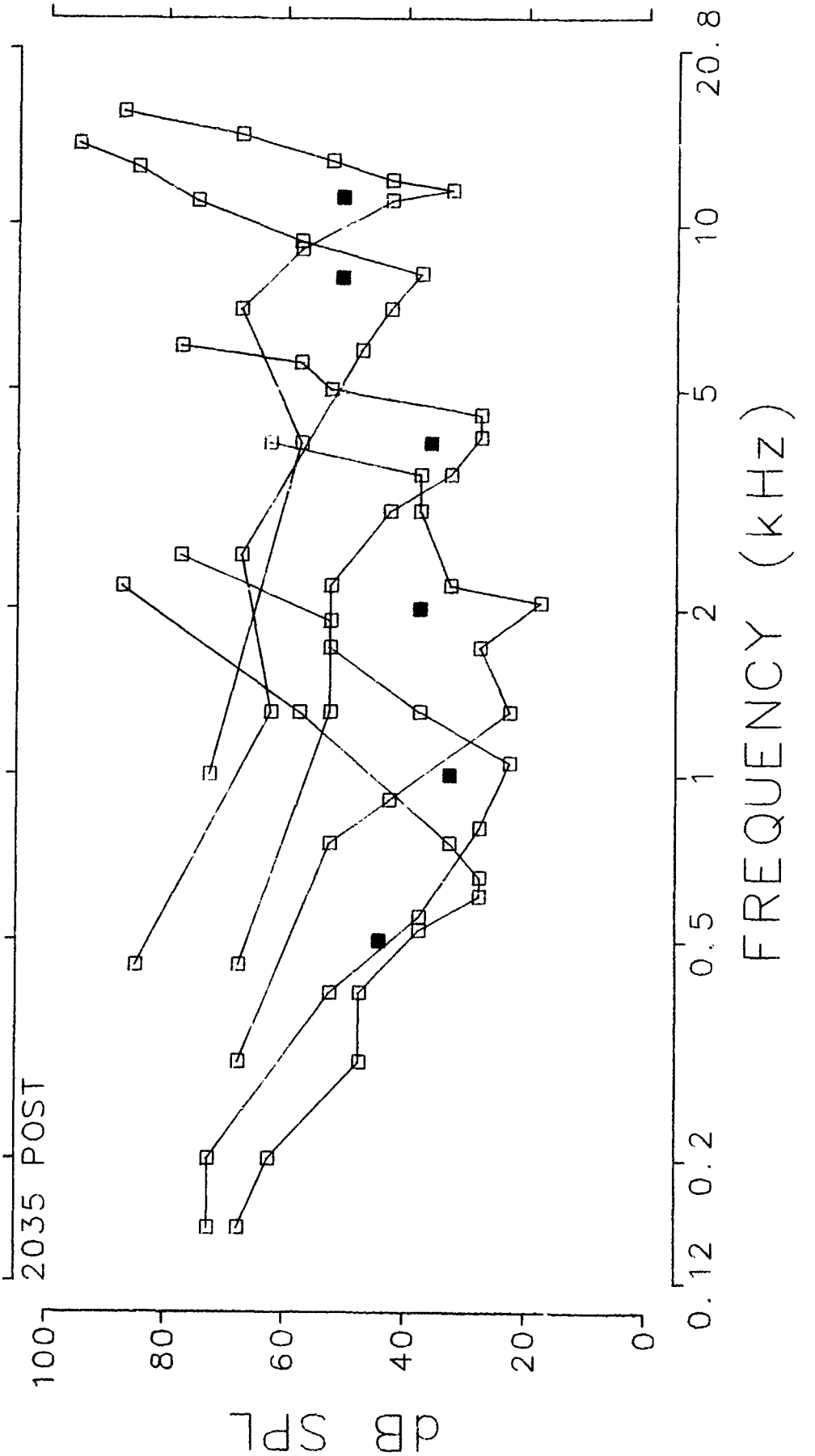
A356

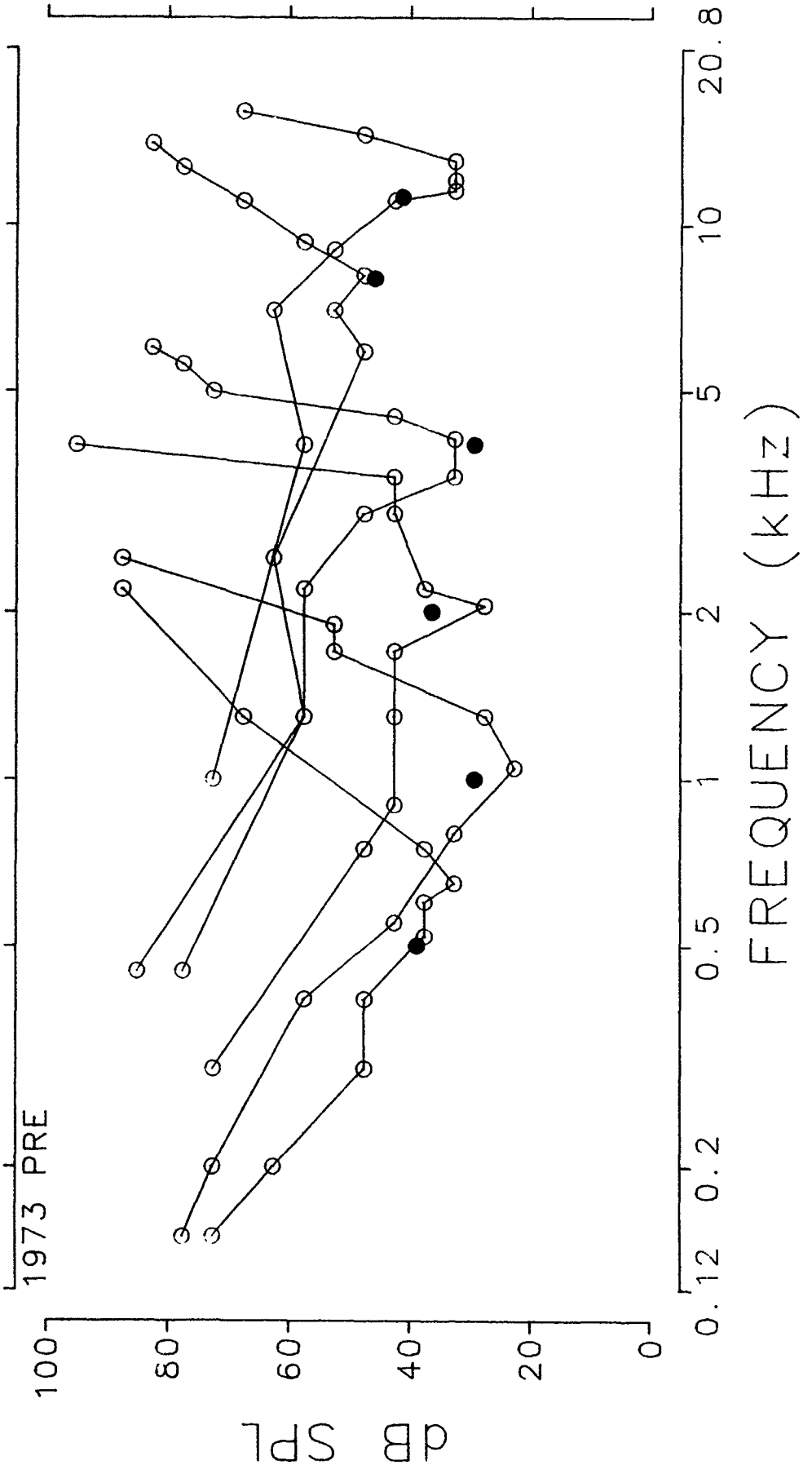

1843 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

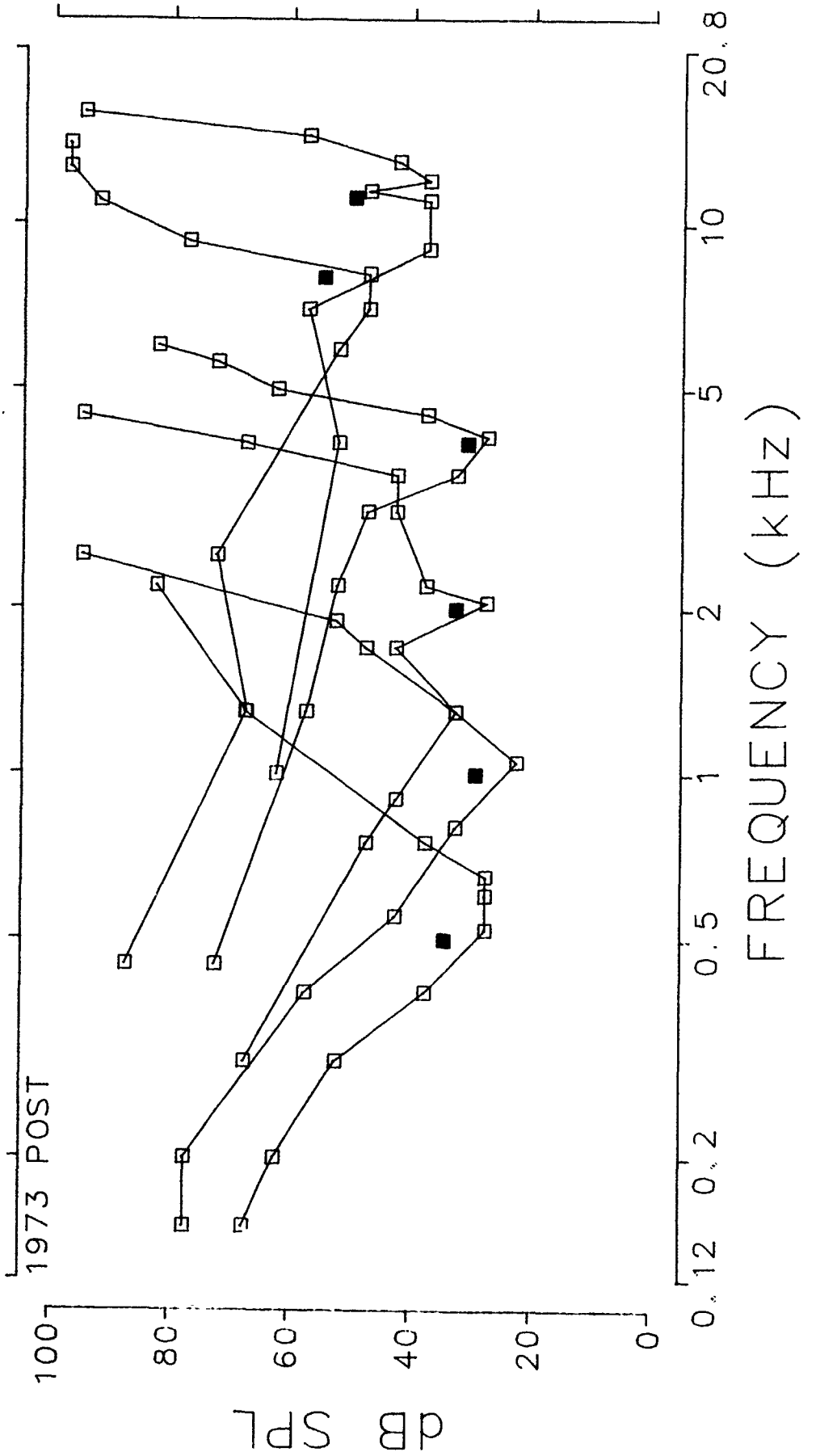

2057 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

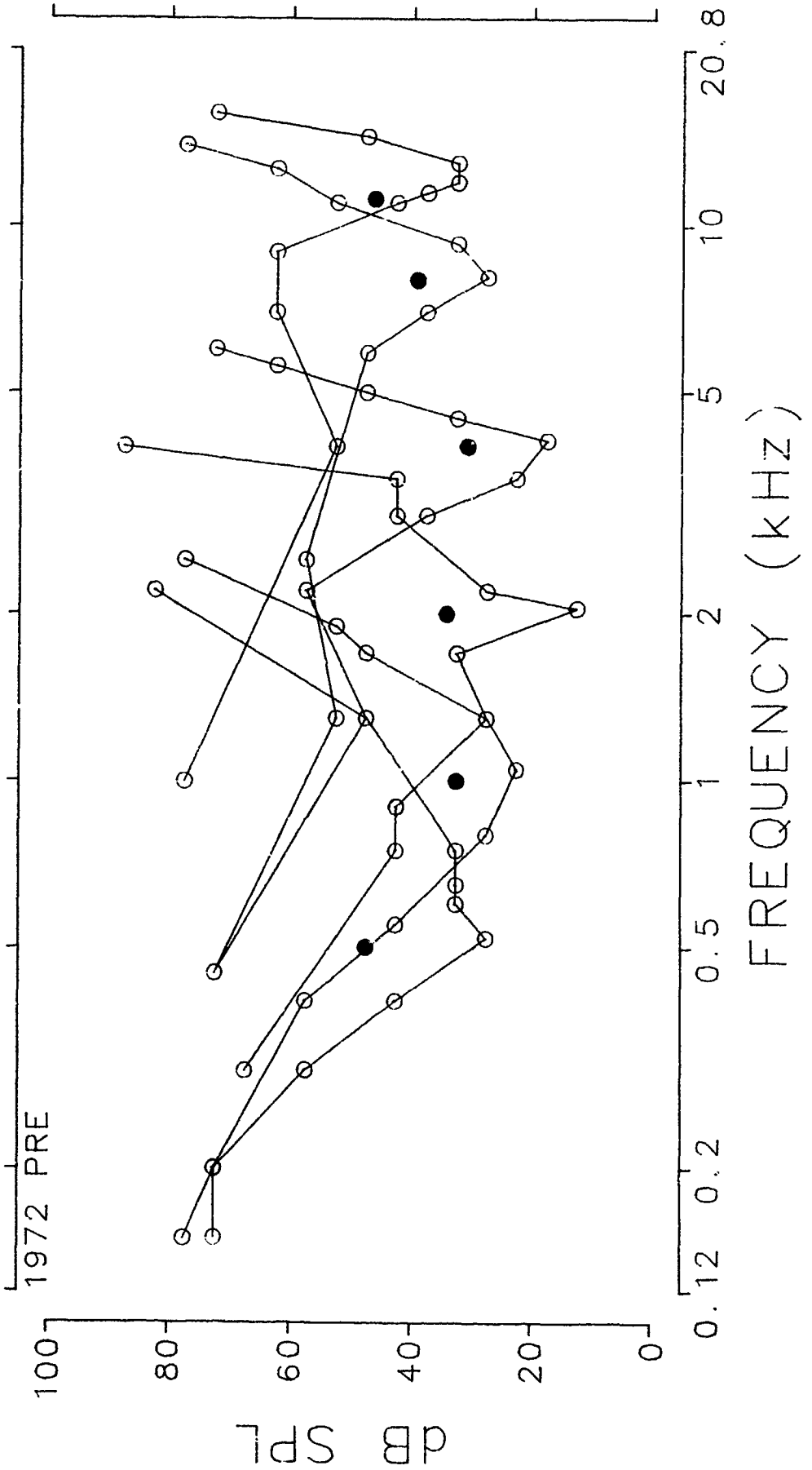

2057 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

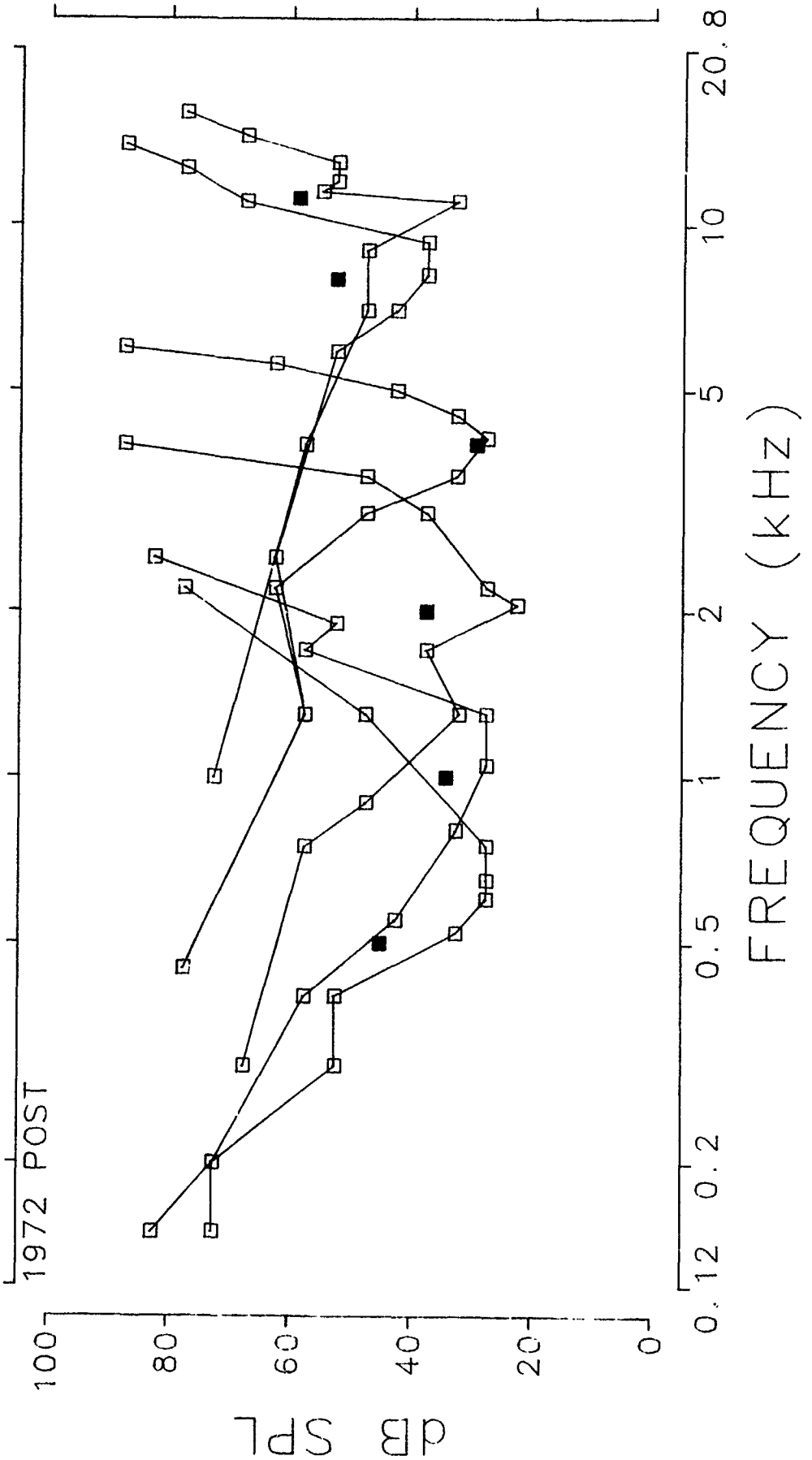

2035 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

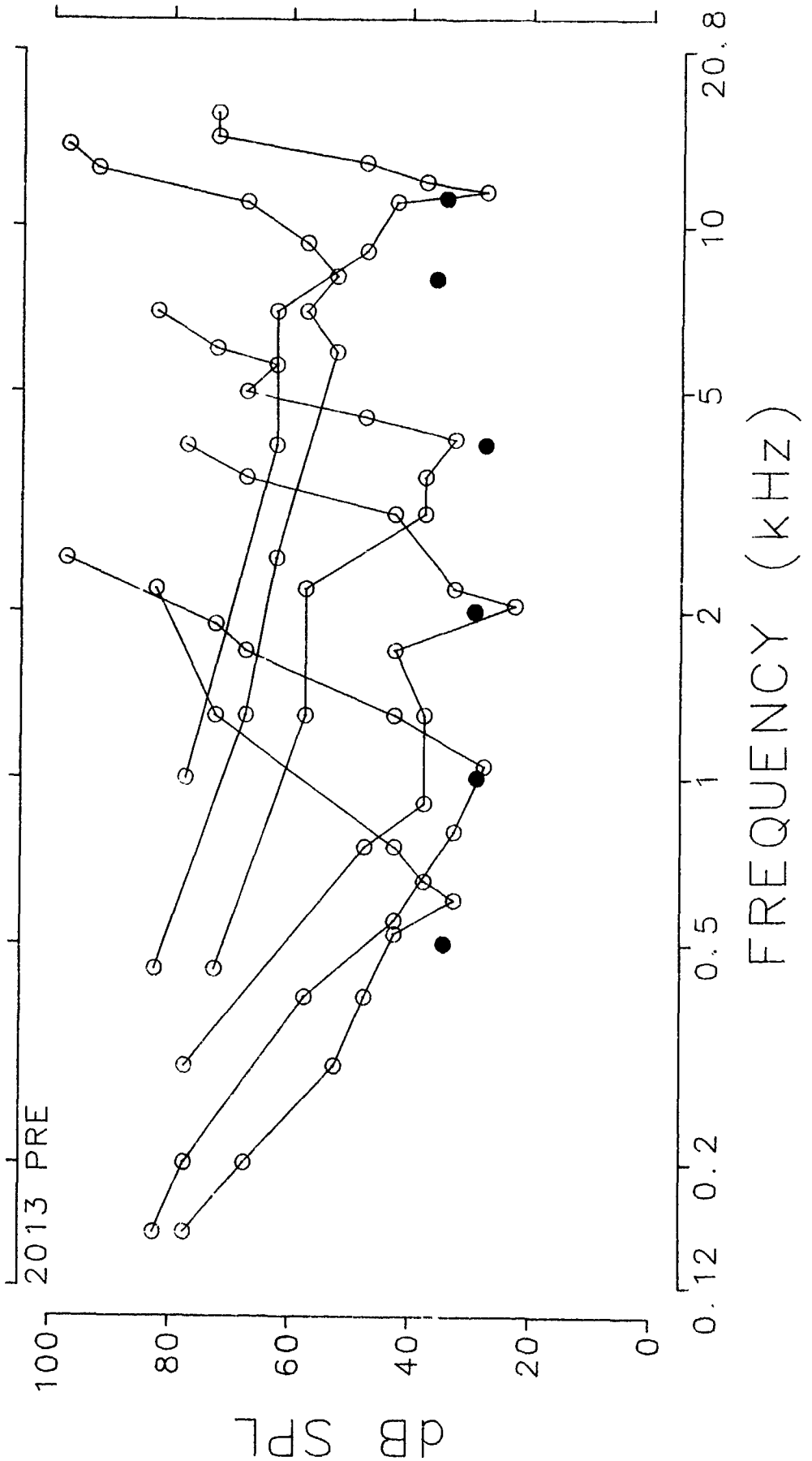

2035 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

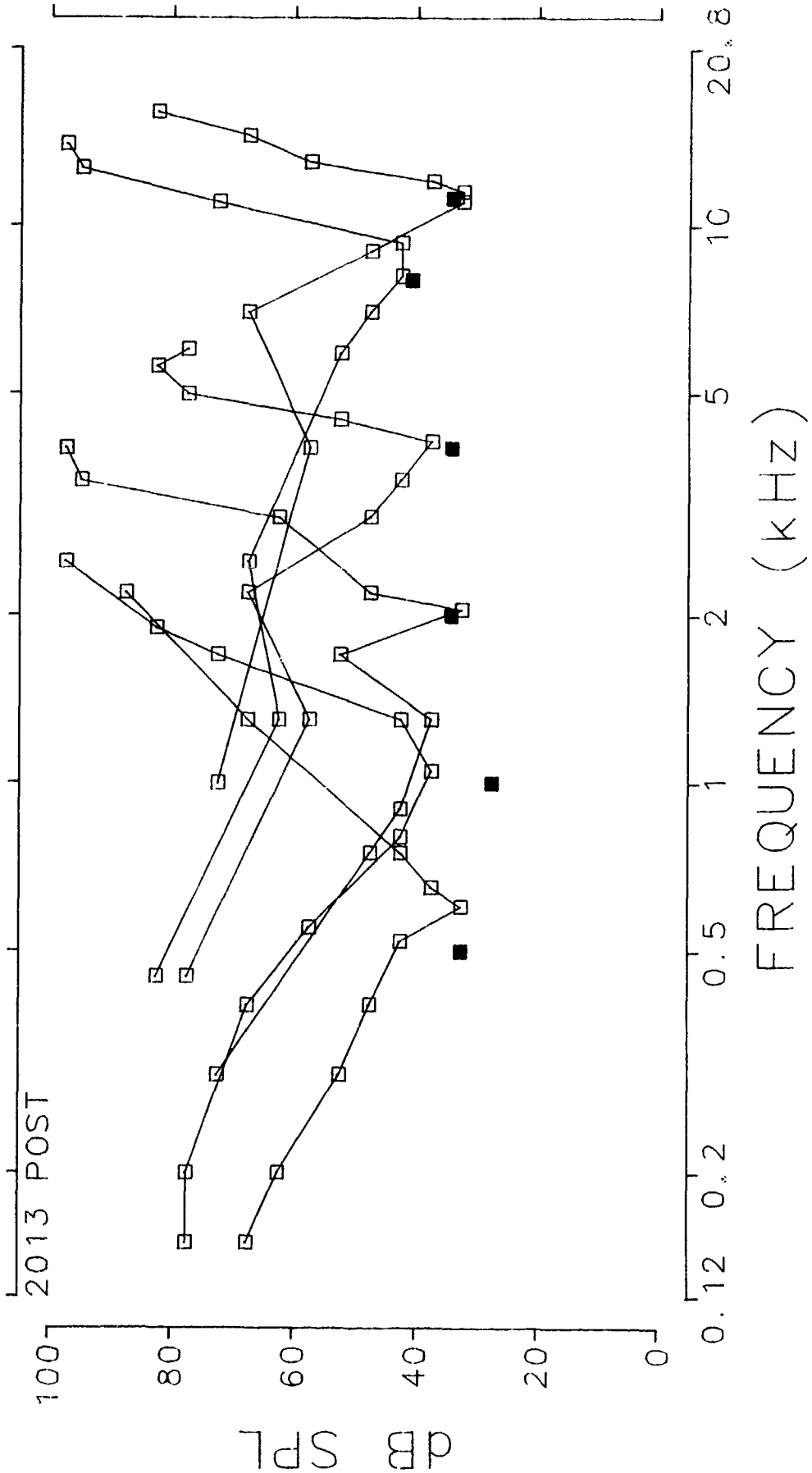

1973 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1973 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1972 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1972 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


2013 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


2013 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)

SHOCK TUBE EXPOSURE
160 dB, 1X

TOTAL NUMBER OF COCHLEAR SENSORY CELLS MISSING

ANIMAL NUMBER	INNER HAIR CELLS	1ST ROW OUTER HAIR CELLS	2ND ROW OUTER HAIR CELLS	3RD ROW OUTER HAIR CELLS	TOTAL OUTER HAIR CELLS
R1973R	15	19	65	95	179
R1843R	13	36	59	104	199
R2013R	18	89	100	95	284
R2035R	17	42	37	100	179
R2057R	20	72	90	77	239
GROUP MEAN	17				216
S.D.	3				45

TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND LENGTHS OF THE COCHLEA CENTERED AT THE FREQUENCIES INDICATED

	OCTAVE BAND CENTER FREQUENCY	INNER HAIR CELLS	OUTER HAIR CELLS
GROUP MEANS			
	0.125 kHz	5.8	53.2
	0.25 kHz	2.8	38.8
	0.5 kHz	1.8	34.4
	1 kHz	1.0	34.4
	2 kHz	.6	9.8
	4 kHz	1.0	19.0
	8 kHz	.8	9.8
	16 kHz	2.2	14.2
STANDARD DEVIATIONS			
	0.125 kHz	3.1	9.1
	0.25 kHz	1.6	17.9
	0.5 kHz	.8	6.7
	1 kHz	1.2	19.2
	2 kHz	.9	6.6
	4 kHz	1.0	18.6
	8 kHz	1.8	9.0
	16 kHz	1.6	9.3

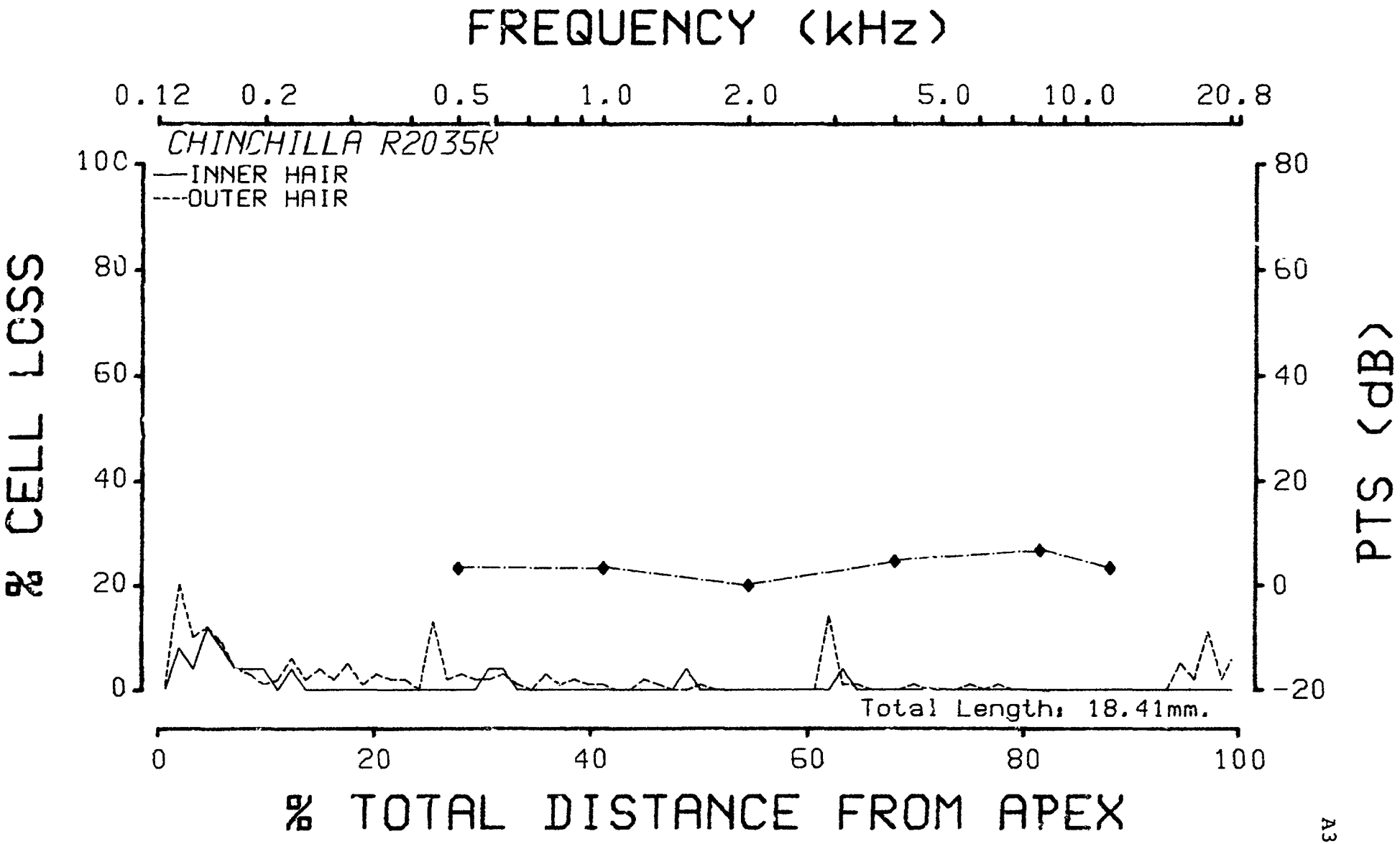
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1973R							
0.125 kHz	9	3	21	40	64	0	1
0.25 kHz	1	2	4	19	25	0	0
0.5 kHz	1	7	14	11	32	0	0
1 kHz	0	5	23	12	40	0	1
2 kHz	0	0	1	5	6	0	0
4 kHz	0	0	1	3	4	0	0
8 kHz	0	1	0	3	4	0	0
16 kHz	3	1	1	2	4	0	0
TOTALS	15	19	65	95	179	0	2
CHINCHILLA R1843R							
0.125 kHz	2	9	18	25	52	0	5
0.25 kHz	1	2	19	48	69	0	0
0.5 kHz	1	4	8	14	26	0	0
1 kHz	3	9	6	8	23	0	0
2 kHz	0	2	4	4	10	0	0
4 kHz	2	4	3	2	9	0	0
8 kHz	0	3	1	0	4	0	0
16 kHz	4	3	0	3	6	0	0
TOTALS	13	36	59	104	199	0	5
CHINCHILLA R2013R							
0.125 kHz	4	9	11	26	46	0	13
0.25 kHz	4	7	12	22	41	1	0
0.5 kHz	2	11	23	10	44	0	0
1 kHz	1	12	20	4	36	1	1
2 kHz	2	9	1	8	18	0	0
4 kHz	2	21	15	15	51	1	0
8 kHz	0	9	9	3	21	0	0
16 kHz	3	10	9	7	26	1	0
TOTALS	18	89	100	95	284	4	14

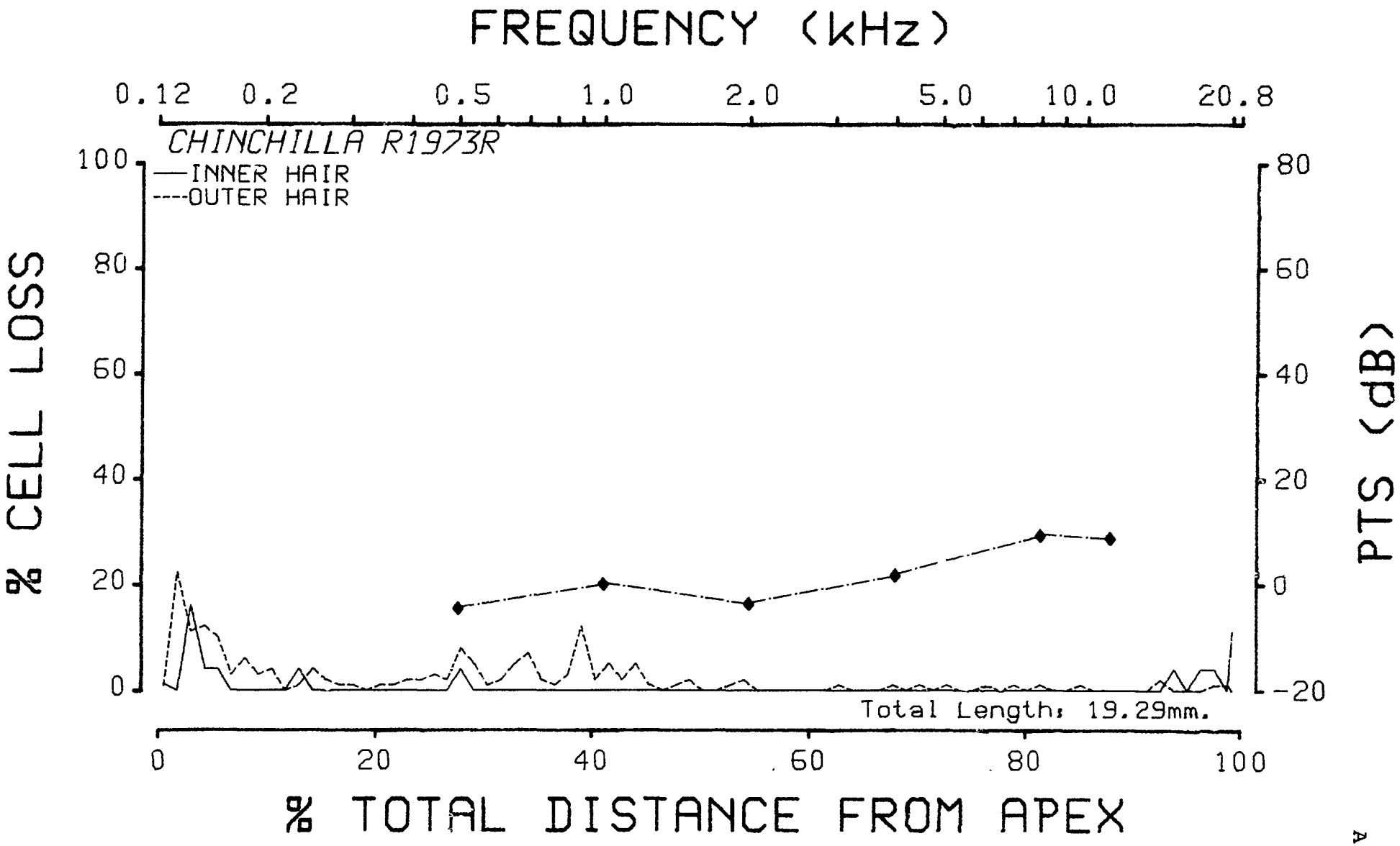
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R2035R							
0.125 kHz	9	8	9	44	61	0	0
0.25 kHz	4	4	1	25	30	0	0
0.5 kHz	2	6	15	12	33	3	0
1 kHz	0	7	2	2	11	0	0
2 kHz	1	1	0	0	1	0	0
4 kHz	1	10	6	1	17	5	5
8 kHz	0	1	0	1	2	0	0
16 kHz	0	3	2	15	20	0	0
TOTALS	17	42	37	100	179	8	5
CHINCHILLA R2057R							
0.125 kHz	5	10	14	19	43	0	1
0.25 kHz	4	10	5	14	29	0	1
0.5 kHz	3	11	17	9	37	0	2
1 kHz	1	19	32	11	62	0	4
2 kHz	0	3	6	5	14	0	1
4 kHz	0	6	5	3	14	0	0
8 kHz	4	6	4	8	18	1	1
16 kHz	1	4	5	6	15	0	0
TOTALS	20	72	90	77	239	1	11

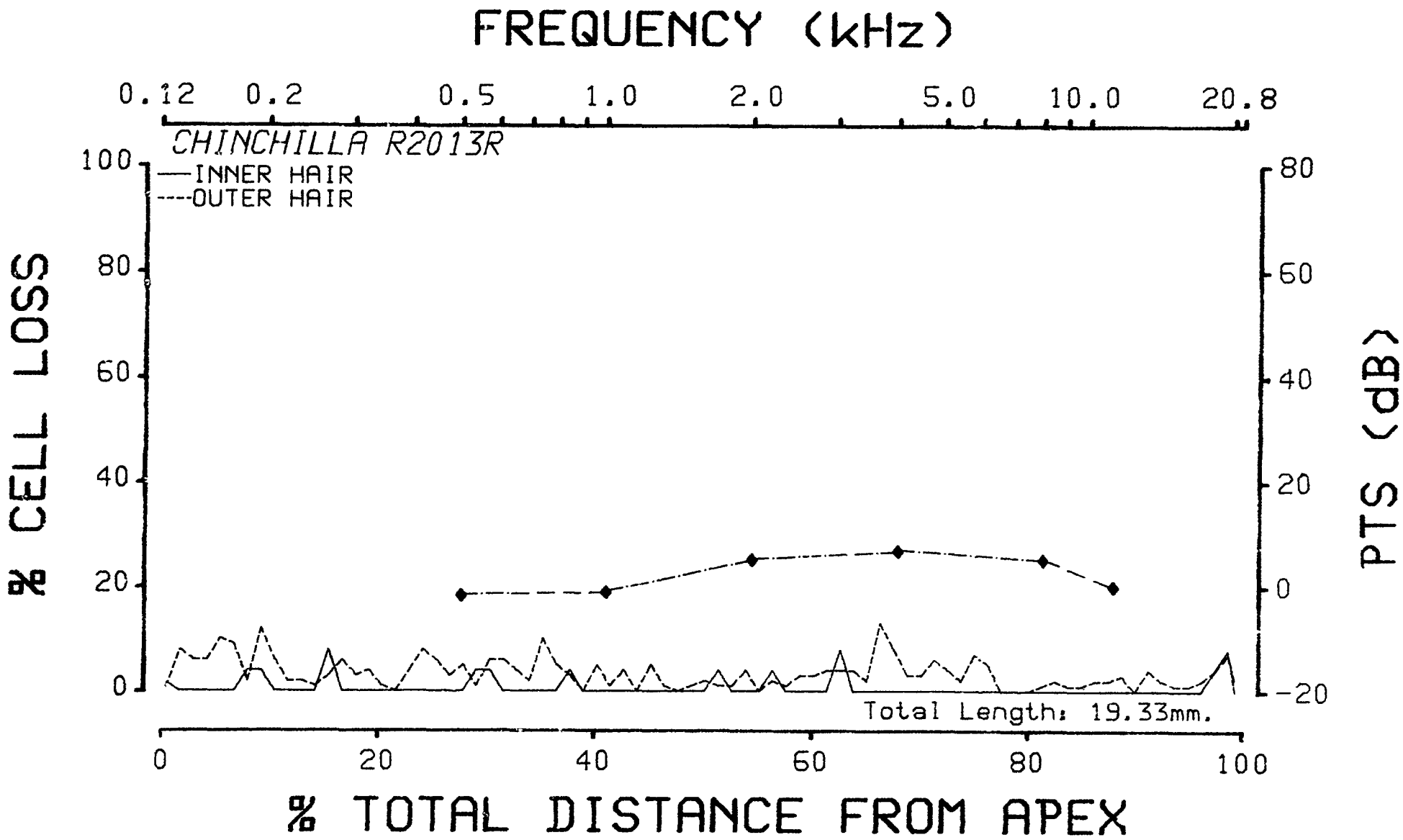
Cochleograms and PTS Audiograms for Individual Animals


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R2035R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.41mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

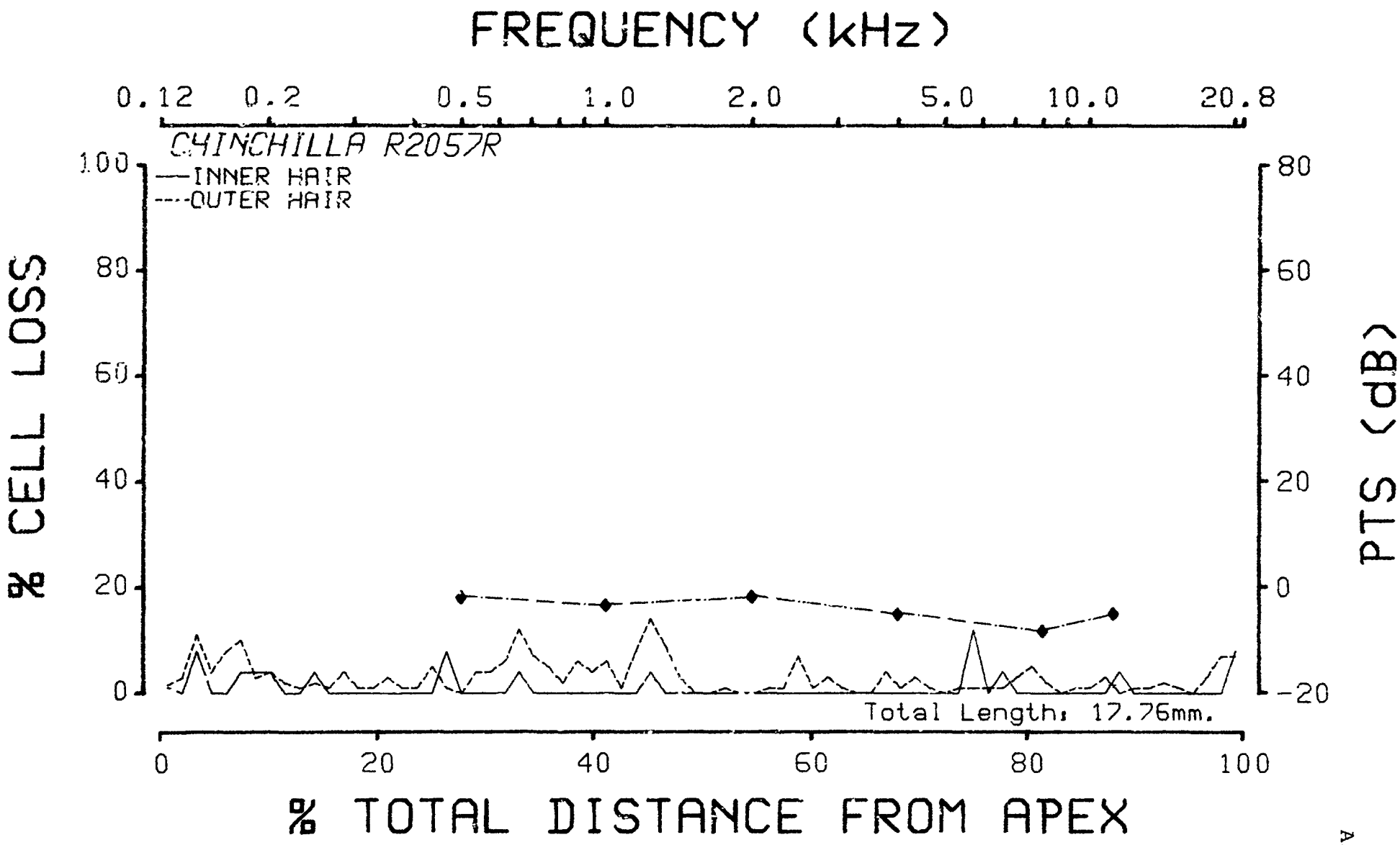
A372


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1973R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.29mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

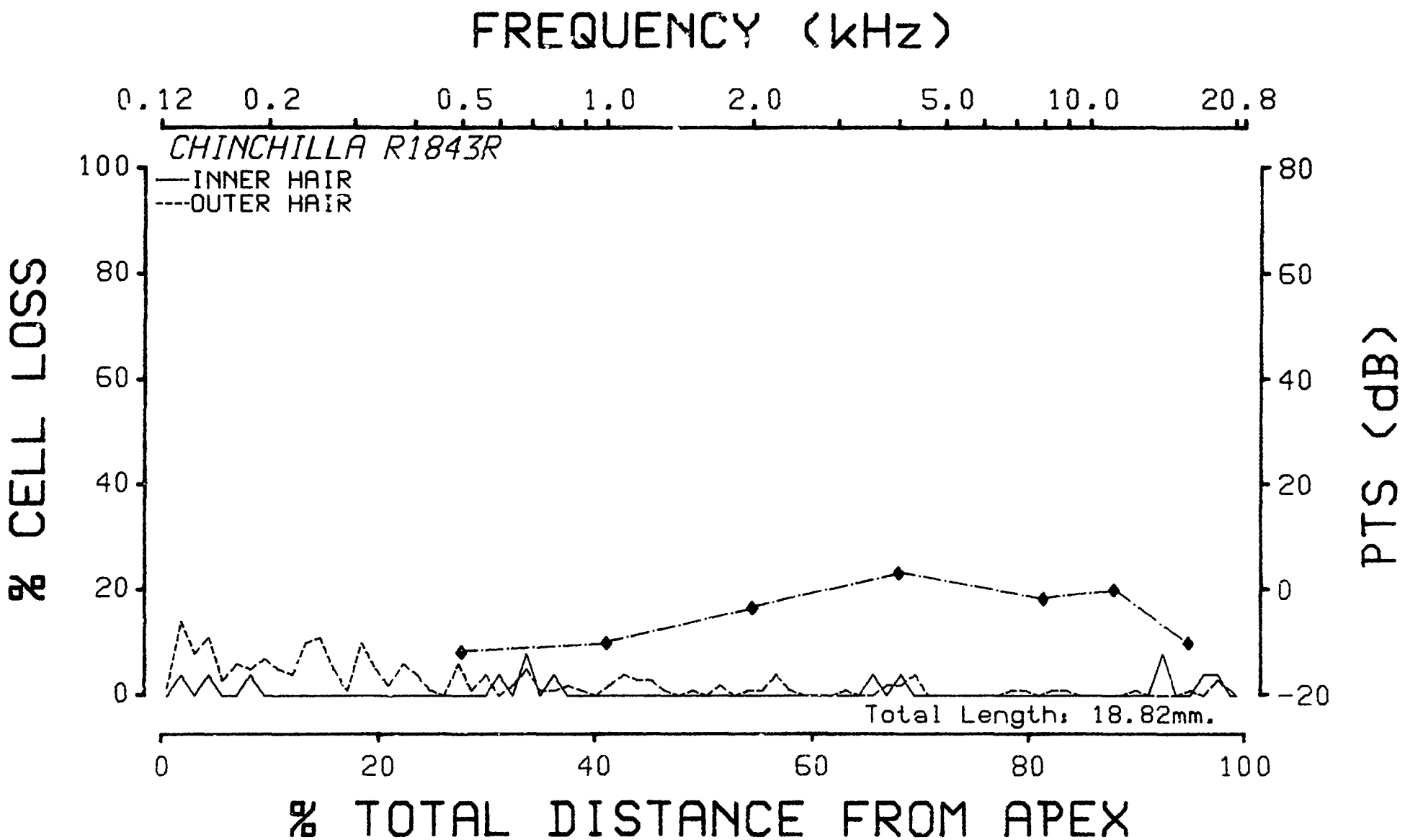
A373


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R2013R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.33mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A374


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R2057R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 17.76mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A375


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1843R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.82mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A376

Summary Data for the Group Exposed to:

160 dB, 10X, 1/M

Animal #		
1714	-	Completed the Entire Protocol
1764	-	Completed the Entire Protocol
1776	-	Completed the Entire Protocol
1778	-	Completed the Entire Protocol
1779	-	Completed the Entire Protocol
1785	-	Completed the Entire Protocol

160 dB 10X 1/M

PRE-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1714	17.5	10.8	22.5	-0.8	19.2	24.2	35.8
1764	7.5	-0.9	5.0	-7.5	1.2	-2.5	*****
1776	19.2	5.8	12.5	4.2	10.8	25.8	*****
1778	29.2	17.5	20.8	12.5	24.2	32.5	*****
1779	7.5	4.2	7.5	4.2	20.8	27.5	*****
1785	19.2	10.8	17.5	9.2	24.2	24.2	*****
Mean	16.7	8.1	14.3	3.6	16.7	21.9	35.8
S.D.	8.2	6.4	7.2	7.1	9.0	12.4	*****

POST-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1714	19.2	7.5	20.8	4.2	27.5	29.2	*****
1764	22.5	29.2	32.5	-0.8	7.5	0.8	12.5
1776	24.2	12.5	15.8	9.2	14.2	27.5	*****
1778	37.5	19.2	24.2	14.2	30.8	42.5	*****
1779	12.5	7.5	7.5	5.8	15.8	22.5	*****
1785	30.8	15.8	17.5	9.2	24.2	32.5	*****
Mean	24.4	15.3	19.7	6.9	20.0	25.8	12.5
S.D.	8.8	8.2	8.4	5.1	8.9	13.9	*****

PERMANENT THRESHOLD SHIFT (dB)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1714	1.7	-3.3	-1.7	5.0	8.3	5.0	*****
1764	15.0	30.0	27.5	6.7	6.2	3.3	*****
1776	5.0	6.7	3.3	5.0	3.3	1.7	*****
1778	8.3	1.7	3.3	1.7	6.7	10.0	*****
1779	5.0	3.3	0.0	1.7	-5.0	-5.0	*****
1785	11.7	5.0	0.0	0.0	0.0	8.3	*****
Mean	7.8	7.2	5.4	3.3	3.3	3.9	*****
S.D.	4.9	11.7	11.0	2.6	5.0	5.3	*****

160 dB 10X 1/M

TEMPORARY THRESHOLD SHIFT (dB)

Frequency 0.5 kHz

Animal\Hr	0	2	8	24	240	Max
1714	15.0	5.0	0.0	0.0	-5.0	15.0
1764	55.0	65.0	55.0	40.0	20.0	65.0
1776	13.3	8.3	8.3	-1.7	-1.7	13.3
1778	13.3	-6.7	-1.7	-1.7	-1.7	13.3
1779	15.0	10.0	10.0	5.0	5.0	15.0
1785	3.3	3.3	8.3	8.3	-1.7	8.3
Mean	19.2	14.2	13.3	8.3	2.5	21.7
S.D.	18.1	25.6	21.0	16.0	9.2	21.4

Frequency 2.0 kHz

Animal\Hr	0	2	8	24	240	Max
1714	35.0	30.0	10.0	-5.0	-10.0	35.0
1764	57.5	72.5	67.5	47.5	37.5	72.5
1776	20.0	10.0	10.0	0.0	5.0	20.0
1778	26.7	6.7	11.7	6.7	1.7	26.7
1779	15.0	10.0	10.0	0.0	0.0	15.0
1785	10.0	10.0	5.0	5.0	5.0	10.0
Mean	27.4	23.2	19.0	9.0	6.5	29.9
S.D.	17.2	25.6	23.9	19.3	16.1	22.7

Frequency 8.0 kHz

Animal\Hr	0	2	8	24	240	Max
1714	23.3	13.3	13.3	8.3	3.3	23.3
1764	61.3	81.2	36.3	1.2	6.2	81.2
1776	26.7	11.7	11.7	6.7	1.7	26.7
1778	23.3	3.3	13.3	13.3	8.3	23.3
1779	21.7	11.7	11.7	1.7	-3.3	21.7
1785	18.3	18.3	8.3	8.3	-1.7	18.3
Mean	29.1	23.3	15.8	6.6	2.4	32.4
S.D.	16.0	28.8	10.2	4.6	4.5	24.1

MASKED THRESHOLDS (dB SPL) Group: 160 dB 10X 1/M

Probe Frequency: 0.5 kHz

Masker (kHz):		0.150	0.200	0.300	0.400	0.520	0.600	0.650	0.750	1.300	2.200
Animal (Q-10 dB)						Pre-Exposure					
1714	(2.05)	57.5	62.5	52.5	42.5	32.5	27.5	27.5	37.5	72.5	92.5
1764	(2.21)	62.5	62.5	47.5	42.5	37.5	27.5	32.5	32.5	82.5	87.5
1776	(2.12)	72.5	67.5	62.5	52.5	37.5	27.5	27.5	32.5	72.5	95.0*
1778	(1.89)	72.5	72.5	47.5	47.5	47.5	37.5	37.5	42.5	67.5	95.0*
1779	(4.36)	52.5	52.5	47.5	32.5	27.5	27.5	17.5	27.5	52.5	87.5
1785	(1.12)	62.5	57.5	42.5	37.5	22.5	22.5	27.5	27.5	42.5	77.5
Mean	(2.29)	63.3	62.5	50.0	42.5	34.2	28.3	28.3	33.3	65.0	89.2
S.D.	(1.09)	8.0	7.1	6.9	7.1	8.8	4.9	6.6	5.8	14.7	6.6
Animal (Q-10 dB)						Post-Exposure					
1714	(1.26)	72.5	72.5	67.5	57.5	47.5	42.5	42.5	42.5	67.5	87.5
1764	(2.20)	62.5	67.5	52.5	42.5	37.5	32.5	37.5	57.5	87.5	87.5
1776	(1.17)	67.5	62.5	52.5	52.5	37.5	32.5	32.5	37.5	47.5	82.5
1778	(1.49)	77.5	72.5	62.5	57.5	47.5	42.5	47.5	47.5	67.5	95.0*
1779	(2.05)	62.5	57.5	47.5	37.5	32.5	27.5	22.5	27.5	52.5	77.5
1785	(1.68)	67.5	67.5	52.5	52.5	42.5	32.5	32.5	32.5	67.5	95.0*
Mean	(1.64)	58.3	66.7	55.8	50.0	40.8	35.0	35.8	40.8	65.0	87.5
S.D.	(0.42)	5.8	5.8	7.5	8.2	6.1	6.1	8.8	10.8	14.1	6.9

MASKED THRESHOLDS (dB SPL) Group: 160 dB 10X 1/M

Probe Frequency: 1.0 kHz

Masker (kHz):		0.150	0.200	0.400	0.550	0.800	1.050	1.300	1.700	1.900	2.500
Animal (Q-10 dB)						Pre-Exposure					
1714	(2.55)	72.5	72.5	57.5	52.5	32.5	22.5	37.5	67.5	85.0*	87.5
1764	(1.31)	67.5	67.5	52.5	42.5	17.5	17.5	27.5	42.5	52.5	67.5
1776	(1.42)	72.5	77.5	62.5	42.5	32.5	27.5	27.5	62.5	62.5	95.0*
1778	(1.65)	72.5	72.5	62.5	42.5	32.5	27.5	37.5	57.5	62.5	85.0*
1779	(1.09)	67.5	67.5	52.5	47.5	22.5	22.5	27.5	42.5	57.5	87.5
1785	(1.92)	77.5	77.5	32.5	42.5	32.5	27.5	42.5	57.5	62.5	87.5
Mean	(1.66)	71.7	72.5	53.3	45.0	28.3	24.2	33.3	55.0	63.8	85.0
S.D.	(0.52)	3.8	4.5	11.1	4.2	6.6	4.1	6.6	10.4	11.2	9.2
Animal (Q-10 dB)						Post-Exposure					
1714	(1.48)	77.5	67.5	52.5	37.5	27.5	22.5	27.5	52.5	77.5	87.5
1764	(0.85)	77.5	77.5	67.5	57.5	47.5	47.5	52.5	62.5	62.5	72.5
1776	(1.53)	82.5	77.5	67.5	52.5	42.5	32.5	32.5	52.5	72.5	95.0*
1778	(1.26)	72.5	72.5	62.5	47.5	27.5	32.5	37.5	57.5	57.5	77.5
1779	(1.84)	72.5	62.5	52.5	47.5	27.5	22.5	32.5	52.5	52.5	77.5
1785	(0.97)	67.5	72.5	57.5	47.5	27.5	27.5	27.5	47.5	47.5	72.5
Mean	(1.32)	75.0	71.7	60.0	48.3	33.3	30.8	35.0	54.2	61.7	80.4
S.D.	(0.37)	5.2	5.8	6.9	6.6	9.2	9.3	9.4	5.2	11.6	9.0

MASKED THRESHOLDS (dB SPL) Group: 160 dB 10X 1/M

Probe Frequency: 2.0 kHz

Masker (kHz):		0.300	0.750	0.900	1.300	1.700	2.050	2.200	3.000	3.500	4.000
Animal (Q-10 dB)					Pre-Exposure						
1714	(1.20)	57.5	42.5	37.5	47.5	42.5	37.5	42.5	82.5	87.5	92.5
1764	(1.49)	77.5	42.5	32.5	32.5	32.5	27.5	37.5	37.5	47.5	82.5
1776	(6.88)	82.5	72.5	62.5	67.5	47.5	22.5	32.5	37.5	72.5	95.0*
1778	(5.24)	82.5	52.5	47.5	47.5	52.5	37.5	47.5	62.5	85.0*	95.0*
1779	(1.02)	77.5	42.5	37.5	32.5	27.5	27.5	32.5	42.5	52.5	87.5
1785	(7.27)	87.5	62.5	57.5	57.5	42.5	22.5	37.5	42.5	47.5	72.5
Mean	(3.85)	77.5	52.5	45.8	47.5	40.8	29.2	38.3	50.8	65.4	87.5
S.D.	(2.95)	10.5	12.6	12.1	13.8	9.3	6.8	5.8	18.1	18.6	8.8
Animal (Q-10 dB)					Post-Exposure						
1714	(3.02)	72.5	42.5	37.5	37.5	37.5	27.5	32.5	52.5	62.5	77.5
1764	(2.86)	82.5	47.5	42.5	47.5	52.5	47.5	52.5	32.5	27.5	37.5
1776	(2.59)	82.5	52.5	42.5	37.5	37.5	27.5	27.5	52.5	62.5	95.0*
1778	(1.58)	77.5	52.5	37.5	37.5	42.5	32.5	37.5	42.5	52.5	95.0*
1779	(5.01)	52.5	57.5	52.5	22.5	7.5	-2.5	22.5	27.5	62.5	72.5
1785	(2.36)	77.5	47.5	42.5	32.5	32.5	22.5	27.5	37.5	42.5	67.5
Mean	(2.90)	74.2	50.0	42.5	35.8	35.0	25.8	33.3	40.8	51.7	74.2
S.D.	(1.15)	11.3	5.2	5.5	8.2	15.1	16.3	10.7	10.3	14.3	21.3

MASKED THRESHOLDS (dB SPL) Group: 160 dB 10X 1/M

Probe Frequency: 1.0 kHz

Masker (kHz):		0.450	1.300	2.200	3.000	3.500	4.100	4.500	5.000	5.600	6.000
Animal (Q-10 dB)					Pre-Exposure						
1714	(3.62)	67.5	52.5	57.5	37.5	17.5	12.5	22.5	27.5	52.5	67.5
1764	(3.49)	72.5	47.5	52.5	27.5	12.5	7.5	17.5	32.5	47.5	57.5
1776	(4.10)	82.5	62.5	57.5	47.5	37.5	27.5	37.5	62.5	77.5	95.0*
1778	(2.33)	62.5	57.5	57.5	47.5	37.5	37.5	47.5	57.5	77.5	87.5
1779	(4.76)	82.5	47.5	52.5	37.5	27.5	17.5	32.5	42.5	57.5	72.5
1785	(2.61)	82.5	67.5	52.5	42.5	27.5	27.5	37.5	57.5	77.5	82.5
Mean	(3.49)	75.0	55.8	55.0	40.0	26.7	21.7	32.5	46.7	65.0	77.1
S.D.	(0.91)	8.8	8.2	2.7	7.6	10.2	11.1	11.0	14.6	14.1	13.8
Animal (Q-10 dB)					Post-Exposure						
1714	(8.09)	72.5	52.5	57.5	42.5	22.5	2.5	22.5	37.5	57.5	67.5
1764	(3.95)	67.5	47.5	57.5	27.5	12.5	7.5	22.5	27.5	42.5	52.5
1776	(5.06)	87.5	62.5	62.5	47.5	42.5	27.5	37.5	47.5	67.5	87.5
1778	(2.91)	67.5	47.5	42.5	37.5	22.5	22.5	37.5	47.5	67.5	77.5
1779	(3.88)	72.5	42.5	67.5	37.5	17.5	12.5	7.5	37.5	47.5	47.5
1785	(5.16)	77.5	52.5	52.5	*****	22.5	12.5	32.5	42.5	47.5	77.5
Mean	(4.84)	74.2	50.8	56.7	38.5	23.3	14.2	26.7	40.0	55.0	68.3
S.D.	(1.80)	7.5	6.8	8.6	7.4	10.2	9.3	11.6	7.6	10.8	15.6

MASKED THRESHOLDS (dB SPL) Group: 160 dB 10X 1/M

Probe Frequency: 8.0 kHz

Masker (kHz):		0.450	1.300	2.500	5.900	7.000	8.100	9.300	11.000	12.700	14.000
Animal (Q-10 dB)					Pre-Exposure						
1714	(1.79)	82.5	57.5	57.5	37.5	32.5	37.5	47.5	62.5	82.5	87.5
1764	(3.52)	77.5	57.5	62.5	27.5	22.5	12.5	22.5	42.5	52.5	67.5
1776	(4.15)	82.5	57.5	57.5	42.5	42.5	27.5	37.5	57.5	70.0*	87.5
1778	(1.71)	95.0*	62.5	62.5	37.5	37.5	37.5	32.5	47.5	57.5	77.5
1779	(2.38)	87.5	57.5	62.5	37.5	32.5	27.5	37.5	62.5	82.5	87[illegible]
1785	(3.52)	87.5	67.5	62.5	47.5	42.5	32.5	42.5	67.5	87.5	95.0*
Mean	(2.85)	85.4	60.0	60.8	38.3	35.0	29.2	36.7	56.7	72.1	85.8
S.D.	(1.02)	6.0	4.2	2.6	6.6	7.6	9.3	8.6	9.7	14.5	9.7
Animal (Q-10 dB)					Post-Exposure						
1714	(2.29)	82.5	57.5	52.5	42.5	27.5	27.5	37.5	52.5	77.5	82.5
1764	(2.65)	72.5	57.5	57.5	27.5	12.5	12.5	27.5	32.5	57.5	87.5
1776	(2.08)	95.0*	62.5	67.5	47.5	32.5	37.5	37.5	62.5	85.0*	95.0*
1778	(1.50)	87.5	62.5	57.5	42.5	42.5	37.5	42.5	57.5	72.5	95.0*
1779	(2.58)	82.5	52.5	52.5	37.5	27.5	22.5	27.5	57.5	57.5	67.5
1785	(3.05)	95.0*	67.5	67.5	42.5	37.5	32.5	57.5	67.5	77.5	95.0*
Mean	(2.36)	85.8	60.0	59.2	40.0	30.0	28.3	38.3	55.0	71.3	87.1
S.D.	(0.54)	8.6	5.2	6.8	6.9	10.4	9.7	11.1	12.1	11.4	10.9

MASKED THRESHOLDS (dB SPL) Group: 160 dB 10X 1/M

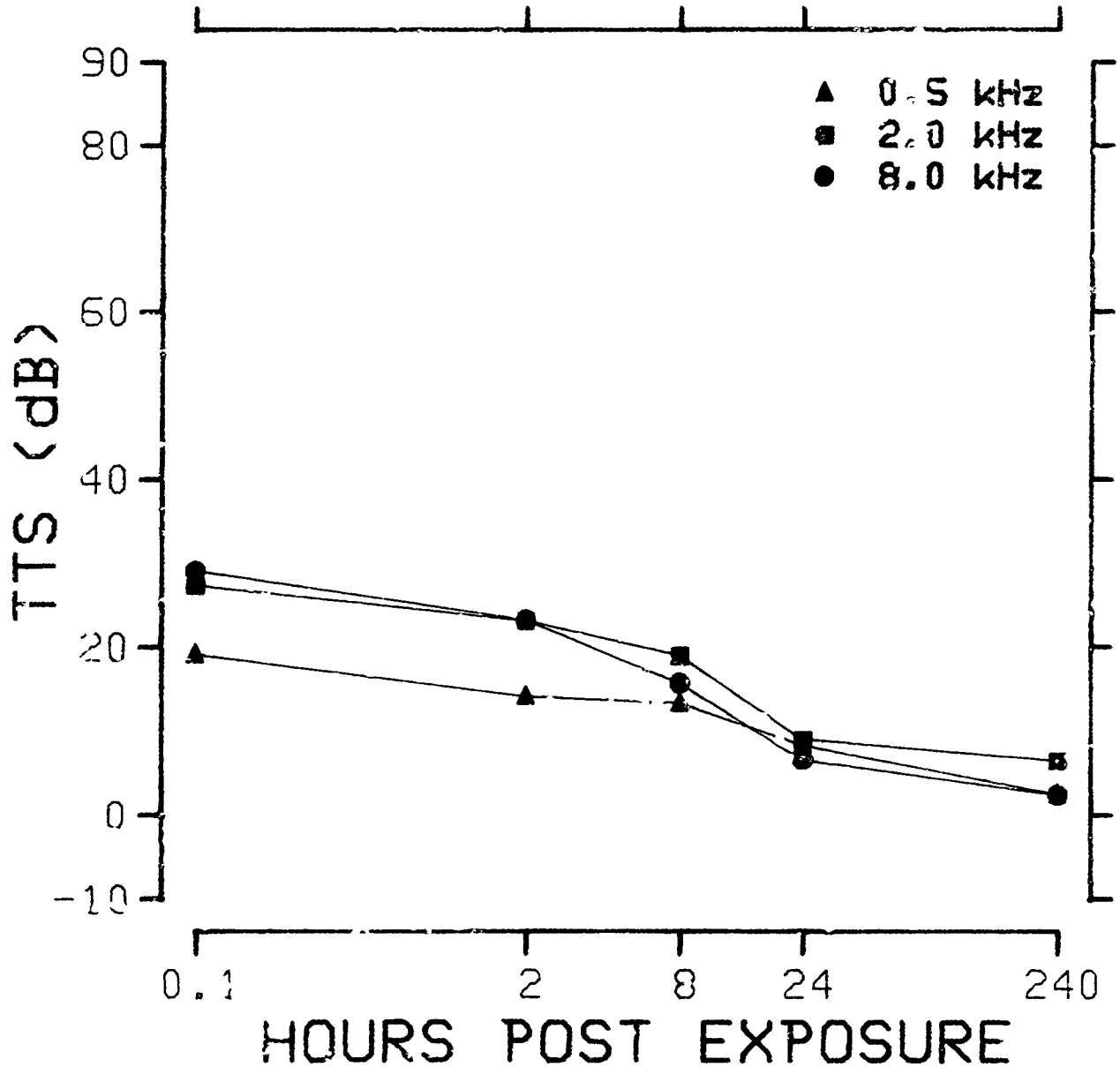
Probe Frequency: 11.2 kHz

Masker (kHz):		1.000	4.000	7.000	9.000	11.000	11.500	12.000	13.000	14.500	16.000
Animal (Q-10 dB)					Pre-Exposure						
1714	(4.06)	67.5	57.5	52.5	52.5	32.5	32.5	32.5	47.5	62.5	72.5
1764	(6.27)	57.5	42.5	37.5	37.5	27.5	12.5	17.5	22.5	47.5	57.5
1776	(5.75)	67.5	52.5	62.5	62.5	42.5	32.5	37.5	42.5	62.5	87.5
1778	(2.30)	72.5	52.5	57.5	52.5	52.5	47.5	57.5	62.5	72.5	95.0*
1779	(4.53)	72.5	47.5	47.5	52.5	42.5	37.5	42.5	52.5	72.5	82.5
1785	(2.75)	72.5	57.5	57.5	52.5	42.5	42.5	42.5	52.5	72.5	95.0*
Mean	(4.28)	68.3	51.7	52.5	51.7	40.0	34.2	38.3	46.7	65.0	81.7
S.D.	(1.58)	5.8	5.8	8.9	8.0	8.8	12.1	13.2	13.6	9.9	14.5
Animal (Q-10 dB)					Post-Exposure						
1714	(3.44)	62.5	52.5	52.5	47.5	37.5	32.5	37.5	37.5	62.5	77.5
1764	(4.53)	62.5	47.5	27.5	32.5	22.5	17.5	22.5	32.5	42.5	52.5
1776	(4.70)	72.5	52.5	57.5	57.5	32.5	37.5	37.5	47.5	72.5	95.0*
1778	(3.15)	77.5	62.5	62.5	52.5	42.5	42.5	47.5	57.5	67.5	87.5
1779	(2.52)	77.5	52.5	52.5	57.5	47.5	47.5	47.5	52.5	72.5	87.5
1785	(4.24)	77.5	62.5	67.5	62.5	47.5	42.5	42.5	52.5	85.0*	95.0*
Mean	(3.77)	71.7	55.0	53.3	51.7	38.3	36.7	39.2	46.7	67.1	82.5
S.D.	(0.86)	7.4	6.1	13.9	10.7	9.7	10.7	9.3	9.7	14.2	16.0

The Group Mean Recovery Curves

Measured at Three Test Frequencies

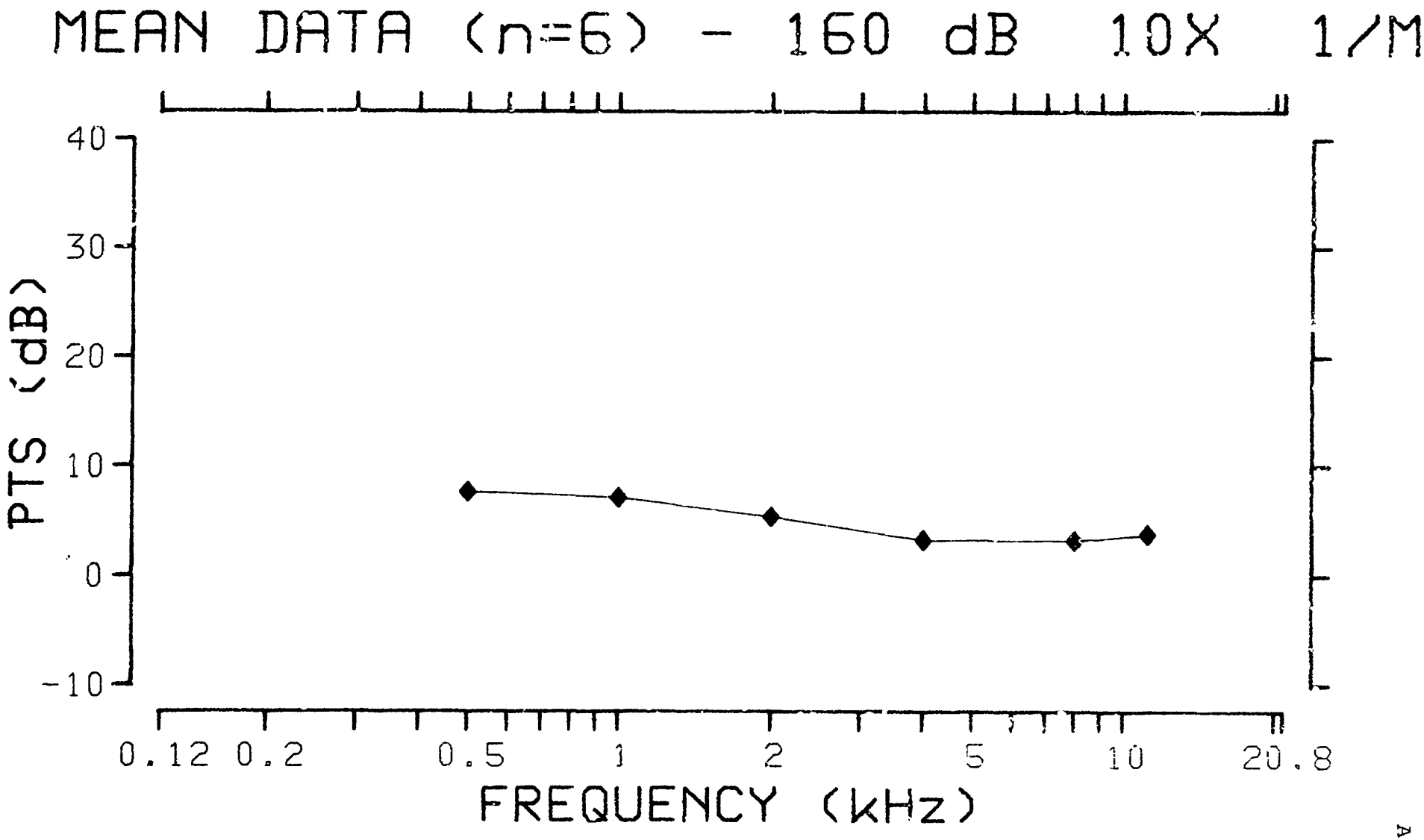
MEAN DATA (n=6) - 160 dB 10X 1/M



A387

The Group Mean Permanent Threshold Shift (PTS)

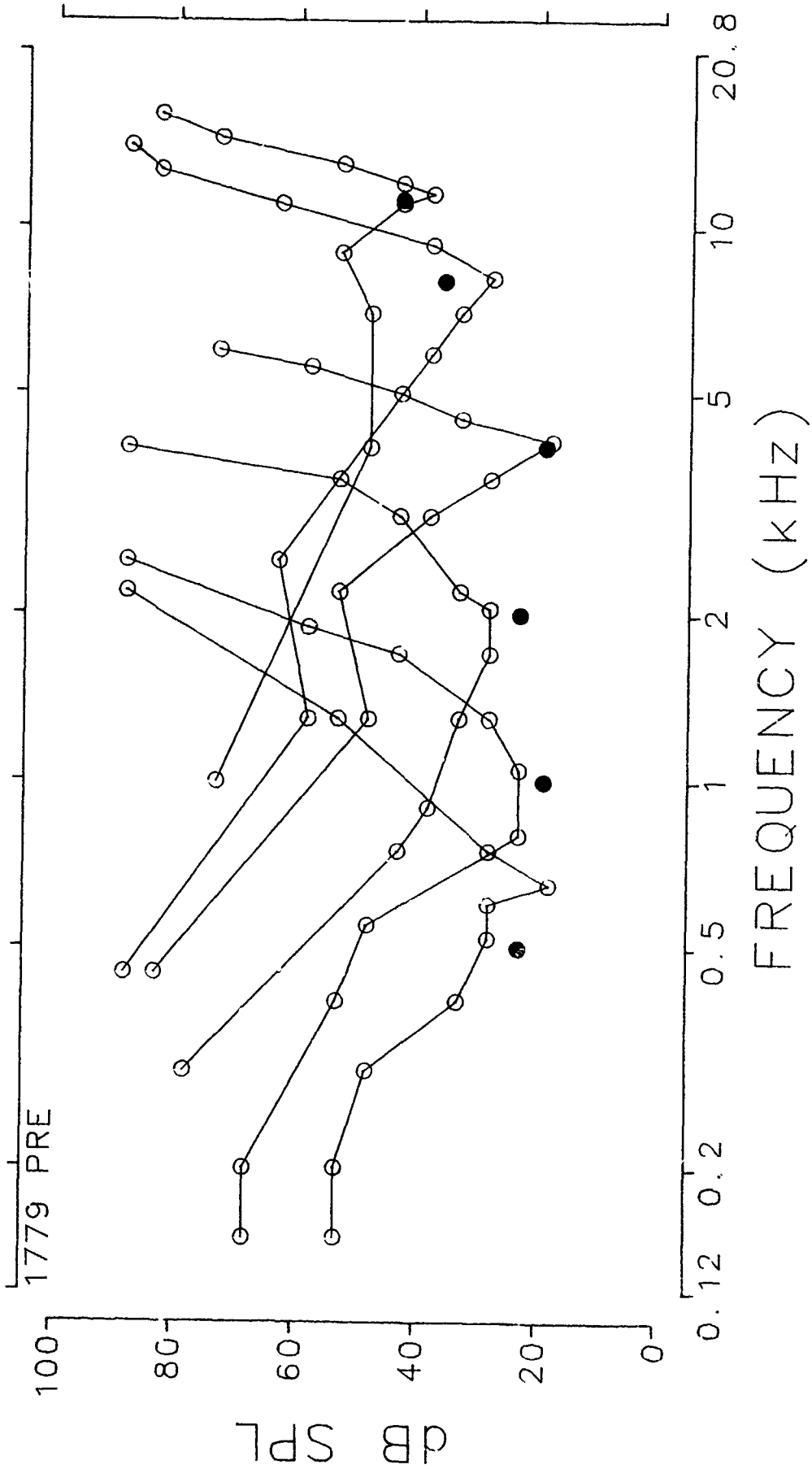
for all Test Frequencies

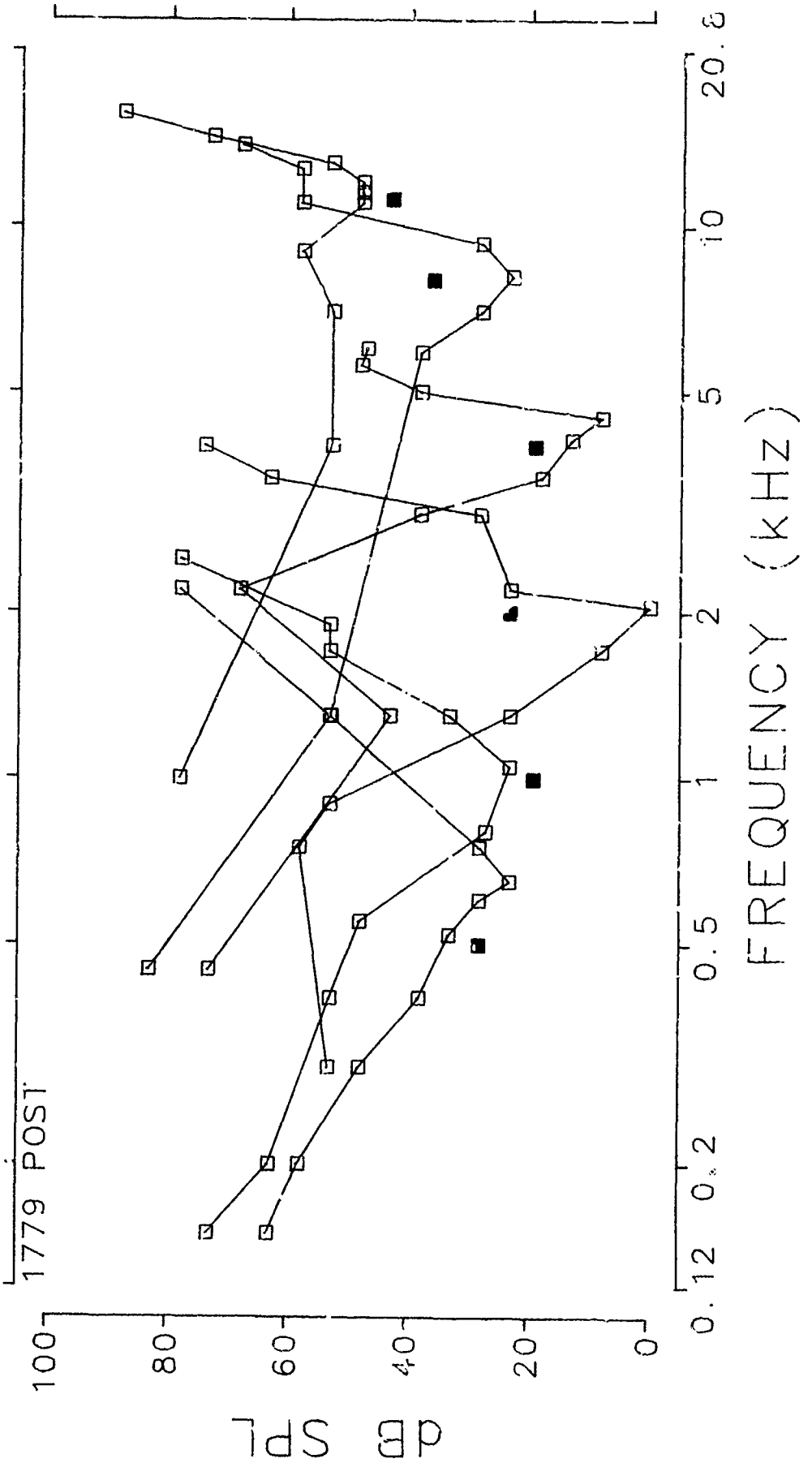

MEAN DATA (n=6) - 160 dB 10X 1/M
PTS (dB)
40
30
20
10
0
-10
0.12 0.2 0.5 1 2 5 10 20.8
FREQUENCY (kHz)

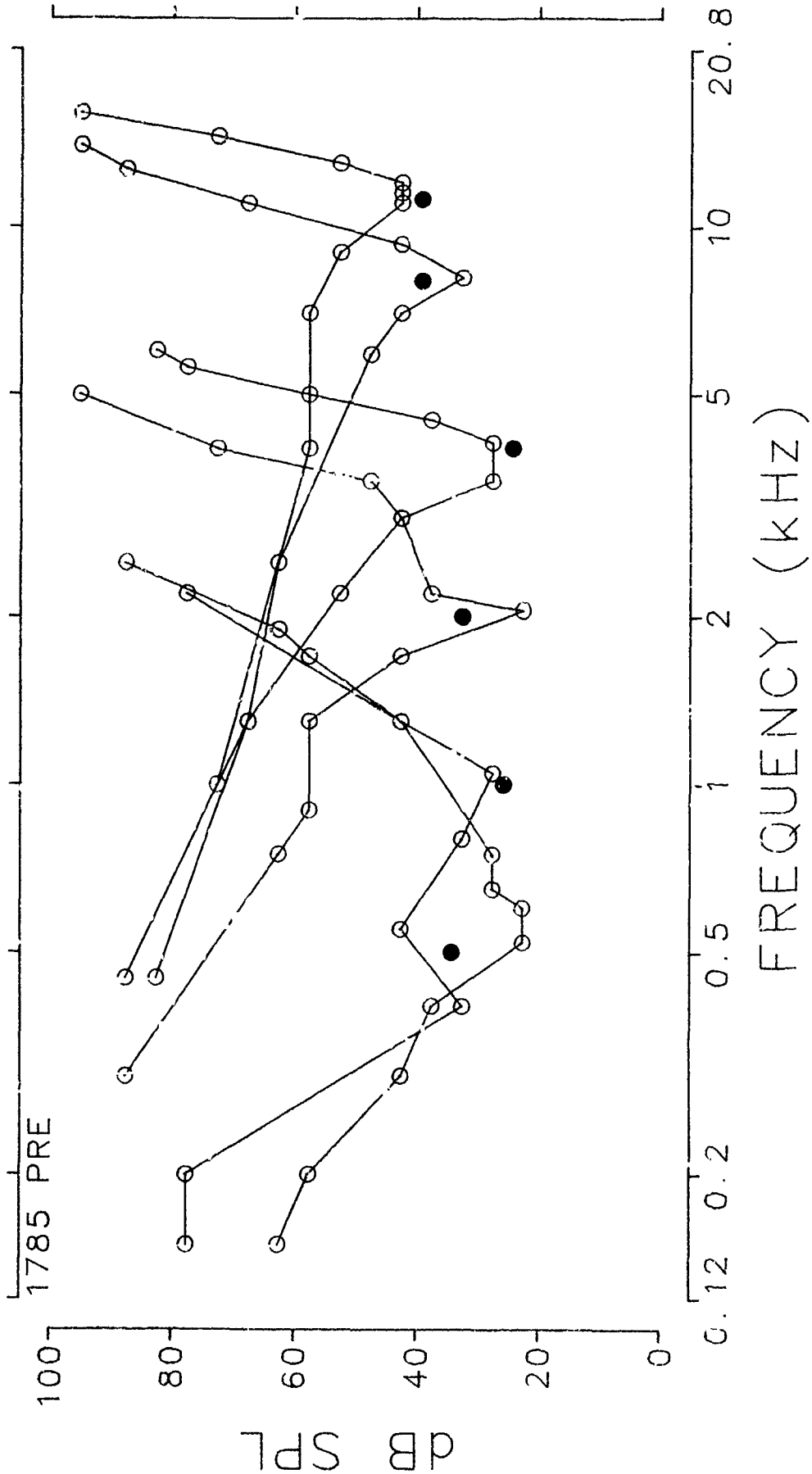
A389

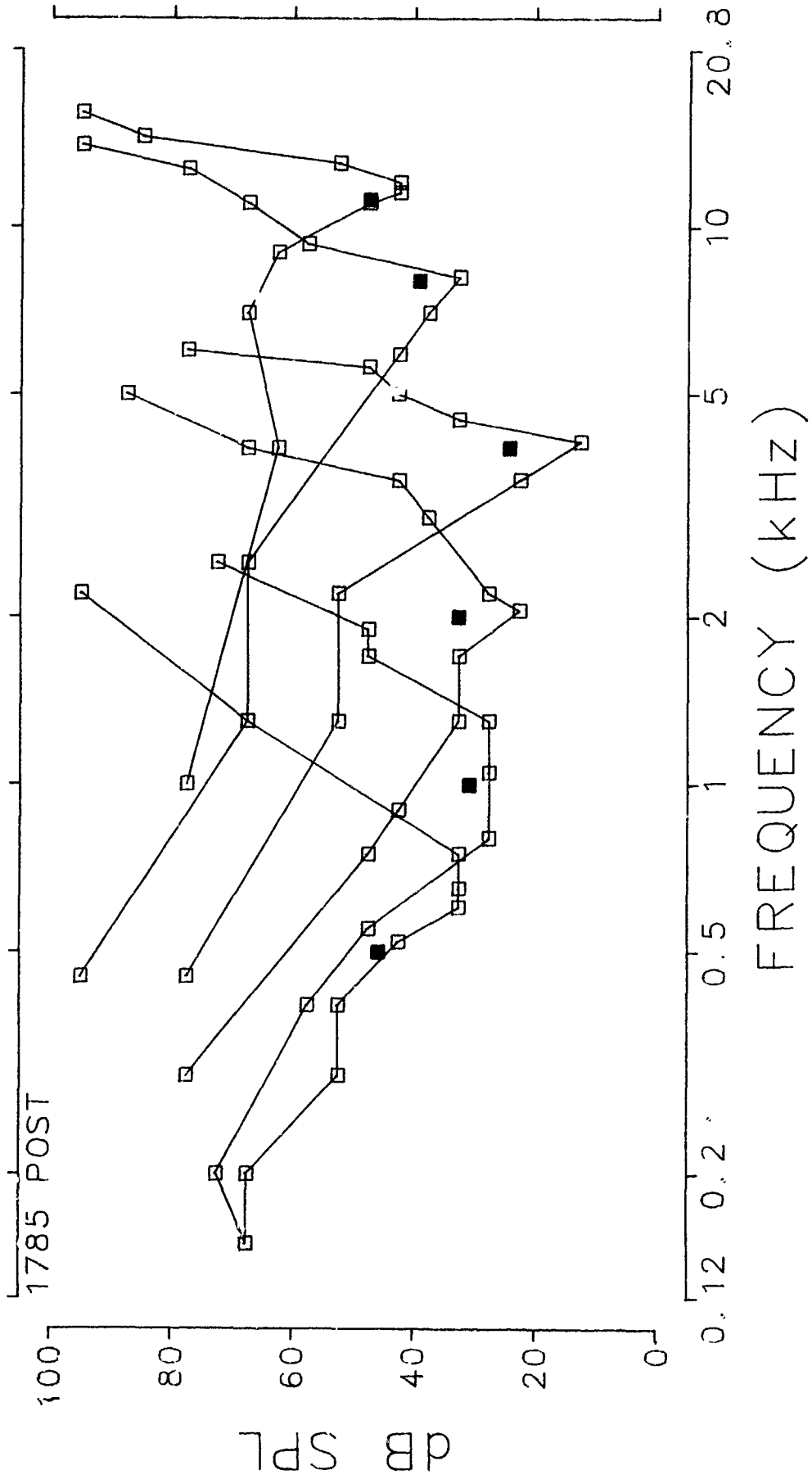
The Pre and Postexposure Tuning Curves for Individual Animals in this Exposure Group.

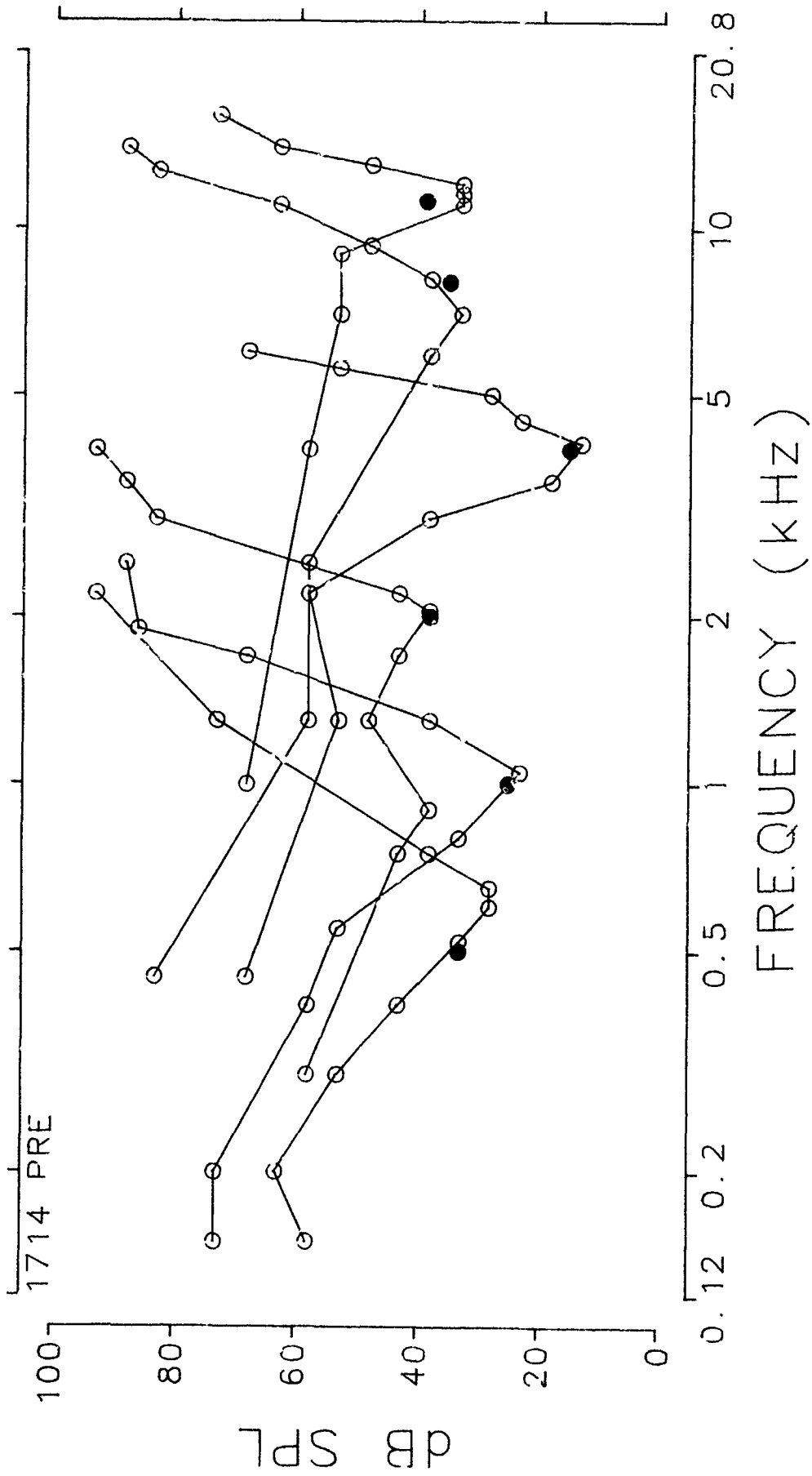
The solid symbol represents the threshold of the probe tone.

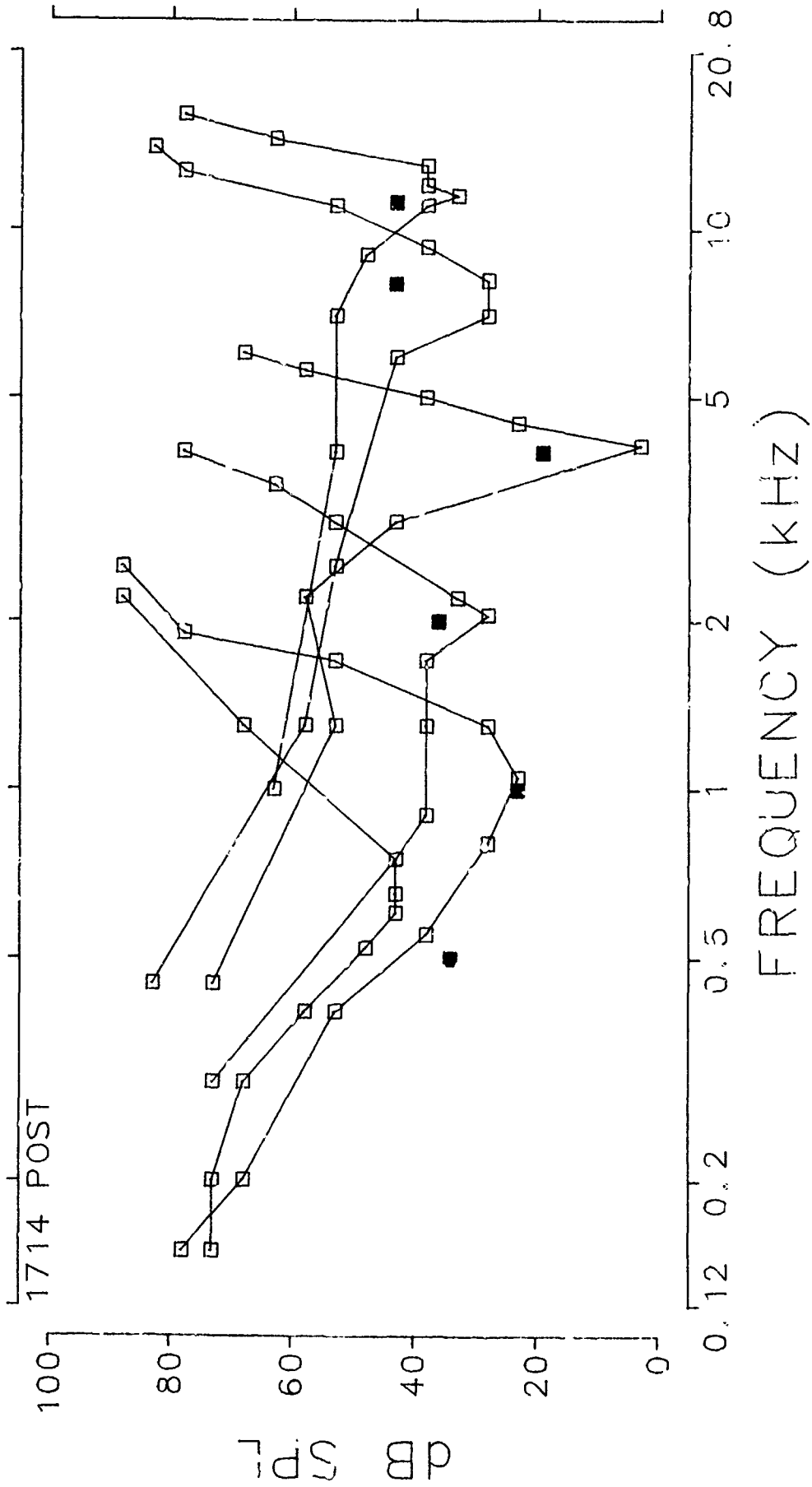

1779 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

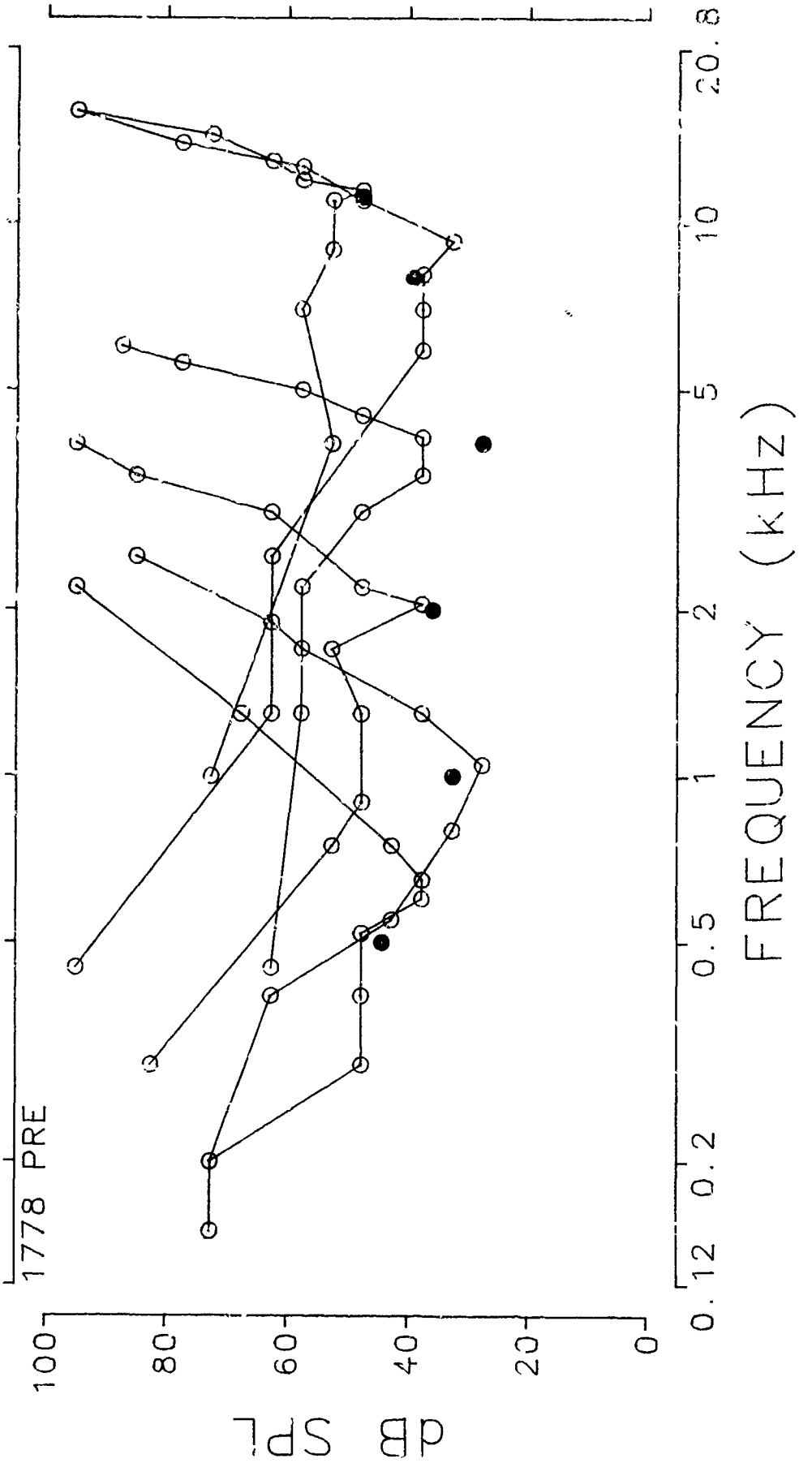

1779 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.0
FREQUENCY (kHz)

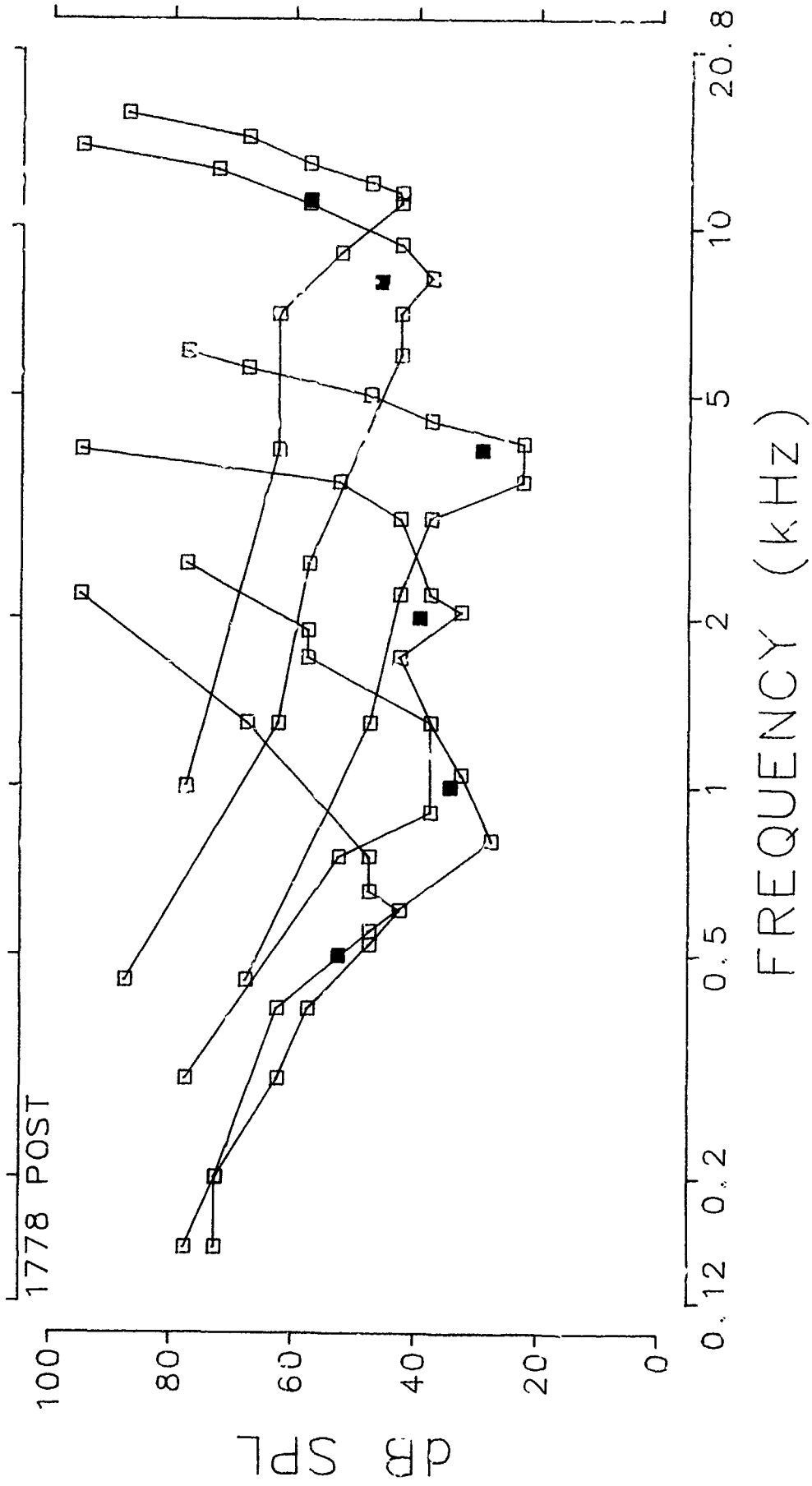

1785 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

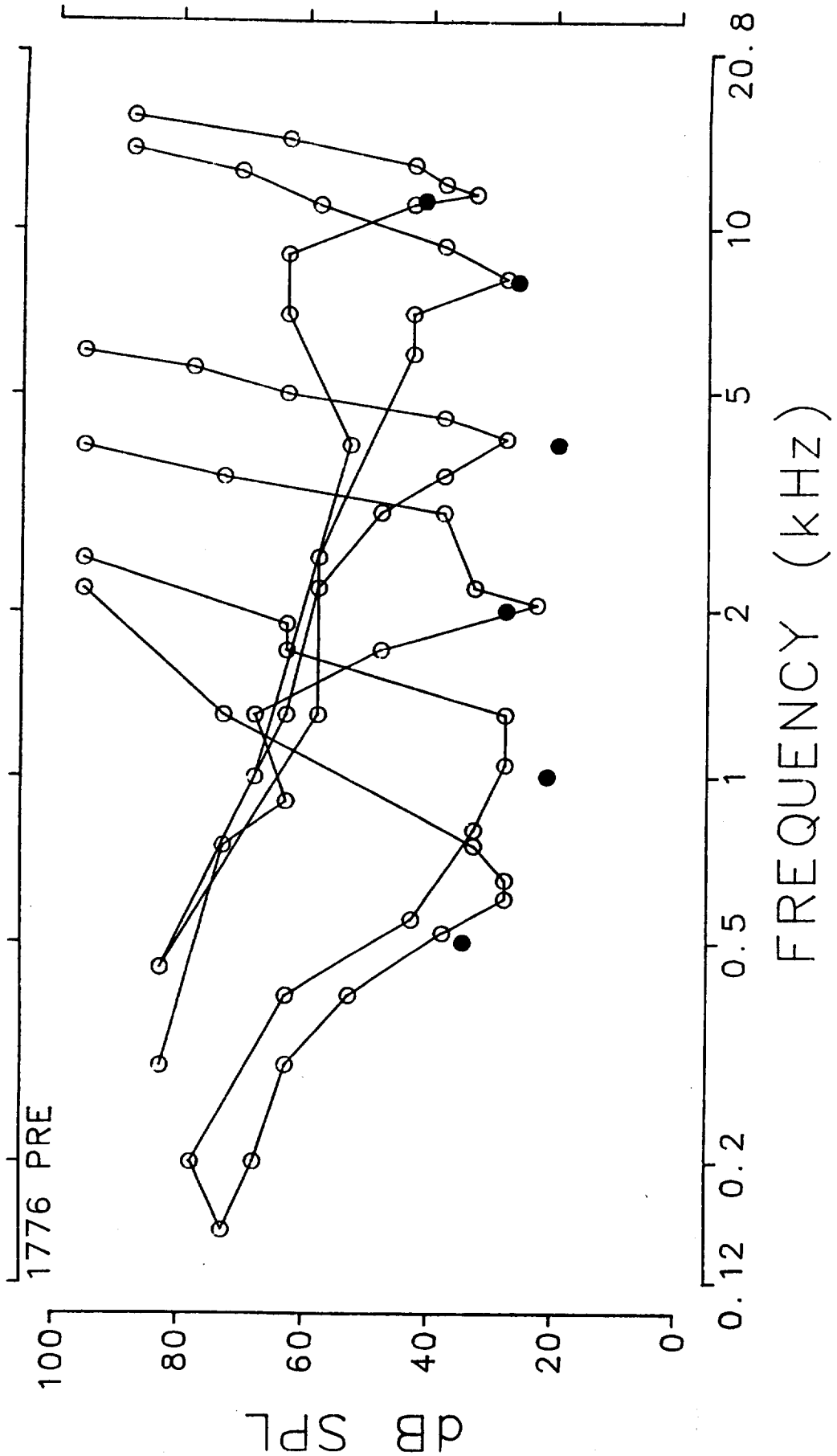

1785 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

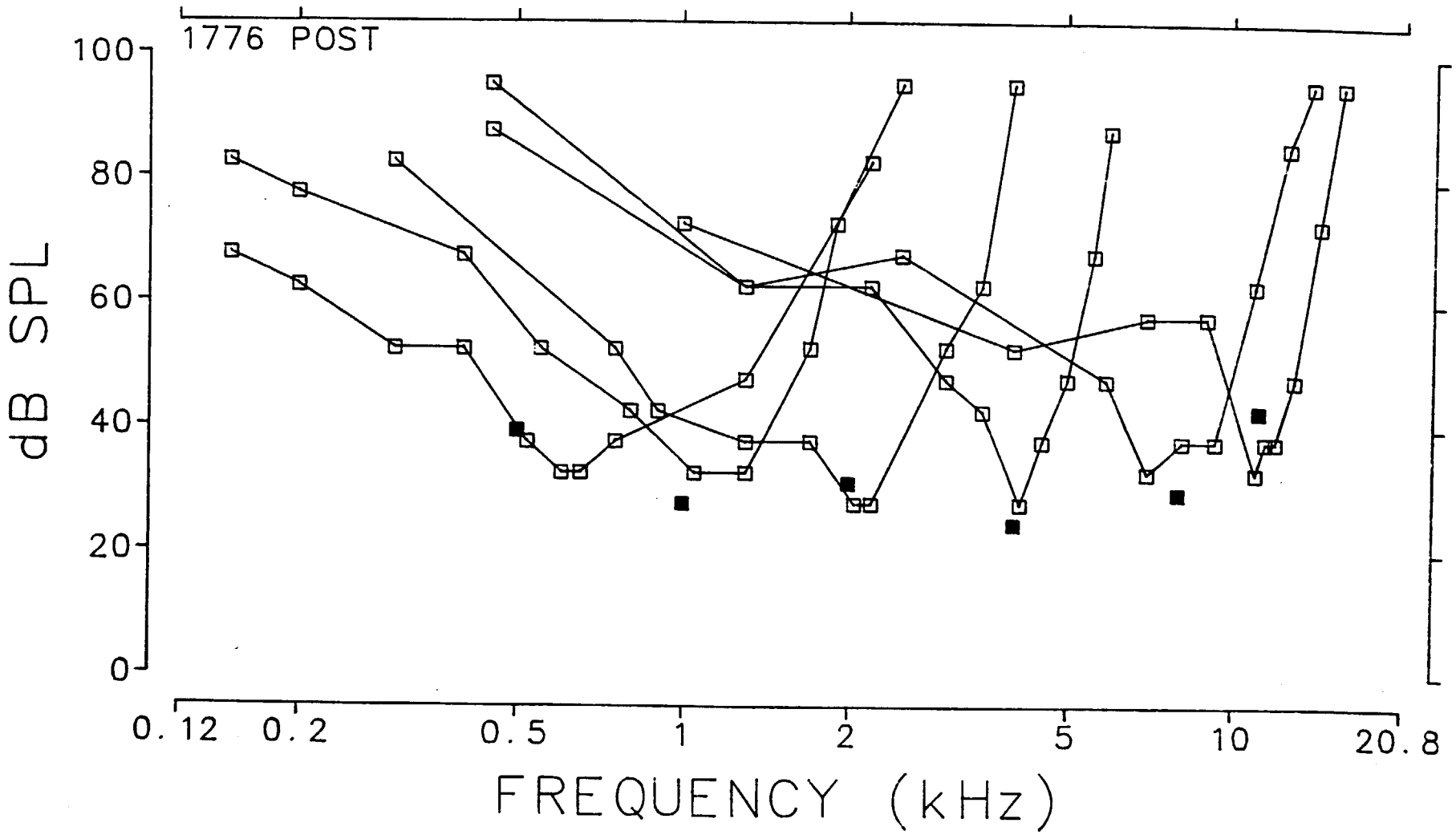

1714 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1714 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

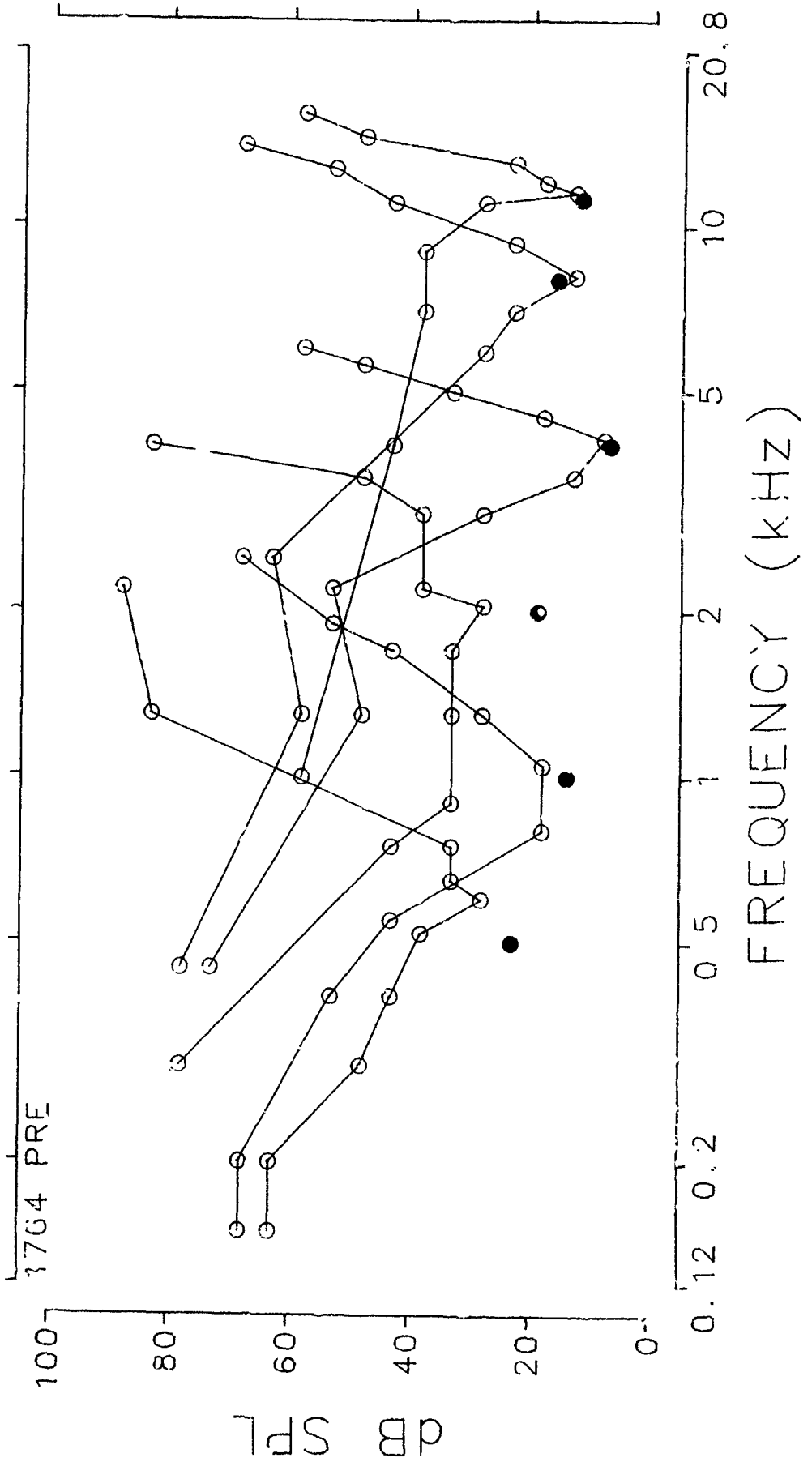

1778 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.0
FREQUENCY (kHz)

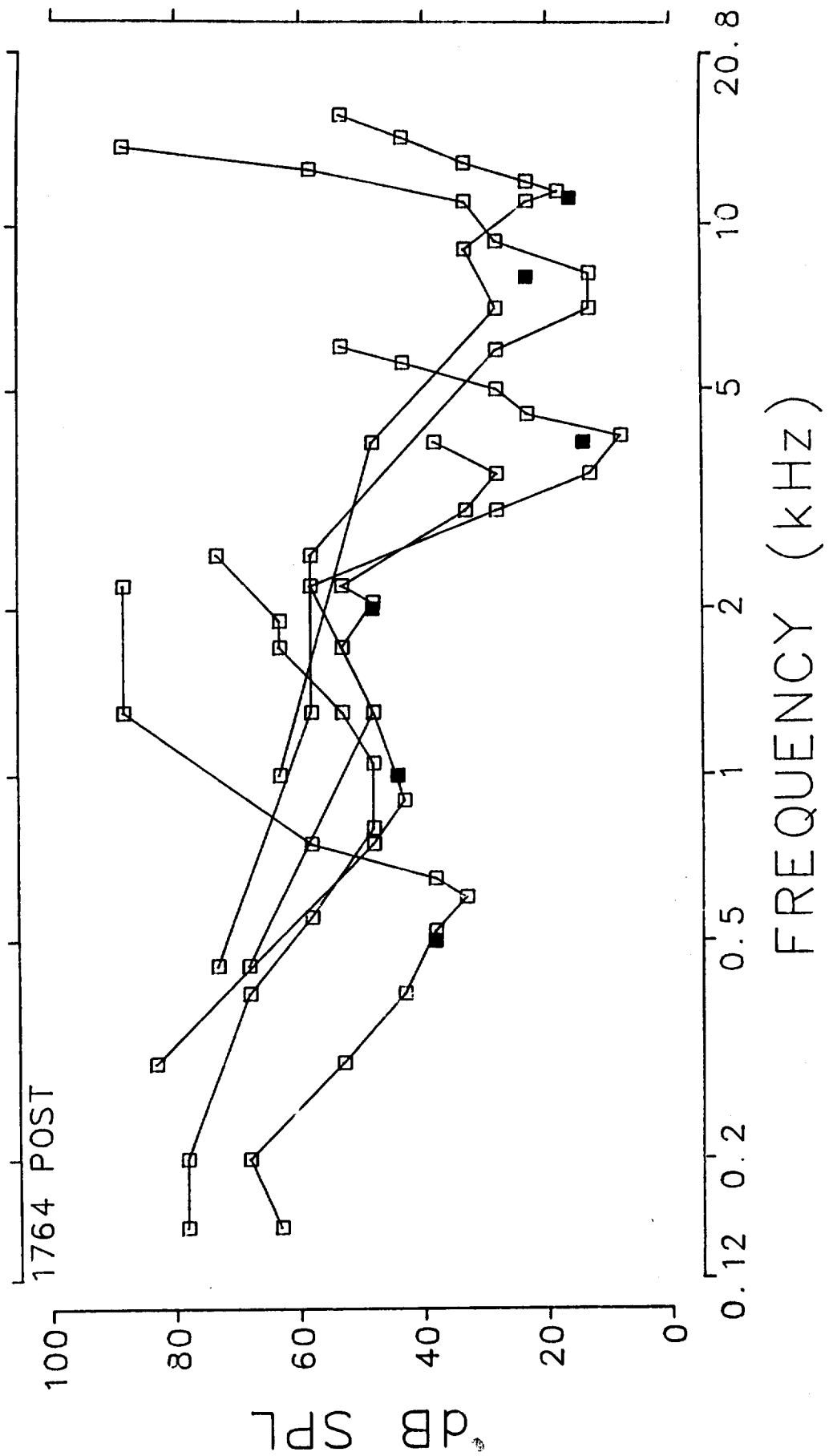

1778 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1776 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1776 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

A400


1764 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1764 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

SHOCK TUBE EXPOSURE
160 dB, 10X, 1/MIN

TOTAL NUMBER OF COCHLEAR SENSORY CELLS MISSING

ANIMAL NUMBER	INNER HAIR CELLS	1ST ROW OUTER HAIR CELLS	2ND ROW OUTER HAIR CELLS	3RD ROW OUTER HAIR CELLS	TOTAL OUTER HAIR CELLS
R1714R	14	86	65	136	287
R1764R	42	569	515	178	1262
R1776R	41	65	99	128	292
R1778R	11	59	161	176	396
R1779R	20	100	89	115	304
R1785R	32	104	114	143	361
GROUP MEAN	27				484
S.D.	14				384

TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND LENGTHS OF THE COCHLEA CENTERED AT THE FREQUENCIES INDICATED

	OCTAVE BAND CENTER FREQUENCY	INNER HAIR CELLS	OUTER HAIR CELLS
GROUP MEANS			
	0.125 kHz	2.3	62.2
	0.25 kHz	1.7	44.5
	0.5 kHz	3.5	45.0
	1 kHz	4.0	98.2
	2 kHz	4.8	139.3
	4 kHz	2.8	45.2
	8 kHz	6.2	28.2
	16 kHz	1.3	18.7
STANDARD DEVIATIONS			
	0.125 kHz	1.5	22.1
	0.25 kHz	1.6	25.8
	0.5 kHz	1.4	33.4
	1 kHz	6.5	124.7
	2 kHz	4.0	259.5
	4 kHz	2.0	35.8
	8 kHz	8.8	26.1
	16 kHz	1.4	11.8

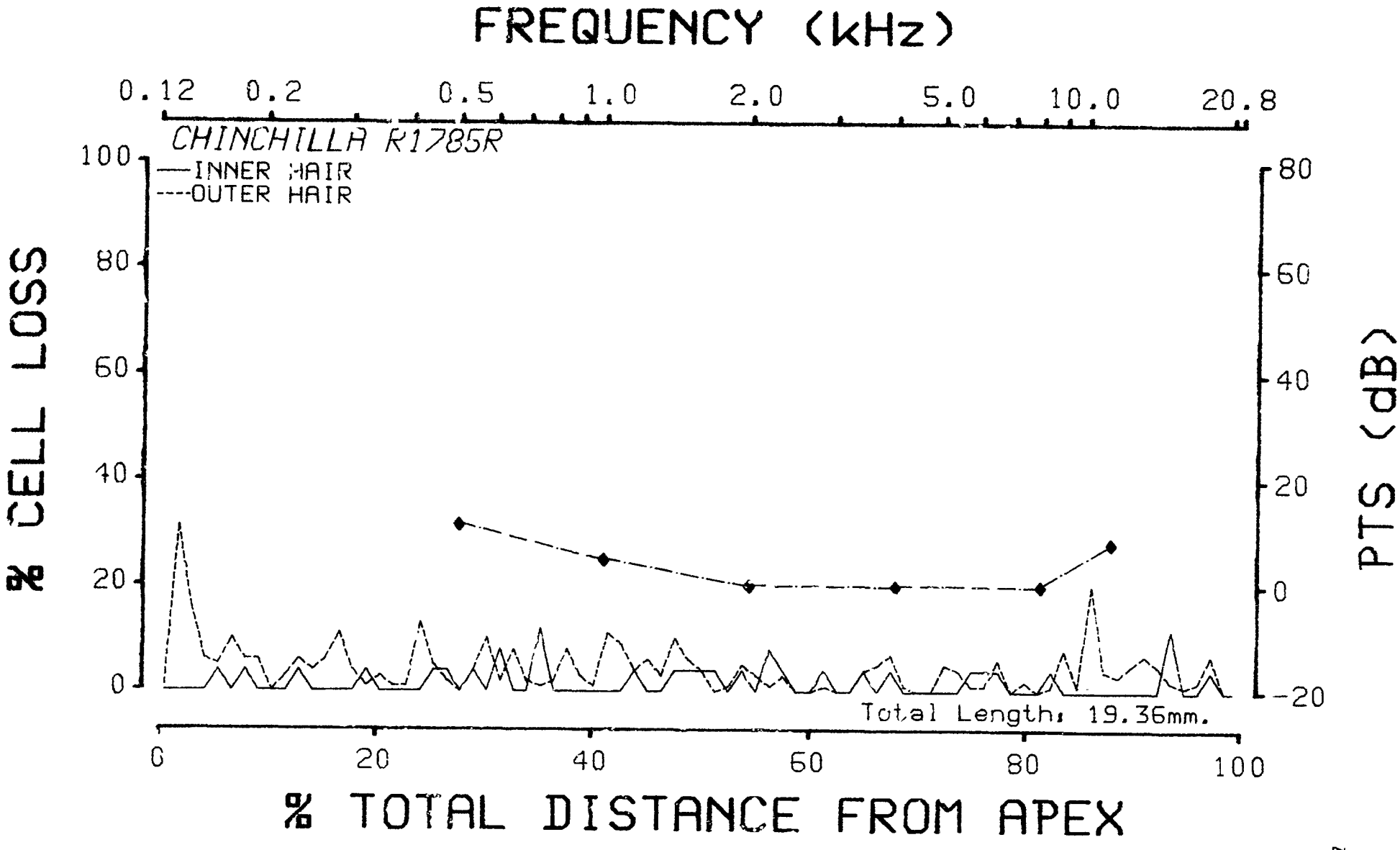
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1714R							
0.125 kHz	1	12	12	49	73	0	0
0.25 kHz	2	8	9	13	30	0	0
0.5 kHz	4	13	1	8	22	0	0
1 kHz	0	11	17	22	50	0	0
2 kHz	4	12	12	23	47	2	1
4 kHz	1	10	0	13	23	0	0
8 kHz	1	15	7	2	24	2	0
16 kHz	1	5	7	6	18	0	1
TOTALS	14	86	65	136	287	4	2
CHINCHILLA R1764R							
0.125 kHz	4	6	20	37	63	0	0
0.25 kHz	0	1	6	23	30	0	0
0.5 kHz	3	23	10	9	42	2	2
1 kHz	17	195	142	12	349	0	1
2 kHz	11	319	284	65	668	2	3
4 kHz	5	23	52	20	95	0	0
8 kHz	1	1	0	6	7	0	0
16 kHz	1	1	1	6	8	0	0
TOTALS	42	569	515	178	1262	4	6
CHINCHILLA R1776R							
0.125 kHz	4	16	28	36	80	1	3
0.25 kHz	1	11	8	19	38	1	1
0.5 kHz	4	3	11	5	19	0	0
1 kHz	0	5	20	21	46	0	0
2 kHz	3	16	16	21	53	0	1
4 kHz	5	5	9	9	23	0	1
8 kHz	23	5	3	8	16	0	1
16 kHz	1	2	4	9	15	0	0
TOTALS	41	65	99	128	292	2	7

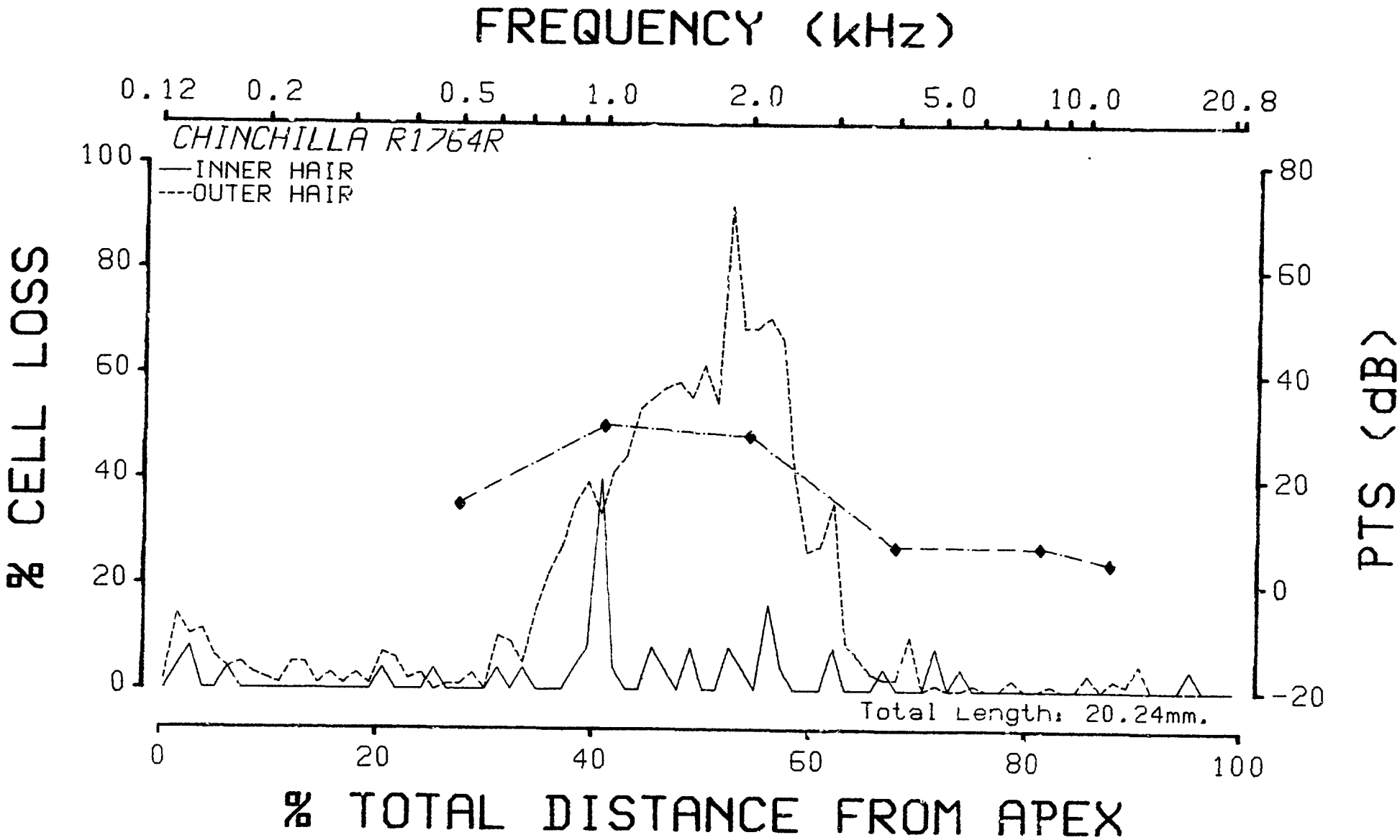
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1778R							
0.125 kHz	3	4	19	34	57	0	0
0.25 kHz	0	10	18	67	95	0	0
0.5 kHz	1	11	50	48	109	0	1
1 kHz	1	14	53	13	80	0	0
2 kHz	3	10	10	6	26	0	1
4 kHz	3	5	7	4	16	0	0
8 kHz	0	3	4	0	7	0	0
16 kHz	0	2	0	4	6	0	0
TOTALS	11	59	161	176	396	0	2
CHINCHILLA R1779R							
0.125 kHz	1	7	3	11	21	0	0
0.25 kHz	4	6	10	11	27	0	2
0.5 kHz	4	6	8	15	29	0	0
1 kHz	2	2	2	10	14	0	0
2 kHz	0	3	3	3	9	0	2
4 kHz	0	24	33	30	87	0	3
8 kHz	8	19	25	31	75	3	3
16 kHz	1	24	3	2	29	0	0
TOTALS	20	100	89	115	304	3	10
CHINCHILLA R1785R							
0.125 kHz	1	14	18	47	79	1	0
0.25 kHz	3	14	12	21	47	0	1
0.5 kHz	5	16	20	13	49	1	3
1 kHz	4	16	17	17	50	0	0
2 kHz	8	12	13	8	33	0	0
4 kHz	3	13	5	9	27	1	0
8 kHz	4	11	15	14	40	1	1
16 kHz	4	8	14	14	36	0	0
TOTALS	32	104	114	143	361	4	5

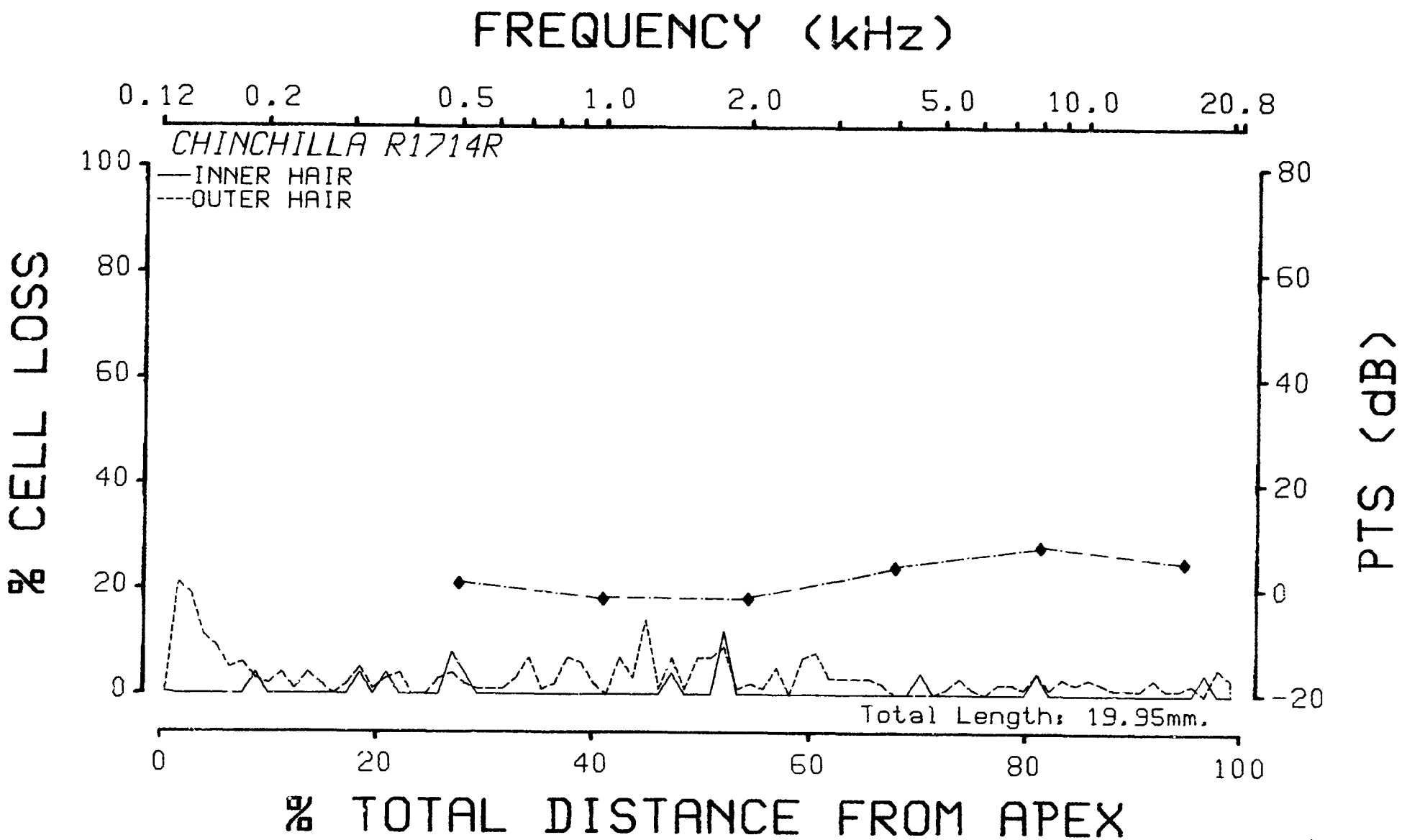
Cochleograms and PTS Audiograms for Individual Animals


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1785R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.36mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

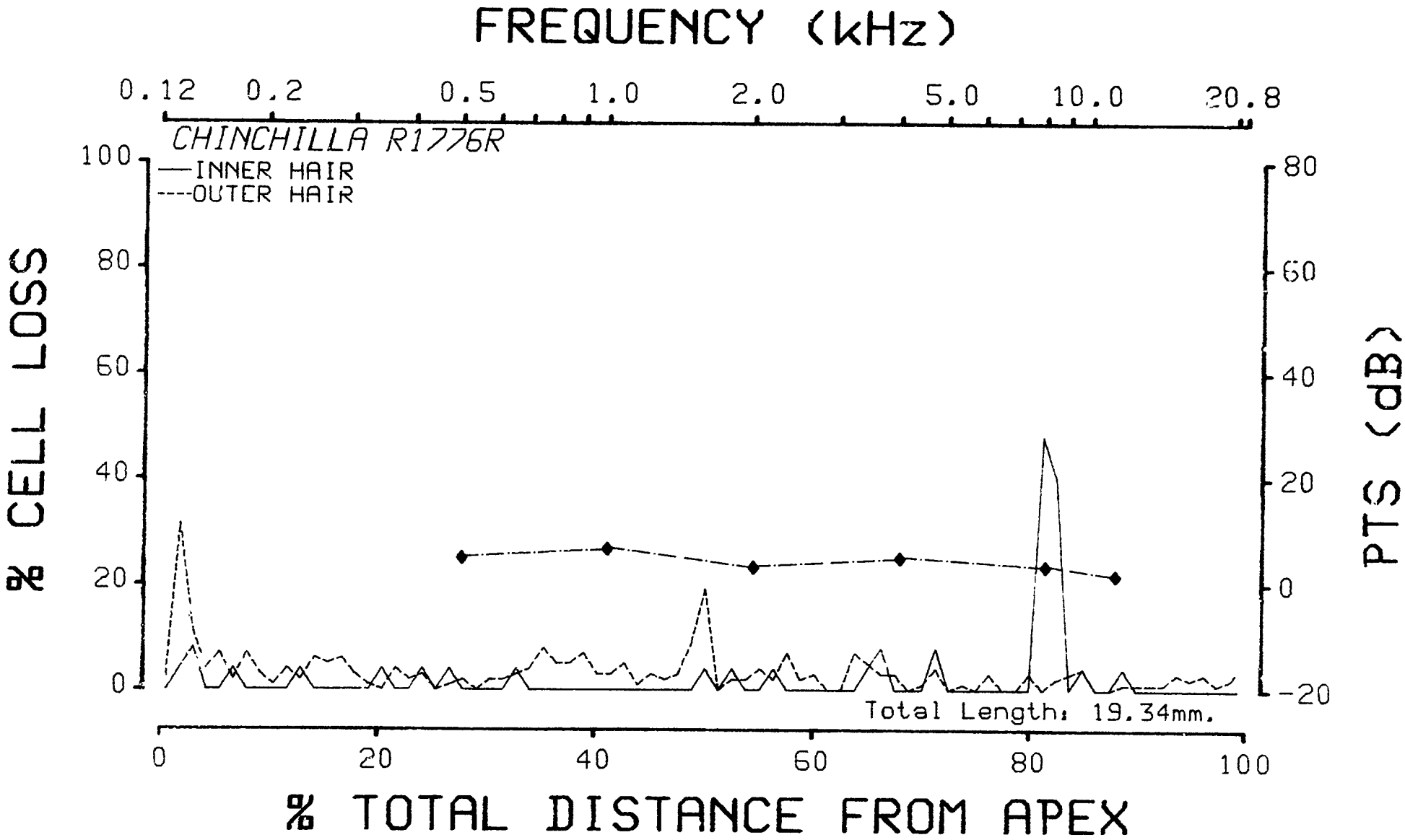
A407


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1764R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 20.24mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

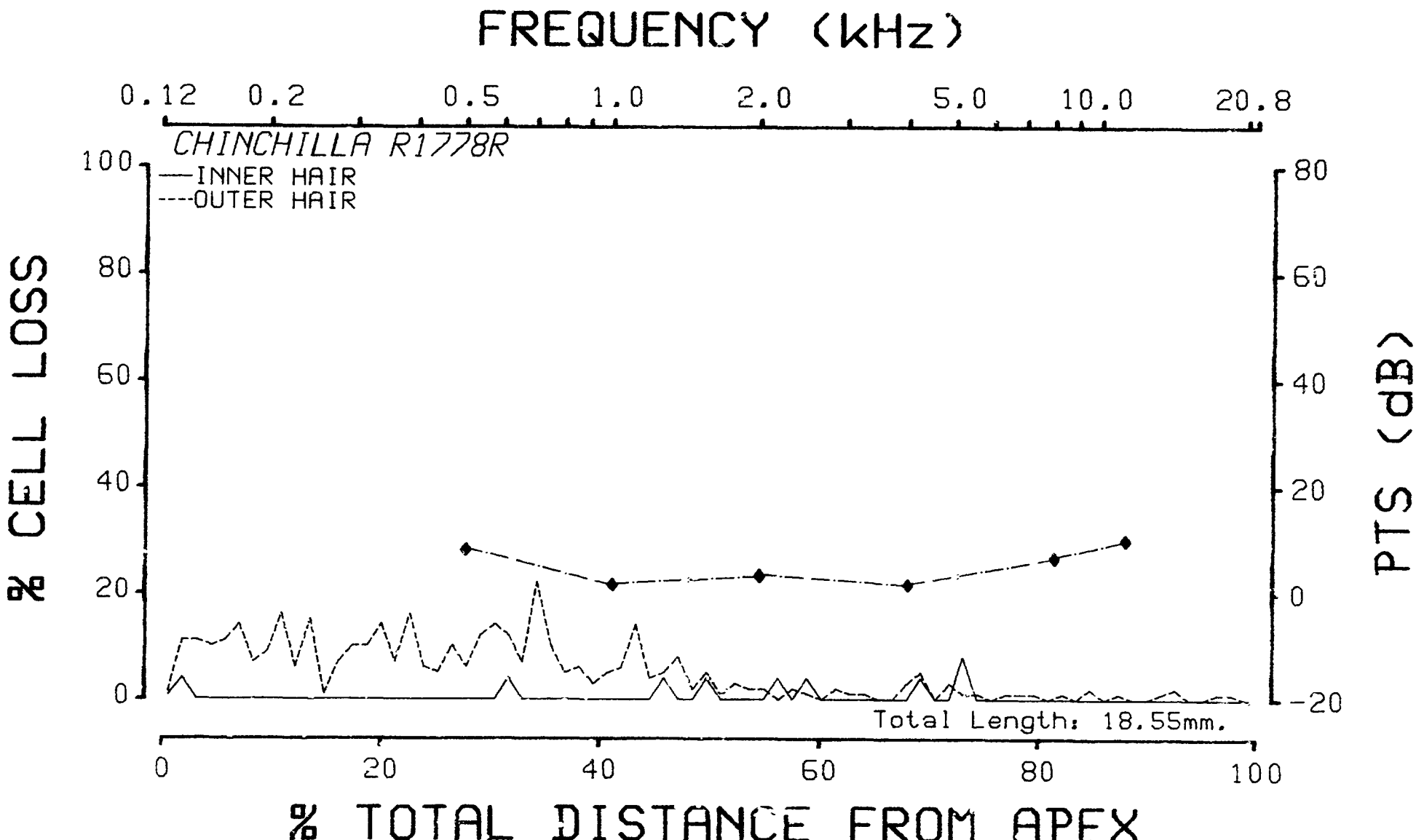
A408


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1714R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.95mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

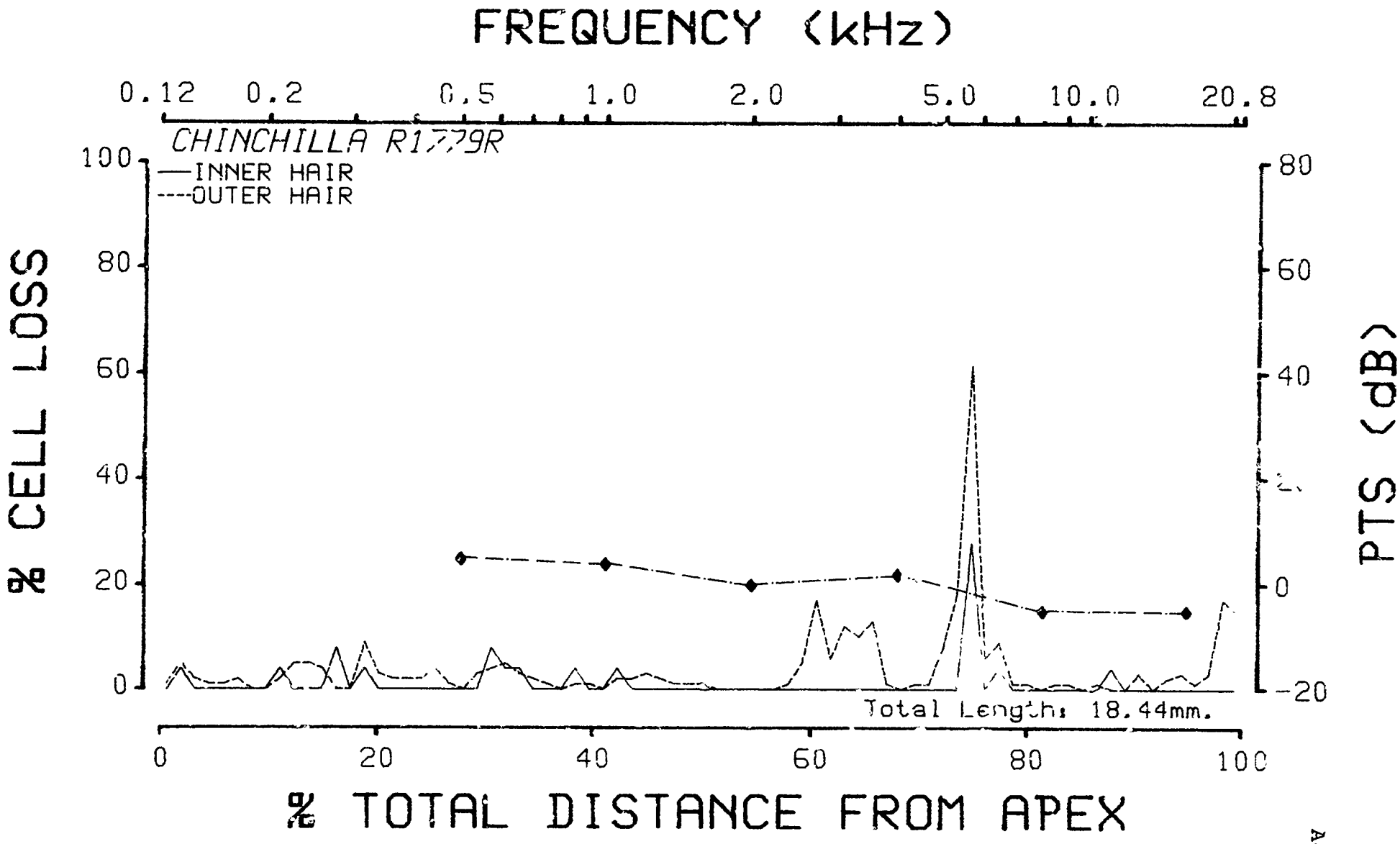
A409


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1776R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.34mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A410


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1778R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.55mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A411


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1779R
INNER HAIR
OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
pTS (dB)
80
60
40
0
-20
Total Length: 18.44mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A412

Summary Data for the Group Exposed to:

160 dB, 100X, 1/M

Animal #		
1698	-	Completed the Entire Protocol
1775	-	Completed the Entire Protocol
1782	-	Completed the Entire Protocol
1787	-	Completed the Entire Protocol
1817	-	Completed the Entire Protocol

160 dB 100X 1/M

PRE-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1698	17.5	10.8	15.8	14.2	24.2	34.2	*****
1775	12.5	5.8	14.2	9.2	29.2	22.5	*****
1782	22.5	19.2	25.8	12.5	27.5	34.2	*****
1787	14.2	4.2	-1.7	-9.2	7.5	10.8	*****
1817	30.8	22.5	24.2	10.8	19.2	29.2	*****
Mean	19.5	12.5	15.7	7.5	21.5	26.2	*****
S.D.	7.4	8.1	10.9	9.5	8.7	9.8	*****

POST-EXPOSURE THRESHOLDS (dB SPL)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1698	25.8	14.2	39.2	32.5	50.8	65.8	*****
1775	19.2	9.2	17.5	20.8	24.2	25.8	*****
1782	29.2	44.2	45.8	22.5	32.5	47.5	*****
1787	32.5	20.5	11.5	4.5	34.5	37.5	*****
1817	30.8	24.2	29.2	17.5	27.5	27.5	*****
Mean	27.5	22.4	28.6	19.6	33.9	40.8	*****
S.D.	5.3	13.4	14.4	10.1	10.3	16.5	*****

PERMANENT THRESHOLD SHIFT (dB)

Animal\kHz	0.5	1.0	2.0	4.0	8.0	11.2	16.0
1698	8.3	3.3	23.3	18.3	26.7	31.7	*****
1775	6.7	3.3	3.3	11.7	-5.0	3.3	*****
1782	6.7	25.0	20.0	10.0	5.0	13.3	*****
1787	18.3	16.3	13.2	13.7	27.0	26.7	*****
1817	0.0	1.7	5.0	6.7	8.3	-1.7	*****
Mean	8.0	9.9	13.0	12.1	12.4	14.7	*****
S.D.	6.6	10.3	8.9	4.3	14.1	14.4	*****

160 dB 100X 1/M

TEMPORARY THRESHOLD SHIFT (dB)

Frequency 0.5 kHz

Animal\Hr	0	2	8	24	240	Max
1698	10.0	10.0	20.0	10.0	5.0	20.0
1775	65.0	70.0	55.0	10.0	0.0	70.0
1782	60.0	60.0	60.0	45.0	-5.0	60.0
1787	8.3	3.3	3.3	3.3	3.3	8.3
1817	6.7	1.7	11.7	1.7	-3.3	11.7
Mean	30.0	29.0	30.0	14.0	0.0	34.0
S.D.	29.7	33.2	25.9	17.7	4.3	28.8

Frequency 2.0 kHz

Animal\Hr	0	2	8	24	240	Max
1698	31.7	11.7	6.7	21.7	1.7	31.7
1775	68.3	73.3	68.3	43.3	8.3	73.3
1782	61.7	61.7	61.7	56.7	11.7	61.7
1787	24.2	14.2	9.2	9.2	4.2	24.2
1817	18.3	23.3	18.3	3.3	3.3	23.3
Mean	40.8	36.8	32.8	26.8	5.8	42.8
S.D.	22.7	28.6	29.8	22.7	4.1	23.1

Frequency 8.0 kHz

Animal\Hr	0	2	8	24	240	Max
1698	43.3	18.3	18.3	23.3	13.3	43.3
1775	58.3	58.3	48.3	18.3	-1.7	58.3
1782	60.0	60.0	60.0	55.0	5.0	60.0
1787	35.0	25.0	25.0	20.0	5.0	35.0
1817	68.3	53.3	53.3	23.3	-1.7	68.3
Mean	53.0	43.0	41.0	28.0	4.0	53.0
S.D.	13.5	19.8	18.3	15.3	6.2	13.5

MASKED THRESHOLDS (dB SPL) Group: 160 dB 100X 1/M

Probe Frequency: 0.5 kHz

Masker (kHz):		0.150	0.200	0.300	0.400	0.520	0.600	0.650	0.750	1.300	2.200
Animal (Q-10 dB)					Pre-Exposure						
1698	(3.57)	62.5	52.5	42.5	27.5	17.5	12.5	32.5	37.5	47.5	67.5
1775	(2.48)	62.5	62.5	42.5	32.5	22.5	17.5	22.5	32.5	52.5	62.5
1782	(2.32)	62.5	57.5	47.5	32.5	22.5	27.5	37.5	42.5	47.5	67.5
1787	(2.94)	67.5	62.5	47.5	47.5	37.5	22.5	27.5	32.5	77.5	95.0*
1817	(1.89)	77.5	72.5	62.5	62.5	42.5	37.5	37.5	42.5	82.5	95.0*
Mean	(2.64)	66.5	61.5	48.5	40.5	28.5	23.5	31.5	37.5	61.5	77.5
S.D.	(0.64)	6.5	7.4	8.2	14.4	10.8	9.6	6.5	5.0	17.1	16.1
Animal (Q-10 dB)					Post-Exposure						
1698	(2.62)	62.5	57.5	32.5	37.5	22.5	12.5	17.5	22.5	37.5	52.5
1775	(2.05)	62.5	62.5	47.5	37.5	27.5	22.5	27.5	32.5	52.5	77.5
1782	(4.65)	67.5	67.5	57.5	42.5	42.5	32.5	42.5	47.5	67.5	82.5
1787	(6.19)	95.0*	77.5	75.0*	57.5	55.0*	37.5	47.5	52.5	77.5	95.0*
1817	(1.69)	67.5	57.5	62.5	52.5	37.5	37.5	32.5	37.5	57.5	95.0*
Mean	(3.44)	71.0	64.5	55.0	45.5	37.0	28.5	33.5	38.5	58.5	80.5
S.D.	(1.91)	13.6	8.4	16.0	9.1	12.8	10.8	11.9	11.9	15.2	17.4

MASKED THRESHOLDS (dB SPL) Group: 160 dB 100X 1/M

Probe Frequency: 1.0 kHz

Masker (kHz):		0.150	0.200	0.400	0.550	0.800	1.050	1.300	1.700	1.900	2.500
Animal (Q-10 dB)						Pre-Exposure					
1698	(0.92)	72.5	67.5	52.5	32.5	22.5	22.5	27.5	42.5	52.5	72.5
1775	(1.84)	77.5	72.5	47.5	42.5	22.5	17.5	27.5	42.5	52.5	62.5
1782	(1.18)	62.5	57.5	47.5	37.5	22.5	22.5	32.5	47.5	47.5	67.5
1787	(1.87)	72.5	77.5	57.5	47.5	32.5	22.5	27.5	57.5	85.0*	95.0*
1817	(1.10)	82.5	82.5	72.5	57.5	42.5	42.5	47.5	82.5	87.5	97.5
Mean	(1.38)	73.5	71.5	55.5	43.5	28.5	25.5	32.5	54.5	65.0	79.0
S.D.	(0.44)	7.4	9.6	10.4	9.6	8.9	9.7	8.7	16.8	19.5	16.2
Animal (Q-10 dB)						Post-Exposure					
1698	(2.97)	72.5	67.5	42.5	37.5	17.5	22.5	12.5	32.5	67.5	82.5
1775	(2.10)	72.5	72.5	57.5	47.5	27.5	17.5	27.5	57.5	62.5	72.5
1782	(1.47)	82.5	77.5	67.5	57.5	42.5	47.5	57.5	67.5	67.5	72.5
1787	(1.39)	87.5	92.5	87.5	72.5	62.5	57.5	57.5	87.5	92.5	102.5
1817	(1.42)	77.5	77.5	62.5	57.5	42.5	37.5	37.5	62.5	85.0*	82.5
Mean	(1.87)	78.5	77.5	63.5	54.5	38.5	36.5	38.5	61.5	75.0	82.5
S.D.	(0.68)	6.5	9.4	16.4	13.0	17.1	16.7	19.5	19.8	13.0	12.2

MASKED THRESHOLDS (dB SPL) Group: 160 dB 100X 1/M

Probe Frequency: 2.0 kHz

Masker (kHz):		0.300	0.750	0.900	1.300	1.700	2.050	2.200	3.000	3.500	4.000
Animal (Q-10 dB)						Pre-Exposure					
1698	(2.38)	77.5	57.5	47.5	42.5	22.5	22.5	32.5	42.5	62.5	77.5
1775	(4.57)	72.5	47.5	32.5	32.5	27.5	17.5	32.5	42.5	57.5	82.5
1782	(4.09)	67.5	62.5	47.5	37.5	32.5	22.5	32.5	42.5	52.5	67.5
1787	(2.59)	72.5	42.5	32.5	32.5	32.5	22.5	22.5	47.5	62.5	95.0*
1817	(1.81)	67.5	42.5	37.5	42.5	52.5	32.5	37.5	42.5	52.5	87.5
Mean	(3.09)	71.5	50.5	39.5	37.5	33.5	23.5	31.5	43.5	57.5	82.0
S.D.	(1.18)	4.2	9.1	7.6	5.0	11.4	5.5	5.5	2.2	5.0	10.4
Animal (Q-10 dB)						Post-Exposure					
1698	(1.53)	77.5	52.5	32.5	32.5	32.5	27.5	37.5	32.5	52.5	67.5
1775	(1.36)	72.5	47.5	37.5	32.5	27.5	27.5	42.5	52.5	72.5	82.5
1782	(1.52)	77.5	52.5	52.5	52.5	47.5	47.5	47.5	47.5	42.5	90.0*
1787	(4.87)	87.5	77.5	72.5	72.5	47.5	32.5	27.5	67.5	95.0*	95.0*
1817	(1.57)	72.5	57.5	52.5	52.5	60.0*	47.5	52.5	52.5	85.0*	95.0*
Mean	(2.17)	77.5	57.5	49.5	48.5	43.0	36.5	41.5	50.5	69.5	86.0
S.D.	(1.51)	6.1	11.7	15.7	16.7	13.0	10.2	9.6	12.5	21.9	11.5

MASKED THRESHOLDS (dB SPL) Group: 160 dB 100X 1/M

Probe Frequency: 4.0 kHz

Masker (kHz):		0.450	1.300	2.200	3.000	3.500	4.100	4.500	5.000	5.600	6.000
Animal (Q-10 dB)						Pre-Exposure					
1698	(2.73)	82.5	57.5	47.5	42.5	32.5	27.5	32.5	42.5	47.5	67.5
1775	(3.95)	82.5	52.5	52.5	42.5	27.5	22.5	37.5	37.5	57.5	82.5
1782	(3.07)	67.5	52.5	52.5	37.5	22.5	17.5	22.5	37.5	47.5	62.5
1787	(6.77)	62.5	52.5	47.5	42.5	27.5	12.5	32.5	37.5	47.5	62.5
1817	(3.49)	77.5	57.5	52.5	47.5	32.5	27.5	37.5	47.5	42.5	72.5
Mean	(4.00)	74.5	54.5	50.5	42.5	28.5	21.5	32.5	40.5	48.5	69.5
S.D.	(1.61)	9.1	2.7	2.7	3.5	4.2	6.5	6.1	4.5	5.5	8.4
Animal (Q-10 dB)						Post-Exposure					
1698	(1.23)	72.5	57.5	47.5	47.5	22.5	17.5	32.5	52.5	57.5	72.5
1775	(4.76)	82.5	47.5	57.5	42.5	32.5	22.5	37.5	57.5	57.5	67.5
1782	(2.33)	82.5	67.5	67.5	57.5	47.5	47.5	57.5	62.5	62.5	72.5
1787	(4.76)	77.5	62.5	52.5	47.5	37.5	27.5	42.5	62.5	87.5	95.0*
1817	(3.65)	62.5	57.5	52.5	42.5	32.5	27.5	42.5	57.5	67.5	95.0*
Mean	(3.95)	75.5	58.5	55.5	47.5	34.5	28.5	42.5	58.5	66.5	80.5
S.D.	(1.01)	8.4	7.4	7.6	6.1	9.1	11.4	9.4	4.2	12.4	13.4

MASKED THRESHOLDS (dB SPL) Group: 160 dB 100X 1/M

Probe Frequency: 8.0 kHz

Masker (kHz):		0.450	1.300	2.500	5.900	7.000	8.100	9.300	11.000	12.700	14.000
Animal (Q-10 dB)					Pre-Exposure						
1698	(3.73)	67.5	57.5	42.5	42.5	22.5	17.5	32.5	37.5	62.5	72.5
1775	(2.88)	87.5	57.5	62.5	37.5	22.5	27.5	37.5	47.5	77.5	87.5
1782	(3.83)	72.5	62.5	52.5	47.5	22.5	17.5	32.5	47.5	52.5	67.5
1787	(5.69)	77.5	67.5	62.5	47.5	42.5	27.5	52.5	62.5	85.0*	97.5
1817	(3.73)	82.5	62.5	52.5	42.5	27.5	7.5	7.5	47.5	62.5	77.5
Mean	(4.17)	77.5	61.5	54.5	43.5	27.5	19.5	32.5	48.5	68.0	80.5
S.D.	(1.46)	7.9	4.2	8.4	4.2	8.7	8.4	16.2	8.9	13.0	12.0
Animal (Q-10 dB)					Post-Exposure						
1698	(2.62)	82.5	72.5	67.5	57.5	42.5	37.5	42.5	62.5	77.5	82.5
1775	(1.84)	82.5	57.5	57.5	37.5	27.5	27.5	32.5	52.5	52.5	77.5
1782	(4.15)	67.5	57.5	62.5	52.5	42.5	27.5	37.5	47.5	47.5	82.5
1787	(4.31)	97.5	82.5	62.5	57.5	62.5	52.5	67.5	95.0*	95.0*	97.5
1817	(1.08)	72.5	67.5	52.5	32.5	32.5	37.5	42.5	62.5	72.5	87.5
Mean	(2.80)	80.5	67.5	60.5	47.5	41.5	36.5	44.5	64.0	71.0	85.5
S.D.	(1.41)	11.5	10.6	5.7	11.7	13.4	10.2	13.5	18.5	17.6	7.6

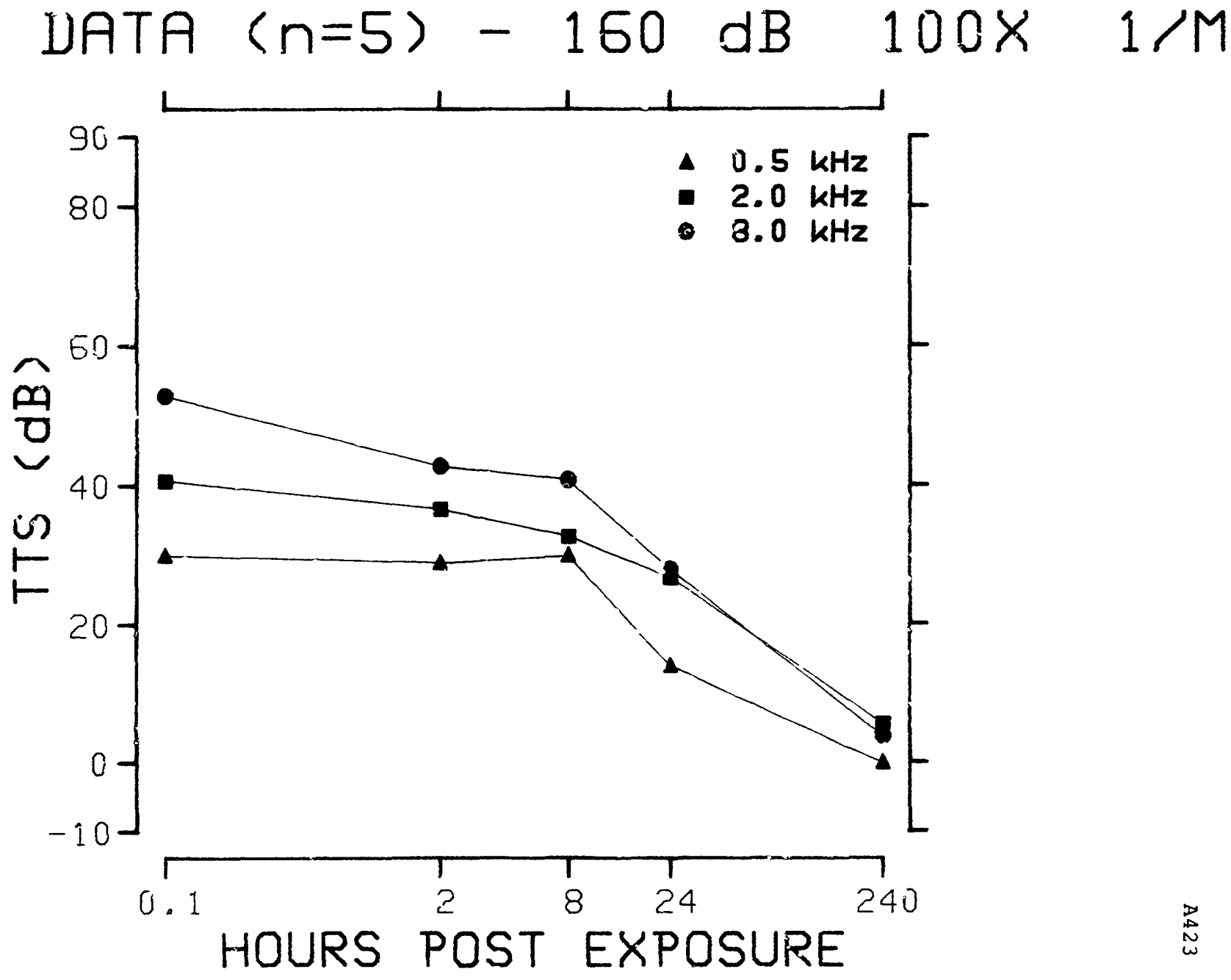
MASKED THRESHOLDS (dB SPL) Group: 160 dB 100X 1/M

Probe Frequency: 11.2 kHz

Masker (kHz):		1.000	4.000	7.000	9.000	11.000	11.500	12.000	13.000	14.500	16.000
Animal (Q-10 dB)						Pre-Exposure					
1698	(4.40)	62.5	57.5	37.5	22.5	12.5	22.5	22.5	32.5	52.5	62.5
1775	(5.86)	72.5	47.5	42.5	37.5	22.5	32.5	37.5	42.5	62.5	72.5
1782	(2.95)	67.5	57.5	47.5	32.5	27.5	32.5	37.5	52.5	67.5	72.5
1787	(8.00)	72.5	47.5	52.5	47.5	32.5	32.5	22.5	32.5	42.5	67.5
1817	(4.21)	67.5	52.5	62.5	52.5	47.5	37.5	37.5	42.5	52.5	87.5
Mean	(5.08)	68.5	52.5	48.5	38.5	28.5	31.5	31.5	40.5	55.5	72.5
S.D.	(1.93)	4.2	5.0	9.6	11.9	12.9	5.5	8.2	8.4	9.7	9.4
Animal (Q-10 dB)						Post-Exposure					
1698	(3.67)	72.5	62.5	67.5	57.5	47.5	47.5	57.5	57.5	77.5	72.5
1775	(7.47)	67.5	57.5	52.5	57.5	37.5	32.5	42.5	47.5	62.5	72.5
1782	(2.95)	82.5	62.5	67.5	52.5	47.5	47.5	57.5	67.5	67.5	72.5
1787	(5.68)	62.5	67.5	67.5	77.5	42.5	42.5	47.5	62.5	85.0*	95.0*
1817	(17.22)	52.5	42.5	47.5	55.0*	42.5	27.5	42.5	32.5	37.5	47.5
Mean	(7.40)	71.5	58.5	60.5	60.0	43.5	39.5	49.5	53.5	66.0	72.0
S.D.	(5.77)	12.4	9.6	9.7	10.0	4.2	9.1	7.6	13.9	18.2	16.8

The Group Mean Recovery Curves

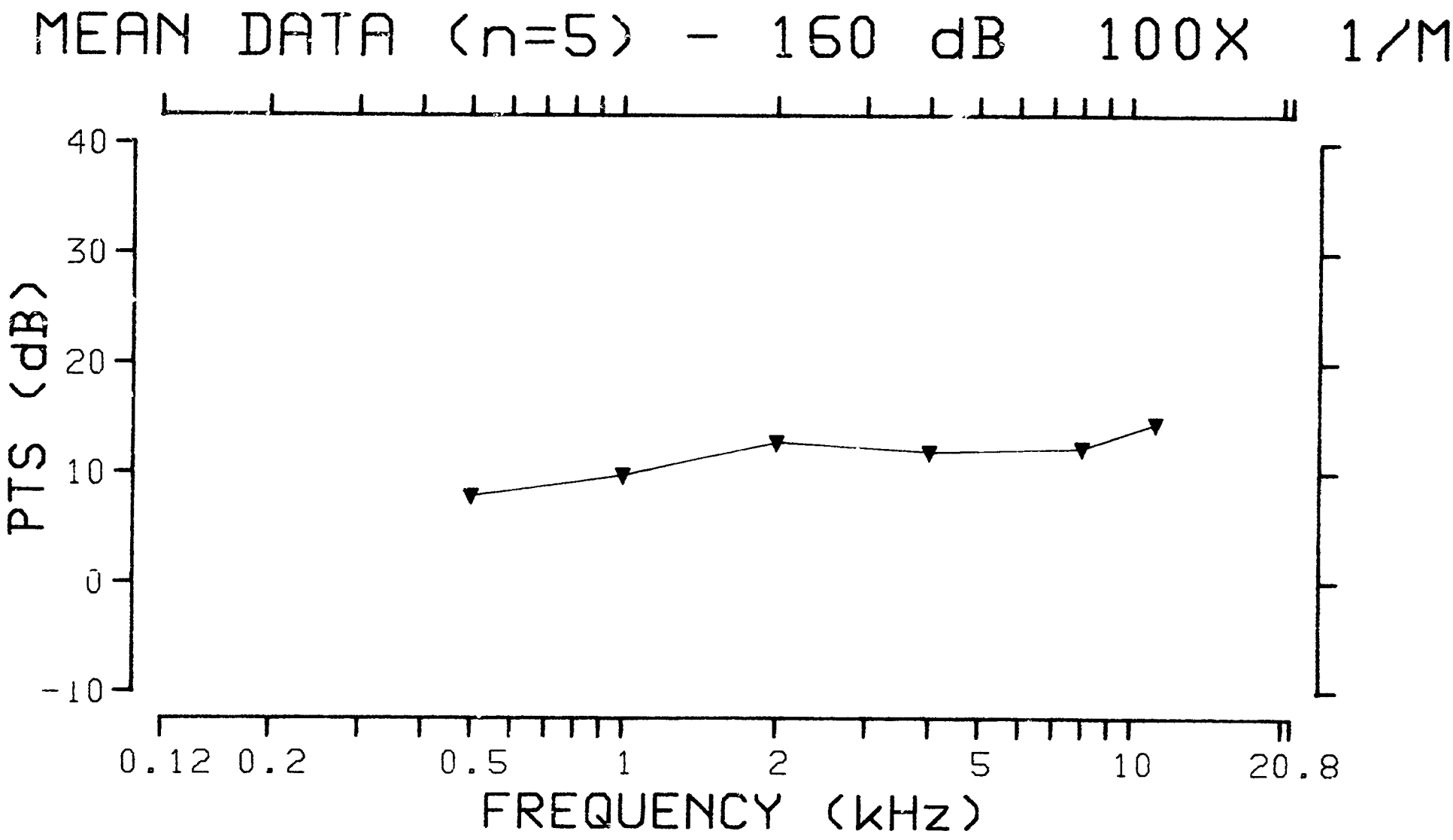
Measured at Three Test Frequencies


MEAN DATA (n=5) - 160 dB 100X 1/M
0.5 kHz
2.0 kHz
8.0 kHz
TTS (dB)
90
80
60
40
20
0
-10
0.1
2
8
24
240
HOURS POST EXPOSURE

A423

The Group Mean Permanent Threshold Shift (PTS)

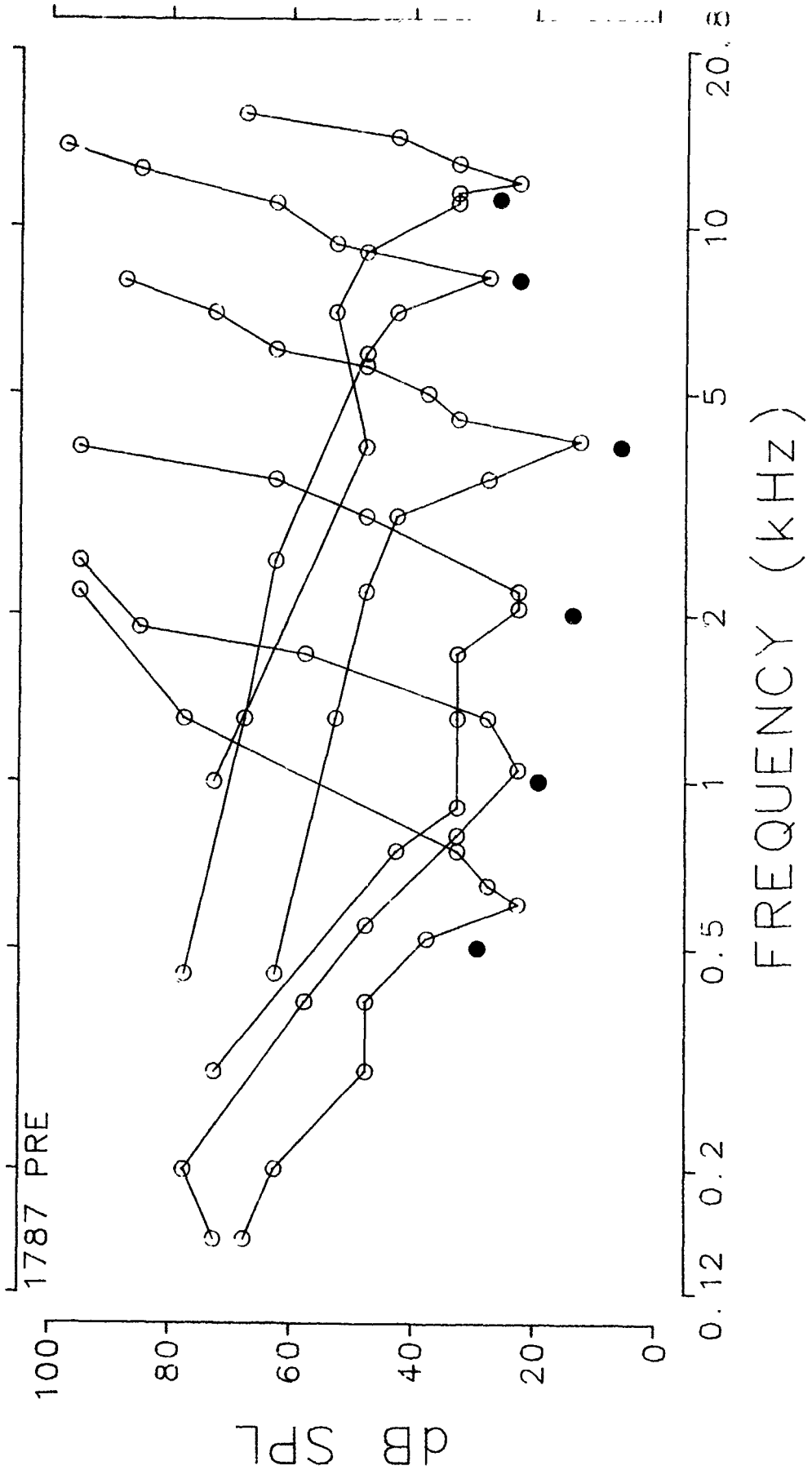
for all Test Frequencies

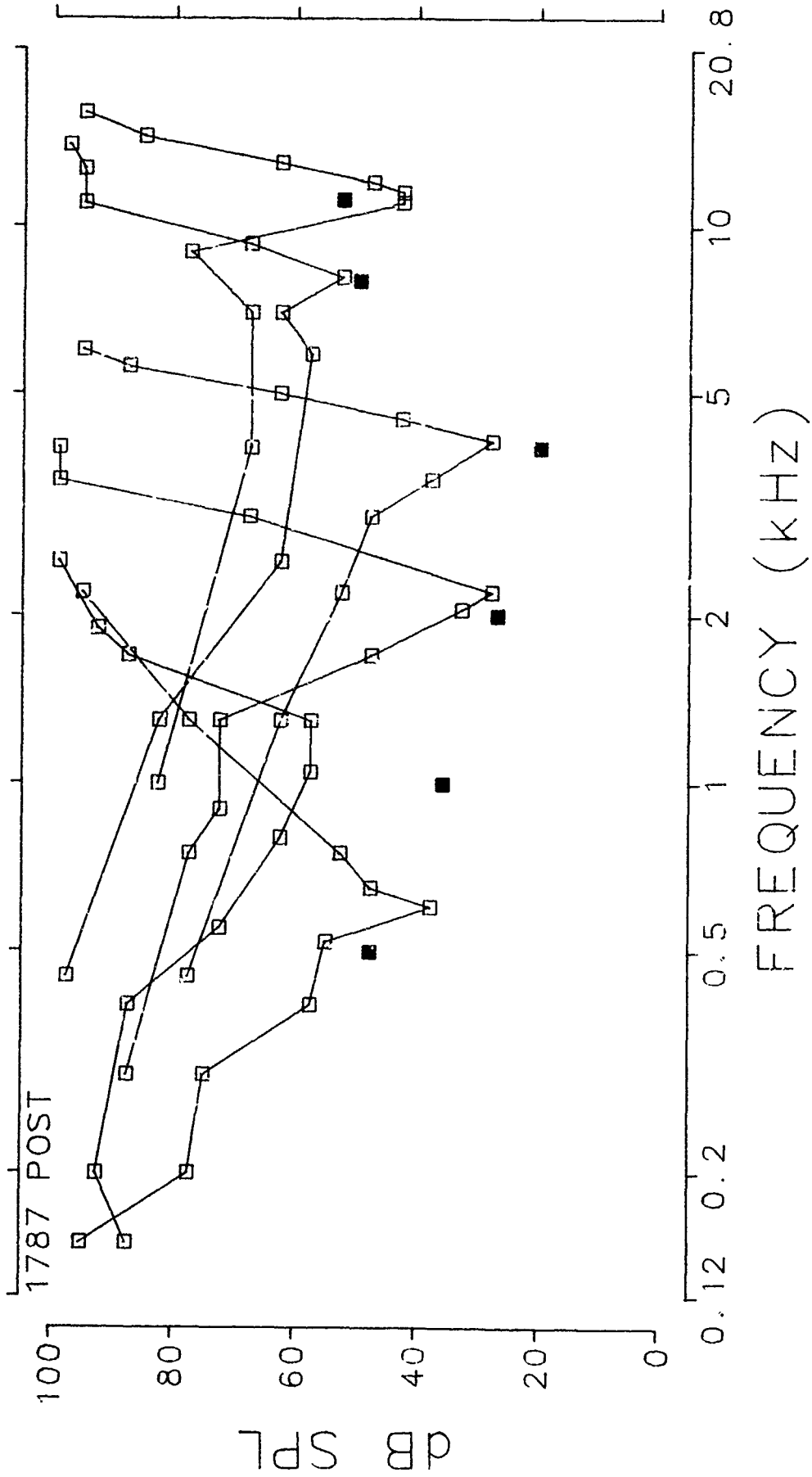

MEAN DATA (n=5) - 160 dB 100X 1/M
PTS (dB)
40
30
20
10
0
-10
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

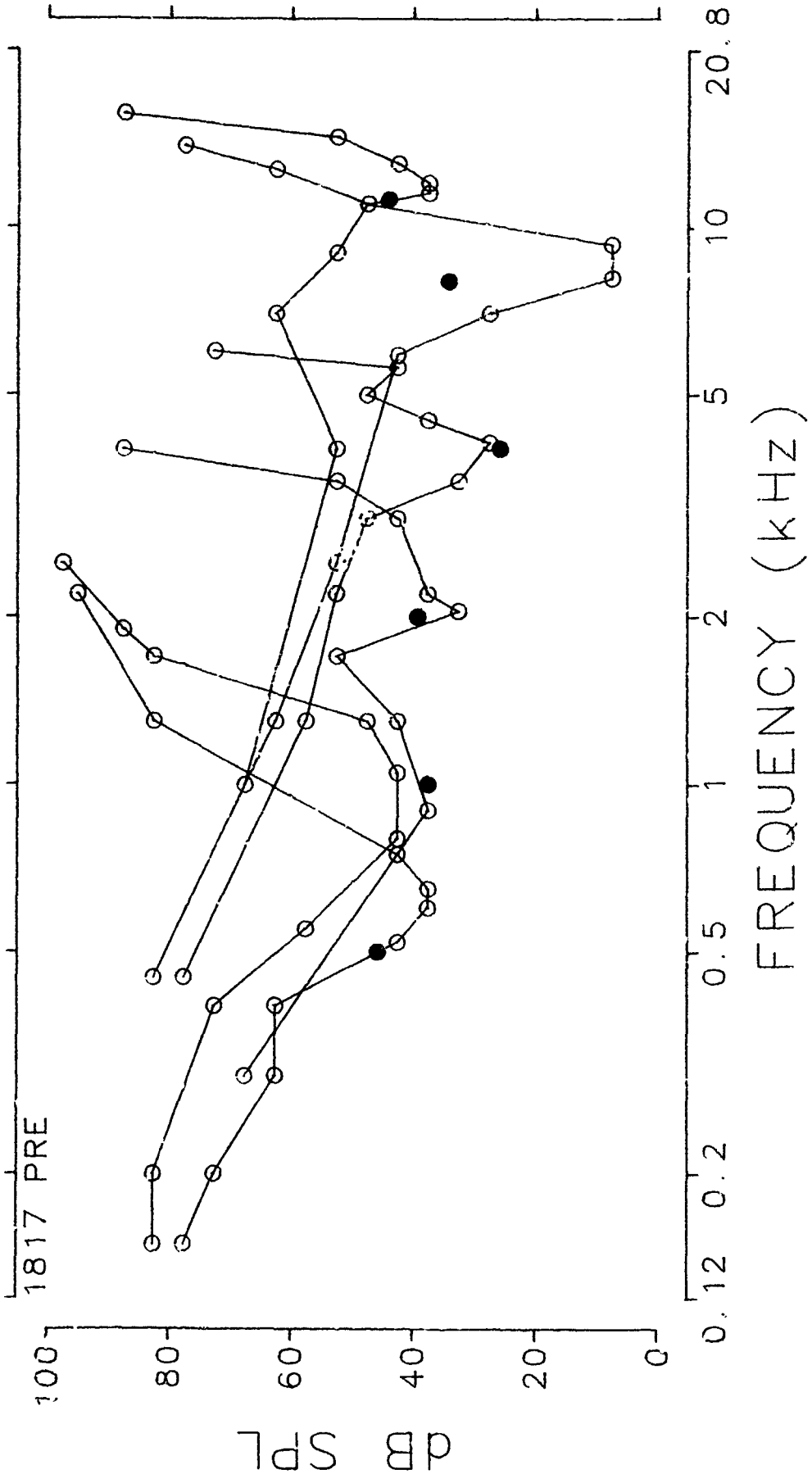
A425

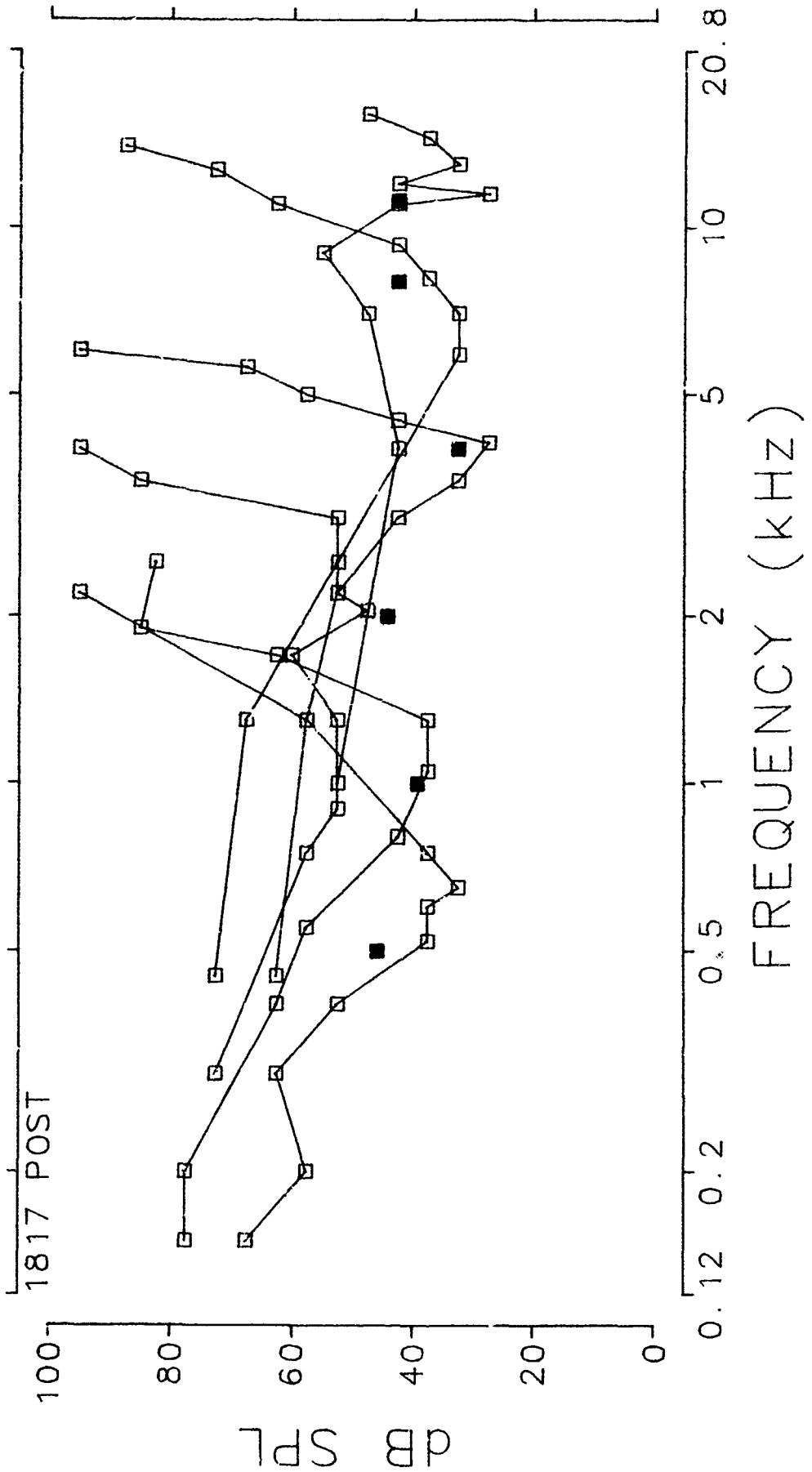
The Pre and Postexposure Tuning Curves for
Individual Animals in this Exposure Group.

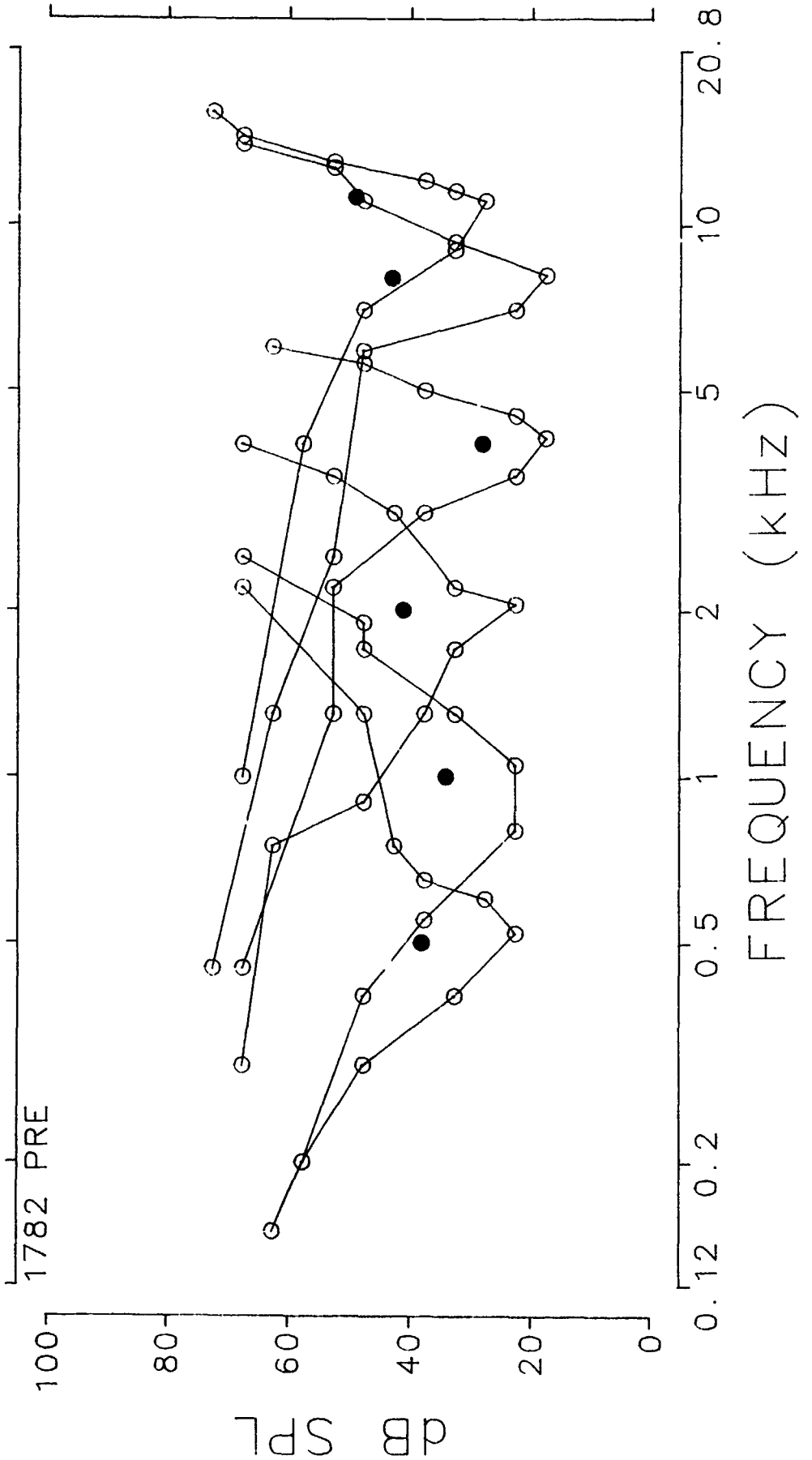
The solid symbol represents the threshold of the probe tone.

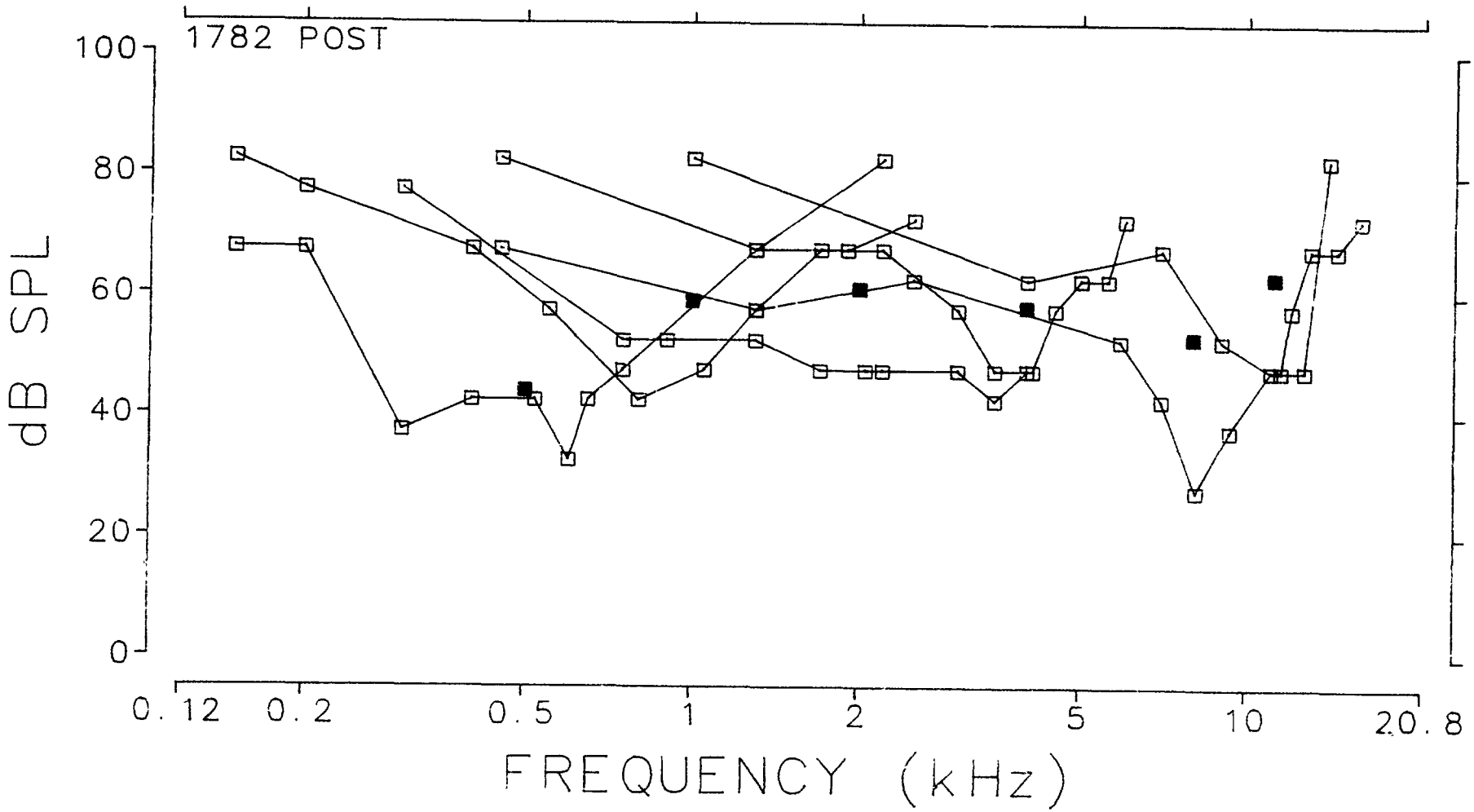

1787 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20
FREQUENCY (kHz)


1787 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (KHZ)

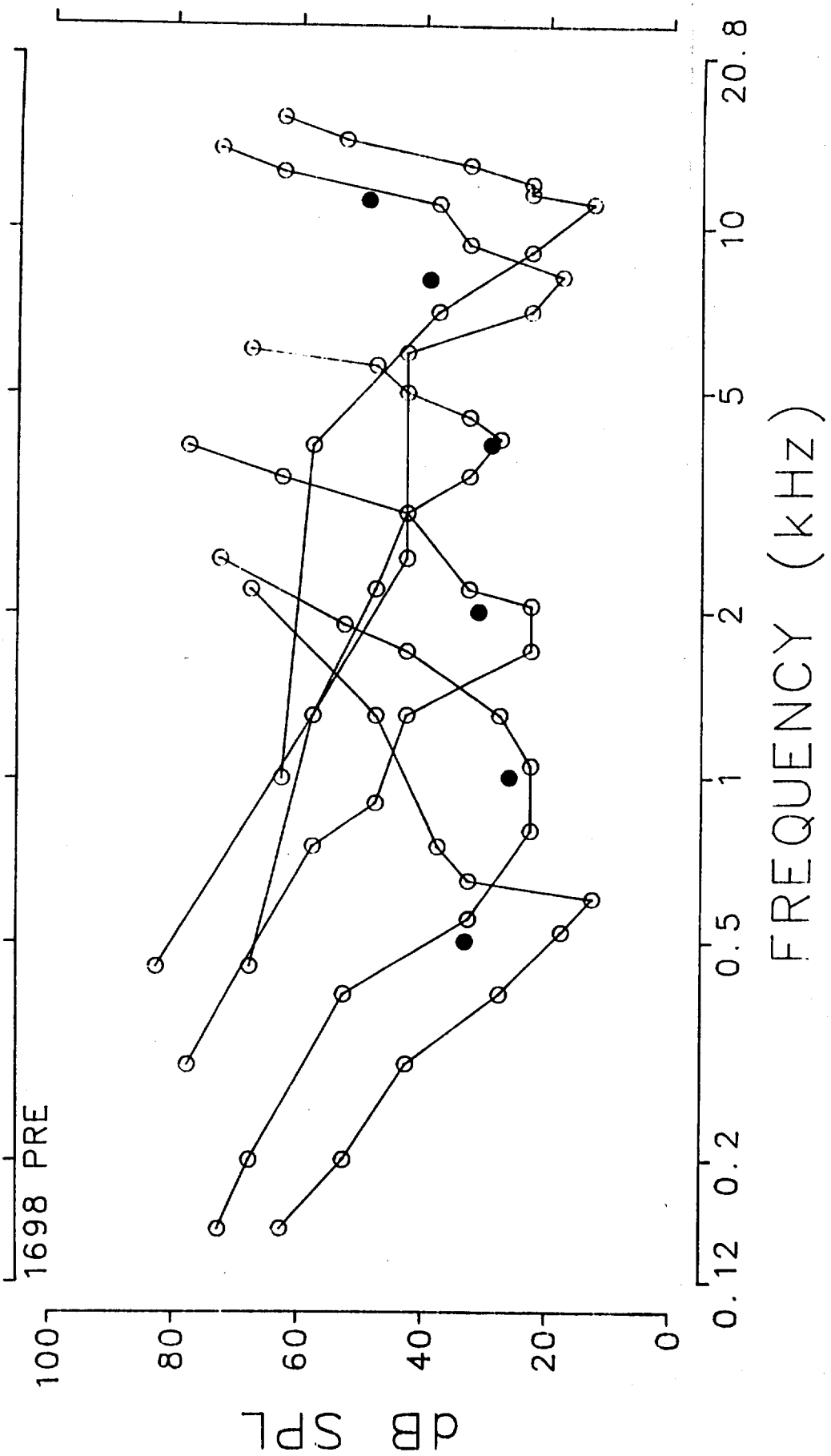

1817 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

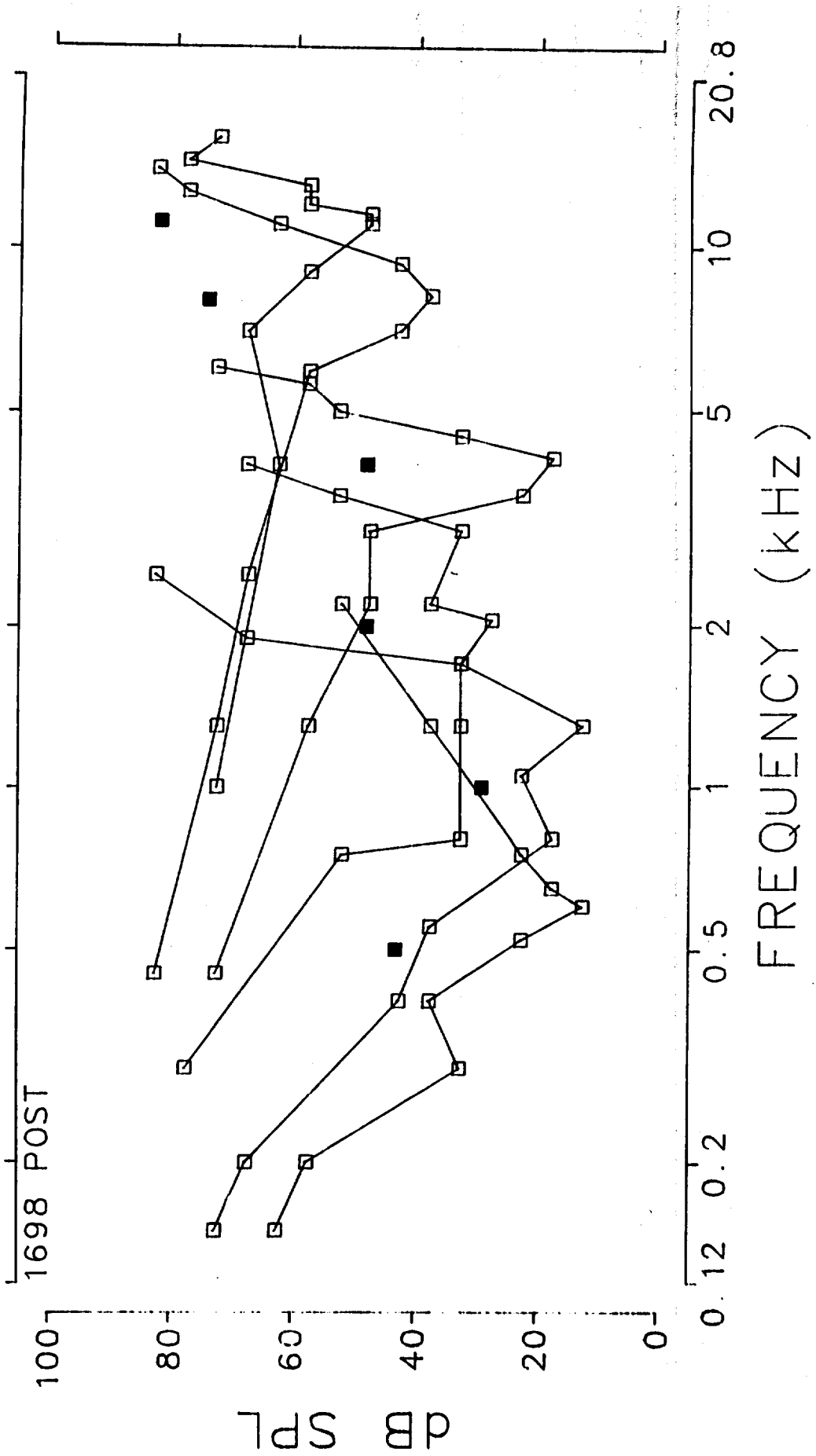

1817 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

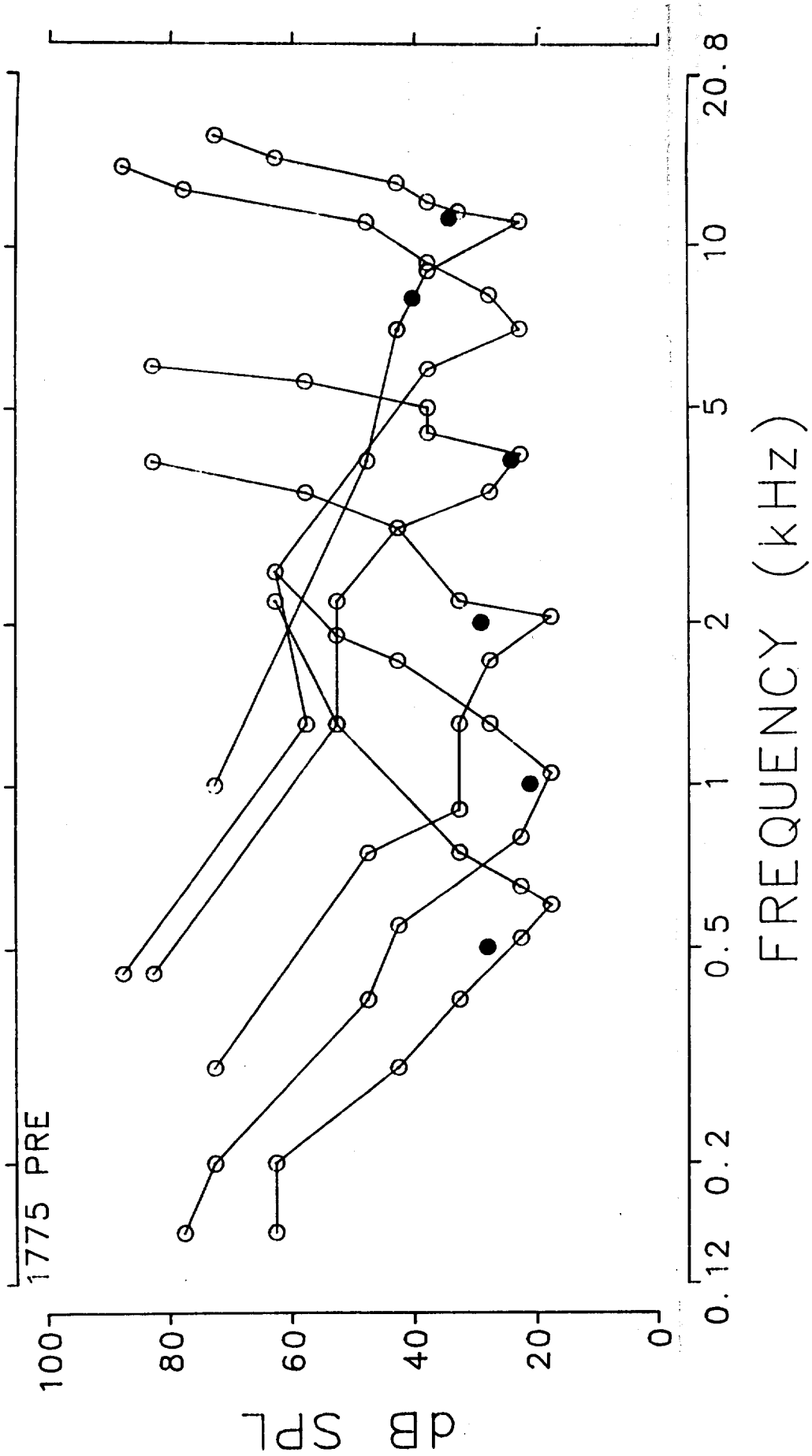

1782 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

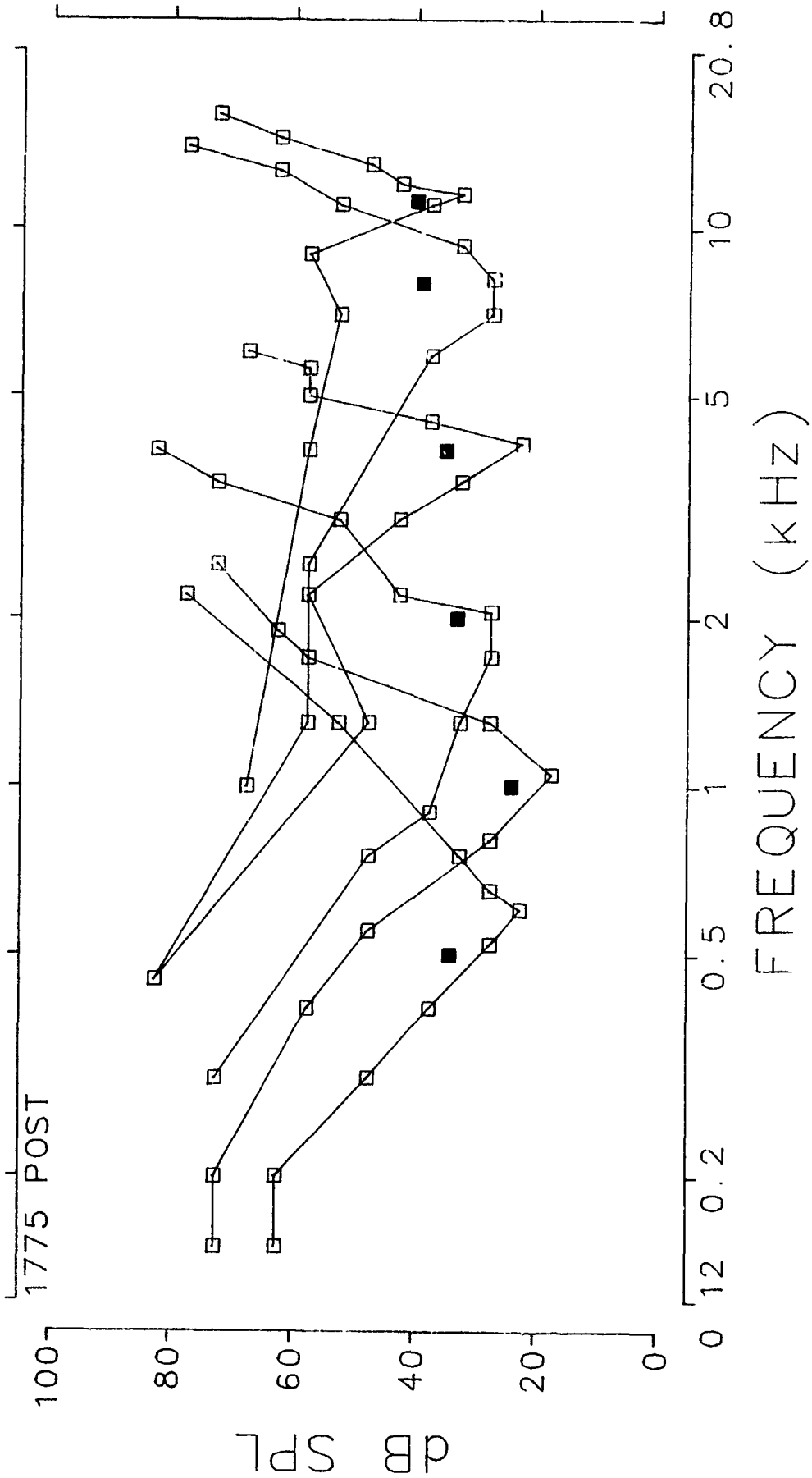

1782 POST
100
80
60
40
20
0
dB SPL
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

A432


1698 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1698 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHZ)


1775 PRE
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)


1775 POST
dB SPL
100
80
60
40
20
0
0.12
0.2
0.5
1
2
5
10
20.8
FREQUENCY (kHz)

SHOCK TUBE EXPOSURE
160 dB, 100X, 1/MIN

TOTAL NUMBER OF COCHLEAR SENSORY CELLS MISSING

ANIMAL NUMBER	INNER HAIR CELLS	1ST ROW OUTER HAIR CELLS	2ND ROW OUTER HAIR CELLS	3RD ROW OUTER HAIR CELLS	TOTAL OUTER HAIR CELLS
R1698R	10	33	53	66	152
R1775R	24	201	202	203	606
R1782R	34	960	1104	833	2897
R1787R	15	53	69	145	267
R1817R	39	129	149	135	413
GROUP MEAN	24				367
S.D.	12				1147

TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND LENGTHS OF THE COCHLEA CENTERED AT THE FREQUENCIES INDICATED

	OCTAVE BAND CENTER FREQUENCY	INNER HAIR CELLS	OUTER HAIR CELLS
GROUP MEANS			
	0.125 kHz	1.4	61.8
	0.25 kHz	2.2	60.6
	0.5 kHz	1.0	53.2
	1 kHz	.6	176.0
	2 kHz	7.6	235.8
	4 kHz	3.0	118.8
	8 kHz	7.0	133.4
	16 kHz	1.6	26.2
STANDARD DEVIATIONS			
	0.125 kHz	1.1	18.5
	0.25 kHz	1.8	60.3
	0.5 kHz	1.0	57.4
	1 kHz	1.3	296.0
	2 kHz	9.2	416.5
	4 kHz	2.1	168.9
	8 kHz	5.6	117.7
	16 kHz	2.5	28.3

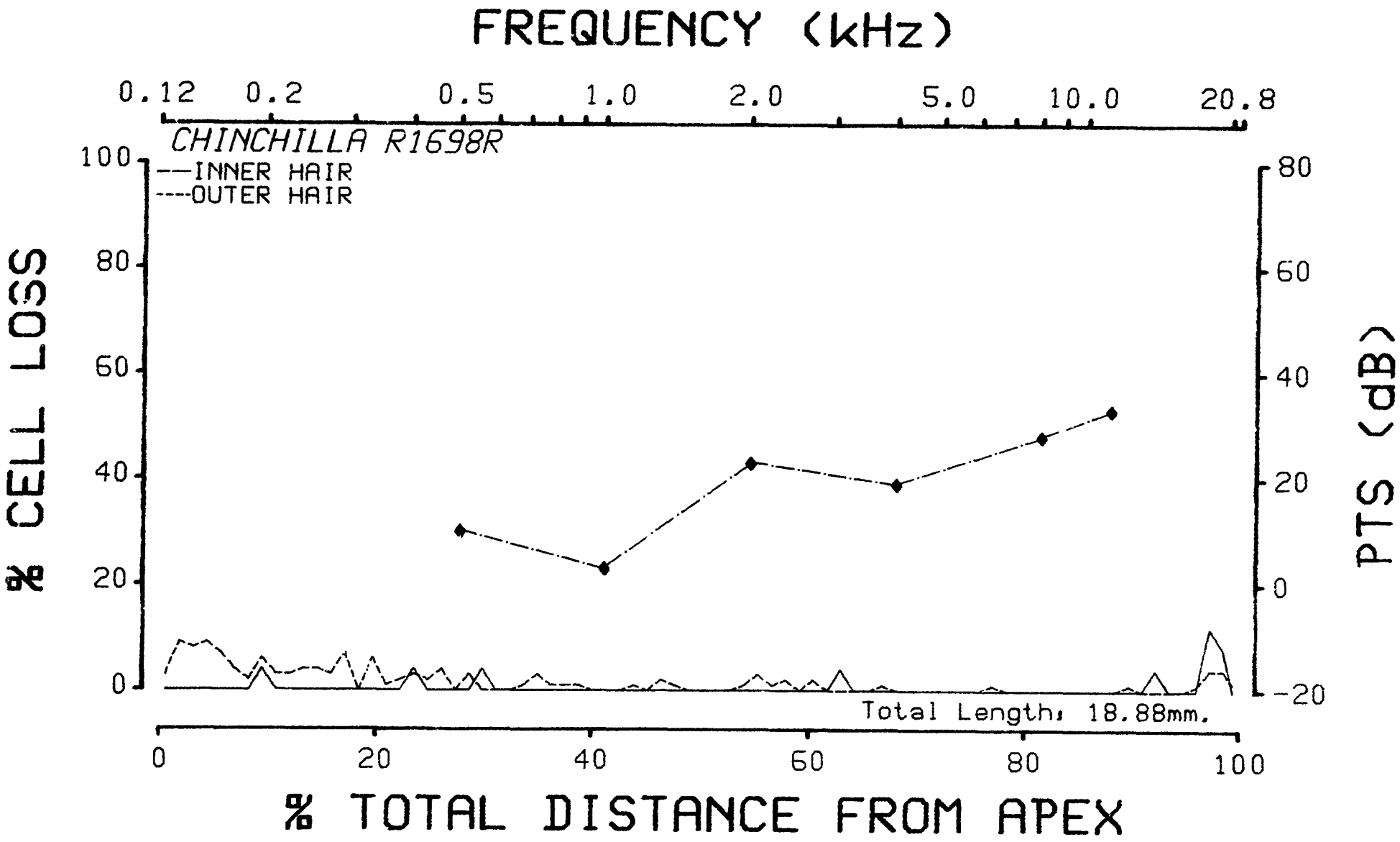
TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1698R							
0.125 kHz	0	11	21	30	62	0	1
0.25 kHz	1	7	8	27	42	0	0
0.5 kHz	2	2	9	4	15	1	0
1 kHz	0	2	7	1	10	0	0
2 kHz	0	3	2	3	8	0	0
4 kHz	1	2	1	0	3	0	0
8 kHz	0	1	0	0	1	0	0
16 kHz	6	4	5	1	10	0	0
TOTALS	10	33	53	66	152	1	1
CHINCHILLA R1775R							
0.125 kHz	1	10	24	28	62	0	0
0.25 kHz	4	12	7	13	32	0	0
0.5 kHz	0	2	17	10	29	0	0
1 kHz	0	23	40	27	90	0	0
2 kHz	4	47	45	53	145	4	7
4 kHz	4	49	13	16	78	7	0
8 kHz	10	54	49	49	152	13	16
16 kHz	1	4	7	7	18	0	0
TOTALS	24	201	202	203	606	24	23
CHINCHILLA R1782R							
0.125 kHz	1	18	22	49	89	1	0
0.25 kHz	2	34	45	89	168	3	3
0.5 kHz	2	52	83	20	155	2	1
1 kHz	3	266	305	132	703	2	10
2 kHz	21	333	335	306	974	7	117
4 kHz	3	174	157	82	413	2	3
8 kHz	2	67	126	124	317	0	1
16 kHz	0	15	29	31	75	0	0
TOTALS	34	960	1104	833	2897	17	135

TOTAL SENSORY CELL LOSSES OVER OCTAVE BAND FREQUENCIES

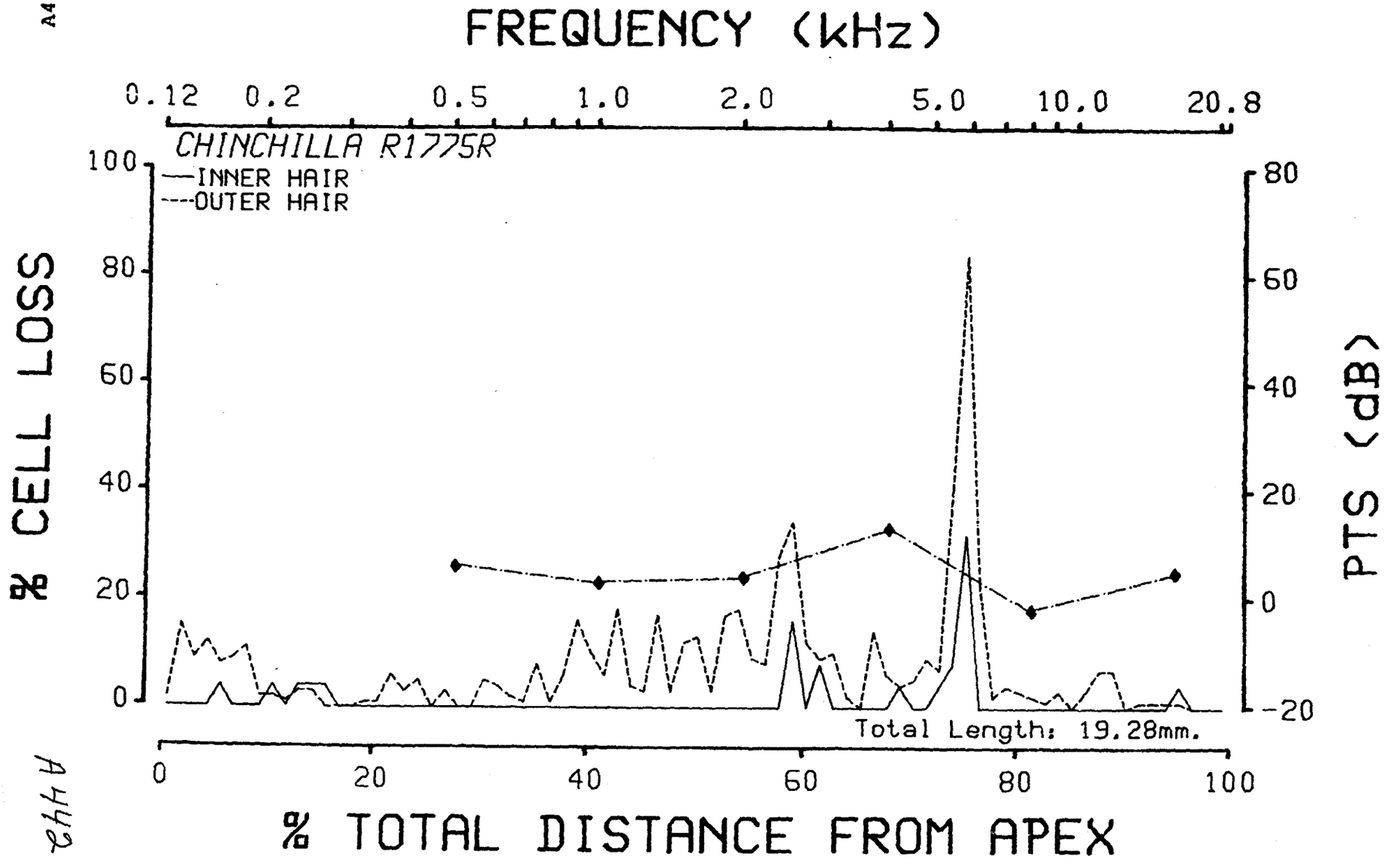
	INNER HAIR CELLS	1st ROW OUTER HAIR CELLS	2nd ROW OUTER HAIR CELLS	3rd ROW OUTER HAIR CELLS	NET OUTER HAIR CELLS	INNER PILLAR CELLS	OUTER PILLAR CELLS
CHINCHILLA R1787R							
0.125 kHz	2	6	14	39	59	0	0
0.25 kHz	0	8	4	22	34	0	0
0.5 kHz	1	3	6	25	34	0	0
1 kHz	0	4	10	29	43	0	0
2 kHz	0	2	3	3	8	0	0
4 kHz	1	4	6	1	11	0	0
8 kHz	11	23	26	23	72	2	6
16 kHz	0	2	0	2	4	0	0
TOTALS	15	53	69	145	267	2	6
CHINCHILLA R1817R							
0.125 kHz	3	4	17	16	37	0	7
0.25 kHz	4	17	0	10	27	0	0
0.5 kHz	0	5	21	7	33	0	1
1 kHz	0	4	15	15	34	0	0
2 kHz	13	16	15	13	44	4	4
4 kHz	6	32	29	28	89	2	8
8 kHz	12	42	41	42	125	9	12
16 kHz	1	9	11	4	24	0	0
TOTALS	39	129	149	135	413	15	32

Cochleograms and PTS Audiograms for Individual Animals

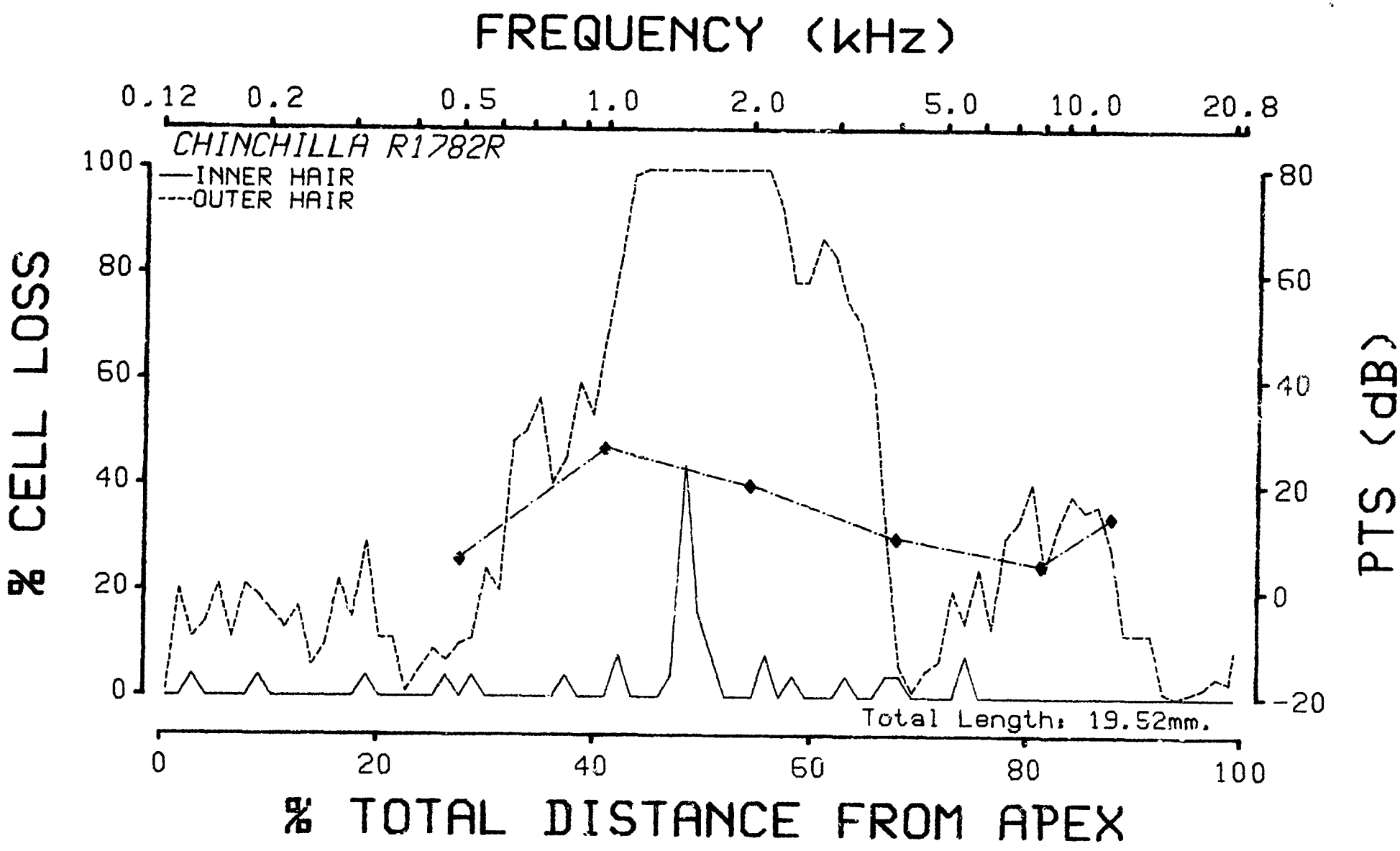

FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1698R
---INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
pTS (dB)
80
60
40
20
0
-20
Total Length: 18.88mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A441

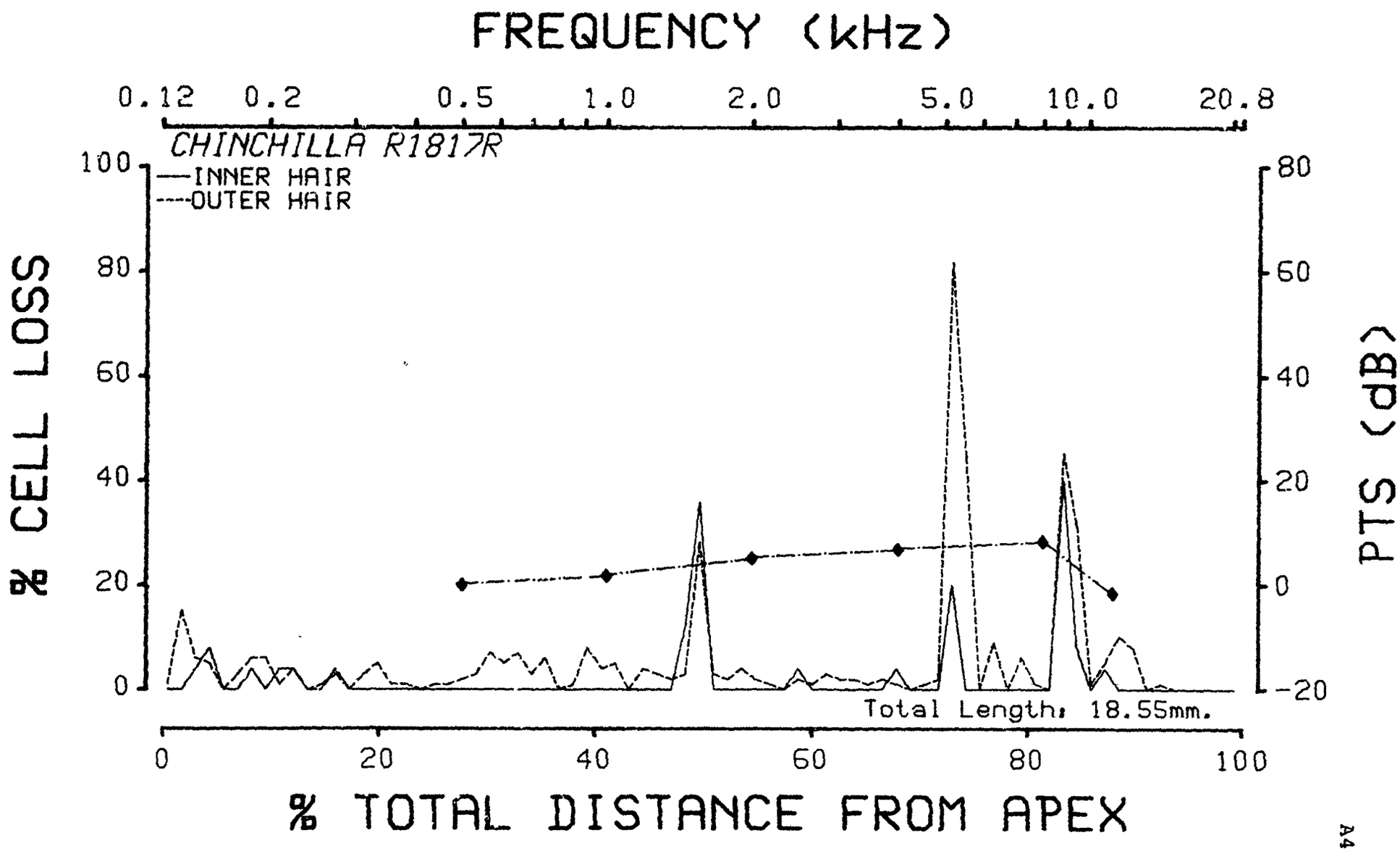
A442


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1775R
—INNER HAIR
---OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.28mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

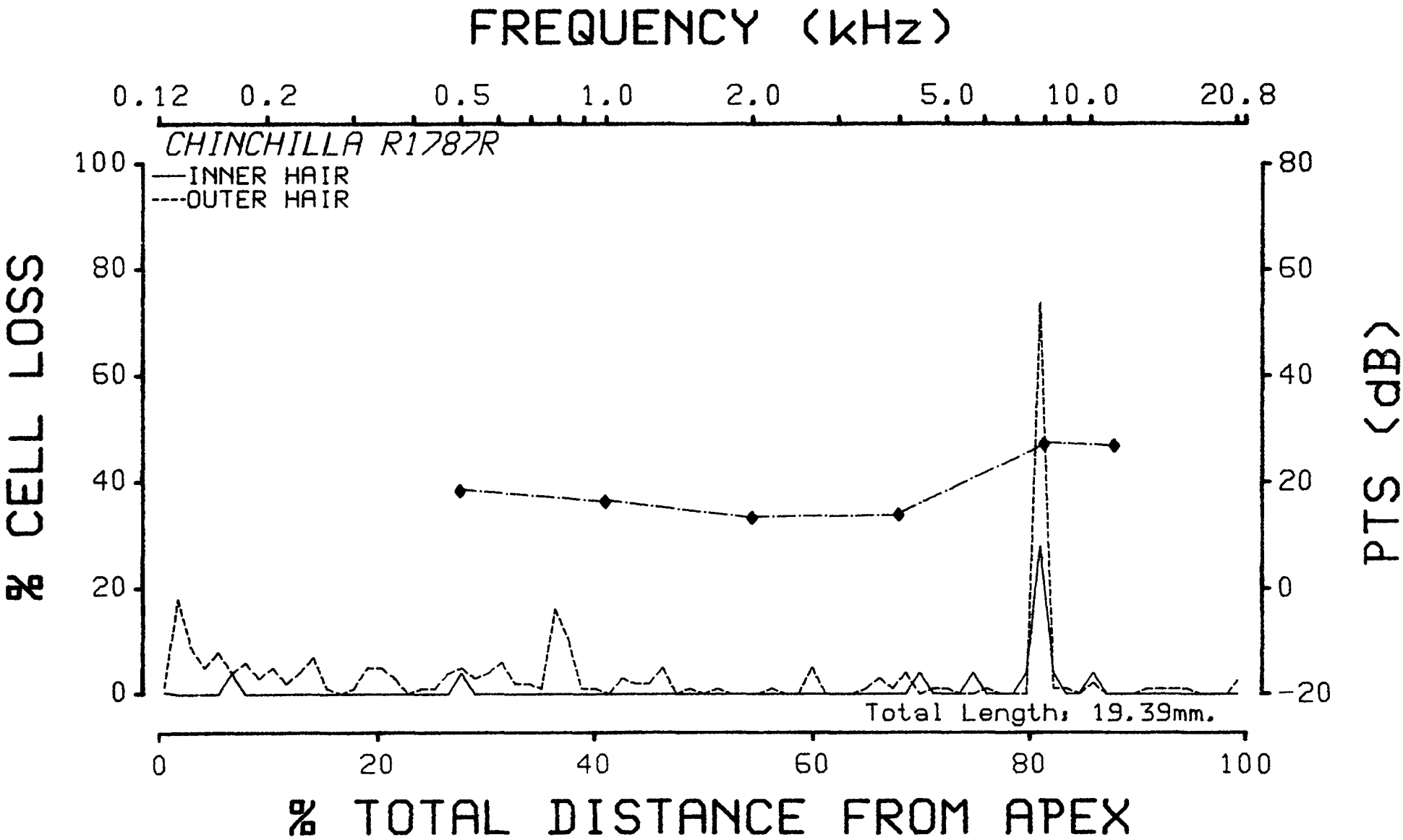
A442


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1782R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.52mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A443


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1817R
INNER HAIR
OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 18.55mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A444


FREQUENCY (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
CHINCHILLA R1787R
—INNER HAIR
----OUTER HAIR
% CELL LOSS
100
80
60
40
20
0
PTS (dB)
80
60
40
20
0
-20
Total Length: 19.39mm.
0
20
40
60
80
100
% TOTAL DISTANCE FROM APEX

A445