

**HYDRAULICS DIVISION**  
Technical Note



**DATE:** June 1982

**REPORT NO.:** E82-11

**TITLE:** Calibration of Fish Census Systems

**AUTHOR:** J. Dolanjski

**REASON FOR REPORT:** This is the post-pre field calibration report for quantity two of Fish Census Systems. The request came from the Great Lakes Fisheries Research Branch (Dr. K. Minns) in support of their fish population studies.

The requirement is to have assurance that the Fish Census System is operating consistently from year to year so that an equipment bias does not come in without being detected.

**STUDY NO:** 82-379

## **1.0 SUMMARY**

In 1974, two Fish Census Systems were produced by an outside contractor, modelled after a CCIW built prototype. Each of the systems consists of:

- Underwater Acoustic Transducer
- Transceiver
- Echo Analysis Control Subsystem (EACS)
- Magnetic Recorder
- Graphic Recorder
- Data Printer.

The Fish Census System is used for monitoring the fish population during the biological surveys of the Canadian lakes. It does this by transmitting the burst of acoustic energy into the water column. Targets (fish, the bottom) scatter the energy back towards the transducer. The received signal is amplified and then processed by the EACS. It accumulates counts corresponding to the size and depth distribution of the target echo received, as well as the depth of the water column. At preset intervals, the digital data is logged on the digital printer and/or magnetic tape recorder. Each transmission is displayed on the graphic recorder.

The rack mounted system has been used in the past by Dr. C.K. Minns/GLFRB (except the 81/82 season). The portable system has been used for the last three seasons by the Ministry of Natural Resources, Thunder Bay, under the auspices of Dr. J.R.M. Kelso/GLFRB.

Each year both systems are electronically and acoustically calibrated to ensure that the data from year to year is valid.

## **2.0 CALIBRATION REPORT**

The calibration of two Edo Western Model 4042 transducers was done at C-Tech Ltd., Cornwall, on March 24, 1982. The data shows some deviation from previous calibrations.

The transducer 101 increased from 215 to 220 ohms in impedance. This has been consistent with aging. The 102 decreased from 170 to 150

ohms. Since all other data for this transducer are almost unchanged, the impedance drop is not considered to be critical, yet.

Transducer 101 has a less well-formed directivity pattern than 102 (-13 dB to first side lobe, rather than -15 dB, first side lobe merges with main beam on 101). The 101 also produces a better defined burst signal in water than 102. Both of these items are consistent with the previous years.

| Transducer No. | Receiving Resonance (KHz) | Transmitting Resonance (KHz) | Impedance at 80 KHz (ohms) | Year |
|----------------|---------------------------|------------------------------|----------------------------|------|
| 101            | 75.5                      | 90                           | 215                        | 1981 |
| 102            | 85.5                      | 78                           | 170                        |      |
| 101            | 75.5                      | 92                           | 220                        | 1982 |
| 102            | 86.0                      | 78                           | 150                        |      |

The resonance deviation for both transducers in the last two years has stayed within 2 KHz.

During 1981 calibration, there was a discrepancy between the plot of impedance/phase angle and the impedance circle for both transducers. C-Tech investigated the matter and found that their standard transducer-hydrophone was out of calibration. This year they are using the new standard transducer.

### 3.0 FIELD EXPERIENCE

The users of the portable system (Ministry of Natural Resources - G. Leering, Thunder Bay) had complained about the weight of the system (150 kg). Four people were required to transport the racks onto the vessel.

They were not able during repeated tries, to get any echo from the steel ball calibration check, that has been specified by B. White (now with OSS/DF0). The latter problem will be reviewed in the next field season.

#### **4.0 CONCLUSIONS**

Both systems are completely calibrated in the lab and ready for the field use.

#### **5.0 RECOMMENDATIONS**

The age of the components of both systems requires more frequent and detailed maintenance. Perhaps the future users should look into updating the electronics. The Echo Analysis Control Subsystem (EACS), magnetic recorder, graphic recorder and data printer could be combined into a minicomputer based system. This system would be programmable, smaller, lighter, and therefore, more manageable. The data it could collect would be displayed on the CRT screen, stored, recorded in some graph form and printed.

It is also recommended that more time be allocated for the testing/troubleshooting of the equipment once it is installed onboard the vessel.

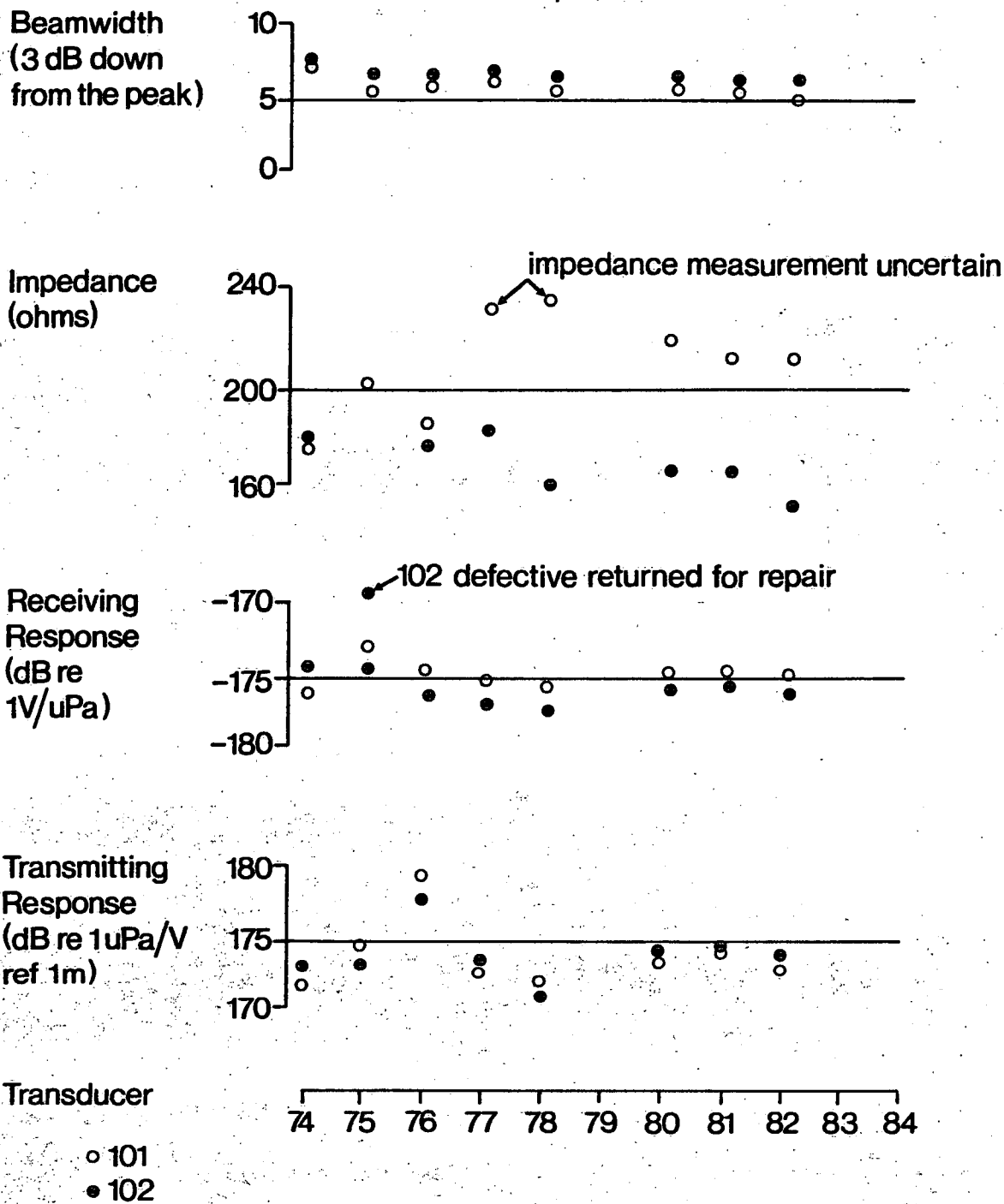


Figure 1.  
Acoustic Fish Census System  
Electroacoustic Transducer Calibration Summary, all data at 80 KHz

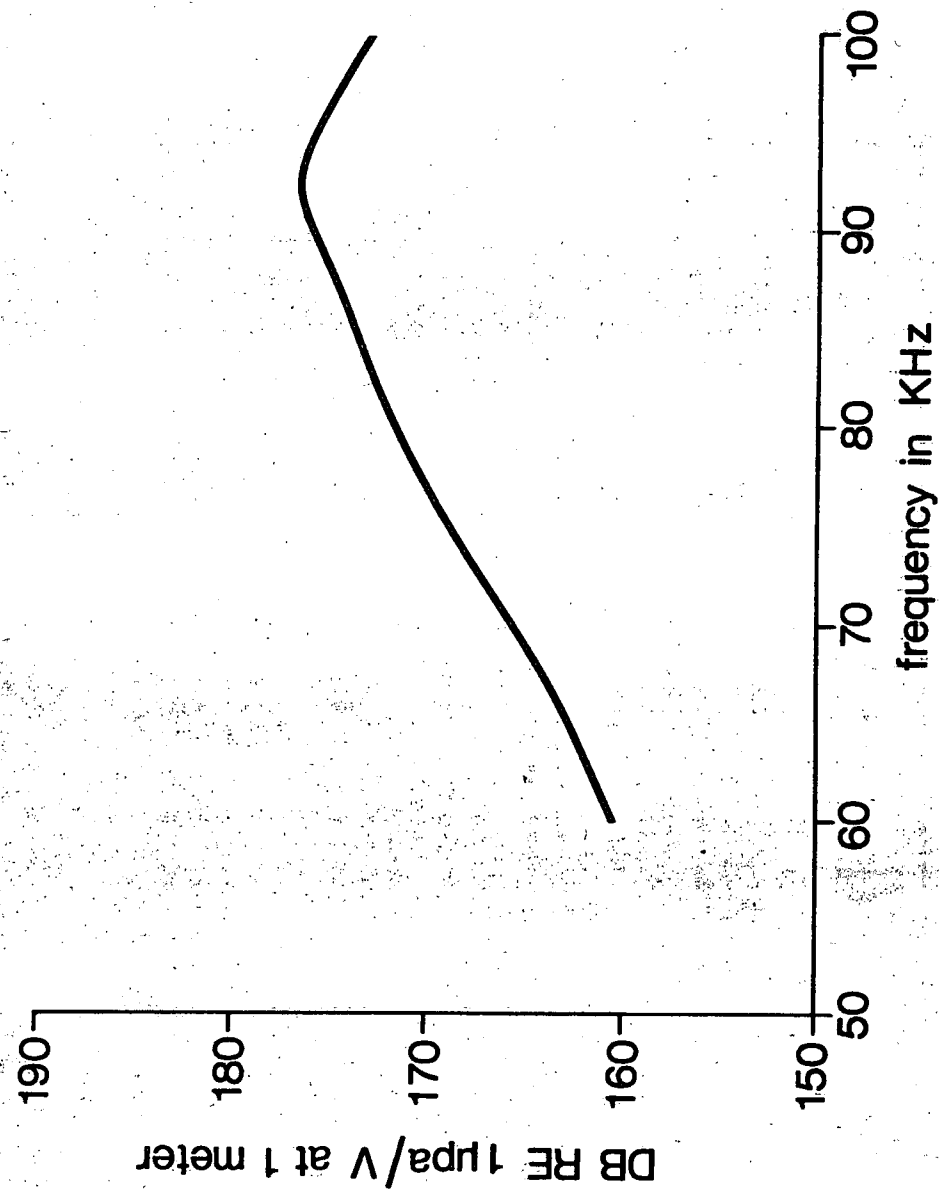


Figure 2 FISH CENSUS XDUCER NO.101 TR/v VS FREQUENCY  
MARCH 24 1982  
ORIGINAL FIGURE BY C-TECH

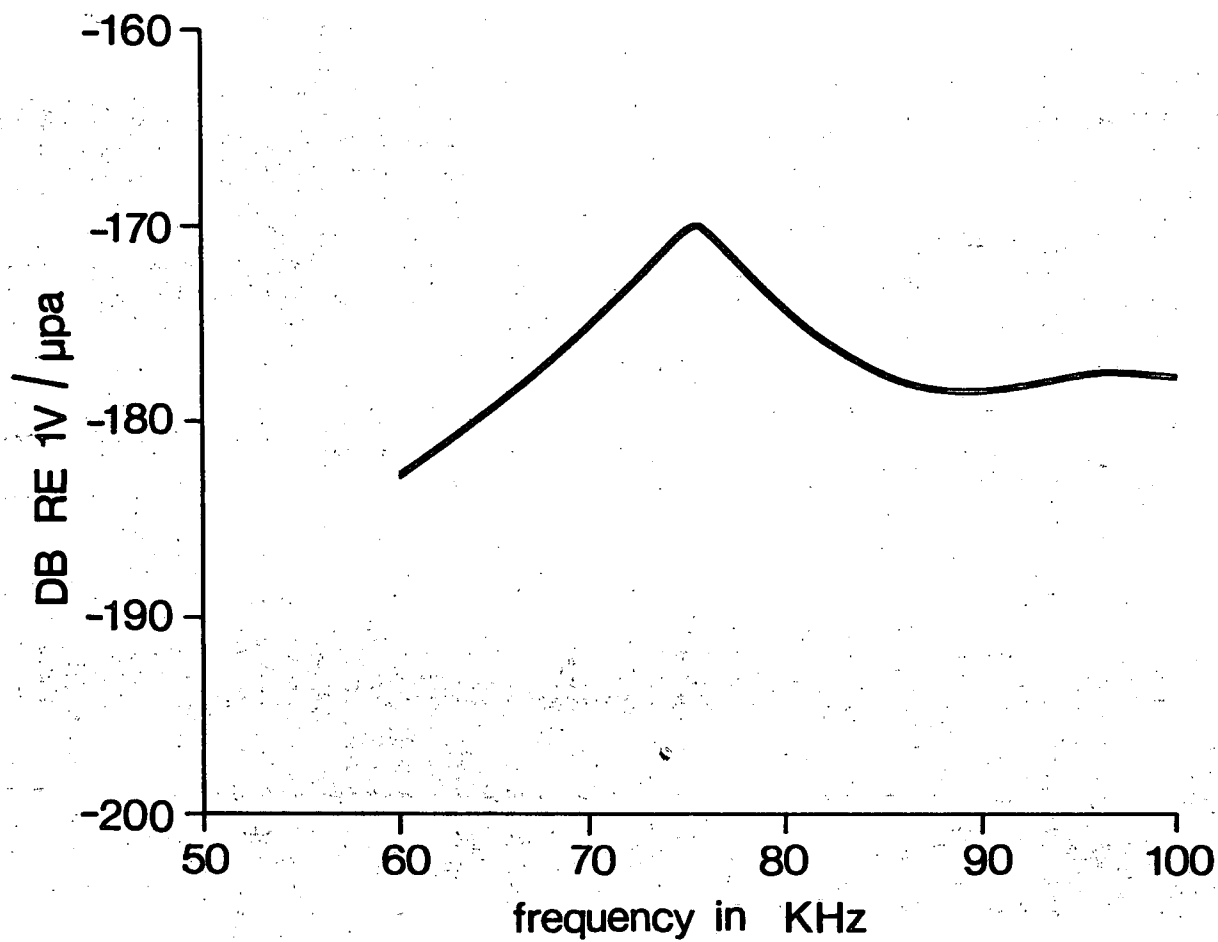


Figure 3. FISH CENSUS XDUCER NO.101 OPEN CIRCUIT RECEIVING RESPONSE. March 24, 1982.

ORIGINAL FIGURE BY C-TECH

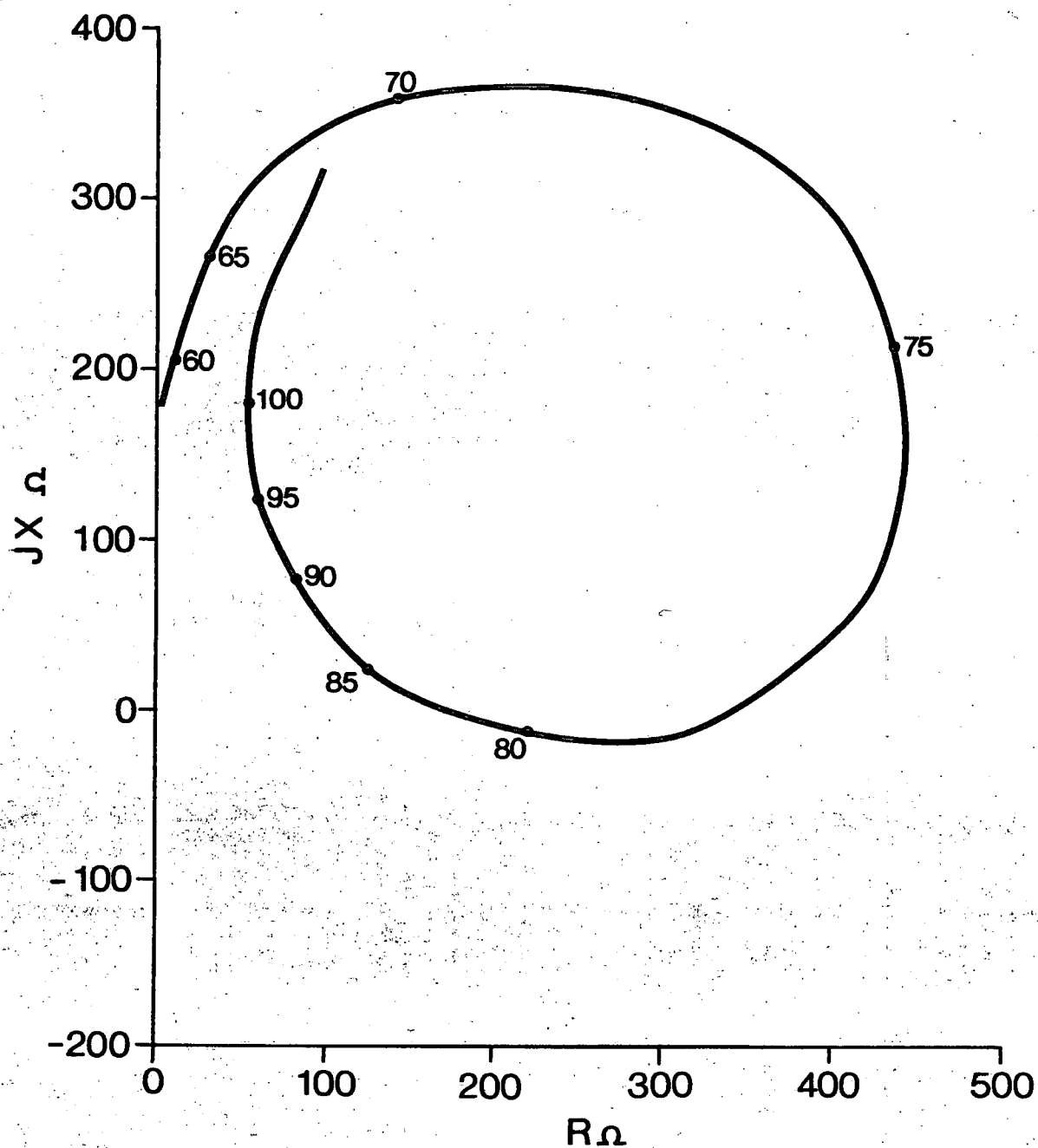


Figure 4. FISH CENSUS NO.101. IMPEDANCE. MARCH 24 1982  
ORIGINAL FIGURE BY C-TECH

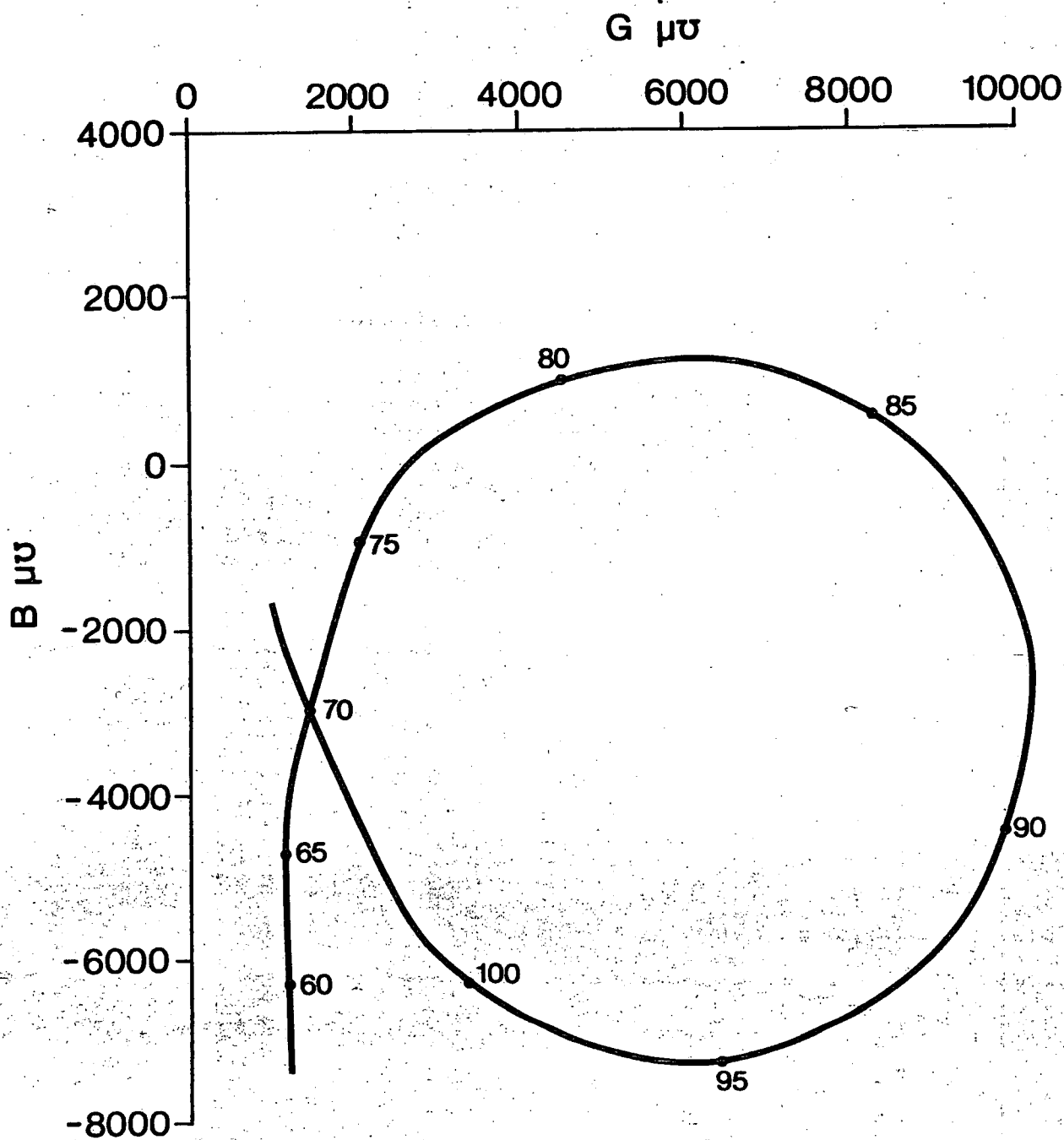


Figure 5. FISH CENSUS NO.101 ADMITTANCE. MARCH 24 1982

ORIGINAL FIGURE BY C-TECH

30°  
330°20°  
340°10°  
350°

0

350°  
10°340°  
20°330°  
30°**C-TECH LTD.**

Figure 6

150 MONTREAL ROAD CORNWALL, ONTARIO

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GRAPH PAPER

NO. 3124: PAPER COORDINATE.

40° 320°  
50° 310°  
60° 300°  
70° 290°  
80° 280°  
90° 270°  
100° 260°  
110° 250°  
120° 240°  
130° 230°  
140° 220°320° 40°  
310° 50°  
300° 60°  
290° 70°  
280° 80°  
270° 90°  
260° 100°  
250° 110°  
240° 120°  
230° 130°  
220° 140°

TEST

BEAM BATTERED

TRANS. X

REC.

|                             |                         |                           |
|-----------------------------|-------------------------|---------------------------|
| TRANSDUCER <i>1500 GENS</i> | SERIAL <i>101</i>       | FREQUENCY <i>20.000 K</i> |
| CONNECTION <i>N/A</i>       | ORIENTATION <i>100°</i> | STANDARD <i>F33</i>       |
| TEST DISTANCE <i>1.82 M</i> | DEPTH <i>2.0 M</i>      | DATE <i>12/2/72</i>       |
| PREPARED BY <i>Rich D</i>   | SCALE <i>10 DB/IN</i>   | TEMP <i>15°</i>           |

150°  
210°160°  
200°170°  
190°180°  
180°190°  
170°200°  
160°210°  
150°

30°  
330°20°  
340°10°  
350°0  
0350°  
10°340°  
20°330°  
30°**C-TECH LTD.**

Figure 7

1150 MONTREAL ROAD, CORNWALL, ONTARIO

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NO. 3124. POLAR CO-ORDINATE.

40°  
820°50°  
810°60°  
800°70°  
290°80°  
280°90°  
270°100°  
260°110°  
250°120°  
240°130°  
230°140°  
220°320°  
40°310°  
50°300°  
60°290°  
70°280°  
80°270°  
90°260°  
100°250°  
110°240°  
120°230°  
130°220°  
140°

TEST

TRANS.

REC.

|                               |                     |   |
|-------------------------------|---------------------|---|
| TRANSDUCER <i>FISH CENSUS</i> | SERIAL <i>101</i>   | FREQUENCY <i>5000 Hz</i>                |
| CONNECTION <i>NOR-794L</i>    | DEPTH <i>2.0m</i>   | ORIENTATION <i>VERTICAL</i>             |
| TEST DISTANCE <i>4.81m</i>    | STANDARD <i>E33</i> | WATER                                   |
| PREPARED BY <i>Rich D</i>     | SCALE 10 DB/IN      | DATE <i>Nov 13/82</i> TEMP <i>18° C</i> |

150°  
210°160°  
200°170°  
190°180°  
180°190°  
170°200°  
160°210°  
150°

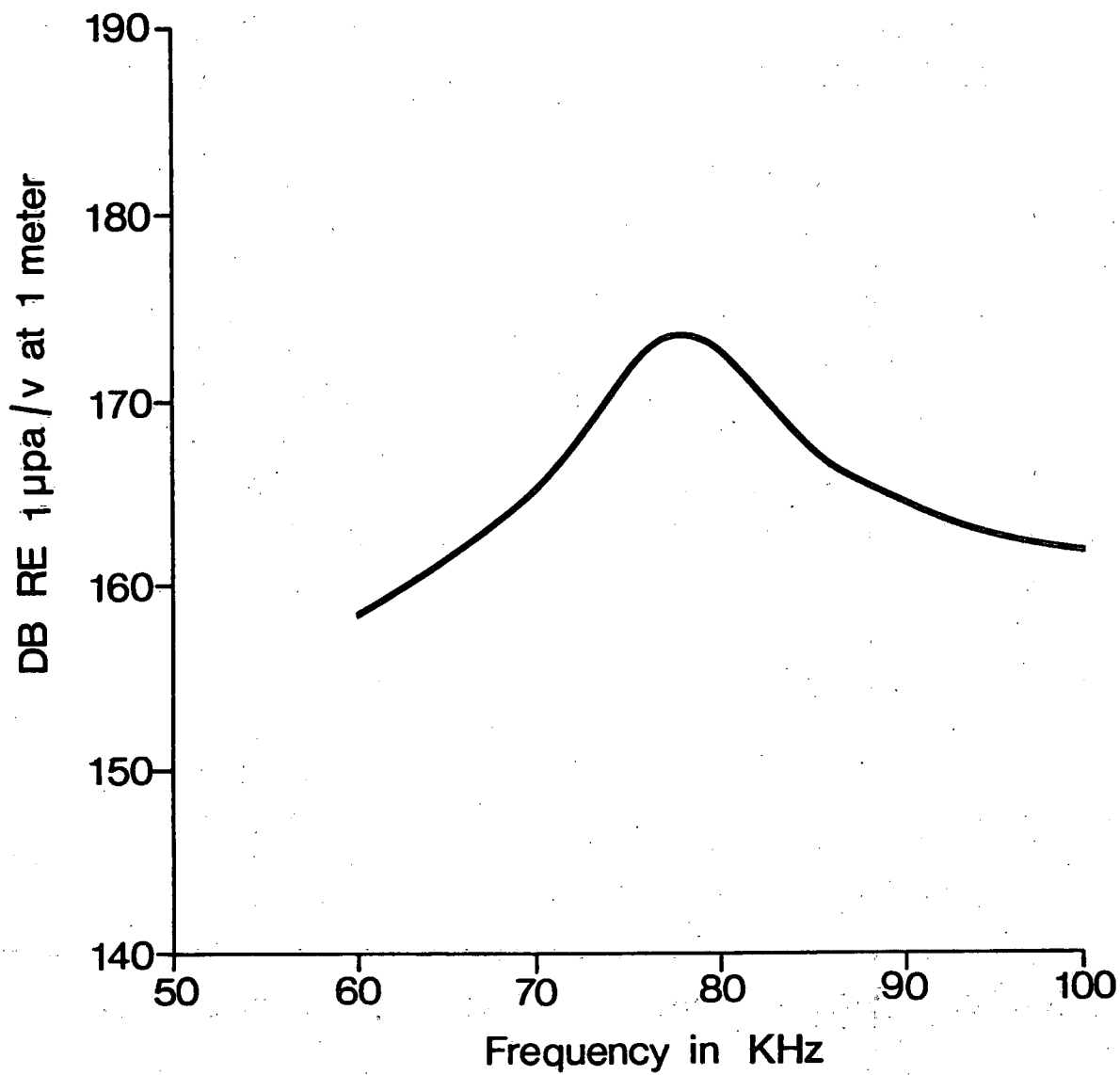


Figure 8. FISH CENSUS XDUCER NO.102. TR/V VS FREQUENCY. MARCH 24 1982

ORIGINAL FIGURE BY C-TECH

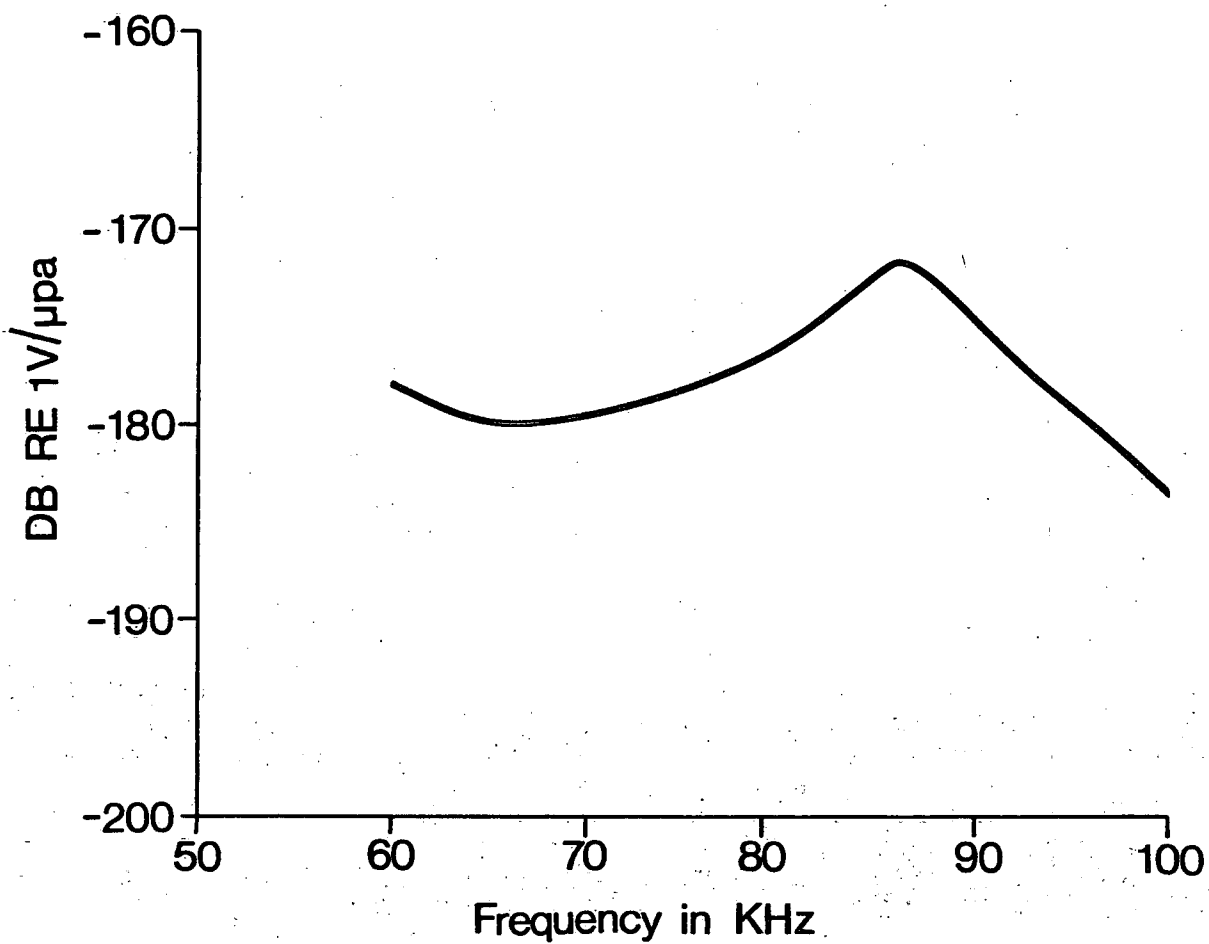


Figure 9 FISH CENSUS XDUCER NO.102 . OPEN CIRCUIT  
RECEIVING RESPONSE. MARCH 24 1982

ORIGINAL FIGURE BY C-TECH

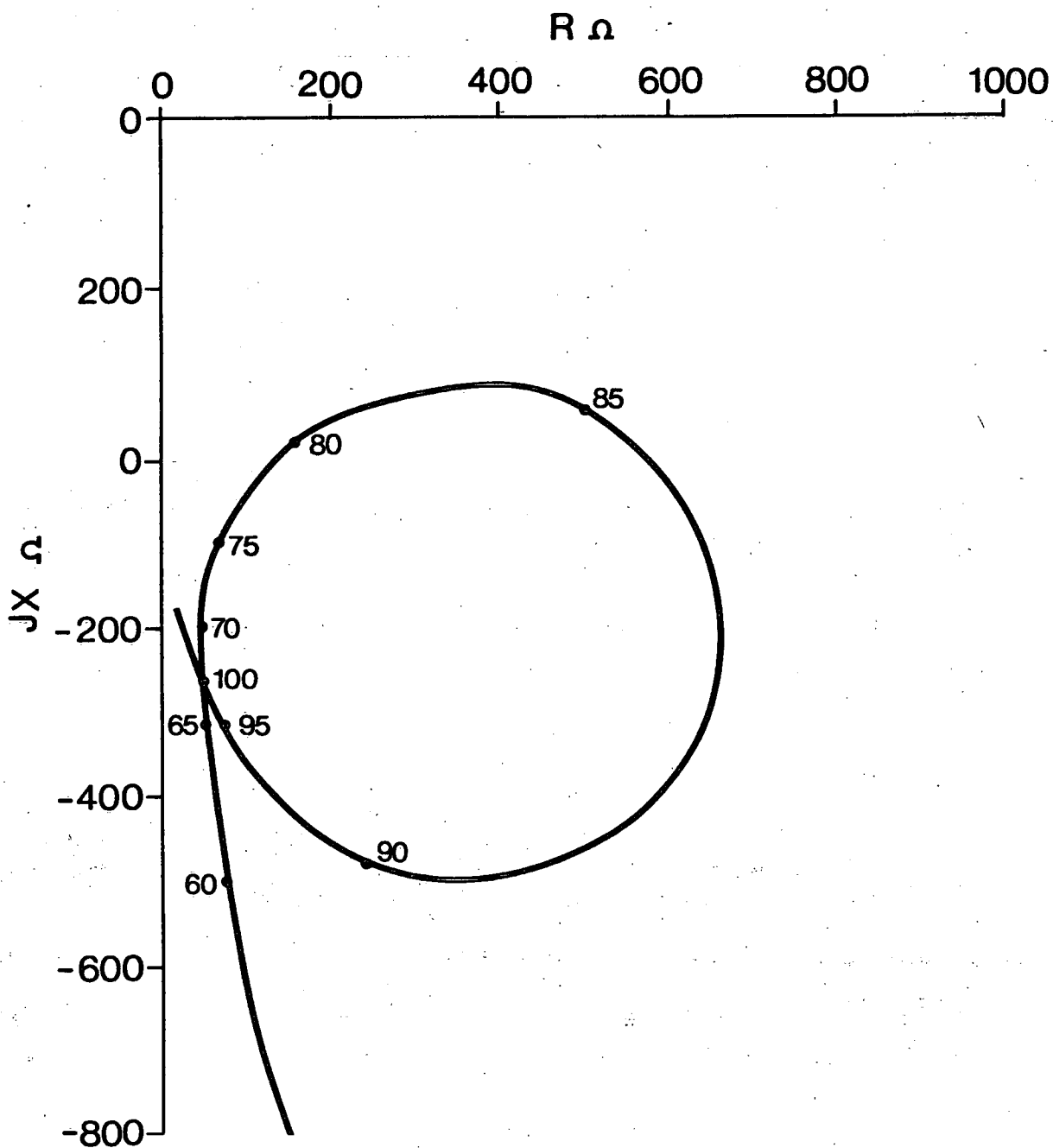


Figure 10. FISH CENSUS XDUCER NO.102. IMPEDANCE  
 $R+X$  VS FREQUENCY. TEST TEMP. 1.4°C, MARCH 24 1982  
 ORIGINAL FIGURE BY C-TECH

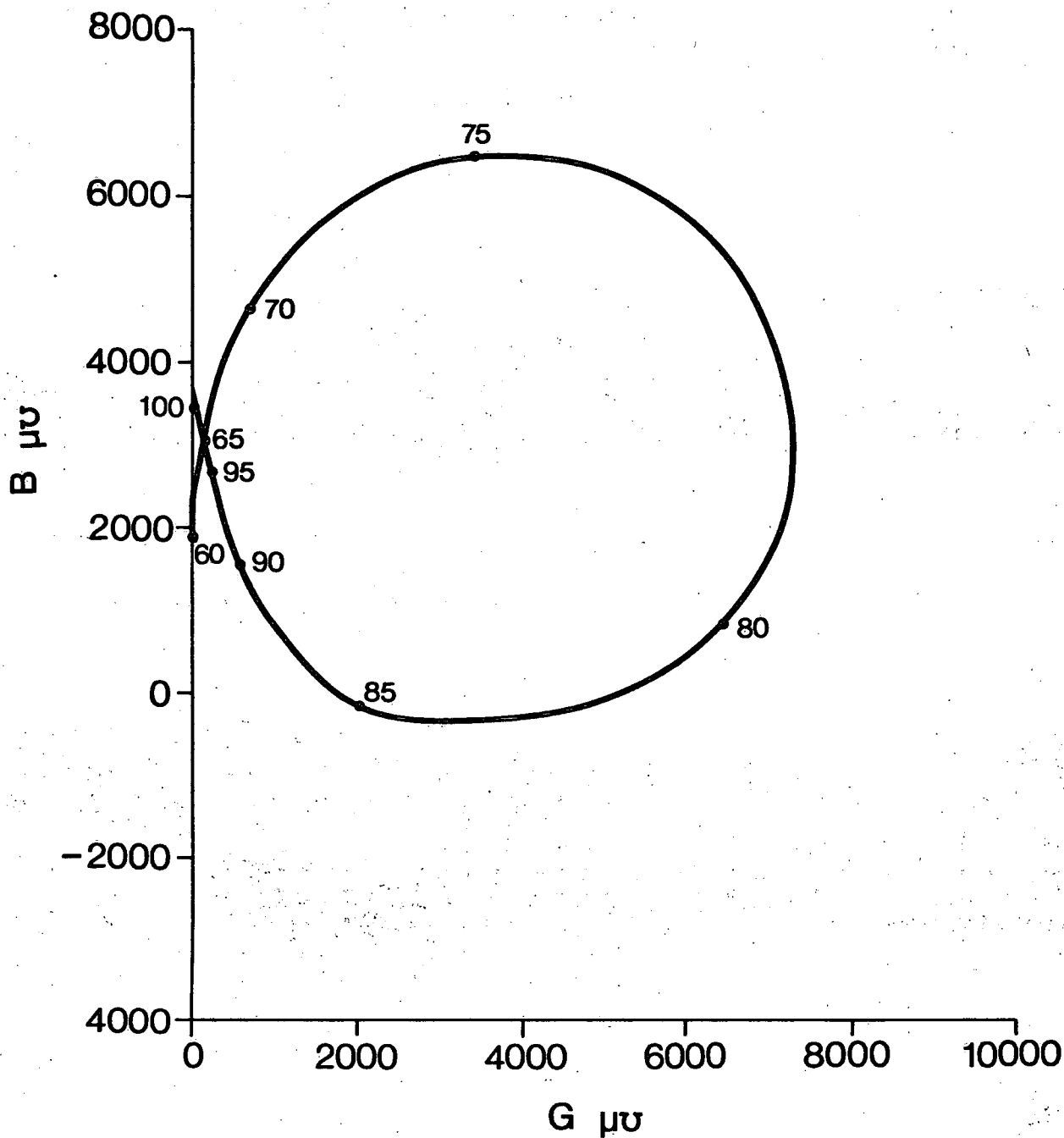


Figure 11. FISH CENSUS XDUCER NO.102. ADMITTANCE  
G+B VS FREQUENCY. TEST TEMP. 1.4°C. MARCH 24 1982

ORIGINAL FIGURE BY C-TECH

30°  
330°

20°  
340°

10°  
350°

- 15 -  
0

350°  
10°

340°  
20°

330°  
30°

**C-TECH LTD.**

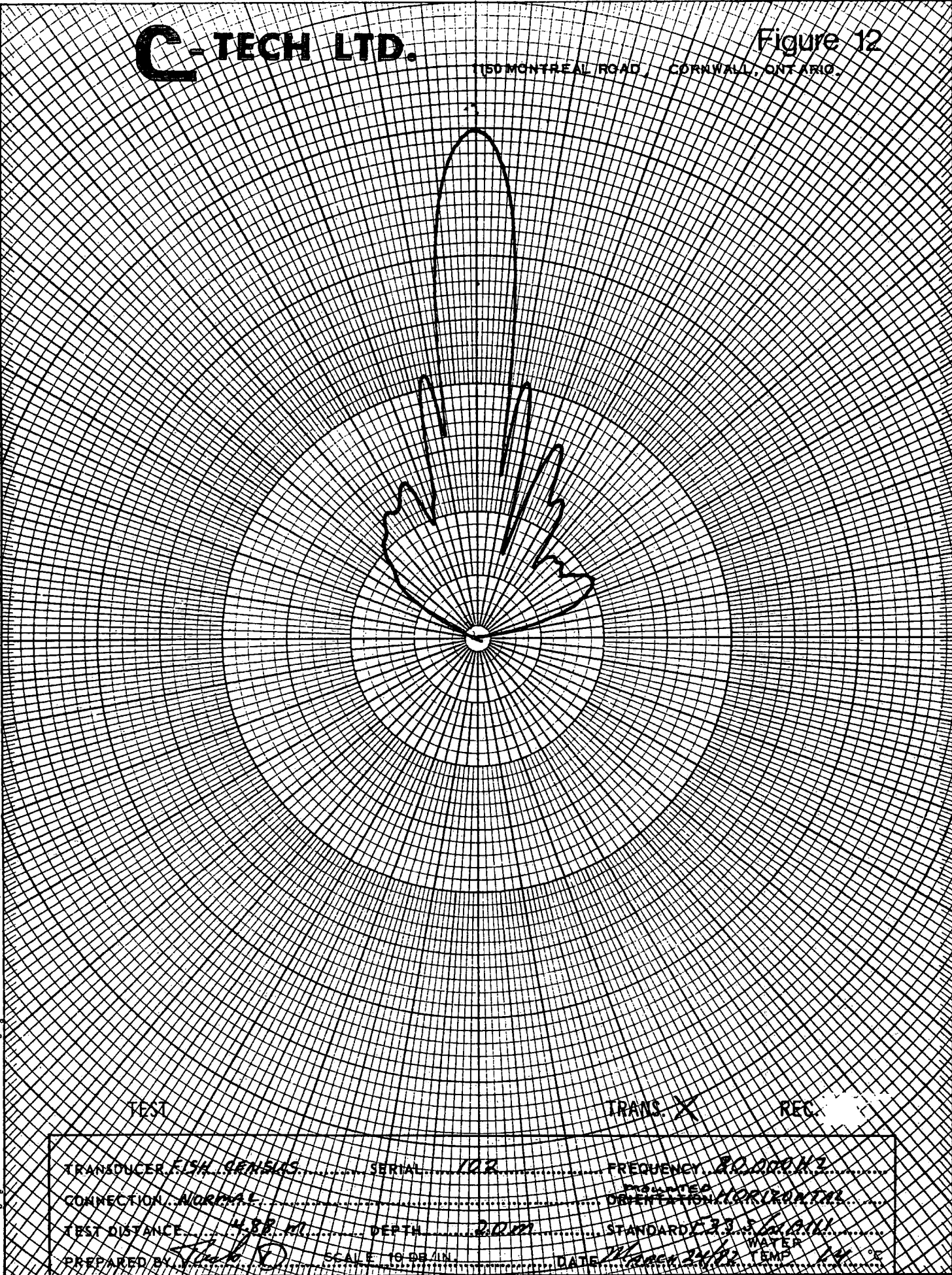
Figure 12

150 MONTREAL ROAD, CORNWALL, ONTARIO

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60° 800°  
70° 790°  
80° 280°  
90° 270°  
100° 260°  
110° 250°  
120° 240°  
130° 230°  
140° 220°

320° 40°  
310° 50°  
300° 60°  
290° 70°  
280° 80°  
270° 90°  
260° 100°  
250° 110°  
240° 120°  
230° 130°  
220° 140°



TEST

TRANS X

REC

|                                |                               |                            |
|--------------------------------|-------------------------------|----------------------------|
| TRANSDUCER <i>FISH GENESIS</i> | SERIAL <i>102</i>             | FREQUENCY <i>20,000 Hz</i> |
| CONNECTION <i>NORMAL</i>       | ORIENTATION <i>NOR ORNATE</i> | STANDARD <i>3.3</i>        |
| TEST DISTANCE <i>4.88 m</i>    | DEPTH <i>2.0 m</i>            | TEMP <i>14</i>             |
| PREPARED BY <i>Stan K. D.</i>  | SCALE <i>10 DB IN</i>         | DATE <i>March 24/82</i>    |

150°  
210°

160°  
200°

170°  
190°

180°  
180°

190°  
170°

200°  
160°

210°  
150°

30°  
330°20°  
340°10°  
350°

0

350°  
10°340°  
20°330°  
30°

23795

**C-TECH LTD.**

150 MONTREAL ROAD, CORNWALL, ONTARIO

Figure 13

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NO. 3124. POLAR COORDINATE.

40°  
320°  
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60°  
300°  
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270°  
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120°  
240°  
130°  
230°  
140°  
220°320°  
40°  
310°  
50°  
300°  
60°  
290°  
70°  
280°  
80°  
270°  
90°  
260°  
100°  
250°  
110°  
240°  
120°  
230°  
130°  
220°  
140°

TEST BEAM PATTERN

TRANS. IV REC.

TRANSDUCER FISH SENSORS

SERIAL 102

FREQUENCY 80,000 Hz

CONNECTION NORMAL

MOUNTED VERT. 00°

TEST DISTANCE 7.2m

DEPTH 20m

STANDARD 53.5m 20m

PREPARED BY Rick D.

SCALE 10 DB/IN.

DATE March 21/82 TEMP 18°C

150°  
210°160°  
200°170°  
190°180°  
180°190°  
170°200°  
160°210°  
150°