Long Lake (Yellow Point)
Stocking Assessment, 2004

Region 1, Nanaimo
Nanaimo/Cowichan Planning Unit

Prepared by:

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November, 2004

1.0 Introduction

1.1 Objective

Long Lake (Yellow Point), in the Nanaimo Cowichan planning unit, was assessed in the fall of 2004 as part of a stocking evaluation of Vancouver Island lakes. These assessments were carried out with the purpose of determining the overall effectiveness of past stocking efforts and/or to determine future actions in the lake stocking program.

The Long Lake assessment will focus on:

- effectiveness of the current stocking plan in providing adequate numbers of trout of suitable size to sustain the fishery
- current level of natural recruitment of trout in the lake
- condition factor, size at age and age structure of the trout population in the lake
- presence and relative abundance of other fish species
- future considerations for the Long Lake fish stocking and management program

1.2 Background

Long Lake was previously assessed by provincial fisheries staff in 1994. The lake is located approximately 17 km southeast of Nanaimo in the Yellow Point District and lies in the Coastal Douglas Fir Biogeoclimatic Zone, within the South Island Forest District. The lake is situated at an elevation of 42 m in Management Zone 1-05. The surface area is 3.172 ha and the perimeter is 1.047 km. The lake has a maximum depth of 6.9 m. Cutthroat trout were stocked once in 1955 and once in 1988, othrewisethe lake has been stocked with rainbow between 1985 and 2004 (Table 1).

Table 1. Stocking history of Long Lake.

Year	Species (Stock)	Number	Stage	Size (g)	Clip
1955/01/01	Cutthroat Trout (SFH)	3100	Fingerling	0	---
1985/04/01	Rainbow Trout (Frazer Valley)	2000	Unknown	131.84	---
1985/10/01	Rainbow Trout (Frazer Valley)	2000	Unknown	153.8	---
1986/04/01	Rainbow Trout (Frazer Valley)	2000	Unknown	114.9	---
1986/11/01	Rainbow Trout (Frazer Valley)	1150	Unknown	120.2	---
1987/03/01	Rainbow Trout (Frazer Valley)	2500	Unknown	137	---
1987/05/01	Rainbow Trout (Frazer Valley)	4484	Unknown	5	---
1988/03/01	Cutthroat Trout (Taylor)	2000	Unknown	38.3	---
1988/04/01	Rainbow Trout (Frazer Valley)	2500	Unknown	147.1	---
1988/12/01	Rainbow Trout (Frazer Valley)	561	Unknown	142.9	---
1989/04/19	Rainbow Trout (Frazer Valley)	2500	Catchables	109.9	---
1994/05/26	Rainbow Trout (Pennask)	1000	Yearling	16.8	---
1996/05/28	Rainbow Trout (Pennask)	500	Yearling	16.18	---
1998/05/13	Rainbow Trout (Tzenzaicut)	500	Yearling	33.99	---
2000/04/07	Rainbow Trout (Tzenzaicut)	500	Yearling	25.1	---
2002/05/06	Rainbow Trout (Tzenzaicut DR)	500	Yearling	31.63	---
2004/04/26	Rainbow Trout (Tzenzaicut TW)	500	Yearling	29.14	---

2.0 Methods and Materials

Long Lake was one of 45 lakes selected in Vancouver Island Region for assessment of the current lake stocking plan, in a 3-years project funded by the Freshwater Fisheries Society of BC, through the Small Lakes Management and Conservation Initiative.

Fish were sampled in the fall of 2004. At that time water transparency, temperature and oxygen data were collected. The 1978 assessment report included reconnaissance information, so that was not repeated in this assessment.

Depth sounder transects were run to plot a new bathymetric map of Long Lake. The new information was used to locate the deepest part of the lake as well as select locations in which to set the floating and sinking gill nets (Figure 1). Depth measurements were obtained using a Lowrance X-65 sounder. The temperature/oxygen/depth profile and Secchi disk readings were taken near the deepest part of the lake (survey site, Figure 1, Appendix A). The temperature and oxygen readings were obtained with a model 51B YSI meter with a 30 m long cable on the sensor.

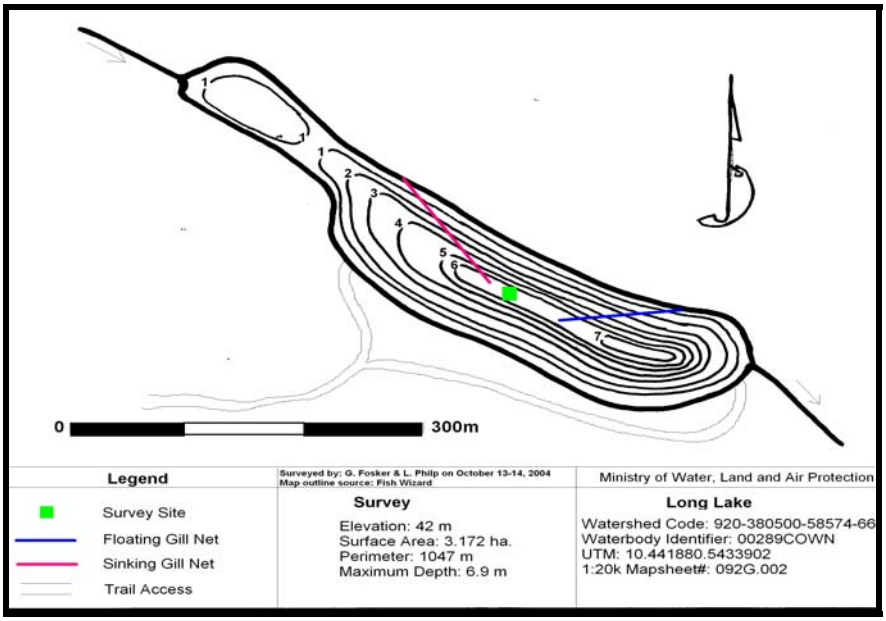


Figure 1. A bathymetric map of Long Lake showing the survey site location and the positions of the floating and sinking gill nets.

Fish sampling was done with overnight gillnet sets of one floating and one sinking, standard experimental gang net. The nets were each 91.2 m long, 2.4 m deep and consisted of six, 15.2 m long panels of different mesh sizes (25, 76, 51, 89, 38 and 64 mm stretch mesh). The floating gill net was set to cover shoal areas and extend over open water. The sinking gill net was set where it would extend into a deeper part of the lake (Figure 1). The nets were set with the smallest mesh-size panel near shore and extended roughly perpendicular to the contours. Both nets were set late in the day, left overnight, and were retrieved the following morning. A summary of the gillnet sets is given in Appendix B.

Data recorded from the gillnet catch included length (cm), weight (g), sex, stage of gonad maturity, stomach contents and parasite presence, for all trout captured. The catch record is listed in Appendix C, and photographs of the catch are in Appendix D.

Scale samples were taken from all rainbow trout in the samples. Scales were removed from the area between the posterior edge of the dorsal fin and the lateral line, approximately 2 scale rows above the lateral and placed between labelled glass microscope slides. A contractor, Bob Hamaguchi, read the scales to determine age. Printed copies of each scale sample, with contractor's determination of annuli indicated, are presented in Appendix E.

Condition factor, length-age, and length-weight relationships were calculated for all trout sampled. Condition factor was calculated using the following equation:

$$K = \frac{100000W}{L^3}$$

where W represents weight in grams and L represents length in millimetres.

3.0 Results

3.1 Temperature-Oxygen Profile

Long Lake has a maximum depth of 6.9 m. The temperature-oxygen profile shows the entire water column is well mixed, with no thermocline present at the time of survey (Figure 2). Temperature values dropped gradually from 15.0°C, at the surface, to 12.5°C near the lake bottom at 6 m. Oxygen levels decreased progressively with depth through the water column to near anoxic conditions below 5 m. Oxygen levels ranged from 7.8 mg/L, at the surface, to 0.4 mg/L at 6 m.

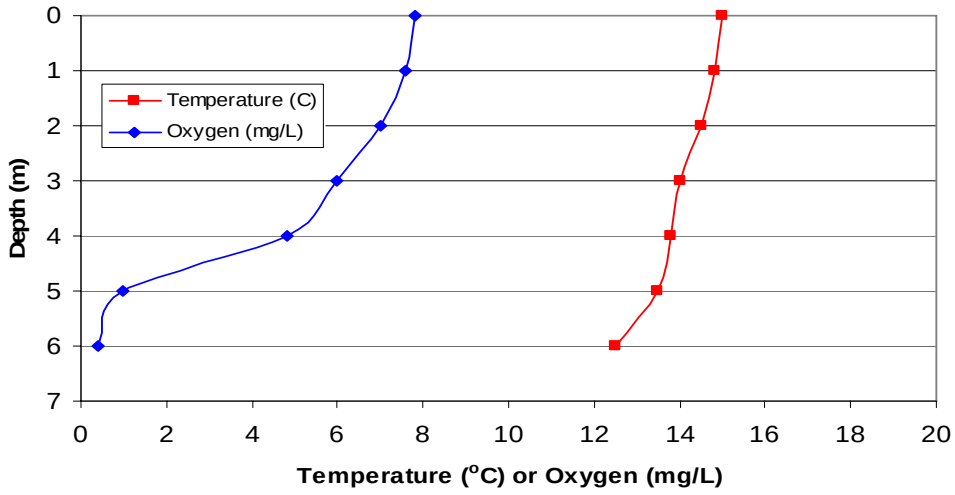


Figure 2. Temperature-oxygen profile of Long Lake, October 13, 2004.

3.2 Netting Data

A total of 50 rainbow trout and 2 sculpin were captured in the floating and sinking gill nets in Long Lake (Table 2). The length distribution of rainbow trout ranged from 17.6 cm to 29.5 cm. The length distribution of sculpin ranged from 11.9 cm to 14.0 cm.

Table 2. Summary of catch from the floating and sinking gill nets in Long Lake.

Species	Sample Size	% of Catch	Size Range	Mean Length (cm)	Mean Weight (g)	Mean K Value	K Value Std. Dev.	Sex Ratio (M:F:U)
Rainbow Trout	50	96.2	16.9cm – 29.5cm 54g – 254g	20.7	94.3	1.0017	0.0656	39:11:0
Sculpin	2	3.8	11.9cm – 14.0cm 24g – 40g	13.0	32.0	1.4410	0.02371	---

The length-frequency distribution, by age class, of rainbow trout sampled in Long Lake is shown in Figure 3. Of the 50 rainbow sampled, 14 were aged as 1+, 28 were aged as 2+, four were aged as 3+, and four were aged as 4+. Length at age is low for rainbow in Vancouver Island lakes. The length-frequency distribution is normal. Some distinct age classes are apparent from the length-frequency distributions as separation in length exists between the age 2+, 3+ and 4+ classes, but overlap in length exists between the age 1+ and 2+ classes.

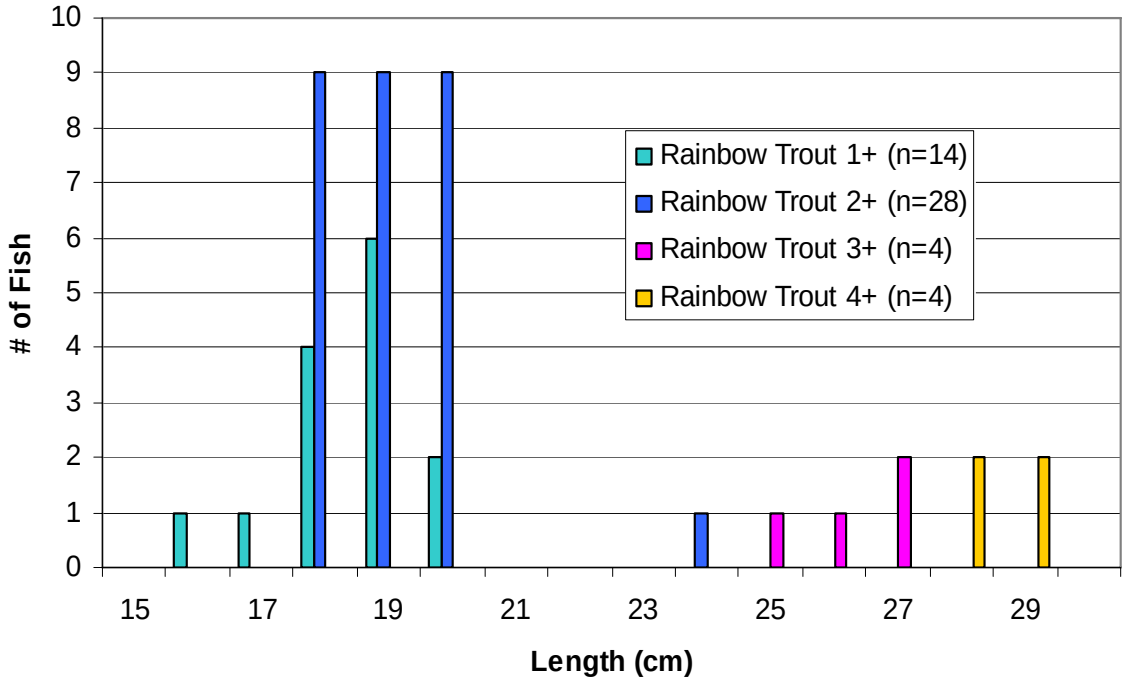


Figure 3. Length-frequency distribution, by age class, of rainbow in Long Lake, October 14, 2004.

Figure 4 illustrates the length/weight relationship and mean condition factor of all rainbow trout captured in Long Lake. The length/weight curve for rainbow trout in the samples indicates size increased according to the formula $W = 7.1982e^{0.1197L}$, where W represents weight in grams and L represents length in centimetres. The closeness of fit or R^2 value is equal to 0.9814. The mean condition factor for rainbow was 1.0017.

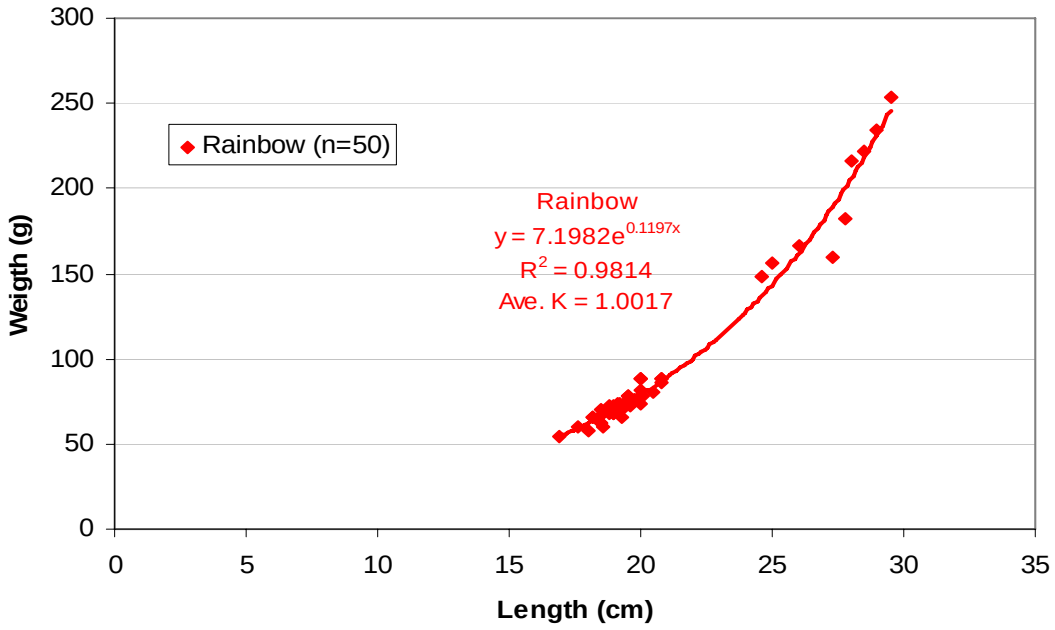


Figure 4. Length/weight relationship and average condition factor of all rainbow trout, sampled in Long Lake, October 14, 2004.

3.3 Presence/Absence Other Species

The presence of rainbow trout and sculpin in the gill nets in Long Lake is consistent with the BC Fisheries database. No other fish species, including non-native species, were found in the samples. Bullfrogs and bullfrog tadpoles were observed in Long Lake and are not native to Vancouver Island. Five beavers were observed swimming in the lake during the morning of the gill net retrieval.

4.0 Discussion

4.1 Temperature-Oxygen Profile

The temperature-oxygen profile shows a well mixed water column with oxygen values suitable for fish only in the surface waters. Conditions in the upper 2 m of the water column are suitable for fish health and development. Below 3 m, oxygen levels are less

than optimal for fish. Warm water temperatures at the surface, combined with low oxygen levels at deeper depths, may pose water quality problems for trout during the warm summer months.

4.2 Netting Data

The length-frequency distribution of rainbow trout appears normal, but growth is below normal for Vancouver Island small lakes. The mean condition factor is at the low end of the normal range for Vancouver Island rainbow trout.

4.3 Netting Data in Relation to Stocking History

Fifty rainbow trout were captured in the gill nets in Long Lake. The hatchery stocked rainbow trout were not marked to differentiate them from wild rainbow, so it is difficult to determine the natural recruitment level of rainbow trout in Long Lake. However, numbers of rainbow in the samples are sufficient to sustain a trout fishery but the average size is small.

5.0 Conclusion

The assessment of Long Lake indicates current conditions are satisfactory for sustaining the fishery. Continued bi-annual stocking of 500 rainbow yearlings will be necessary to sustain the fishery. Growth and condition of rainbow trout in Long Lake appears normal for Vancouver Island.

6.0 Recommendations

The recommendation by the Regional Lakes Biologist is that stocking of Long Lake remain unchanged.

Appendix A – Temperature-Oxygen Data

Locality:	Long Lake
Date:	October 13, 2004
Time:	14:27
Weather:	Sunny, moderate N/W wind, 17°C
Secchi:	4.5 m
Surface pH:	7.4
Bottom Depth:	6.9 m

Depth (m)	Oxygen (mg/L)	Temperature (oC)
surface	7.8	15.0
1.0	7.6	14.8
2.0	7.0	14.5
3.0	6.0	14.0
4.0	4.8	13.8
5.0	1.0	13.5
6.0	0.4	12.5

Appendix B – Net Set Information

NETTING SITE #1	
Type:	Floating monofilament gill net
Date Set:	October 13, 2004
Time Set:	1500 hours
Date Lifted:	October 14, 2004
Time Lifted	0900 hours
Total Time:	18 hrs 0 min
Shallow End Depth:	2.0 m
Shallow End Substrate:	organics, aquatic plants
Deep End Depth:	6.8 m
Maximum Depth Along Net:	6.8 m

NETTING SITE #2	
Type:	Sinking monofilament gill net
Date Set:	October 13, 2004
Time Set:	1510 hours
Date Lifted:	October 14, 2004
Time Lifted	0930 hours
Total Time:	18 hrs 20 min
Shallow End Depth:	1.0 m
Shallow End Substrate:	organics, aquatic plants
Deep End Depth:	6.2 m
Maximum Depth Along Net:	6.2 m

Comments: Five beavers seen swimming during morning net retrieval.

Appendix C – Catch Record

Sinking Gill Net

		Fish Characteristics							Stomach Contents					
#	Species	Fork Length (cm)	Weight (g)	Sex	Maturity	Mark	Age	Sample Type	Bottom Organisms	Plankton	Terrestrial	Fish	Volume (full)	Comments
1	RB	29.5	254	M	MG	NO	4+	scale	caddis				1/4	
2	RB	28.5	222	M	MG	NO	4+	scale	caddis cases				full	
3	RB	27.3	160	F	MG	NO	3+	scale	clam				1/4	
4	RB	20.0	88	M	MG	NO	2+	scale	caddis cases				full	
5	RB	20.0	88	M	MG	NO	2+	scale	caddis cases				full	
6	RB	19.4	74	M	MG	NO	2+	scale			small black flies		full	white segmented worms
7	RB	18.2	66	M	MG	NO	1+	scale			small black flies		3/4	
8	RB	18.5	70	M	MG	NO	1+	scale	caddis cases				full	
9	RB	19.8	76	M	IMM	NO	1+	scale	caddis cases				1/4	
10	RB	18.5	62	F	IMM	NO	2+	scale					3/4	digested plant matter
11	RB	18.9	70	M	MG	NO	2+	scale	caddis cases		small black flies		3/4	
12	RB	19.0	72	M	MG	NO	2+	scale			small black flies		1/2	digested plant matter
13	RB	19.2	74	M	IMM	NO	2+	scale			small black flies		1/2	digested plant matter
14	RB	18.8	68	F	IMM	NO	2+	scale			small black flies		1/2	digested plant matter
15	RB	18.9	70	M	MG	NO	1+	scale			small black flies		1/2	
16	RB	20.0	82	M	MG	NO	2+	scale	caddis cases				full	
17	RB	19.0	68	M	MG	NO	1+	scale	caddis cases				1/2	
18	RB	19.8	76	M	MG	NO	2+	scale			small black flies		1/4	
19	RB	18.0	58	M	MG	NO	1+	scale			small beetle		1/4	digested plant matter
20	RB	19.1	74	M	MG	NO	1+	scale	caddis cases				1/4	
21	RB	20.5	80	M	IMM	NO	2+	scale			spider, insects		full	
22	RB	20.0	78	M	MG	NO	2+	scale	caddis cases				full	
23	RB	19.5	78	M	MG	NO	2+	scale					empty	
24	RB	19.3	66	F	IMM	NO	1+	scale	caddis cases				1/2	
25	RB	20.8	86	M	MG	NO	1+	scale			ladybug, spider		full	
26	RB	18.9	70	M	IMM	NO	2+	scale	caddis cases				1/2	
27	RB	18.8	72	M	MG	NO	2+	scale			insects		1/4	
28	RB	18.2	66	M	MG	NO	2+	scale	caddis cases		beetle, black flies		full	
29	RB	17.6	60	M	IMM	NO	1+	scale	caddis cases				1/2	
30	RB	19.6	72	F	IMM	NO	2+	scale			small black flies		1/2	digested plant matter
31	RB	20.1	78	M	MG	NO	2+	scale	caddis cases		small black flies		full	
32	RB	19.5	74	M	MG	NO	2+	scale					empty	
33	RB	20.0	74	M	IMM	NO	2+	scale					empty	
34	RB	19.3	70	M	IMM	NO	2+	scale			ladybug, flies		full	
35	RB	16.9	54	M	MG	NO	1+	scale	caddis cases		small black flies		3/4	
36	RB	18.6	68	F	MG	NO	2+	scale		daphnia			1/4	
37	CC	14.0	40											
38	CC	11.9	24											

Floating Gill Net

		Fish Characteristics							Stomach Contents					
#	Species	Fork Length (cm)	Weight (g)	Sex	Maturity	Mark	Age	Sample Type	Bottom Organisms	Plankton	Terrestrial	Fish	Volume (full)	Comments
1	RB	29.0	234	M	MG	NO	4+	scale					full	
2	RB	28.0	216	M	MG	NO	4+	scale	caddis cases				full	
3	RB	26.0	166	M	MG	NO	3+	scale		water mites			1/4full	
4	RB	27.8	182	F	MG	NO	3+	scale	caddis cases		spider		1/2full	
5	RB	24.6	148	M	MG	NO	2+	scale			insect		1/4full	
6	RB	25.0	156	M	IMM	NO	3+	scale					empty	
7	RB	20.8	88	M	MG	NO	2+	scale			black flies		1/2full	
8	RB	20.8	88	F	IMM	NO	2+	scale		daphnia			1/2full	
9	RB	19.5	78	M	MG	NO	1+	scale	caddis cases				full	
10	RB	20.0	78	M	IMM	NO	1+	scale					1/2full	digested matter
11	RB	19.0	68	M	IMM	NO	2+	scale	caddis cases				1/2full	
12	RB	19.4	72	F	IMM	NO	2+	scale			beetle, black flies		1/4full	
13	RB	18.6	60	F	IMM	NO	2+	scale			beetle, black flies		3/4full	
14	RB	18.5	62	F	IMM	NO	2+	scale	caddis cases				full	

IMM	immature	R	ripe	LM	left maxillary clip	NO	no clip
MG	maturing	SP	spent	AD	adipose clip	M	male
MT	mature	?	not obvious	RM	right maxillary clip	F	female

RB	rainbow trout
CC	sculpin (general)

Appendix D – Photos

Picture 1. Looking southeast from northwest end of lake.

Picture 2. Looking northwest from northwest end of lake.

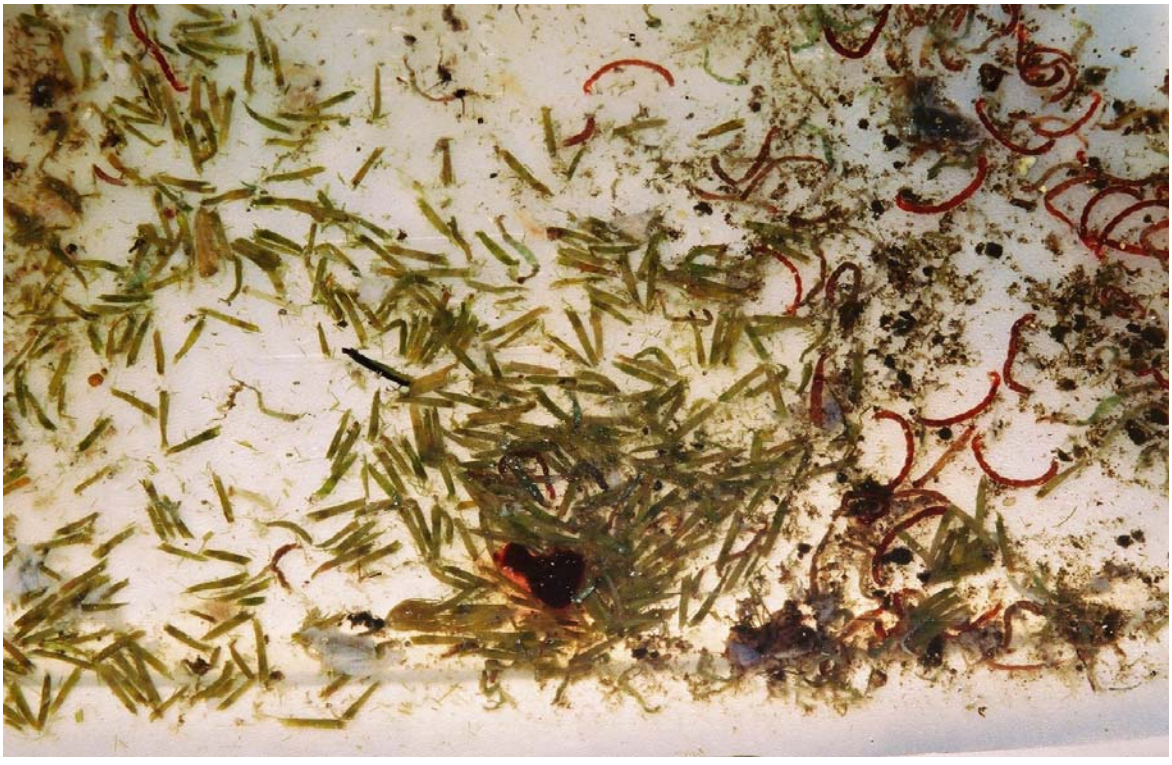
Picture 3. Looking northwest from survey site.

Picture 4. Looking southeast from survey site.

Picture 5. Floating gill net catch.

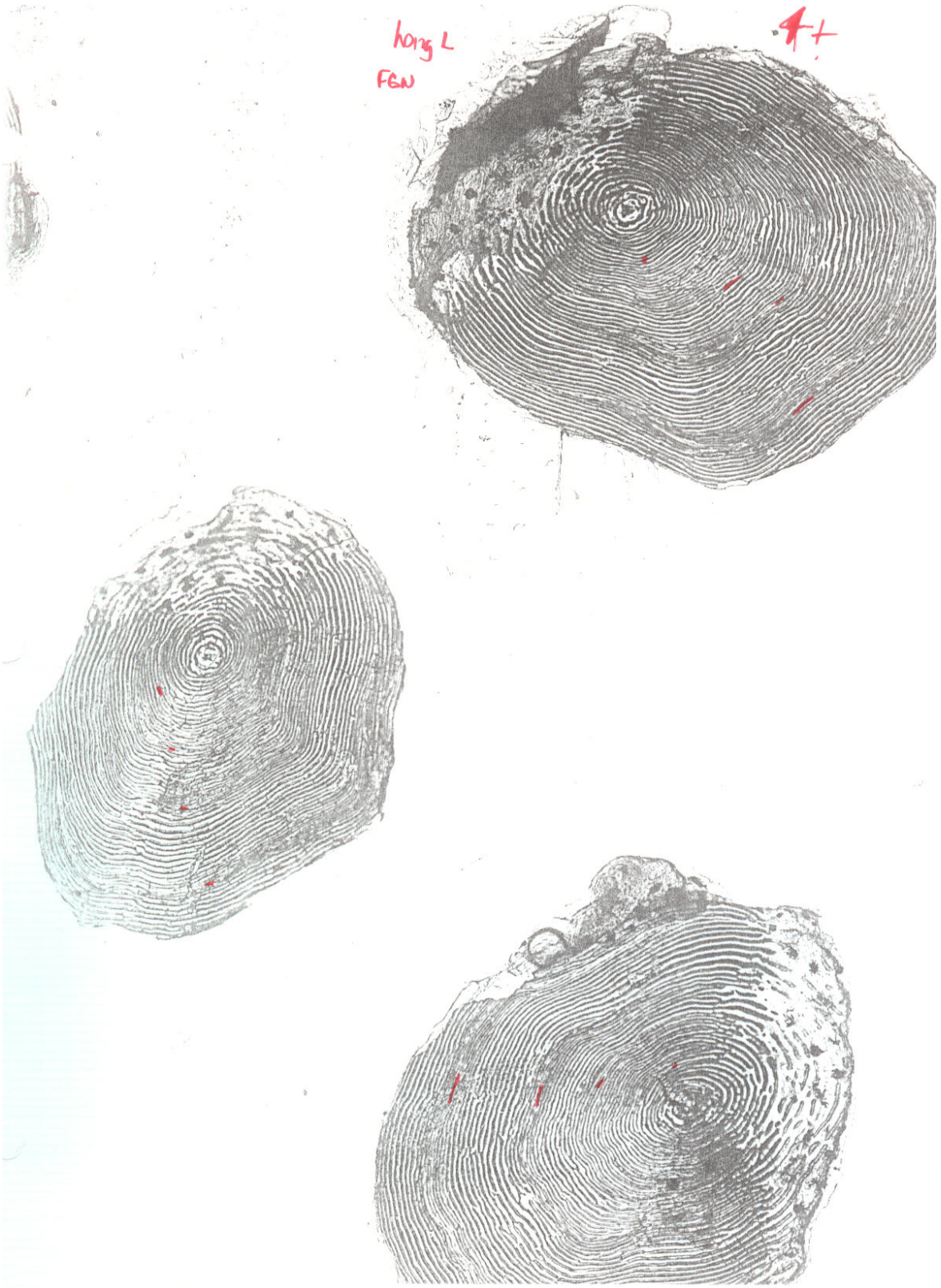
Picture 6. Sinking gill net catch.

Picture 7. Stomach contents.



Picture 8. Stomach contents.

Appendix E – Scale Readings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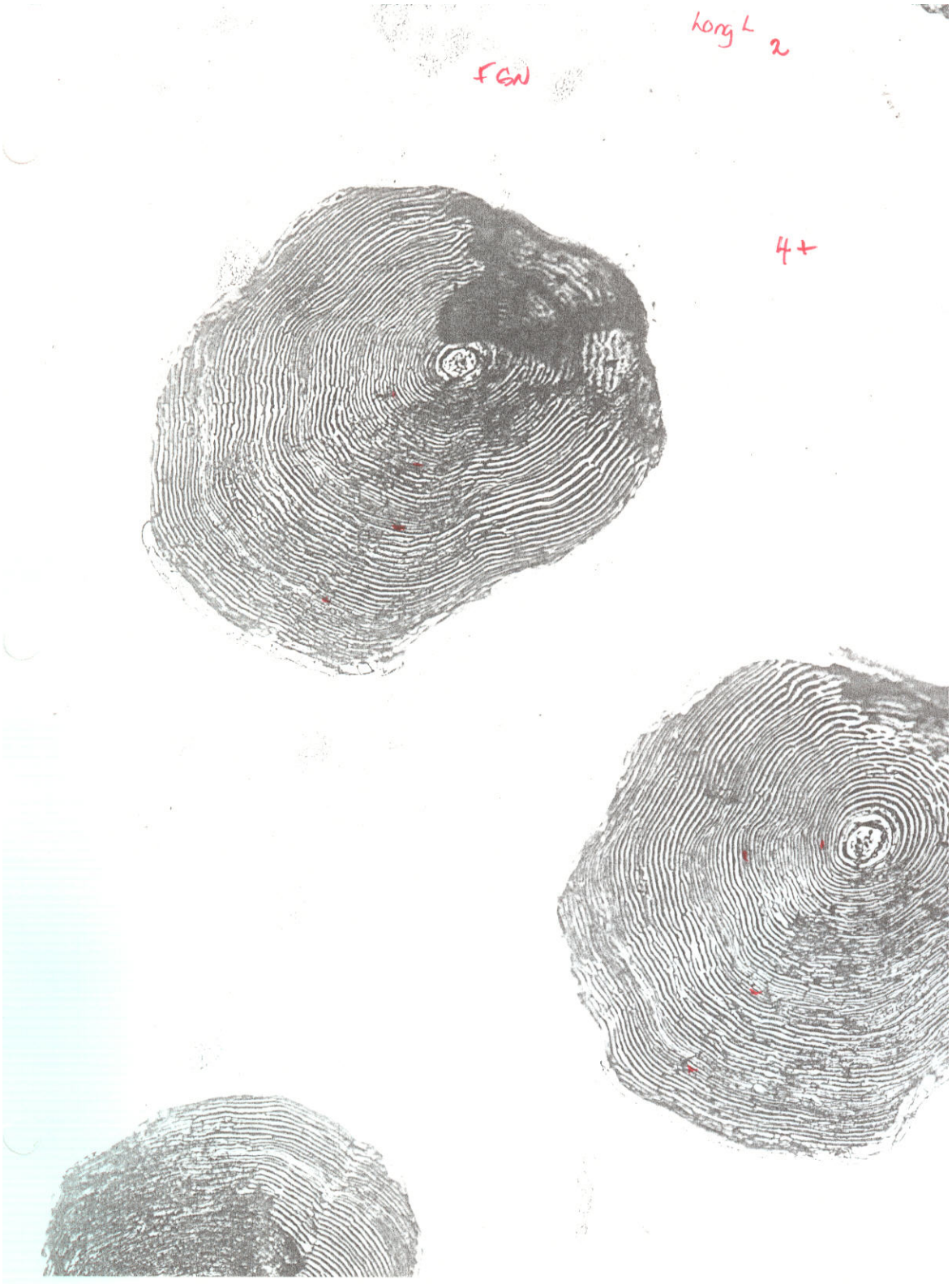

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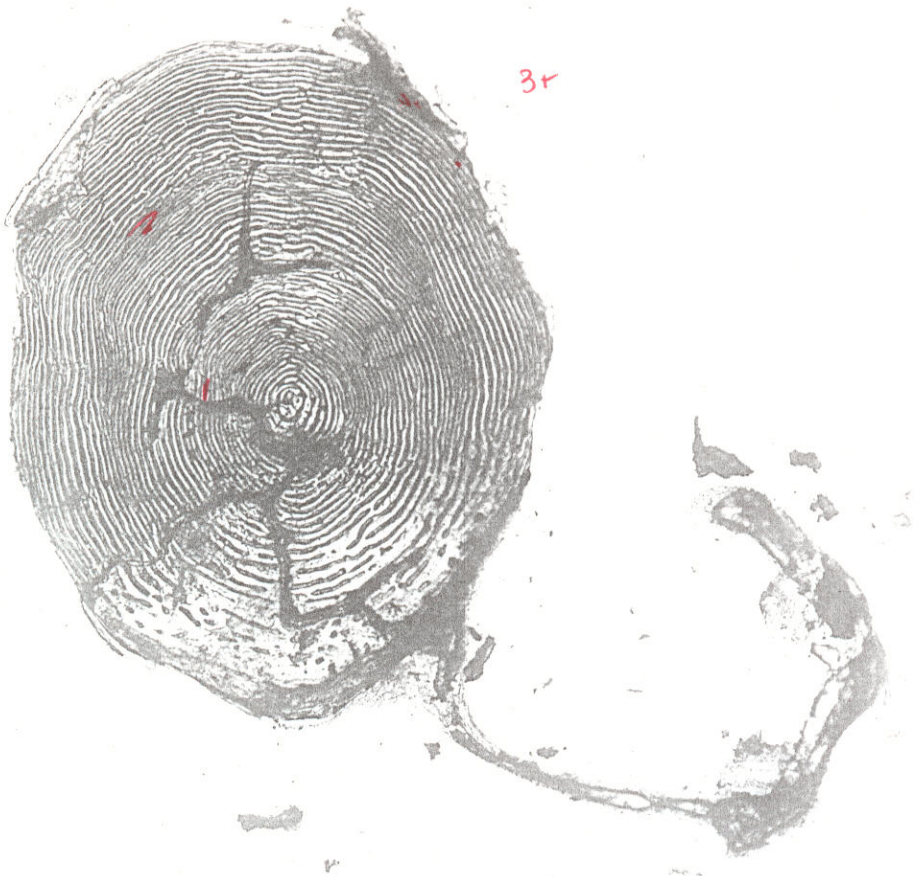

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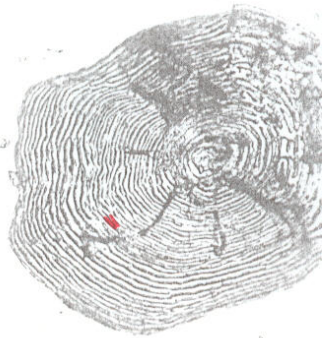

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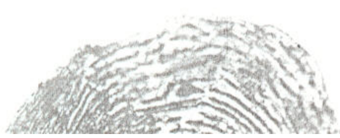

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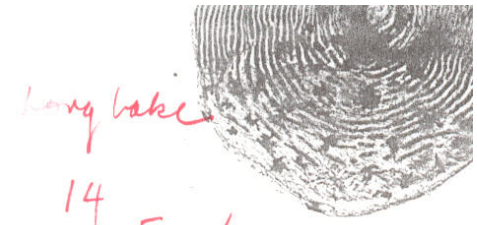

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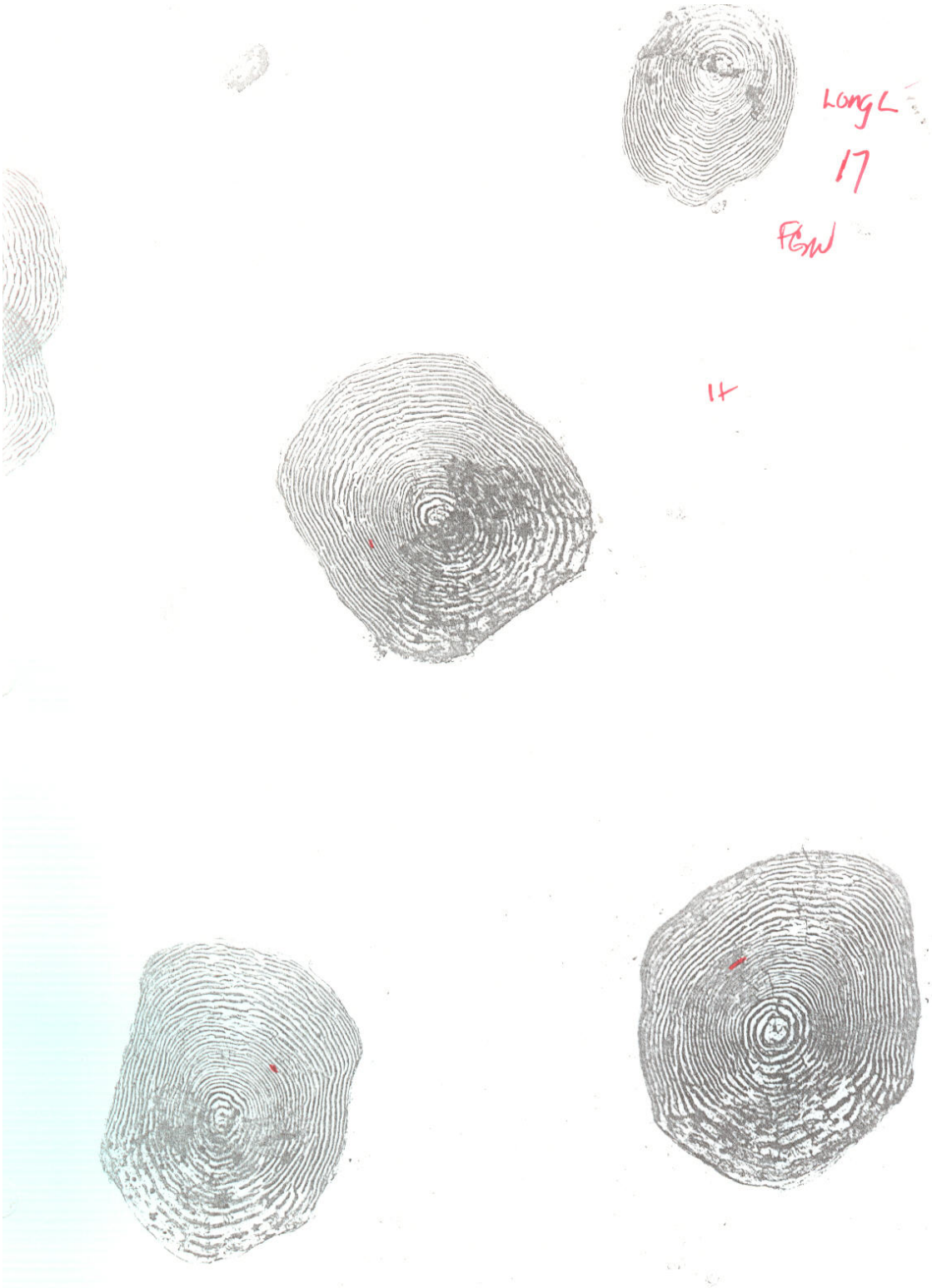
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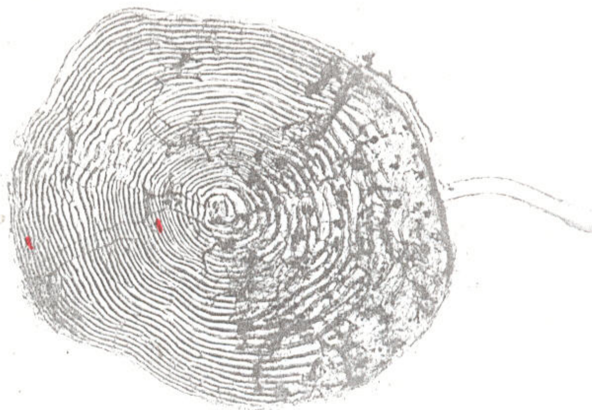

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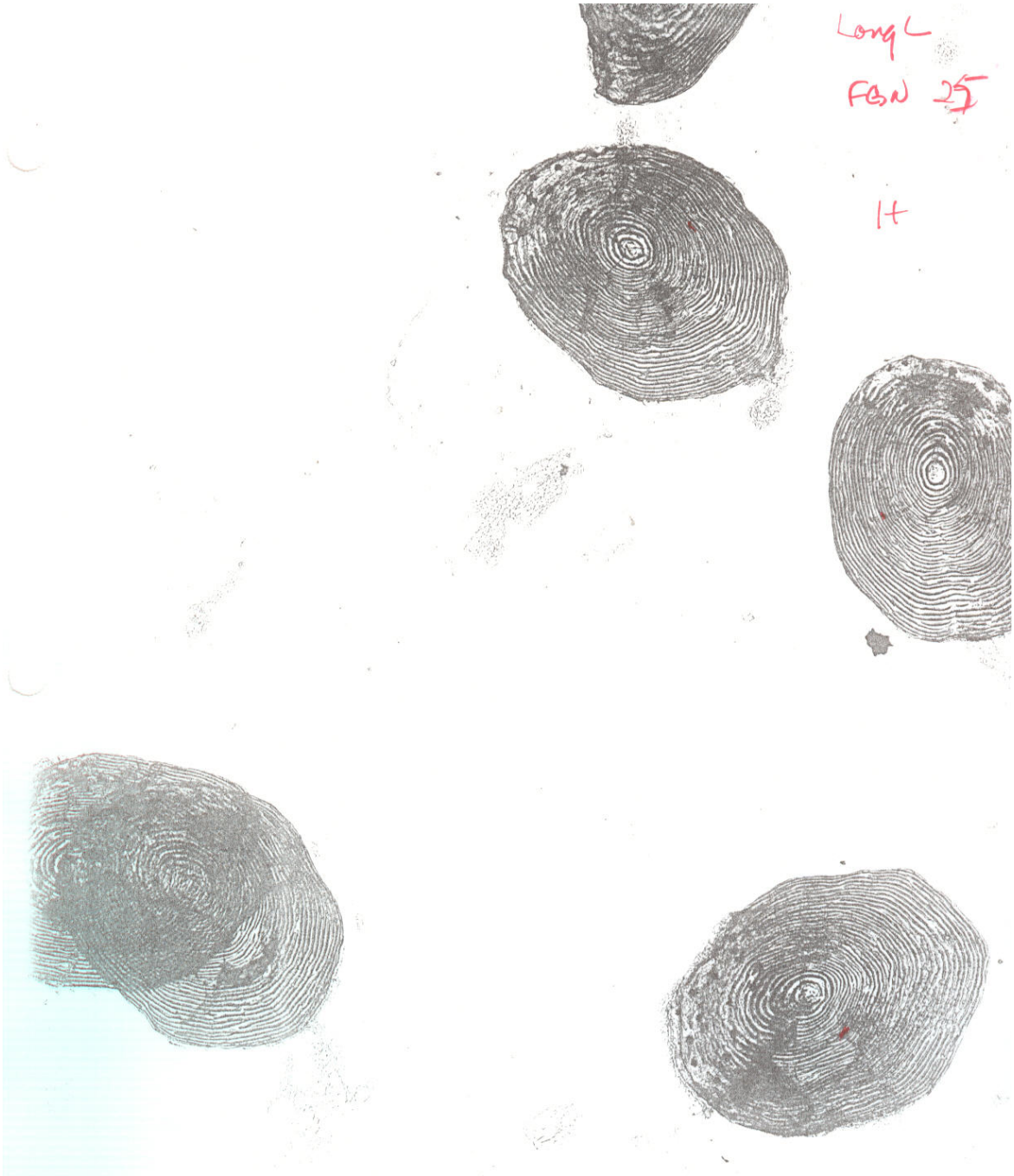
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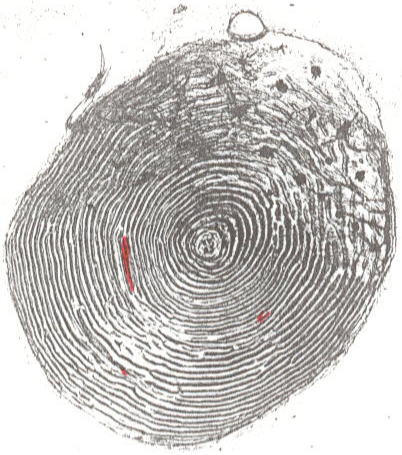

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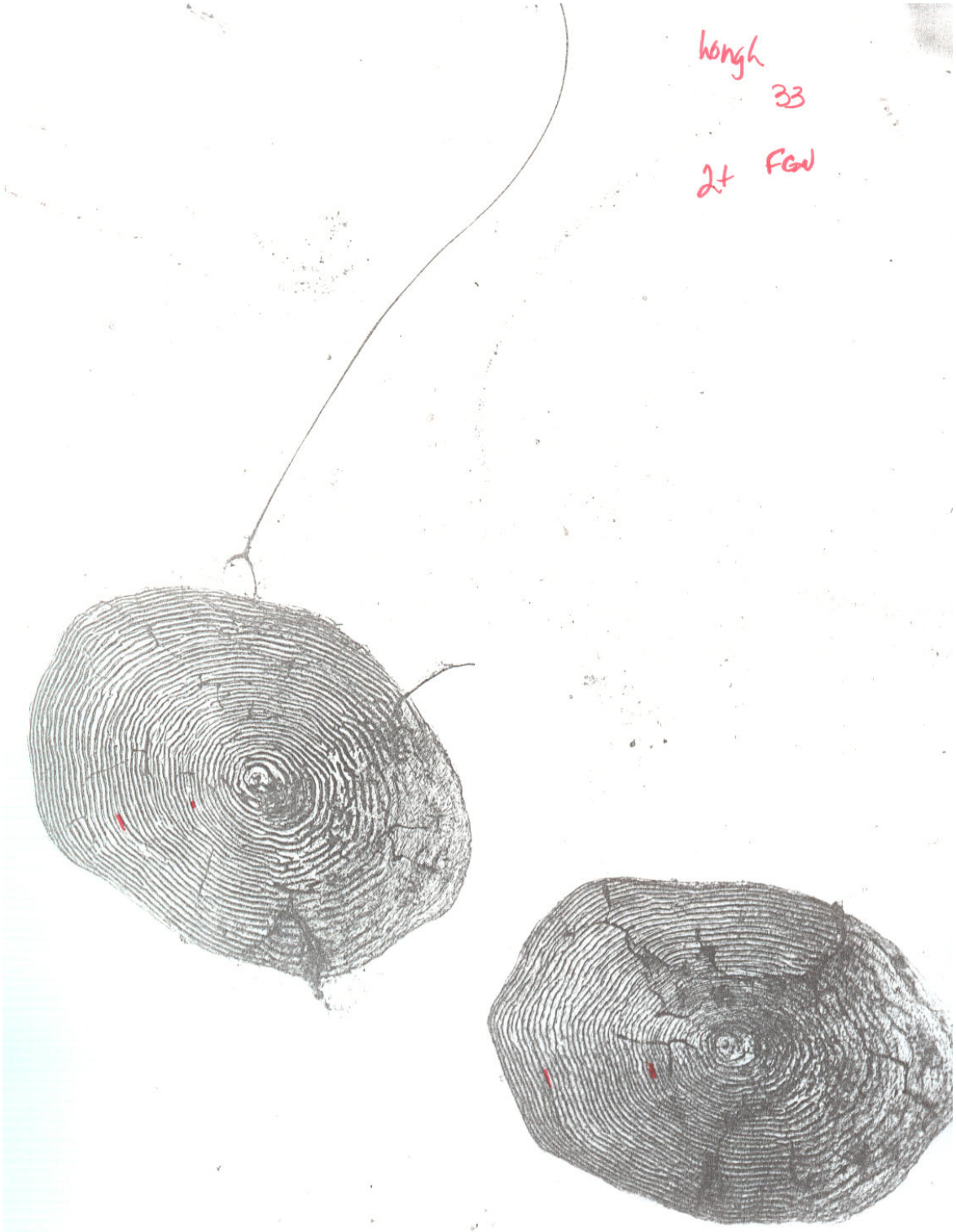
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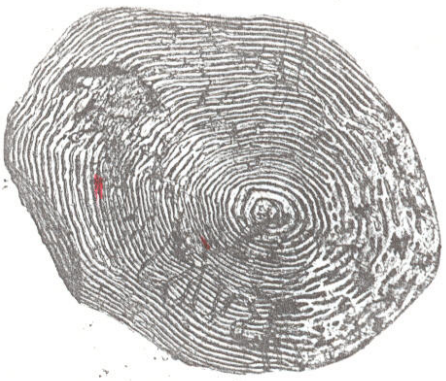

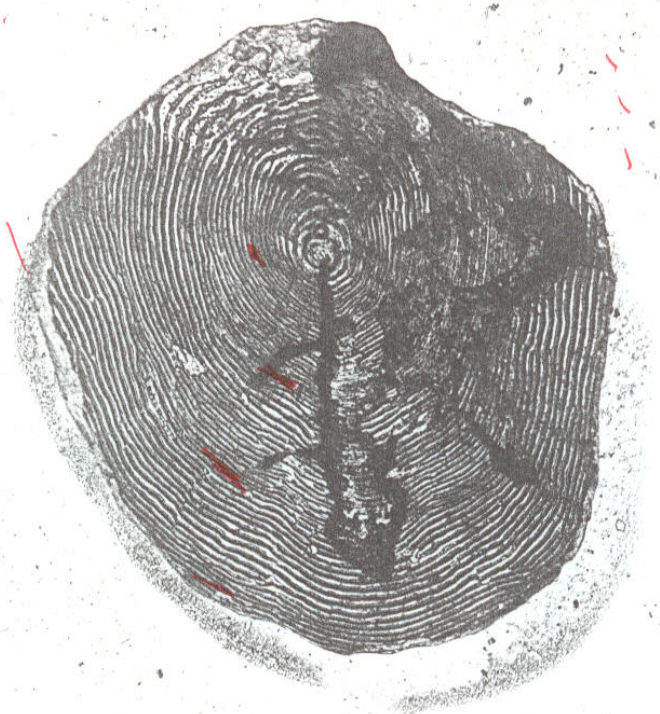

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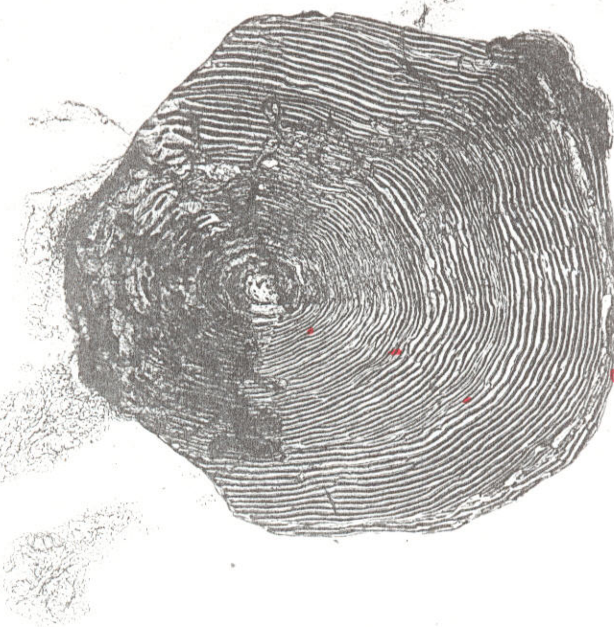

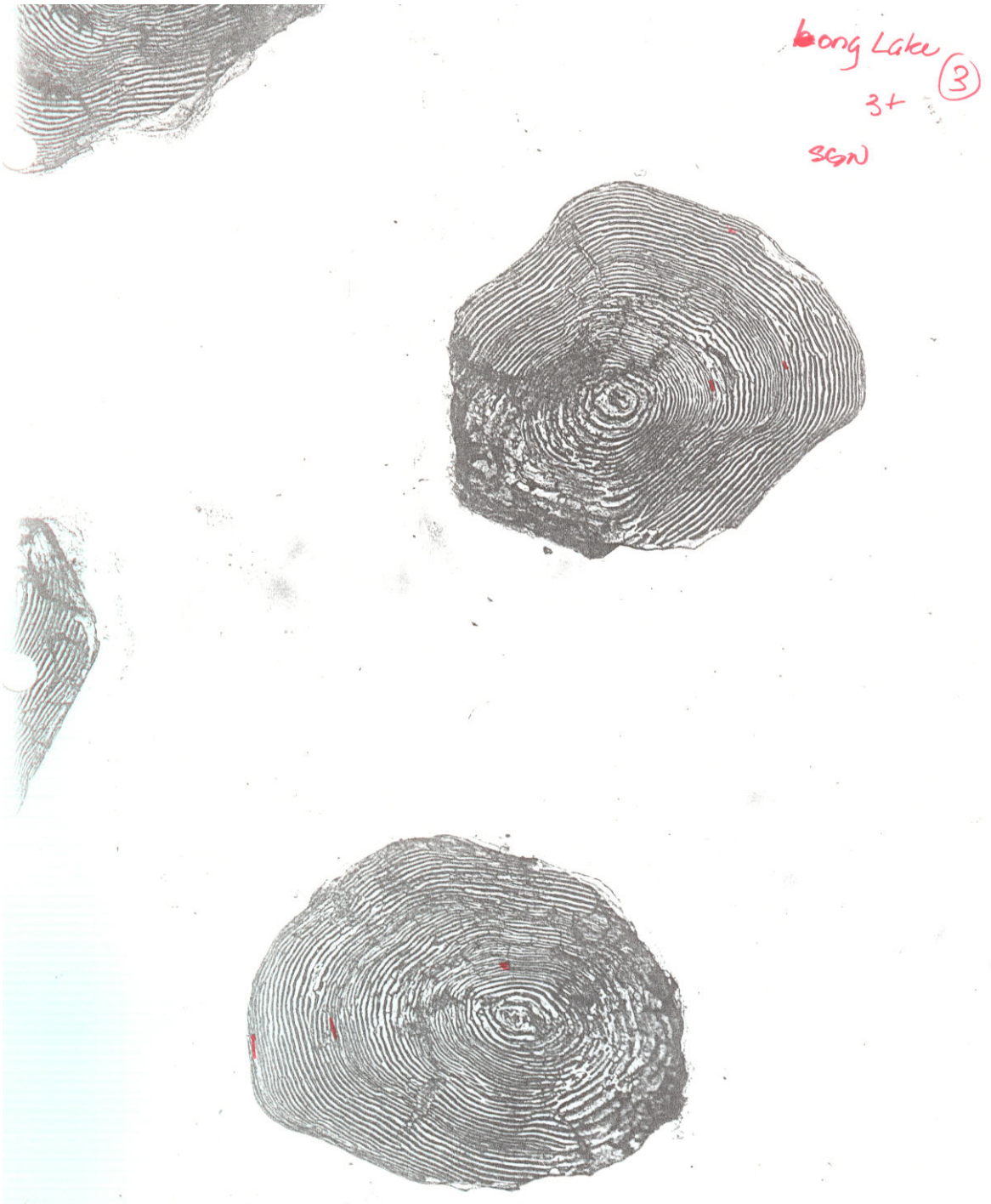
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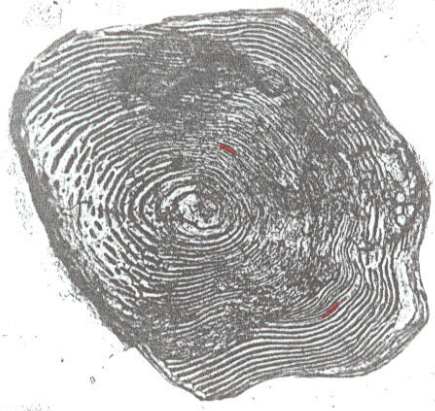
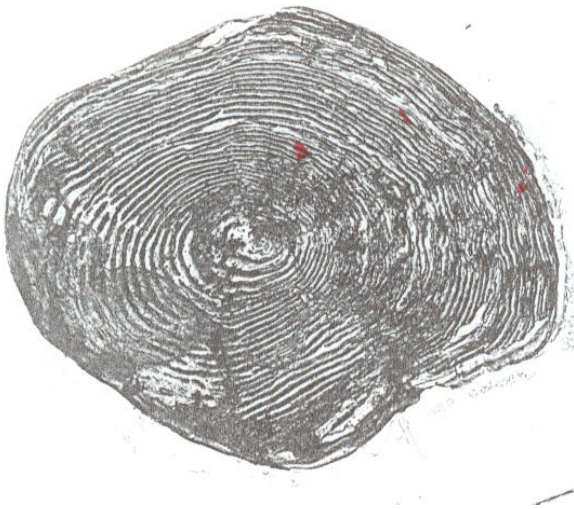
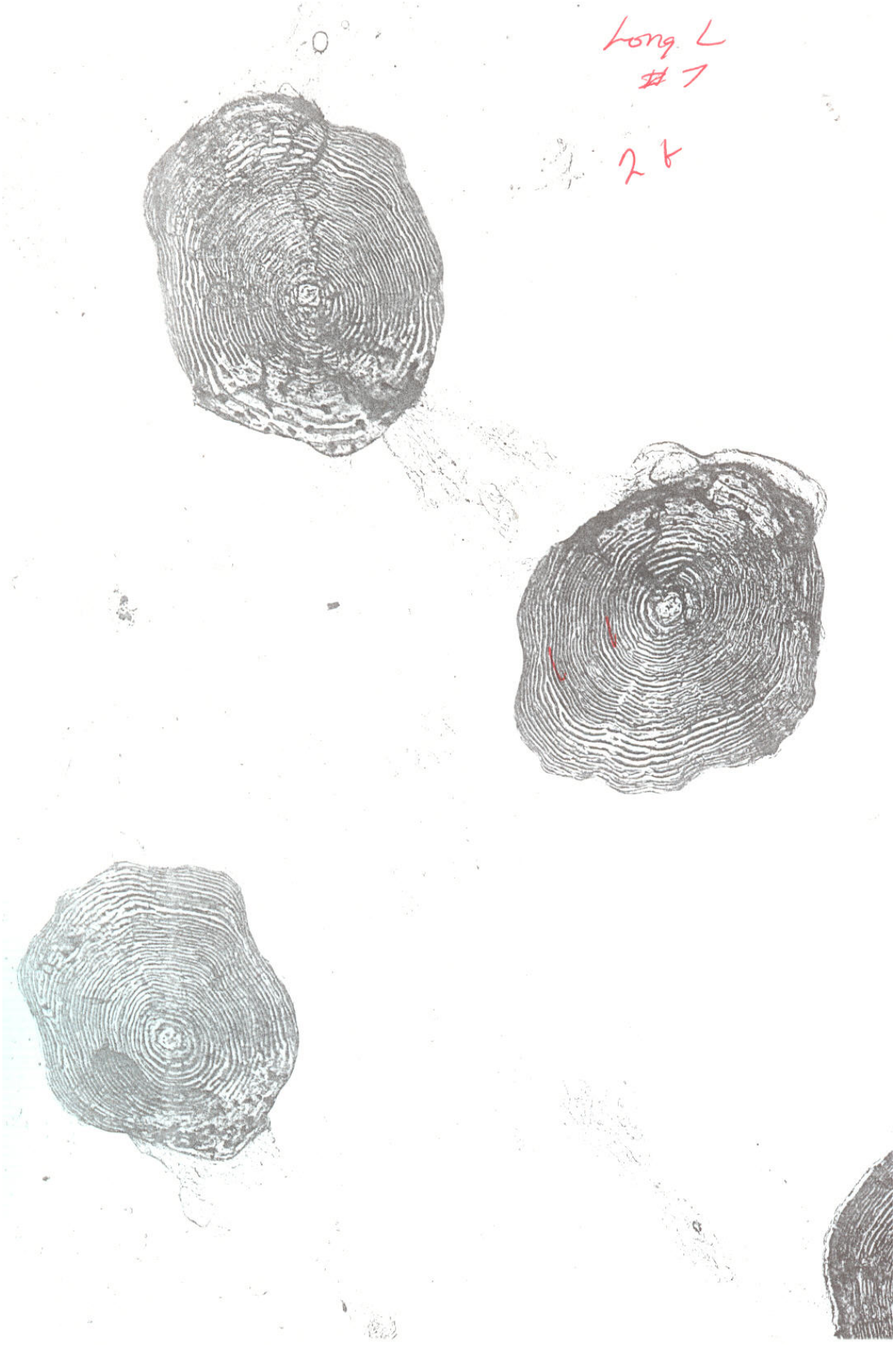
SGN 5

2+






Long L
#7
24

SGN Long L
8

14 | 2+

LongL 9

SGN

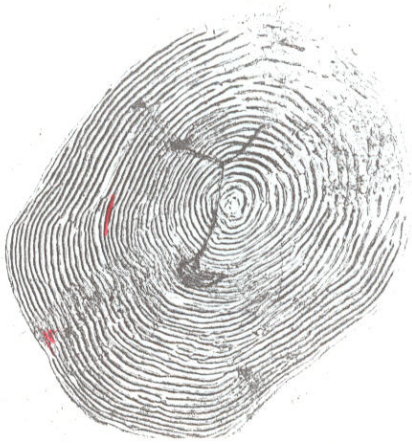
H

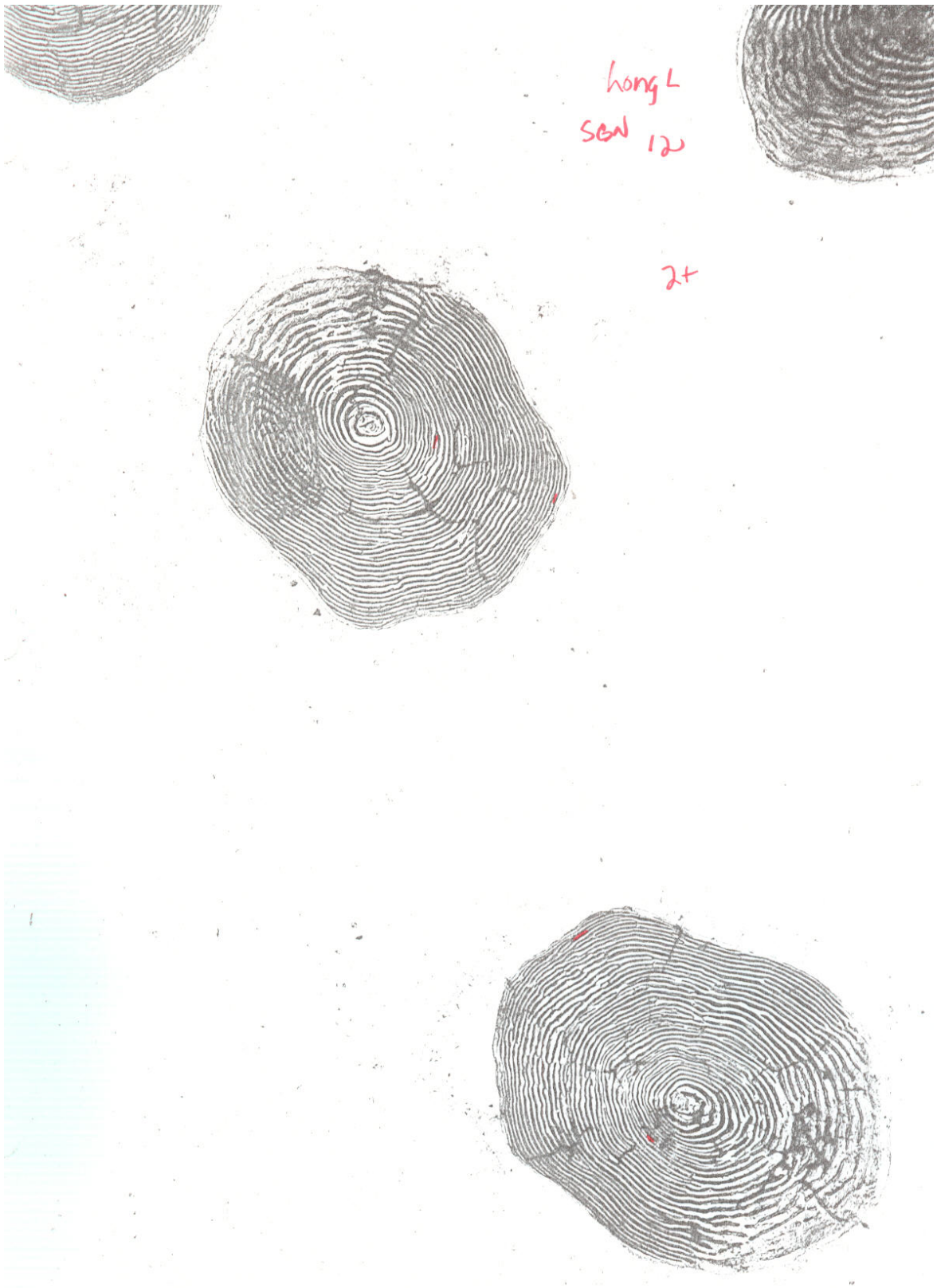
Long L
10
SRbN 1+

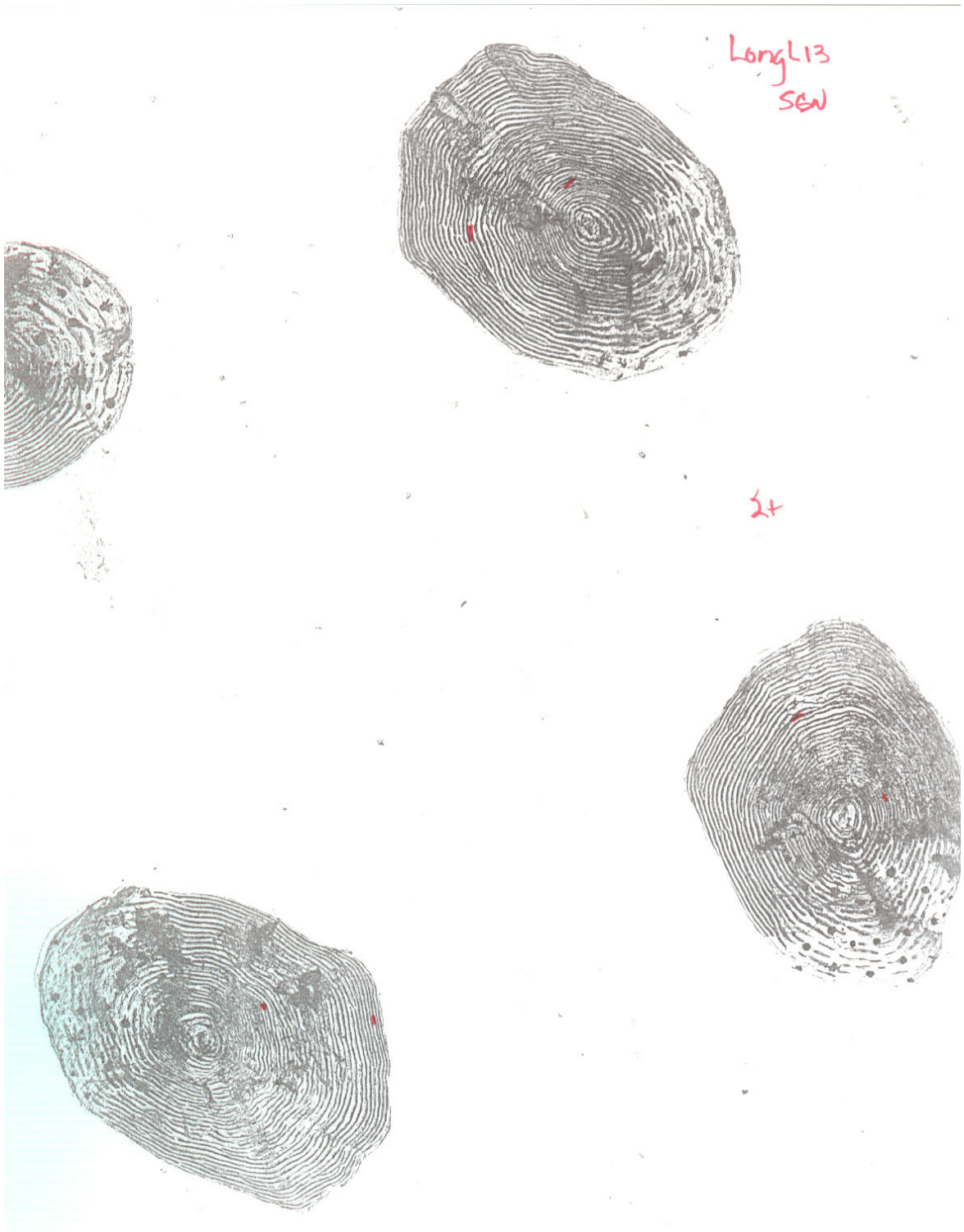
Long L

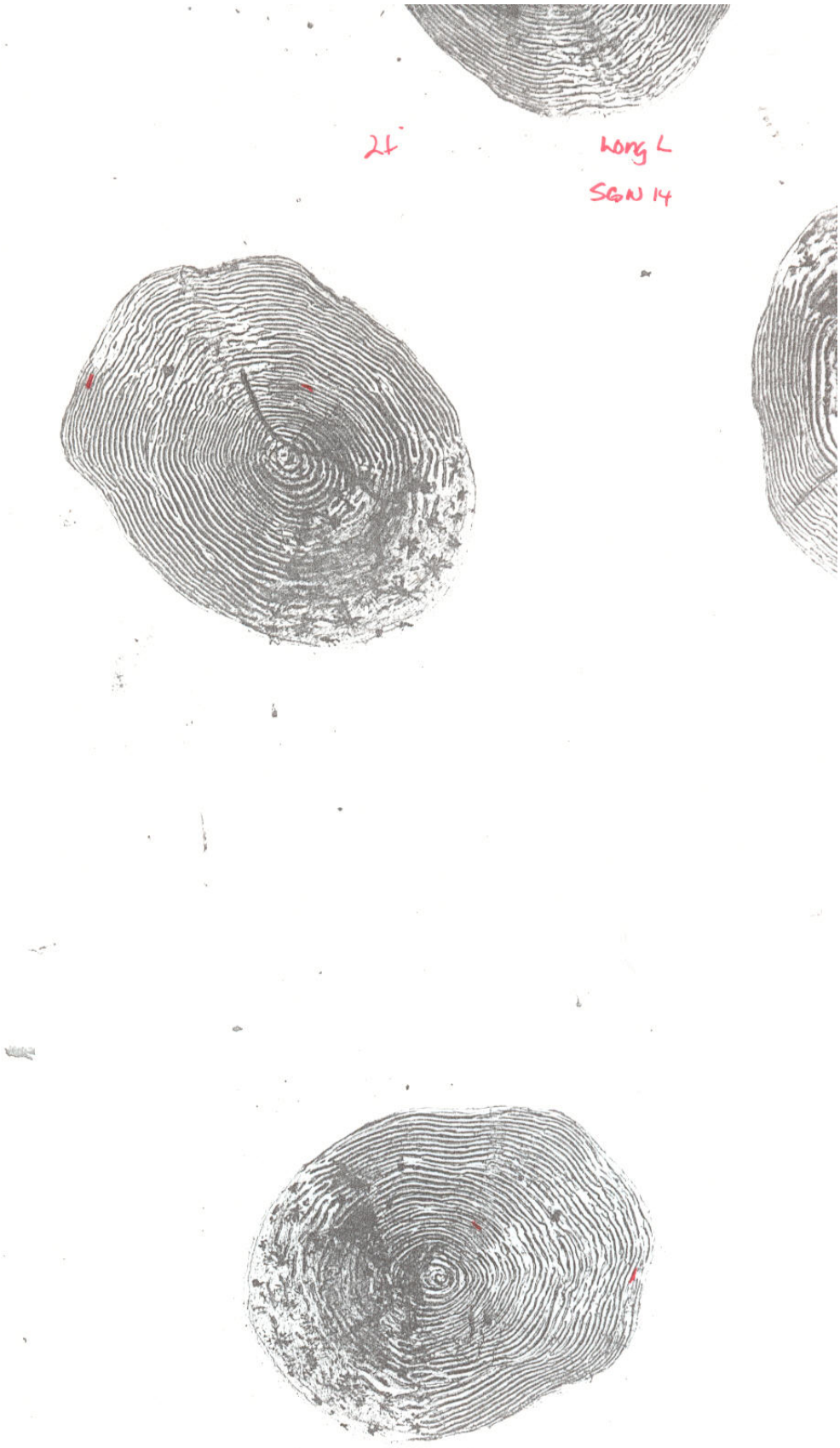
SGN 11

2+




hong L
SGN 12
2+


Long L13
SEW
1+


21
Long L
SGN 14