BEFORE THE COMMISSION
APPOINTED BY THE OTAGO REGIONAL COUNCIL

UNDER	the Resource Management Act 1991 (RMA)
IN THE MATTER	an application to amend the draw down rate of Lake Onslow, Pioneer Energy
BY	**PIONEER ENERGY LIMITED** **Applicant**

BRIEF OF EVIDENCE OF ROSS GORDON DUNGEY

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1. Introduction

1.1 My full name is Ross Gordon Dungey. I am a freshwater aquatic ecologist and hold a BSc. in Zoology and a diploma in freshwater ecology from the University of Otago.

1.2 I am a Director of Ross Dungey Consulting Limited, an environmental consultant established 1998, now based in Albert Town. Previously I was employed by Fisheries Research Division, Otago Acclimatisation Society, and Fish and Game Otago

1.3 For approximately 38 years, I have been involved in a wide variety of studies on freshwater ecology particularly in Otago but throughout the South Island of New Zealand. I have designed and conducted a variety of studies on freshwater ecosystems in support of resource consent applications and monitoring over the last 22 years.

1.4 As a consultant freshwater ecologist (since 1998) I have conducted surveys for conservation, freshwater habitat management, and resource consent applications and monitoring throughout the South Island.

1.5 I have considerable experience with hydro-electric power schemes and have been involved as support and project design and implementation of ecological assessments on a number of existing and proposed power schemes including support for the Waiau, Arnold, Branch, Clutha, Gowan, Monowai, and Waitaki schemes. I have conducted full project design and completion for Wye Creek, Roaring Meg, Ox Burn, Teviot River, Talla Burn, and Fraser River, through to presenting evidence at the Environment Court for the Nevis scheme.

1.6 I have designed and conducted ecological surveys on Lake Onslow and the Teviot River since the 1990's in support of consent monitoring, conditions, and renewal, on behalf of Pioneer Energy Limited.

1.7 These include in-depth invertebrate studies, fish population assessment and monitoring on the Teviot River, a lobster (*Paranephrops zealandicus)* survey and a general bathymetry survey

on Lake Onslow (a repeat and extension of the Cawthron Institute study of 1993, reported in 1997).

1.8 I was involved in the design of the proposed monitoring surveys for Lake Onslow in support of monitoring potential effects of the increased draw down rate (Refer Appendix 1). This program was peer reviewed by ORC and accepted with the addition of sampling invertebrates in macrophyte communities. Survey work commenced in March 2021.

1.9 I am an avid angler with 59 years experience and have taught fly-fishing classes during and after my tenure with Fish and Game.

1.10 I have visited Onslow frequently over the past few decades, most recently for the March 2022 “monitoring surveys”.

1.11 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note (Consolidated practice note 2014). I have read and agree to comply with that Code. Except where I state that I am relying upon the specified evidence of another person, my evidence in this statement is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions which I express.

2. Scope of evidence

2.1 My evidence will address the following:

(a) Outline the proposed monitoring study to assess any effects of the proposed increased draw-down rate;(200 to 400mm/week).

(b) assess the likely effects, if any, of an increase in draw-down rate on angling and lake ecology.

(c) respond to some comments from submitters.

(d) Respond to certain elements of Ms Coates’ and Dr Booth’s evidence.

2.2 My comments relate to using “scenario B” as the existing environment.

3. Survey Methodologies

3.1 The methodologies used are standard and I have followed the survey techniques of Cawthron Institute for the invertebrate studies. Other surveys have followed standard approaches and sampling times programed to match seasonal differences. I have conducted assorted general surveys to note particular topographic features and species-specific habitat use, for example spawning stream access for brown trout.

3.2 The proposed monitoring study (LOMP) was planned in association with F&G and subsequently peer reviewed by ORC and some invertebrate surveys of macrophyte invertebrate habitat added to the study.

4. Lake Onslow Ecology

5. Current knowledge of the Lake Onslow ecology is largely based on the original Cawthron Survey of 1997 and follow up surveys of the same design including the same and additional locations in 2016 and 2017 (conducted by me on behalf of Pioneer Energy Ltd.).

6. Gathering baseline information has included most of these original survey sites and added others. Fish and plant populations are also included in the latest round of surveys, 2021 and 2022 as part of the proposed Lake Onslow Monitoring Plan (LOMP).

7. I conducted a freshwater Lobster survey in 2006 for PEL, to describe the population of this species of invertebrate.

8. There is a relatively narrow productive band (2.5m in vertical extent) around the lake shore delineated by a plant community. This develops whenever there is a period of relatively stable lake level. The upper limits are probably controlled by wave action and hydration and the lower limit by light penetration.

9. During periods of relative stability, with respect to lake level, such as the last few decades, aquatic productivity is expected to also have been stable. When a period of reduced lake level (from a background of a stable period) occurs this checks productivity as plant and invertebrate communities decline in the subsequently dewatered zone.

10. When re-flooding occurs, there is a spike in production as newly available habitat is recolonised and plant, invertebrate, and fish communities bounce back.

11. The comparison between the Cawthron study and follow-ups demonstrated this recovery.

12. The pattern of low lake levels (characterised for this purpose by lake levels receding below the normal productive band) and subsequent re-flooding has typically occurred once every 7-8 years since 1982, and this pattern is evident in Figure 2 of Mr Jack's evidence.

13. The check and therefore the extent of influence on productivity depends on the frequency of the dewatering event and the period the productive zone is exposed to air. This will occur regardless of the position of the productive band with respect to crest level.

14. The lake level variability allowed under the existing consent is 5.2m below crest level. The fact that the lake level has been relatively high and stable since about 1982 and particularly 2005 has been a fortunate consequence of climate and operational factors and resulted in lake levels at the top end of the consented operational range.

15. Scenarios which may adversely affect ecological and amenity values are possible under the existing consent conditions and therefore outside the parameters of this application, which deals with a change in drawdown rate.

16. The development of the LOMP was in recognition that there is a possibility of some adverse effect, from an increase in draw down rate, and covering plant, invertebrate, and fish communities. The Plan was designed to pick any response to the change in drawdown rate that might differentially effect communities with differing susceptibility.

17. The adaptive management approach and review periods would allow some definition of the extent of changes in ecology in response to the increase in drawdown rate.

18. The study was designed to assess response of the production zone, regardless of what level it was at in the lake, to an increase in drawdown rate.

19. To date 2 seasons of baseline data sampling of fish, invertebrate, and plant communities, have been conducted. Length frequency histograms of fish sampled so far are shown in Appendix 3.

20. Gently sloping shorelines have a much broader production zone per metre of vertical fall than a steep shoreline so the production zone is relatively wider and therefore makes a greater contribution to overall productivity. The narrow production zone on the steep shoreline is more critical to lake ecology because it is a smaller proportion of the overall extent of the lake. Overall productivity can be expected to be greater at high lake levels because of the extent of broad shallow areas.

21. It is well known that steep sided lakes with a low proportion of shallow margins are less productive.

22. Using scenario B as the baseline, I cannot identify any likely significant adverse effect on the lake ecology (which includes the trout population) resulting from an increase in drawdown rate up to 400mm/week. I also note Mr Jack's evidence that the operational parameters of the Lake will not change fundamentally following this variation and so I would expect Lake levels to remain similar to those we have seen historically.

23. Potential Effects on Angling/Trout Spawning

24. Lake Onslow is a regionally significant trout fishery and provides renowned angling opportunities in a high-country setting. However, it is a hydro/irrigation storage reservoir and the fishery is a fortunate addition and not the primary reason for the reservoirs existence.

25. Navigation hazards are an aspect of all boating activity and especially in peat-stained waters such as Pool Burn, Logan Burn, and Onslow. A cautious approach to new water is fairly standard practice in the interests of maximising angling time; extricating oneself from a "sand-mud bar" is time consuming, messy, and exhausting.

26. Stranding of anglers on Onslow by receding water level is a most unlikely occurrence. Anglers know the level may change but it is at such a slow rate it would be unlikely to result in stranding. If angling coincided with a sustained period of draw down at 400/week that

would equate to a 28.6mm drop in water level over 12 hours; not enough to leave one stranded, particularly as there would likely be several visits back to the boat for changes of location and tea breaks.

27. In comparison the Clutha River can change in level more than a meter, below Roxburgh, in the course of 6 hours or less. (Refer Appendix 4 - Hydrograph 300-700 cumecs per day, 11-15th June 2022) This attenuates with distance downstream but still results in water level changes of an estimated 400mm/day (personal experience on the Lower Clutha below Balclutha). Lake Dunstan typically fluctuates about 600mm/ day, (pers com A Jack)

28. Access to trout spawning streams at low lake levels is still present, the old river channels that formed the inflow tributaries prior to dam construction are still present (refer photos in Appendix 2 - Onslow). They have not been damaged in the creation of the lake and are clearly visible at low levels (-2.5m). They are well defined, deep, and impassable on foot. The North Branch of the Teviot flows under a small bridge and a collection of boulder and concrete likely creates an impassable barrier at present when the lake is approximately -2m, however this barrier also maintains ponding upstream and is a favoured angling location. There are almost certainly a large number of trout above this barrier that use the stream for spawning even if the lake level is low enough to deny access to fish from the main part of the lake.

29. Specific comments on issues raised by Section 42A report and submitters

29.1 A Coates.

(a) Placement of rocks/boulders on the shoreline. The lake shoreline is measured in kilometres so this would be a huge logistical operation fraught with many access difficulties if it were to provide a significant amount of habitat.

(b) Based on my observations 15% of the shoreline is currently classified as rocky/gravel Shoreline. In my opinion there is no need to add further rocky/gravel habitat. Given the way the lake as operated we have not been able to observe whether the

shoreline characteristics remain constant at lower lake levels. If they do, no further rocky material would be necessary. In my opinion an assessment of the extent to which current rocky shorelines are present at lower lake levels would be require to refine knowledge of the extent of rocky shoreline habitat and the value of any enhancement project.

(c) With regard to Mrs Coates comment (para 72) about the number of replicates (5vs3). The LOMP sampling procedure followed Cawthron study design to allow comparability with previous surveys and assess trends. Sampling depths are relative to weir crest.

(d) With regard to Mrs Coates comment (para 73). The bully sampling has been very successful using electrofishing. Overnight sets of G-minnow traps failed to catch significant numbers.

29.2 **Dr Booth**.

(a) I agree that access is a potential issue and maintenance of this is important to maintain angling opportunity. However, the increase in draw down rate is much less of an issue than the minimum consented lake level, which will not change under the proposal and is allowed under the current consent.

(b) The extent to which angling accessibility around the shoreline maybe limited at low lake levels (<3.5m) could be assessed by recording the proportion of rocky vs traversable “mud” vs “untraversable mud” when the lake is below this level.

(c) The “draft Interim Lake Onslow Amenity Report” was a first step in identifying amenity values, opportunities, and limitations (access) and considered appropriate given the small scale of the change applied for.

(d) The focus for the LOMP was on ecological values vs amenity values as it is easier to measure actual changes vs perceived. My opinion as an angler likely differs from another angler but a change in the invertebrate community composition or fish

average length, for example, would be a concrete detectable difference if there was an effect from the exercise of a consent.

(e) This is especially important if a likely change is small and where maximum “resolution” is needed to be able to detect and measure the change.

(f) As noted by Dr Booth the residual flow in the Teviot River will occur 25% more often. This is potentially an issue for algal build up but the algal growths that may result during low flows are covered by an algal monitoring program that requires flushing flows when agreed limits are reached.

(g) With regard to trout movement and angling in shallow vs deeper water during late summer. Brown trout are temperature sensitive and as the water warms over summer and on a daily basis they spend less time in the shallows. To be successful anglers need to fish deeper water or the shallows very close (2m) to deep (>2m) water. Fishing shallow water is exciting because one can see and stalk (sight fishing) the fish. As the temperature rises this opportunity diminishes and one must follow the fish to where they chose to go, namely deeper cooler water.

29.3 **Fish and Game Otago**.

(a) Much of F&G’s evidence is based on the historic lake levels of recent times where the lake has not been operated to the full extent allowed under the existing consent, an all-together different consideration from the scenario B state that has been defined as the receiving environment by ORC. (6.1.1 ORC, “receiving environment for effects assessment.” S42A Hearing Report.) My brief is to consider the potential effects of a change in draw-down rate.

(b) Choosing ecological vs less well-defined parameters against which to measure change discussed above. My opinion is that any change resulting from 200 to 400mm/week will be difficult to detect so my selection of parameters to measure was broad, fish, invertebrates, plants, and provided the best resolution to observe changes available.

30. I note that my comments boave also address matters discussied in Ms Pritchard's report so I do not repeat those.

31. Lake References

32. Dungey RG, 2017, Lake Onslow Lake bed Profile and Invertebrate Survey. Report to Pioneer Energy Ltd.

33. Dungey RG 2008. A survey of Fresh water lobsters in Lake Onslow. Report to Pioneer Energy Ltd

34. Stark J 1993, Cawthron report 229, A survey of macroinvertebrates in seventeen South Island lakes.

35. Stark J and J Hayes 1997; Cawthron report 389, Freshwater biological assessment of environmental effects for the proposed Central Electric Ltd Horseshoe bend hydro-electric scheme on the Teviot River.

Ross Dungey

21 June 2022.

Appendix 1.- Onslow Monitoring Proposal

Lake Onslow Monitoring Proposal.

Interested parties, Pioneer Energy, Fish & Game Otago, Otago Regional Council, Teviot Angling Club, Dept of Conservation, Aukaha. This schedule contains sampling regimes as required by ORC.

Background.

After extensive discussions with affected parties the following monitoring plan was devised. It will be conducted in accordance with consent conditions drafted for the variation in drawdown rate. No other aspects of the current consent have been changed.

Reason.

To check if an increase in Lake Onslow draw down rate has any adverse effects on lake ecology. The current consent allows for a maximum draw down rate of 200mm/week. The variation sought is to increase this to 400mm/week. A baseline survey is to be conducted and future surveys will be triggered by the use of the increased drawdown rate.

Methods.

Parameters to be assessed were established after consultation with affected parties. Methods were fine-tuned after site inspections to determine what survey techniques were suitable.

1. Monitor the species composition, extent and density of key weed beds.
2. Collect invertebrate kick samples, from weed beds and from a rocky shoreline.
3. Collect invertebrate sediment core samples, from the boat ramp and two weed bed sample sites, (3 sites).
4. Collect “bag” invertebrate samples from weed bed sites.
5. Sample the bully population on a rocky shoreline.
6. Monitor fish lengths of angler caught Onslow Trout.
7. Visually inspect fish passage to 2 spawning streams (Nth and Sth Branches of the Teviot River) to ensure fish passage is not compromised by the increase in drawdown rate.
8. All survey sites are recorded by photographs

Detail.

The detail of the monitoring has been established after initial investigation of sites to assess their suitability.

Weed bed monitor

There are 3 sites selected for weed bed monitoring, The Boat Ramp site, a bay NW about 1 km from the boat ramp, another to the North past the pylons. These have been selected to assess weed-bed extent and areal cover. It will be necessary to select calm weather for surveys to ensure weed beds can be viewed and therefore assessed.

Transects are GPS recorded to determine weed bed margins and ensure repeatability of surveys. Density of the weed-beds could be determined by recording presence along transects at 5m intervals. Two sets of parallel lines at right angles to each other (~#) would provide four transects per site and the means to record macrophyte cover and extent.

The aquatic plant communities in general are also to be noted at the survey sites in association with the macrophytes present, other than the rocky shore where they are absent.

Invertebrate samples

Kick samples provide presence /absence information on species present and compliment assessing the extent and density of the weed beds. Previous Onslow surveys have included kick samples and these have recorded small fish (bullies), lobster, and invertebrates.

Quantitative “bag” samples over weed beds are required to supplement kick samples at the same sites (3 samples).

In addition invertebrate sediment core samples are required at 3 sites, the boat ramp, and the two weed beds. This sampling and analysis is to follow the original Cawthron sampling (Stark & Hayes 1997) protocol that involved sampling at 4 depths with 3 samples per site giving an additional 36 invertebrate samples for quantitative analysis.

Bully Population.

While some bullies can be collected in the kick samples electric fishing along rocky shoreline can provide a larger sample to help define population demographics and provide another avenue to check for effects of the draw down rate change.

Water Quality

Lawa water quality data will be referred to in the reporting of the monitoring results.

Figure 1, location of sampling sites.

Monitoring

Monitoring is to be triggered by the draft condition A1 (b) in that the trigger will be a draw down rate of greater than 200mm/week and a lake level that equates to 2.5m or more below the weir crest. Monitoring is be scheduled for the same period each year to ensure sampling at the same stage in seasonal growth pattern of the weed-beds. The next major consideration is to sample at a time when lake levels are sufficiently low to allow the weed beds to be observed. Mid to late summer seems to be an ideal time to survey. Setting a sample time for January to March allows some flexibility to manage weather and water level issues.

Establishing some baseline against which to assess change is essential. The extent of baseline survey will be determined by the point at which the variation in draw down rate is initiated. One additional baseline survey in 2022 is scheduled. This gives an extensive baseline of 5 surveys from 1998-2022.

However it is likely the increase in draw rate will be initiated sooner so that 1 or 2 seasons may be the only baseline recorded. After the baseline the next survey would be as triggered by a draw down event. If the ecological response to a draw-down event is immediate one subsequent survey would be adequate but if the response is delayed then it may not be evident until the following season, two annual surveys post the first draw down event would therefore be advisable.

Supplementary monitoring

Onslow Trout

Existing information.

There is some limited information from angling club records and Fish and Game Creel surveys. Additional information on the fish population is required and collaboration with angling clubs can be a worthwhile approach to monitoring fish size and age class demographics. Teviot River Fishing Competition 22 year record provides a model to monitor the lake for potential effects on the trout population from the increased draw-down rate.

Expert Anglers

The use of expert anglers to record catch and effort data is an established method to gather information on a fish population. I have spoken to Laurie Crossan of Teviot Anglers. He has identified 4 reliable anglers of better than average skill who fish Lake Onslow on a regular basis. Providing these anglers with support and information to record fish and catch data is a very

cost effective way of gathering this data and establishing a reliable monitoring methodology. Replacement expert anglers will be done in association with Teviot Angling Club. A standard data sheet/angling diary and measuring board has been provided.

Teviot Angling Club competition records could be reviewed and a request to record fish lengths in future competitions be made. This approach can be supported with data sheets, advice on recording, and provision of measuring boards.

The aim is for Expert angler and Teviot Angling Club catch records to be maintained at levels required to gather a sample of fish lengths for at least 100 angler caught Lake Onslow trout per year. Teviot Angling Club members play a critical role in gathering this information.

Anglers have provided a sample of fish in the Teviot River Fishing Competition for 22 years and this has proved valuable in monitoring the river for potential effects from the hydro- scheme. It has shown no adverse effect or significant change, other than a slight increase in mean length, since 1998.

Access to spawning streams at very low lake levels.

A potential effect of unusually low lake levels is an impediment to spawning habitat although the variation of consent conditions relates only to the rate of drawdown. A check for access to spawning streams at first "low level" (perhaps defined as 1m below the usual operating range) is advisable to ensure access is still available.

Summary of monitoring.

1. Two sites for weed-bed monitoring.
2. Three sites for invertebrate kick samples
3. A rocky shoreline site for bully sampling.
4. Collaboration with Teviot Anglers to record Onslow fish lengths at competitions.

1. Establish "expert angler" diaries for 4 expert Lake Onslow anglers.

Analysis.

Analysis will be based on comparing baseline levels of assessed criteria against post an "increased draw down rate event" levels with particular reference to the hydrographic record. The additional sediment core invertebrate samples are to be analysed broadly following the Cawthron analysis in the 1997 report, Stark & Hayes 1997.

In particular;

1. Species composition, density, and extent of weed beds at two locations.
2. Species list and relative abundance of invertebrates.
3. Size range and size class distribution for bully populations.
4. Angler caught Onslow trout analysis based on the Teviot angling competition.
5. Fish passage to spawning streams, Sth Branch Teviot River and Fortification Creek, based on visual inspection and measurement of pinch points.

Baseline survey and sample site setup.

Initial investigations have identified survey sites and refined survey methods. The invertebrate surveys have followed the Cawthron sites of previous surveys and the Pioneer Energy 2017 Lake bed profile and invertebrate survey. This essentially provides a baseline dataset for the invertebrates established over 4 surveys from 1997, 2016, 2017, and 2021.

The weed beds have changed their extent since the 2017 survey and the revised locations that cover a range of weed bed/aquatic plant scenarios from

1. limited cover, Pylon Site
2. variable cover, First Bay and
3. total cover, Boat Ramp

Survey sites and the initial survey were completed within the allowed time frame except for the "bag" macrophyte invertebrate sampling which has been delayed due to material shortages associated with Covid restricted supply lines.

Spawning stream fish passage access issues have been checked.

References.

Dungey R G 2017. Lake Onslow Lake bed profile and invertebrate survey. Report to Pioneer Energy Ltd, Ross Dungey Consulting Ltd.

Stark & Hayes 1997, Cawthron report 389, Freshwater biological assessment of environmental effects for the proposed Central Electric Ltd, Horseshoe Bend hydro scheme on the Teviot River.

Ross Dungey May 2021.

Appendix 1, Angling diary.

Angling Diary

Location: Date:

Water: Time; start

Barometer: finish
Total:

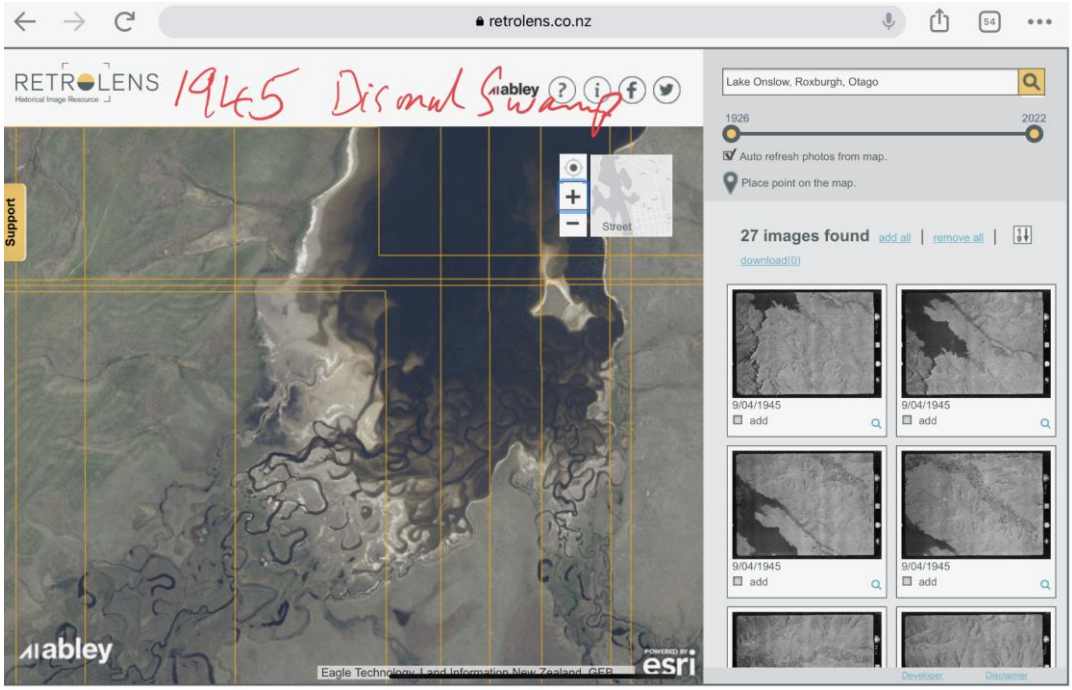
Weather:

Team:

Method. Fish Caught
No. Length mm Weight gm Species Sex Kept

Observations

Appendix 2. Onslow Photos



1945

Recent Google earth photo.

Close up 2021 image of meanders inspected for impediments to fish passage.

Appendix 3 - fish population length frequency.

Lake Onslow Angler Caught Trout and electro-fished bullies.

Anglers recorded lengths of trout they caught in Lake Onslow for the season 2020-21 in diaries provided. A total of 191 trout were recorded, mean length 422.5mm, and range in length from 200 to 650mm. 89% of the fish recorded were between 340 and 500mm in length. The 2022 season analysis is still to be completed.

The figure shows the length frequency distribution. There are possible age groups centred at approximately 300, 380, and 480mm but more samples will be required to clarify these “lengths at age”.

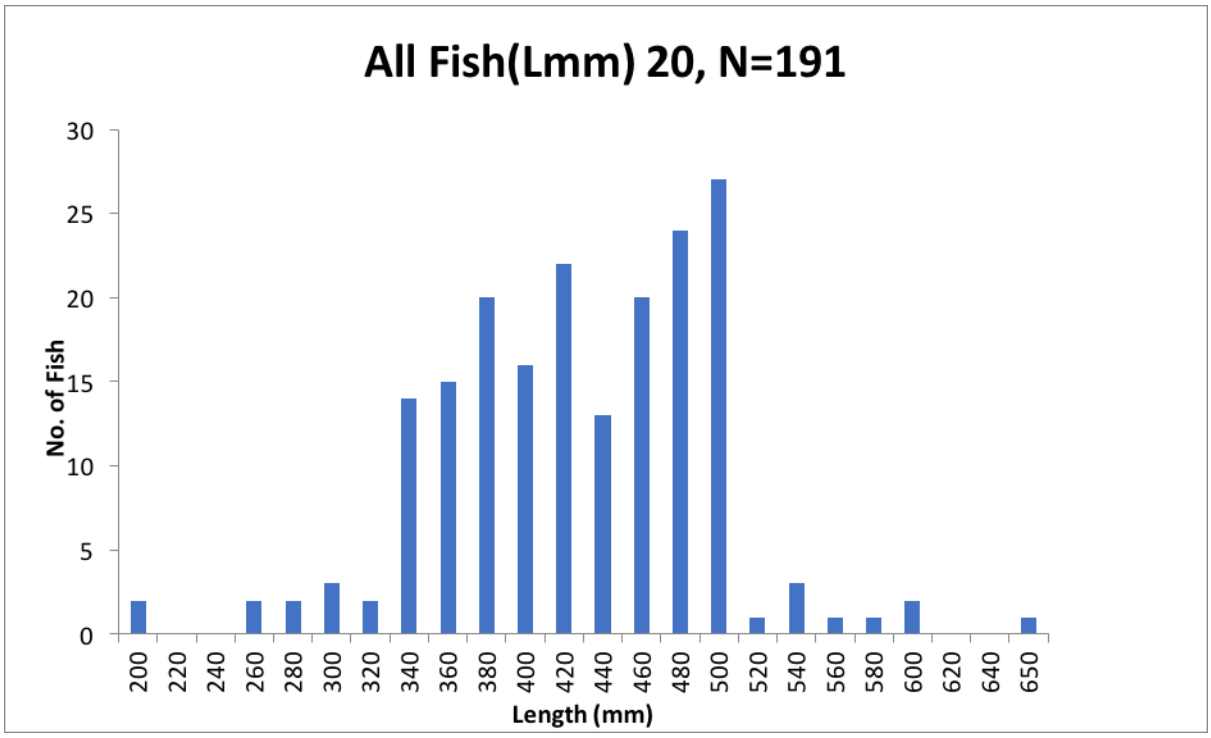
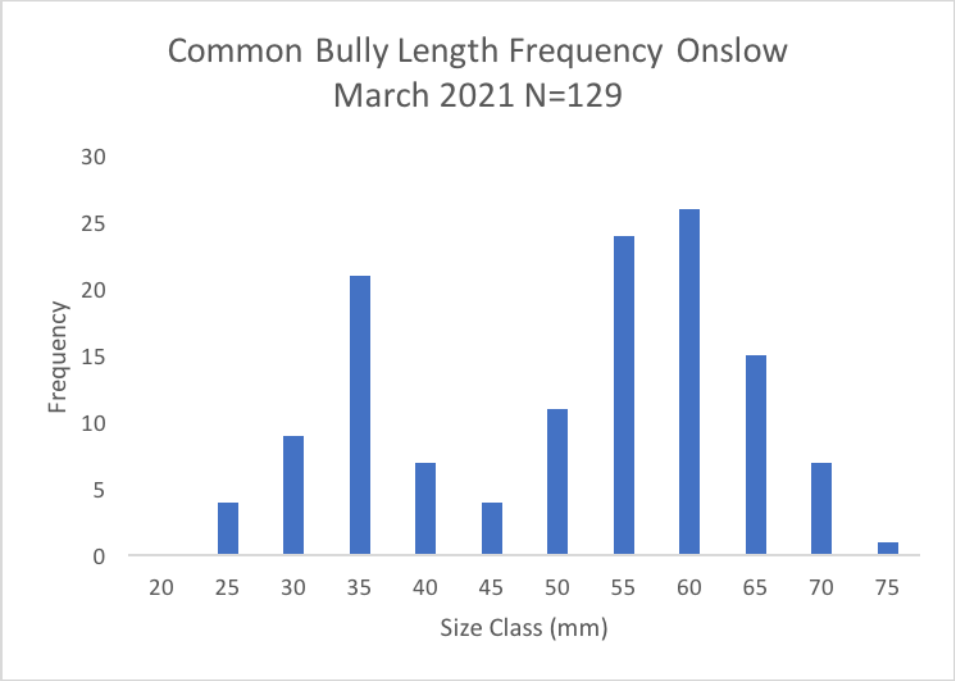
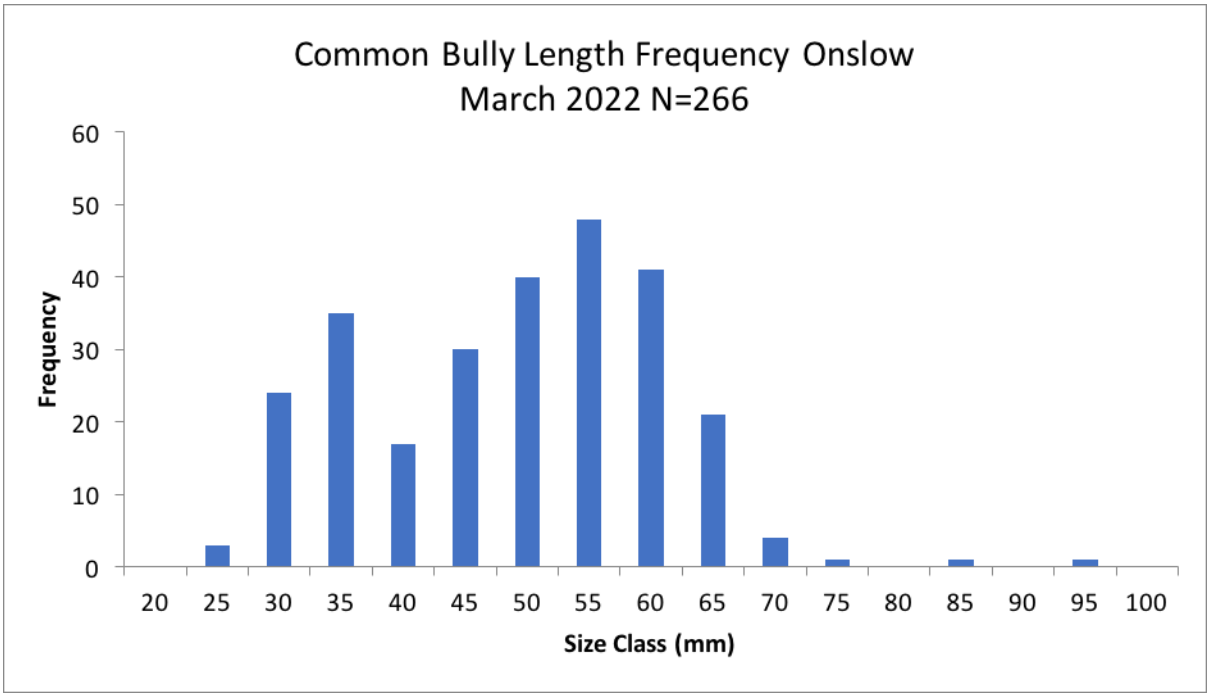


Figure 1, size class distribution for brown trout caught in Lake Onslow.

In two consecutive years, in March, the same section of rocky shoreline was electro-fished and the bullies captured measured and returned to the water. This allows comparison of size class distributions from year to year. From the histograms it can be seen that there are size class peaks at 35 and 55-60mm representing 2 age groups.





Length frequency histograms for common bully age classes 2021 and 2022.

Ross Dungey
12/6/22

APPENDIX 4 – CLUTHA RIVER HYDROGRAPH