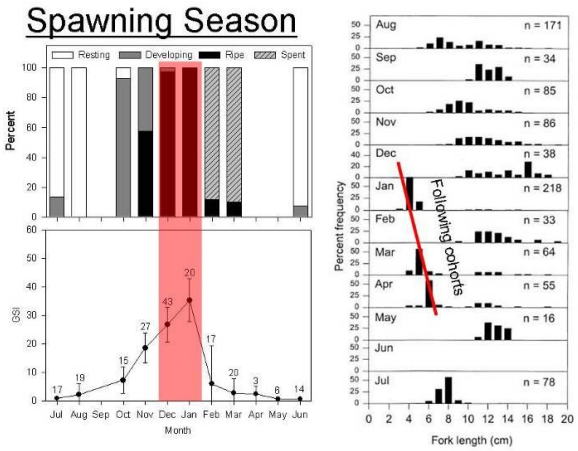
Course Assignment – GENERAL FEEDBACK

The key questions drive this experiment and their requirements affect your sampling design.

- **When is the spawning season?**

This is achieved through sampling fish throughout the year and you could do this by:

a) Relative change in GSI from mature fish.
b) Proportion of mature fish from macroscopic staging.
c) The presence of juveniles in the shallows.



Unfortunately you do not know at what size the fish spawn in this lake, so you will have to sample a good size range with every sampling date and adjust/discard values from immature fish once you have calculated maturity.

- **Where do the fish spawn?**

This is achieved by looking for congregations of fish over the spawning season. Here you would monitor CPUE from gears at set sampling sites and determine if CPUE increases at certain localities over the spawning season. If the majority of fish caught at a site/sites is mature and CPUE of mature individuals declines elsewhere, then one can conclude that the fish are aggregating to spawn. The abundance of juveniles (fry seine CPUE) may also increase near spawning sites.

- **What is the size/age at maturity?**

Here you need to sample a large number of fish over the spawning season and for each length category determine the number of mature fish from macroscopic staging. As you only have one year in which to sample, a good method here would be to look at the maturity of the largest fish and when a large proportion of these is mature, adapt the sampling strategy to target large numbers of fish in all size classes. Then fit a maturity ogive. If you remove otoliths from these fish then you can estimate age at maturity directly. You may validate this growth either by using OTC and

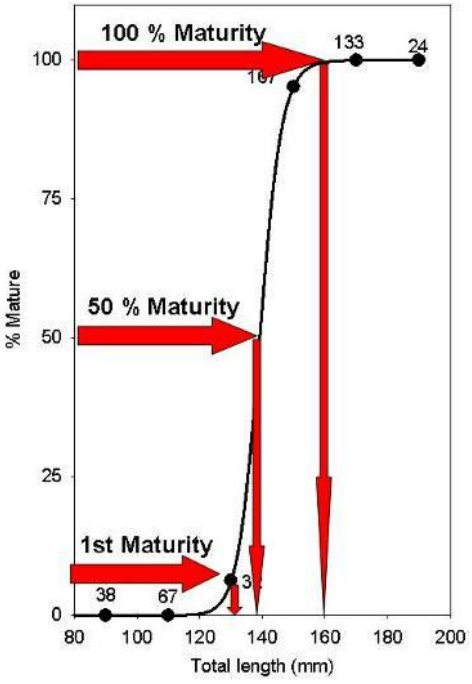
- Fit a 2-parameter logistic ogive (see King 1995 for worked example)

$$P(L) = \frac{1}{1+e^{-(L-L_{50})/\delta}}$$

P(L) = % of mature fish at length L

L_{50} = Length at 50% sexual maturity

δ = Width or steepness of ogive



tags from early samples i.e. 1st trip only and through collecting otoliths from all fish sampled throughout the year and doing Marginal Zone Analysis (MZA).

- What environmental factors influence the spawning period?

Here essentially you need to link your information of seasonal GSI and maturity stage to environmental variables such as rainfall, temperature, day-length, plankton availability, secchi depth etc.

1. A sketch of Glen Melville reservoir showing the main habitats that may influence your study.

What is important is that the fish may be anywhere in the dam at any given time and you need good coverage. The main habitats were:

- Steep slopes near the wall with gravel beds
- 2 inflowing rivers one main channel at the top of the dam and another smaller one.
- Deep central portion of the dam.
- Gently sloping shores with trees
- Bays.
- Steep slope/cliff area

2. The location of your sampling sites and a justification for choosing these.
Good coverage is needed and essentially both stratified and random designs are appropriate, as long as all habitats are covered. For this reason, stratification may be more suitable. Generally, most covered the dam appropriately.

3. What gear you will use to sample and where you will employ it. There is need for replication and not each gear type is appropriate for each area. A typical design might be:

Gear	Deep central area	Clear area near dam wall	Gently sloping shores with trees	Bays	River inlets	Remarks
Gill net	X	X	X	X	X	Useful everywhere and can give an indication of movement during the spawning season. Replicate by making at least 3 sets per area per month.
Fyke net	X	X	X	X	X	
Long lines						
30m seine net		X				Severely limited by trees and other obstructions. Probably not all that useful in this study but may provide some information in areas where it can be used.
Fry seine		X	X	X	X	Can be pulled between trees as it is relatively small. Replicate by making 3 hauls per area.
Electrofisher			X	X	X	Could be used to look for juveniles in shallow areas.
Rotenone						May be used in isolated pools but the dam is a drinking water supply so maybe not that useful.
Tagging Kit						This is mainly for mark-recapture and could be used for validation. However, the study is generally too short for undertaking this.

4. Sampling dates and a justification for choosing these.

Here it is important to sample all seasons. Both 3 consecutive days per month or 3 random days per month are appropriate, as long as there was random start. It may also be useful to calculate in the need for intensive sampling over the spawning season to determine length at maturity.

5. Sample size for each of the studies.
This relates to each study. What was important here is to mention that this depends on what confidence is expected of the sample (eg. CV of 20% with a 95% confidence limit). Then sample size can be calculated from your standard deviation from initial samples (check lecture notes for technique). Essentially, I would start with a large sample of fish for GSI (n =60), check mean and standard deviation and then adjust sample size accordingly. For length/age at maturity one would like to target about 30 fish per size class. This may not be achievable but it is important to set goals.

6. A short description of potential sampling bias and how you will overcome this.
All gears have some inherent bias. Therefore, use as wide a variety as possible to sample fish. Examples are listed below but this list is not exhaustive.

Gear	Bias	Solution
Gill net	Size selective	Use many mesh sizes.
Fyke net	Actively moving fish	Supplement with other gears.
Long lines	Size bias Actively feeding fish	Use many hook sizes Supplement with samples from other gears
30m seine net	May select small fish Area limitation	Supplement samples using other gears eg gill nets, fyke nets etc
Fry seine	Selects small fish Area limitation	Supplement samples using other gears eg electro-fisher
Electrofisher	Avoidance	Supplement samples using other gears eg fry seine
Rotenone	None for reproductive study but may kill too many fish and have ecological effects. Difficult to monitor movements.	Supplement with other gears.

7. Your field data sheets showing what information you will collect.

Your study is on the reproductive biology so what is important is to capture all the key elements. Remember that GSI is calculated from gonad mass and eviscerated mass. So your datasheet will need to include temporal, environmental, sampling and fish variables:

Temporal: Date, time & moonphase

Environmental: Sampling site, temperature, pH, rainfall, river flow etc

Sampling: Gear type, gear length, soak time, mesh size, bait type etc.

Fish: Length, sex, fish mass, gonad stage, gonad mass & eviscerated mass.

This may require a series of sheets to be filled in the field and in the laboratory.

SURVEY DATA FORM - Environmental parameters

Sampling date		Waterbody:	Site:
Remarks/description:			

Site	GPS co-ords	Gear	Temp ^{o}C	Secchi Depth	Depth	Substrate	Other descriptive criteria…

SURVEY DATA FORM - CPUE

Sampling date		Waterbody:	Site:
GPS co-ord			
Remarks/description:			

Species composition

Gear Type					
Gear length		Mesh size		Gear depth	
Number of hooks		Hook size		Bait type	
No of traps		Lead length			
Start time		End time		Hours fished	

	Small fish	Medium fish	Large fish	Total Catch
Total catch (kg)				
Sample (kg)				

Species	Weight	Number	Species	Weight	Number

Mesh size	Species	Length	Mesh size	Species	Length

SURVEY DATA FORM – Gonad Analysis

Sampling date		Waterbody:	Site:
Remarks/description:			

Species	TL	FL	SL	Weight	Sex	Gonad stage	Gonad mass	Eviscerated mass	Remarks