
Internal Assessment Resource

Biology 2.1 (AS 91153)

In conjunction with

Biology 2.3 (AS 91155)

Total: 7 credits

Gisborne District Council

Prepared by Amy-Rose Hardy

Nga Mahi Te Taiao

Table of Contents

Internal Assessment Resource	3
Framework Summary	4
Achievement Standard 91153 (Biology 2.1)	5
Teacher Guidelines	6
Student Instruction Sheet	8
Student Checklist	9
Assessment Schedule	10
Exemplar for Achieved	11
Exemplar for Merit	17
Exemplar for Excellence	20
Achievement Standard 91155 (Biology 2.3)	24
Teacher Guidelines	25
Student Instructions	27
Assessment Schedule and Examples	32
Diagrams used as Evidence	37

Gisborne District Council

Produced by
Nga Mahi Te Taiao

2016

Internal Assessment Resource

Biology Level 2

This resource supports assessment against:

<p>Achievement Standard 91153</p> <p>Biology 2.1</p> <p>Carry out a practical investigation in a biology context, with supervision</p> <p>Credits: 4</p>	<p>In conjunction with:</p>	<p>Achievement Standard 91155</p> <p>Biology 2.3</p> <p>Demonstrate understanding of adaptation of plants or animals to their way of life</p> <p>Credits: 3</p>
--	-----------------------------	---

<p>This resource:</p> <p>Clarifies the requirements of the Bio 2.1 standard and the Bio 2.3 standard</p> <p>Supports good assessment practice</p> <p>Should be subjected to the school’s usual assessment quality assurance process</p> <p>Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic</p> <p>Timeframe and deadlines should be modified for the overall outcome of both standards to achieve a total of 7 credits in Biology level 2</p>

Framework Summary

Bio 2.1

This achievement standard is to be completed first.

Outline	
<i>Developing a method</i>	Develop a method to investigate what correlation (strong or weak) occurs in the macroinvertebrate community index (MCI) and/or quantified MCI (QMCI) when invertebrates are gathered from different stream habitats.
<i>Carrying out the investigation</i>	Collect, record and process data from the investigation. This includes: <ul style="list-style-type: none">- 3 – 4 site visits to different stream habitats (2 habitats could be from one site/field trip as outlined in the standard)- Recording and calculating a habitat assessment score and identifying invertebrates to calculate a MCI and QMCI score
<i>Reporting</i>	Process all data to conclude the results and trends of the investigation in relation to the purpose (aim and hypothesis) with an overall evaluation.

Bio 2.3

This achievement standard is to be completed after 2.1, using the findings and results gathered in the above investigation to report on, with additional research, for this final report.

This activity requires students to demonstrate understanding of adaptations across **three** taxonomic animal groups, including the galaxias maculatus (inanga - whitebait species), a stonefly OR mayfly, and a sea bird of their choice (e.g. black billed gull, Hutton's shearwater, or Sooty shearwater), for the life process of reproduction.

Outline	
<i>Practicals</i>	Draw biological drawings and/or take photos, labelling features/adaptations involved in reproduction. Photos can be used from Bio 2.1 where relevant.
<i>Research</i> <ul style="list-style-type: none">- <i>Collecting and Processing</i>	Collecting and processing information for each animal: <ul style="list-style-type: none">- Description of their ecological niche, adaptations for reproduction and how or why these help them to carry out reproduction successfully in their habitat- Advantages and/or limitations of their adaptations Information can be used from Bio 2.1 where relevant and access to online resources, books etc.
<i>Reporting</i>	Final report: <ul style="list-style-type: none">- All information gathered from individual research and selecting relevant data from their Bio 2.1 final report will conclude their report and compare adaptations across the three selected animals for reproduction.

Gisborne District Council

**Produced By
Nga Mahi Te Taiao**

2016

Internal Assessment Resource Biology Level 2

This resource supports assessment against:

Achievement Standard 91153

Biology 2.1

Carry out a practical investigation in a biology context, with supervision

4 credits

Resource title: Life in the Water

This resource:

- Clarifies the requirements of the standard
- Supports good assessment practice
- Should be subjected to the school's usual assessment quality assurance process
- Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic

Teacher Guidelines:

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource. These teacher guidelines do not need to be submitted for moderation.

Context/setting:

Students are expected to carry out a practical investigation at three or four stream sites to complete habitat assessments combined with a biological assessment of the Macroinvertebrate Community Index (MCI) and/or Quantified Macroinvertebrate Community Index (QMCI) to determine if there is a correlation with varied habitats. This will ultimately reveal preferred habitats for varied invertebrate species that are indicative of stream health.

Students will need considerable practice at developing investigations: to plan, carry out, record, process and interpret data; develop a conclusion; discuss biological concepts and processes relating to the investigation (i.e. what the investigation showed about the concept or process), and evaluate the investigation.

Students will need to have some knowledge of freshwater invertebrates, MCI and/or QMCI scoring and their sensitivity of physical elements. They should also be aware of the New Zealand standard protocols for assessing stream health and aware that they will be gathering information and data that are components for indicative water quality levels.

This investigation involves the manipulation of variables (fair test).

The investigation is to be carried out with teacher *supervision* by giving the students guidelines for the investigation (refer to the student's instruction sheet and checklist provided). The investigation must be at level 7 of Biology in the New Zealand Curriculum.

Conditions:

This is a practical activity where the class will work as a group on the site visits (with supervision), however, students will record their own measurements and results individually. Samples will be taken in groups (i.e. gathering macroinvertebrates) and identified and recorded individually. All work done in the classroom will be completed individually.

It is suggested that students are given one class period for development and trial of their investigation (e.g. trial can be from a site near the school such as the Taruheru River at the end of Stanley Road or simply just going through their provided worksheets and concluding how they will document their recordings and practice estimating percentages of sample areas). Two class periods are suggested for recording of data from a range of sites (i.e. Waihirere Domain (two sample sites) and a site in town representative of a soft bottom stream). Extra classes will be used to process the data and write a report concluding this.

Time schedules for this achievement standard are flexible and should be accustomed to your learning context, therefore, teachers are given the opportunity to

adapt this achievement standard with Bio 2.3 (AS91155) for a complete time line for both final reports (Bio 2.1 and Bio 2.3).

Resource requirements:

Hand nets, basins, magnifying glasses, habitat assessment worksheets (provided by Nga Mahi Te Taiao), pens, measuring tape, compartment containers, plastic spoons, water sample containers, Wai Care Invertebrate Monitoring Protocol ID Sheet (provided by Nga Mahi Te Taiao), invertebrate tolerance identification sheet (provided by Nga Mahi Te Taiao), camera (school camera, phone or ipad – these photos can be taken as a group and shared for all students to use in their final reports for Bio 2.1 and Bio 2.3).

Additional information:

Health and safety procedures and compliance with the Animal Welfare Act 1999 must be followed.

Health and safety procedures and policies are to be followed for all out-of-class field trips. A number of health and safety documents are provided for these field trips (provided by Nga Mahi Te Taiao, produced by the Whitebait Connection Programme).

During the teaching and learning of the investigation procedures related to Year 12 Biology, examples of achieved, achievement with merit and achievement with excellence reports should be gathered and annotated to highlight evidence that meets the standard. The annotations should be developed through consultation with other Year 12 Biology teachers and the reports kept for future reference.

It is expected that students will have carried out a similar investigation and have practised the use of the processing and graphing techniques appropriate to this investigation. Therefore students will be familiar with the need to use a presence-absence scoring calculation for MCI scores and a quantified calculation method for the total number of taxa identified for QMCI scores. A document explaining how to calculate these scores can be provided by Nga Mahi Te Taiao.

To gain merit and excellence students need to **discuss and evaluate** the investigation. In the discussion they need to show understanding of how and why habitat assessments correlate with hard and soft bottom MCI scores and be able to relate this to their results and to relevant findings from other source(s) by discussing what their results (i.e. strong or weak correlation) show. In the evaluation they must show understanding by discussing how they ensured that the method they used was **valid and reliable** i.e. how sources of errors were minimised, limitations overcome, how bias (the lack of objectivity when carrying out the investigation) was removed and how they know they gathered sufficient data.

Gisborne District Council

Produced by Nga Mahi Te Taiao

2016

Internal assessment Resource

Subject Reference: **Biology 2.1**

“Life in the Water”

Supports internal assessment for:

Achievement Standard 91153

Carry out a practical biological investigation with supervision.

Credits: 4

Student Instructions Sheet

Conditions

1. This is a practical activity; stream site visits include both group and individual work. Samples are to be gathered in groups, identifying and recording results are to be completed individually. All class work is to be completed individually.
2. You are given one hour (1 class lesson) to develop and trial your investigation (e.g. trial will occur near the school i.e. Taruheru River at the end of Stanley Road or by going through your worksheets to conclude how results will be recorded and how to estimate percentages etc).
3. You will be allowed two site visits (two lessons) to carry out the investigation and record all data.
4. **Teachers:** Please include a timeframe that will coincide with your teaching criteria and context.
5. **Teachers:** Please include whether students can take home their work or if they need to hand it in at the end of each classroom session.

Teacher Note: Please adapt and modify the timeframe and deadlines as appropriate to coincide with your students learning context.

The following equipment is available:

Hand nets, basins, magnifying glasses, habitat assessment worksheets, MCI and QMCI assessment worksheets, pens, measuring tape, Macroinvertebrate Identification Sheet, tolerance invertebrate identification sheet, camera, compartment containers, water sample containers.

Instructions: You are to develop and carry out an investigation of different stream habitats (site visits) and identify the absence or presence of macroinvertebrates that are indicative of stream health at each.	CHECK LIST
Task 1: Developing a method Develop a method to investigate what correlation (strong or weak) occurs in the macroinvertebrate community index (MCI) and/or quantified MCI (QMCI) when invertebrates are gathered from different stream habitats. <i>Your method should state:</i>	
<ul style="list-style-type: none"> the purpose for your investigation (aim and hypothesis) in relation to the MCI and/or QMCI 	
<ul style="list-style-type: none"> the range over which the independent variable will be changed 	
<ul style="list-style-type: none"> how the dependent variable will be measured 	
<ul style="list-style-type: none"> how you will control or measure other variables or factors that could have a significant impact on your investigation 	
<ul style="list-style-type: none"> how you will ensure your results are accurate, valid and reliable 	
Trial your investigation method, then use the information you found out in your trial to develop it into a step by step method .	
Task 2: Carrying out the investigation	
1. Carry out your investigation, recording any changes that you make to your initial method developed in task 1.	
2. Record data and observations relevant to your investigation in an appropriate way.	
3. Process your data to produce results that can be compared directly with each other i.e. to enable a trend or pattern (or absence) to be determined.	
4. Graph the processed data in a way that allows you to interpret the trend in the data.	
Task 3: Reporting Write a well-organised report on your investigation which includes:	
<ul style="list-style-type: none"> The purpose of the investigation (e.g. explicit aim and hypothesis) in relation to the MCI and/or QMCI 	
<ul style="list-style-type: none"> The final step by step method used in the investigation. 	
<ul style="list-style-type: none"> Recorded measurements and observations. 	
<ul style="list-style-type: none"> All processed data, including a graph. 	
<ul style="list-style-type: none"> A conclusion interpreting the trend shown by the data in relation to the purpose of the investigation. 	
<ul style="list-style-type: none"> Relevant findings from another source(s) are identified and included 	
<ul style="list-style-type: none"> A discussion of MCI and/or QMCI scores in relation to the results of the investigation and those from relevant finding from other source(s). 	
<ul style="list-style-type: none"> An evaluation of the investigation. This could consider reliability of the data or the validity of the method (i.e. how sources of error, limitations, or bias were minimised or overcome). 	

Assessment schedule: Bio 2.1 – Life in the Water

To be awarded the grade (A, M or E) the student must meet the holistic judgement statement at the top of the column.

Achieved	Achieved with Merit	Achieved with Excellence
The report shows the development and carrying out of an investigation.	The report shows the development and carrying out of a quality investigation.	The report shows development, carrying out and evaluation of a quality investigation.
<p>The report includes:</p> <p>Purpose of the investigation (aim and hypothesis) describing what will happen to the absence or presence of invertebrates within different stream habitats</p> <p>A method that includes a description of</p> <ul style="list-style-type: none"> Independent variable - range of stream habitats. For example, at least three different habitats (sites) i.e. two distinct habitats at waihirere domain and one or two habitats from town streams. Dependent variable – MCI score, measured using the invertebrate identification chart (presence-absence measurement/calculation) Control or measurement of some (i.e. at least two) other variables / factors e.g. same size net to collect invertebrates, same amount of sample scoops taken (4 repeats at each site), location in the stream where samples are taken i.e. from emerging plants or from the substrate, same sample size (only gather invertebrates from within a two metre width of the stream), habitat scores are completed within a 20m strip of the stream. <p>Collecting, recording and processing of data relevant to the purpose</p> <ul style="list-style-type: none"> MCI scores against habitat scores collected and recorded Data processed relevant to purpose e.g. averaging of results for MCI and habitat scores or a graph of results <p>Reporting on the findings</p> <ul style="list-style-type: none"> Conclusion reached based on the processed data in relation to the purpose of the investigation. 	<p>The report includes:</p> <p>Purpose of the investigation (aim and hypothesis) describing what will happen to the absence or presence of invertebrates within different stream habitats</p> <p>A method that includes a description of</p> <ul style="list-style-type: none"> Independent variable - valid range of stream habitats. At least three different habitats (preferably four) including a hard bottom stream and a soft bottom stream. Repeats include in the four habitat sites = 2x hard bottom and 2x soft bottom sites. Dependent variable – MCI, measured using the tolerance score sheet for hard bottom and soft bottom invertebrates Control or measurement of most other variables / factors e.g. same size net to collect invertebrates, same amount of sample scoops taken (4 repeats at each site), location in the stream where samples are taken i.e. from emerging plants or from the substrate, same sample size (only gather invertebrates from within a two metre strip of the stream), habitat scores are completed within a 20m strip of the stream. <p>Collecting, recording and processing of data to enable a trend or pattern to be determined</p> <ul style="list-style-type: none"> Sufficient data recorded (valid range, at least 4 different habitats and MCI score recorded through the correct tolerance score in relation to hard or soft bottom streams) Data processing allows a trend or pattern (or absence) to be interpreted – accurate averaging of results, calculation of MCI scores (HB or SB calculations) for each site 	<p>As for merit PLUS:</p> <ul style="list-style-type: none"> Evaluation of the investigation by justification of the conclusion in terms of the method used, such as sufficient data, appropriate processing using QMCI calculations and correct reference to tolerance scores of invertebrates, minimisation or removal of sources of errors, limitations, bias. <p>Example for Excellence:</p> <p>Please refer to the exemplar.</p>

<ul style="list-style-type: none"> • <i>Relevant findings from other source is identified and included.</i> <p>Example for Achieved:</p> <p>Please refer to the exemplar.</p>	<p>as well as a habitat score to reveal relationships and conclusions (A graph of results can also be used)</p> <p>Reporting on the findings</p> <ul style="list-style-type: none"> • Valid conclusion reached based on the processed data in relation to the purpose of the investigation. • Discussion uses knowledge of the stream assessments and those from other sources to explain the trend or pattern in the results i.e. the overall biological scores for stream health. <p>Example of Merit:</p> <p>Please refer to the exemplar.</p>	
---	--	--

Exemplar for Achieved – Life in the water

Purpose:

When the habitat score of a stream increases, the MCI score will increase, resulting in a higher water quality environment.

Method:

A **method** includes:

Three to Four different sites (all exemplars include four sites – this is to be determined by the teacher in relation to their learning context and circumstances);

ACHIEVED – *at least **two** of the following variables need to be in the method.*

MERIT – ***most** of the following variables need to be included in the method (or as proposed by the teacher)*

EXCELLENCE – *as for merit*

repeats (step 11) for four samples of invertebrates at each site; same length of the sample area (step 6), same shape/size of the basin (step 7), same size of the D-net (step 8), same distance/area being sampled from the net (Step 9), same amount of time kicking the substrate (step 8), same size of the habitat sample (step 4).

All factors are shown in the achieved exemplar, however, not all factors need to be considered for achieved, merit or excellence. Therefore, this method is used as an exemplar for all three achievement levels and teachers can assess the student's grade appropriately from this.

Method:

1. Ensure that the sampling net and basin are clean.
2. Visit first site and identify the habitat area to record
(most appropriate site i.e. hard bottom stream = riffle area, soft bottom stream = where emerging plants, woody debris and bank margins are present)
(initiated by the teacher/supervisor)

HARD BOTTOM METHOD



3. Measure 20m along the stream bank where you will gather your invertebrates from. This is your sample size to assess for a habitat score.
4. Complete the habitat assessment worksheet individually, completing visual assessments of the area being examined in percentages of the entire 20m sample. Recording all data on the worksheet.
5. Get into an assigned group and identify the site where you will gather invertebrates (i.e. riffles for hard bottom habitats)
(teacher will assign students into groups prior to field trip)
6. Measure out 2 meters with the measuring tape along the stream bank (from within your habitat sample). This is the sample size where invertebrates are gathered from. (2 meter width of the stream).
7. Fill one rounded basin (30cm diameter) with 1/3 water from the stream. This water needs to be collected 10m downstream from where you have identified your sample site. One group member to do this.
8. One group member will use a D-net (all the same size with a 30cm width along the base and 5mm mesh) and place the net on the streambed facing upstream for invertebrates to flow into. This is placed within the 2 meter width sample area.
9. Once the net is on the streambed, step into the sampling area (0.2 m²) immediately upstream of the net (no

SOFT BOTTOM METHOD



3. Measure 20m along the stream bank where you will gather your invertebrates from. This is your sample size to assess for a habitat score.
4. Complete the habitat assessment worksheet individually, completing visual assessments of the area being examined in percentages of the entire 20m sample. Recording all data on the worksheet.
5. Get into an assigned group and identify the site where you will gather invertebrates (i.e. where emerging plants, woody debris and bank margins are present)
(teacher will assign students into group prior to field trip)
6. Measure out 2 meters with the measuring tape along the stream bank (from within your habitat sample). This is the sample size where invertebrates are gathered from. (2 meter width of the stream).
7. Fill one rounded basin (30cm diameter) with 1/3 water from the stream. This water needs to be collected 10m downstream from where you have identified your sample site. One group member to do this.
8. Sample woody debris, bank margins, or aquatic macrophytes using the following procedures. Avoid dredging the net along the bottom in mud or sand, and avoid leaves and algae if possible. Avoid hard (stony) substrates
9. One group member will use a D-net (all the same size with a 30cm width along the base and 5mm mesh) from within the sample size of 2 metres, sampling either:

- further than 0.5 metres upstream from the net) and disturb the substrate under your feet by kicking to dislodge the upper layer of cobbles or gravel. Kick for 1 minute.
10. Remove the material from the net into the container of 1/3 water.
 11. Repeat step 7 – 9 at three different locations within the 2 meter width of the stream to cover a 0.6 - 1.0m² area. All invertebrates are to be emptied into the same basin.
 12. Once all four samples are completed, bring the container of invertebrates up to a flat and shaded area for identification.
 13. Separate invertebrates out into the other compartment container with a plastic spoon, placing species together in their groups i.e. all rounded snails in one and all mayflies in another.
 14. Individually identify and record all different species in the container using the invertebrate identification chart and record the total number of each species.
 15. Once every group member has recorded their own data, take the container back to the stream and release the invertebrates without harming or damaging them. Rinse all equipment used.
 16. Repeat steps 3 – 15 at all other **hard bottom** sites.

Woody debris - Select submerged and partially decayed woody debris.

Place over the opening of the net and pour water over the substrate while brushing the substrate gently by hand to remove organisms. Larger pieces may be sampled in situ by brushing the log while holding the net directly behind

OR

Bank margins - Locate an area of bank with good structure and aggressively jab the net into the bank for a distance of 1-metre to dislodge organisms, followed by 2-3 cleaning sweeps to collect organisms in the water column.

OR

Macrophytes - Sweep the net through macrophyte beds for a distance of 1-metre to dislodge organisms, followed by 2-3 cleaning sweeps to collect organisms in the water column.

10. Remove the material from the net into the container of 1/3 water.
11. Repeat step 8 – 10 at three different locations within the 2 meter width of the stream to cover a unit effort of 0.3 m². All invertebrates are to be emptied into the same basin.
12. Once all four samples are completed, bring the container of invertebrates up to a flat and shaded area for identification.
13. Separate invertebrates out into the other compartment container with a plastic spoon, placing species together in their groups i.e. all rounded snails in one and all mayflies in another.
14. Individually identify and record all different species in the container using the invertebrate identification chart and record the total number of each species.
15. Once every group member has recorded their own data, take the container back to the stream and release the invertebrates without harming or damaging them. Rinse all equipment used.
16. Repeat steps 3 – 15 at all other **soft bottom** sites.

PLEASE NOTE: For **achieved**, students can complete their recording tables for the MCI and habitat scores OR a graph can be completed with both scores to show as one increases, the other increases. Either one can be used for a pass grade if recorded and calculated correctly. This exemplar includes both, however, both do not need to be completed for an achieved grade.

Habitat Recording Worksheet

Worksheets provided – students are to complete their site scores individually (this is the only component of this worksheet that they will fill out before they calculate the overall habitat score of each site – as shown at the bottom of the worksheet).

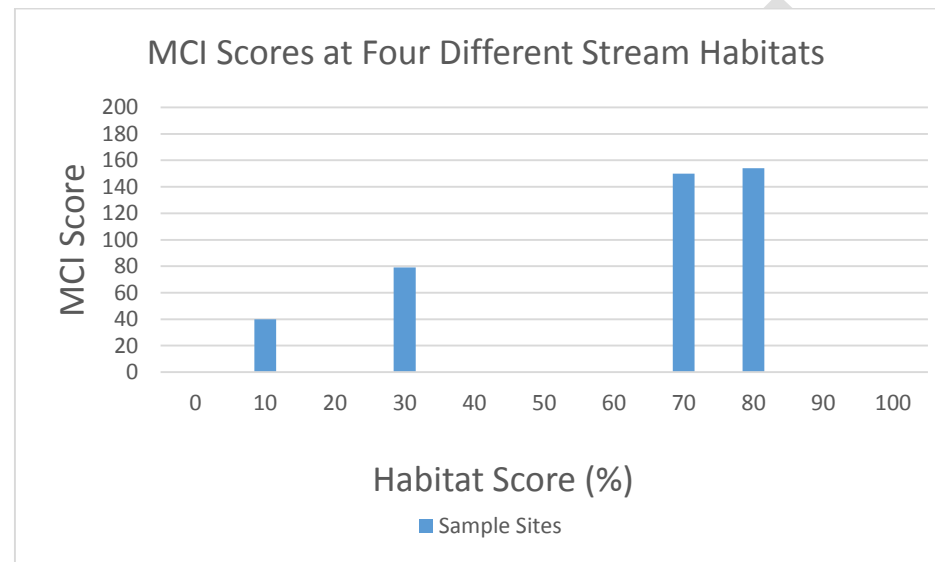
Habitat parameter	Condition category										SCORE			
											Site 1	Site 2	Site 3	Site 4
1. Streambed composition	The percentage of cover making up the stream bed.										8	9	2	1
	Boulders, large cobbles, and/or small cobbles			Small cobbles and gravel		Bedrock, gravel and/or sand		Mud/silt or man-made (e.g. concrete)						
SCORE	10	9	8	7	6	5	4	3	2	1				
2. Macrophytes and Periphyton	The percentage of macrophytes and periphyton covering the stream bed.										6	7	4	1
	≤10	20	30	40	50	60	70	80	90	100				
SCORE	10	9	8	7	6	5	4	3	2	1				
3. Bank vegetation	The maturity, diversity and naturalness of bank vegetation.										8	9	2	1
	Left bank AND Right bank	Mature native trees with diverse and intact understorey	Regenerating native or flaxes/sedges/tussock > dense exotic		Mature shrubs, sparse tree cover > young exotic, long grass		Heavily grazed or mown grass > bare/impervious ground.							
SCORE	10	9	8	7	6	5	4	3	2	1				
4. Riparian shade	The percentage of shading of the stream bed throughout the day due to vegetation, banks or other structure(s).										7	7	4	1
	≥ 90	80	70	60	50	40	25	15	10	≤ 5				
SCORE	10	9	8	7	6	5	4	3	2	1				
5. Water velocity	The velocity of water flowing through the site (m/s).										6	8	3	1
	≥1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1				
SCORE	10	9	8	7	6	5	4	3	2	1				
TOTAL	(Sum of parameters 1-5, averaged and then multiplied by 10 (score) to provide a percentage out of 100)										=35/5=7	=40/5=8	=15/5=3	=5/5=1
											=7x10	=8x10	=3x10	=1x10
											=70%	=80%	=30%	=10%

Macroinvertebrate Recording Sheet

Worksheets provided – only completing the number of each species and the tolerance score shown for that species on the ID sheet provided.

Completed On Site					Completed In Class	
Stream Habitat Sites	Invertebrates (name)	Number of each species	Number of Taxa	HB or SB	Tolerance Score (from ID chart)	MCI Score
Site 1	Rounded snails	20	5	HB	3	$3+8+10+9 = 30$ $30/4=7.5$ $7.5 \times 20 = 150$
	Flat Mayfly	15			8	
	Spiral cased caddisfly	7			10	
	Smooth cased caddisfly	9			9	
	TOTAL	59				150
Site 2	Mayflies	10	3	HB	8	$8+9+6=23$ $23/3=7.7$ $7.7 \times 20=154$
	Smooth cased caddisfly	5			9	
	Stony cased caddisfly	16			6	
	TOTAL	31				154
Site 3	Pond skater	25	4	SB	5	$4.6+5.2+2.2+3.8=15.8$ $15.8/4=3.95$ $3.95 \times 20=79$
	Mite	4			5	
	Backswimmer	15			5	
	Oligochaete	11			1	
	TOTAL	55				79
Site 4	Oligochaete worm	25	2	SB	1	$1+3=4$ $4/2=2$ $2 \times 20=40$
	Rounded snails	19			3	
	TOTAL	44				40

Graph for MCI and Habitat Scores



Observations:

The visual cues of each habitat reflected the overall habitat score. For example, at site 3 it was a silty/soft bottom stream and slow flowing with hardly any vegetation compared with site 2 which had native trees and vegetation along the banks and a stony/hard bottom.

The types of invertebrates found at each site varied significantly. Most of these animals came from the “green” category for stream health with high sensitivity. Site 1 and 2 had larger and more active animals that were easy to identify, whereas site 3 and 4 had smaller worm type animals that were slower passed. Most of these animals came from the “red” category of stream health with low sensitivity.

Conclusion:

My results show that when a stream's habitat score is low, the MCI score is low. As the habitat score increases, the MCI score also increases. This is what we predicted with higher habitat scores, where higher scoring invertebrates are more sensitive to their surroundings and will only survive in higher quality environments. A report produced by Cawthron Institute states that, “assessing entire communities of macroinvertebrate species that are present can be used to convey information about the health of their habitats”. The report also states that, “the invertebrate scores are related in some way to stream condition or an environment gradient, for example, the surrounding habitat indicators”. This confirms our results and conclusion from our investigation.

Exemplar for Merit – Life in the Water

Purpose:

As for achieved

Method:

The variables/factors shown in the achieved exemplar are all included, therefore, a merit report would include most of those variables/factors identified (or as proposed by the teacher).

Habitat Recording Sheet:

Accurate recording and calculating as shown in the achieved exemplar.

Macroinvertebrate Sheet:

As for achieved **PLUS:**

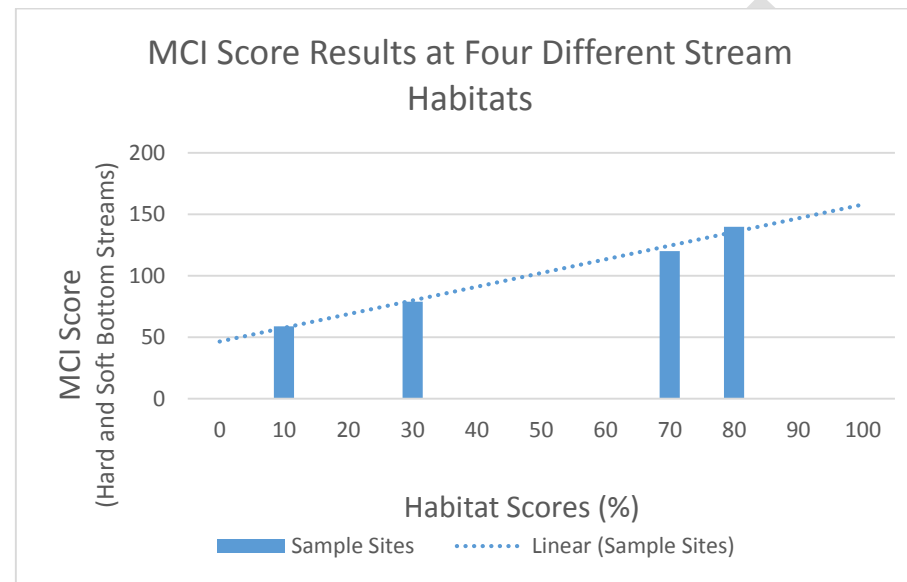
The invertebrate tolerance scores for hard and soft bottom streams are recorded and calculation of the MCI score is completed as shown in the table below:

Please note: For achieved, the MCI can be calculated off the *Wai Care Invertebrate Monitoring Protocol ID Sheet*, whereas, the hard bottom and soft bottom tolerance scores are calculated off the *Invertebrate Tolerance Identification sheet*. Therefore, answers for MCI calculations in achieved will vary to answers for MCI calculations in Merit. Students will not be asked for the scientific names of these invertebrates, an identification sheet will be provided so students gaining merit or excellence can then search for the scientific name provided to get the hard and soft bottom scores for each. They will then identify whether the site was hard bottom or soft bottom and complete their calculations for the MCI using the appropriate score.

Macroinvertebrate Recording Sheet

Stream Habitat Sites	Invertebrates (name)	Number of each species	Number of Taxa	HB or SB	Tolerance Score		MCI Score
					HB	SB	
Site 1	Rounded snails (Potamopyrgus)	20	5	HB	4	2.1	4+8+10+8 = 30 30/5=6 6x20 = 120
	Mayflies (Deleatidium)	15			8	5.6	
	Spiral cased caddisfly (Helicopsyche)	7			10	8.6	
	Smooth cased caddisfly (Olinga)	9			8	7	
		8					
	TOTAL	59					120
Site 2	Mayflies (Deleatidium)	10	3	HB	8	5.6	8+8+5=21 21/3=7 7x20=140
	Smooth cased caddisfly (Olinga)	5			8	7	
	Stony cased caddisfly (Pycnocentroides)	16			5	3.8	
	TOTAL	31					140
Site 3	Pond skater (Microvelia)	25	4	SB	5	4.6	4.6+5.2+2.2+3.8= 15.8 15.8/4=3.95 3.95x20=79
	Mite (Acari)	4			5	5.2	
	Backswimmer (Anisops)	15			5	2.2	
	Oligochaete Worm	11			1	3.8	
	TOTAL	55					79
Site 4	Oligochaete worm	25	2	SB	1	3.8	3.8+2.1=5.9 5.9/2=2.95 2.95x20=59
	Rounded snails (potamopyrgus)	19			4	2.1	
	TOTAL	44					59

Graph for MCI and Habitat Scores:



Observations:

As for achieved

Conclusion:

As for achieved PLUS

When the habitat score increases every 10%, my results show that the MCI score increases by 10 also. This shows a strong correlation between these two factors and that the hard bottom streams show a much higher MCI score compared with the two soft bottom streams. The invertebrates identified within the hard bottom streams had much higher sensitivity/tolerance scores, revealing the importance of their biotic and abiotic surroundings. These results conclude that the higher your MCI and habitat scores are, that it is more indicative of higher water quality of that area and the survival rate for the more sensitive invertebrates increases (shown in the results as they are present within these environments with higher habitat scores).

Discussion:

When we gathered results from all the different habitat sites, the two main factors that influenced our results, and were scored significantly different, were the streambed score and vegetation score between hard bottom and soft bottom sites. The National Institute of Water and Atmospheric Research (NIWA) states that, “the plants and animals that live in and around the beds of streams can provide a very good indication of overall stream health. This is because many organisms have preferences for certain ranges of conditions. Invertebrates in general are good “integrators” of stream condition at a particular site because most do not move around very much in the stream. The community is therefore susceptible to the effects of localised pollution and disturbances”. Our results that transpired are due to this biological idea, therefore, physical components of a stream can be observed through an investigation and assessment of habitat and MCI scores to indicate the changes of these elements through the biotic factors that are present and/or absent.

Exemplar for excellence – Life in the Water**Purpose:**

When the habitat score of a stream increases, the MCI and QMCI scores will increase, resulting in a higher water quality environment for the survival of more sensitive invertebrates.

Method:

As for merit

Habitat Recording Sheet:

As for merit

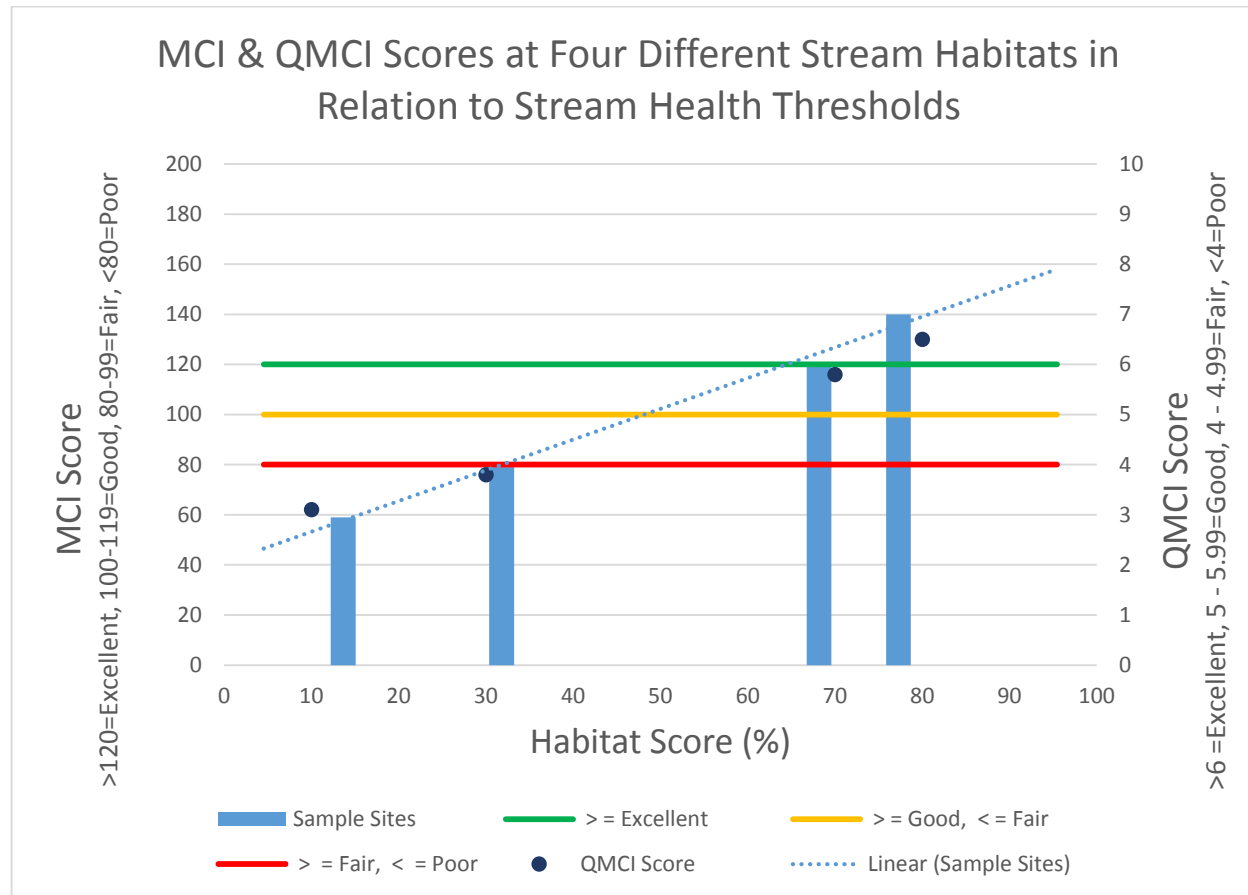
Macroinvertebrate Recording Sheet:

As for merit **PLUS:**

The QMCI score is to be calculated from the MCI score calculated in the merit exemplar (using the tolerance score sheet for hard bottom and soft bottom tolerances). *This is a quantified calculation which can be explained to students prior to this final assessment (calculations and explanations provided by Nga Mahi Te Taiao or from the Cawthron Report No. 1166). The calculations and recordings for the MCI, QMCI and habitat scores are to be used. The use of a graph as shown in this exemplar may be used OR explanations of the correlation that a graph would reveal.*

Stream Habitat Sites	Invertebrates (name)	Number of each species	Number of Taxa	HB or SB	Tolerance Score		MCI Score	QMCI Score
					HB	SB		
Site 1	Rounded snails (Potamopyrgus)	20	5	HB	4	2.1	4+8+10+8 = 30	20x4=80
	Mayflies (Deleatidium)	15			8	5.6	15x8=120	
	Spiral cased caddisfly (Helicopsyche)	7			10	8.6	7x10=70	
	Smooth cased caddisfly (Olinga)	9			8	7	9x8=72	
		8					6x20 = 120	Added = 342
	TOTAL	59					342/59=5.8	
							120	5.8
Site 2	Mayflies (Deleatidium)	10	3	HB	8	5.6	8+8+5=21	10x8=80
	Smooth cased caddisfly (Olinga)	5			8	7	5x8=40	
	Stony cased caddisfly (Pycnocentroides)	16			5	3.8	16x5=80	
							Added= 200	
							7x20=140	200/31=6.5
	TOTAL	31					140	6.5
Site 3	Pond skater (Microvelia)	25	4	SB	5	4.6	4.6+5.2+2.2+3.8=	25x4.6=115
	Mite (Acari)	4			5	5.2	15.8	4x5.2=20.8
	Backswimmer (Anisops)	15			5	2.2	15.8/4=3.95	15x2.2=33
	Oligochaete Worm	11			1	3.8	11x3.8=41.8	
							3.95x20=79	Added=210.6
	TOTAL	55					79	210.6/55=3.8
							79	3.8
Site 4	Oligochaete worm	25	2	SB	1	3.8	3.8+2.1=5.9	25x3.8=95
	Rounded snails (potamopyrgus)	19			4	2.1	5.9/2=2.95	19x2.1=39.9
							2.95x20=59	Added=134.9
								134.9/44=3.1
	TOTAL	44					59	3.1

Graph for MCI, QMCI and Habitat Scores:



Please Note:

This is an example of a graph which reveals all elements that can be discussed.

Teachers can select how many elements need to be identified and discussed to achieve excellence. Threshold values and QMCI values do not need to be placed on the graph, however, QMCI scores need to be discussed in the findings.

Observations:

As for merit

Conclusion:

As for merit

Discussion:

As for merit

Evaluation:

My results showed that the MCI and QMCI scores both increased as the habitat score increased for each sample site. This conclusion is justified because a number of ways were used to ensure a fair test investigation. For example, the same size net is used for gathering invertebrates as well as the number of samples from each site (4x repeats rather than one sample/scoop of invertebrates). This meant that a larger area was sampled and a range of invertebrates identified, that are more indicative of that environment being assessed.

The technique used to gather invertebrates for hard and soft bottom streams could be considered as a factor of unreliable data or an invalid method, however, the protocols set out in the method are identified as best practice protocols set out in the New Zealand Macroinvertebrate Working Group Report No. 1. Therefore, using these methods confirm its validity and the reliability of the results from both hard bottom and soft bottom sample sites and the different techniques that need to be applied at the varied sites.

The results of the data gathered coincides with the standards that have been assessed by experts in the field (table below) where the sites with higher habitat scores had higher MCI and QMCI scores which can reflect the overall water quality. The thresholds for these, gives some reliability to our data gathered. The two sites with lower scoring habitats both had MCI and QMCI scores that fell into the “poor” category for water quality with “fair” habitat scores. In comparison, the two higher scoring habitat scores (“excellent” category), fell into the “good” and “excellent” categories for MCI and QMCI scores. These results are indicative of the invertebrate’s sensitivity to their ecological niche and the required habitat for survival from high and low tolerance species.

Index	Excellent	Good	Fair	Poor
MCI	>120	100-119	80-99	<80
QMCI	>6	5-5.99	4-4.99	<4
Habitat	>60	40-60	20-40	<20

Please note: The last paragraph and table are not required, however, if some knowledge is shown of the thresholds and *why*, an excellence mark should be acknowledged and considered.

Gisborne District Council

**Produced By
Nga Mahi Te Taiao**

2016

Internal Assessment Resource Biology Level 2

This resource supports assessment against:

Achievement Standard 91155

Biology 2.3

Demonstrate understanding of adaptation of plants or animals
to their way of life

3 credits

Resource title: Reproduction Strategies

This resource:

Clarifies the requirements of the standard

Supports good assessment practice

Should be subjected to the school's usual assessment quality assurance process

Should be modified to make the context relevant to students in their school
environment and ensure that submitted evidence is authentic

Internal Assessment Resource

Achievement Standard Biology 91155: Demonstrate understanding of adaptation of plants or animals to their way of life

Resource reference: Biology 2.3

Resource title: Reproduction Strategies

Credits: 3

Teacher guidelines

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by achievement standard Biology 91155.

Context/setting

This activity requires students to demonstrate understanding of adaptations across **three** taxonomic animal groups, including the galaxias maculatus (inanga - whitebait species), a stonefly OR mayfly, and a sea bird of their choice (e.g. black billed gull, Hutton's shearwater, Sooty shearwater etc.), for the life process of reproduction.

Students are required to link the described adaptations to the organism's way of life. It includes:

- reproductive strategies and processes
- adaptations to their physical habitat, life cycle processes

Teachers should note however that adaptations only need to be described, explained or discussed in relation to those aspects relevant to the investigated organism's way of life. Thus evidence statements in the assessment schedule should be modified accordingly.

Conditions

Evidence for this assessment might include annotated diagrams and/or drawings, photos, models etc. which may have come from practical sessions. These practical sessions are completed in Bio 2.1.

Any information regarding habitat, adaptation, survival or environmental surroundings for successful breeding can be used from Bio 2.1 reports. Students who have handed in their final report from Bio 2.1 can use the data and information they individually produced and apply it in this Bio 2.3 assessment.

Students will keep a portfolio in which they will record all information such as drawings, results from investigations, notes from DVDs, class discussions, processed information from internet sites and textbooks; annotated diagrams, formal notes made in class.

Teachers need to decide the format required of the final report. For example, it could be written, or presented as a PowerPoint presentation, seminar, DVD or web page.

More information on the Conditions of Assessment related to this achievement standard can be found at <http://ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards>.

Resource requirements

- access to relevant textbooks
- internet access
- DVDs
- Access to their Bio 2.1 final report and all information and photos they gathered from the stream site visits

Additional information

Students will need to have a base knowledge of:

- the three taxonomic animals; inanga, stonefly or mayfly and a sea bird
- adaptations (structural, behavioural, physiological)
- ecological niche
- reproduction behaviours

A range of teaching and learning opportunities should be provided so students can collect information and add it to their portfolios, including:

- practical activities, such as:
- Field studies/observations (field trip to a proposed site)

Please note: This will be completed in Bio 2.1

- examination of mayflies or stoneflies at a site visit and possibility to identify fish species (e.g. inanga within the whitebait season)
- data collection and observations recorded using the freshwater equipment – habitat assessment, MCI and/or QMCI results (used for research information in their final report)
- models
- classroom discussion
- formal classroom teaching
- Videos/photos of dissections to identify the sex and how the reproduction occurs internally (optional)
- independent research using primary and/or secondary sources

Internal Assessment Resource

Achievement Standard Biology 91155: Demonstrate understanding of adaptation of plants or animals to their way of life

Resource reference: Biology 2.3

Resource title: Reproduction Strategies

Credits: 3

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of adaptation of plants or animals to their way of life.	Demonstrate in-depth understanding of adaptation of plants or animals to their way of life.	Demonstrate comprehensive understanding of adaptation of plants or animals to their way of life.

Student instructions

Introduction

This assessment activity requires you to work individually to produce a portfolio of information which you can use to develop a written report on the adaptations relating to animal reproduction across **three** taxonomic animal groups (inanga, mayfly OR stonefly and a sea bird of your choice) and how these adaptations allow the different animals to carry out their way of life or occupy the ecological niches that they do.

This is a resource-based assessment: you are able to access resources gathered in your programme of learning as you write your report.

You will have 3–4 weeks in and out of class to collect information, develop a portfolio, and present your report.

Teacher Note: This timeframe is to be adapted when completing Bio 2.1 and Bio 2.3 together. The field work in Bio 2.1 is also used for their Bio 2.3 report, therefore, deadline dates etc. are to be modified for your learning context.

Your portfolio will record all the information you collect on animal reproduction, such as drawings from observations and examinations, results and photos from investigations and field trips (completed in Bio 2.1), notes from DVDs, class discussions, processed information from internet sites and textbooks, annotated diagrams, and formal notes made in class. You will use this information to develop your report.

You will have approximately 2 hours of class time to individually write your report.

Teacher note: Amend the time frames and add dates for gathering material for the portfolio and for producing the final report to suit your students and context.

Other formats for the report are possible. For example, it could be written, or presented as a PowerPoint presentation, seminar, DVD or web page. If another format is used, you will need to ensure the sufficiency of the evidence and provide guidance about the time needed to develop the report.

You will be assessed on the extent to which your report shows your comprehensive understanding of how the three animal groups are adapted to their way of life in relation to the life process of reproduction.

An organism's *way of life* is determined by how it relates to other organisms in its surrounding environment, the reproductive strategies it employs to ensure survival of the species and how it adapts to its physical habitat. Their *adaptations* involve the range of ways in which the organism has developed strategies to carry out their life processes in order to survive and reproduce. An adaptation refers to a feature and its function that provides an advantage for the organism in its specific habitat and ecological niche. It may include structural, behavioural, or physiological features of the organism.

Task

Complete a written report on the adaptations relating to animal reproduction across **three** taxonomic animal groups, and how or why these adaptations allow them to survive in their habitat. Use your portfolio of collected, relevant biological information to provide supporting evidence. Your written report should:

- Name the three animal groups you have studied and provide a brief description of each of their ecological niches e.g. physical habitat, relationships with other organisms (*some information from Bio 2.1 may be relevant*)
- Describe the structural, behavioural, and/or physiological adaptations that enable the animals in each group to carry out reproduction. You may use annotated diagrams to support your answer. (*Results and data from Bio 2.1 may be used where relevant*)
- Explain how or why these adaptations enable the animals in each group to reproduce successfully. You should provide examples to support your explanations. (*Results and data from Bio 2.1 may be used where relevant*)
- Discuss the diversity shown in reproduction by comparing the process of animal reproduction and these adaptations across the three animal groups
 - Your discussion should link several biological ideas by comparing diversity of adaptation in response to the same demand across the animal groups to live successfully in their habitat
 - You need to include examples of specific advantages and/or limitations of named features or processes for reproduction across the three animal groups

You may use annotated diagrams to support your answer.

Please note: Data and information gathered and calculated in Bio 2.1 can be used throughout this report where relevant.

Hand your portfolio to your teacher along with your completed report.

Student Instructions Sheet

Introduction

This assessment activity requires you to use practical work, research and a written report to demonstrate your understanding of the reproduction adaptations of inanga, mayflies OR stoneflies, and a sea bird (of your choice) and how or why these adaptations allow the different animals to carry out their way of life.

Following the practical work and research, you will write a report that discusses the diversity in reproduction by comparing the three animal groups and their adaptations in terms of advantages and limitations for each linked to its way of life.

When writing your report, you will have access to your annotated diagrams/photos from the practicals as well as your resources and processed information from your research.

All your data, information and calculations from Bio 2.1 (Life in the water) can be used for this report where relevant.

Part A - Practical

For each of your practicals you will need to -

- Draw biological drawing(s) / take photo(s)
- On the drawing/photo clearly label features/adaptations involved in reproduction. Labels should include a description as well as name of feature.

Part B - Research

Collect and process information about each animal's adaptations for reproduction and how or why they enable them to carry out their way of life.

Step 1: Collecting

Collect relevant information from a range of sources for each animal

Information for each animal should cover the following areas:

- Description of their ecological niche e.g. physical habitat
- Description of structural, behavioural and/or physiological adaptations involved in reproduction
- How or why each adaptation helps the organism carry out reproduction successfully in its habitat
- Advantages and limitations of the animal's adaptations for reproduction linked to its way of life

Bio 2.1 investigation:

(All this information gathered from Bio 2.1 may contribute to your answers for the above criteria)

- Habitat observations/assessments e.g. survival advantages and/or limitations for animals (i.e. from your final 2.1 report, the MCI associated with habitat scores which may reveal why and what animals live in one habitat and not another)
- Observations and photos revealing where reproduction stages may take place, or where other stages in their life cycle may occur
- Notes and photos from your stream site visits that may be useful and relevant for this report

Step 2: Processing

This usually involves:

- Selecting the bits of information (photocopying, printing, notes) that relate to the questions above;
- Summarising the relevant information by highlighting text, writing notes, and circling useful diagrams/illustrations;
- Organising your information;
- Providing references for all your sources, including your own report from Bio 2.1 (e.g. URL or book title and author)

Part C - Report

Discuss the diversity shown by comparing adaptations for reproduction across inanga, mayflies OR stoneflies, and a sea bird (of your choice) that allow the animal groups to carry out their way of life

You should consider -

- Description of reproduction
- Ecological niche of each animal
- Explanation of how or why named adaptations help each animal carry out reproduction successfully in its habitat
- Explanation of specific advantages and/or limitations of each animal's adaptations for reproduction

Acknowledge all your sources of information.

Your annotated diagrams/photos, processed research and final written report should all be handed in.

Assessment schedule: Biology 91155 - Reproduction Strategies

Teacher Note: The examples provided for achieved, merit and excellence are written in a form where not every element identified needs to be assessed. Therefore, please use these examples as guidelines and select the appropriate number of factors that need to be identified for each achievement level.

<p style="text-align: center;">Evidence/Judgements for Achievement</p> <p style="text-align: center;">Evidence should come from annotated diagrams/photos and report</p>	<p style="text-align: center;">Evidence/Judgements for Achievement with Merit</p> <p style="text-align: center;">Evidence should come from report</p>	<p style="text-align: center;">Evidence/Judgements for Achievement with Excellence</p> <p style="text-align: center;">Evidence should come from report</p>
<p>The student demonstrates understanding of adaptation of animals relating to reproduction over three taxonomic or functional groups to their way of life</p>	<p>The student demonstrates in-depth understanding of adaptation of animals relating to reproduction over three taxonomic or functional groups to their way of life.</p>	<p>The student demonstrates comprehensive understanding of adaptation of animals relating to reproduction over three taxonomic or functional groups to their way of life.</p>
<p>The written report will include:</p> <ul style="list-style-type: none"> A description of the reproduction process in animals <p>For example:</p> <p><i>Reproduction is the biological process by which new individual organisms are produced. There are two forms of reproduction, asexual and sexual. Sexual reproduction occurs in Inanga, Mayflies and Sooty Shearwaters which involves the process of a diploid-dominant life cycle.</i></p> <p><i>All three animals produce haploid gametes which are required cells for sexual reproduction. Two haploid cells fuse together to undergo fertilisation which produces a diploid zygote or a fertilised egg.</i></p> <p>The written report will include a named, description of the three taxonomic/functional animal groups studied.</p> <p>For each animal group:</p> <ul style="list-style-type: none"> A description of the ecological niche 	<p><u>As for Achieved PLUS:</u></p> <p>The report may include as evidence, diagrams as appropriate, clearly annotated.</p> <p>AND</p> <p>For at least two animal groups:</p> <ul style="list-style-type: none"> Providing a biological reason explaining how or why two adaptations (structural, behavioural or physiological) for reproduction enables them to survive in their habitat. <p>For Example: Behavioural Adaptation between an Inanga and a Sooty Shearwater sea bird.</p> <p><i>Both inanga and sooty shearwaters migrate to different locations throughout stages of their life cycle. Inanga are diadromous, spending their life stages in different environments. They migrate to the ocean to feed and grow as larvae to return as whitebait into the freshwater environment in order to reproduce amongst the salt</i></p>	<p><u>As for Merit PLUS:</u></p> <p>Linking several biological ideas to compare reproduction across <u>all three</u> animal groups to include:</p> <ul style="list-style-type: none"> the diversity of the adaptations in response to the same demand for reproduction advantages and/or limitations of named features or processes for reproduction. <p>For Example: A sooty shearwater sea bird, inanga and a mayfly.</p> <p><i>External fertilisation transpires in inanga reproduction where both the sperm and eggs are dispersed into their external aquatic environment with the sperm fertilising the egg outside of the organism, known as spawning. Internal fertilisation occurs within sooty shearwaters and mayflies. Both animals utilise the method of oviparity where the eggs are laid, developed and hatched outside the female body. External fertilisation of inanga results</i></p>

<ul style="list-style-type: none"> - Animal 1 - Animal 2 - Animal 3 <p>Information from Bio 2.1 can be used.</p> <ul style="list-style-type: none"> • A description of three adaptations (structural, behavioural AND physiological) that help the animal group reproduce <p>For example: Inanga Fertilisation of inanga is an external process.</p> <p>Structural: Inanga do not develop scales like most other fish, instead they have a slime coating which covers their entire body, including their head and fins. This is called a mucoprotein coating. It helps them to adapt to the changing environment from freshwater to salt water throughout their diadromous life cycle. Their slime coating helps to prevent infection and diseases from both freshwater and marine environments. In relation to reproduction, the elimination of scales allows inanga to swim into bank vegetation when spawning which decreases the risk of catching on overhanging branches or vegetation. Reproduction within the salt wedge environment can impact on their osmoregulation where their mucoprotein coating allows for this regulation and balance of internal electrolytes so they can exchange from freshwater to salt water without having a disturbance in their salt concentrations.</p> <ul style="list-style-type: none"> - Behavioural: A behavioural adaptation of inanga includes how they behave when swimming upstream to reproduce. Inanga stay in schools/shoals where you will see these fish 	<p>water wedge. Sooty shearwaters migrate across the pacific ocean in order to gather food and resources required for reproduction. They are migratory sea birds that always return to their breeding ground in order to begin their reproduction processes. However, inanga and sooty shearwaters reproduction behaviours have significant comparisons. Sooty shearwaters are monogamous and establish a pair bond for life. The behavioural adaptation for this to occur begins through courtship behaviour where they will sing in duet to ensure a compatible mating partner. This secures that their reproduction is successful through displays of strength, maturity, health and mating desirability, allowing different sooty shearwaters to choose the best partner and ensure viable, healthy offspring.</p> <p>In comparison, inanga migrate as a panmictic population where all individual inanga are potential partners. No bond is formed between the two partners, therefore, their behavioural adaptation is to migrate between varying environments through shoaling. This shoaling behaviour allows for increased access to potential mates. In order for fertilisation to occur, the male gametes need to be present within the spawning environment which is made efficient through their shoaling behaviour. This social behaviour also allows for survival of the fertilised ovum as they are reproduced and dispersed within the same environment, leading to an innate shoaling behaviour as the spring tide takes the zygotes out to sea in an already established group.</p> <p>1. Plus one more adaptation between at least two animals</p> <p>For Example: A structural adaptation between a sea bird and a mayfly</p> <p><i>Please refer to the diagrams on pages 15-17 that can be used as evidence.</i></p>	<p>in the production of a larger number of off-spring and are easier to find mates as the male gametes can drift in the water until united with a female gamete. However, predators reduce the chance of surviving into adulthood (from larvae to whitebait and into maturity as inanga). There are also large amounts of gametes that go unfertilised with no guarantee that sperm will come into contact with the eggs.</p> <p>In comparison, sooty shearwaters and mayflies increase their chance of the gametes meeting internally. There is a greater chance of successful fertilisation with more protection against outside environments and predators, therefore, a higher chance of surviving until birth. However, the sooty shearwater only lay one egg per year (once maturity has been reached). This increases their risk of a lower reproduction rate as the pressure for survival on one off-spring is lowered, compared with the chance of more off-spring surviving in both inanga and mayflies who disperse up to hundreds to thousands of eggs at one time.</p> <p>Sooty shearwaters are also monogamous, therefore, allowing a higher chance for survival with long parenting periods associated with their long life span to ensure reproduction of genetically identical off-spring year after year. In contrast, inanga are panmictic which eliminates the time spent finding a lifelong companion as they are short lived, with an average life cycle of one year (sometimes two years and rarely three). Mayflies are semelparous where they have a single reproductive episode before death, focusing their short-lived life solely on reproduction of their genes.</p> <p><i>Please refer to the diagrams on pages 15-17 that can be used as evidence.</i></p> <p><i>Please Note: The examples above are indicative samples only.</i></p>
--	--	---

<p>swimming together as they migrate. Both female and male inanga swim within the school/shoal, this creates a higher chance of successful fertilisation when females release their eggs and the males can then follow with their sperm. This behaviour occurs from the stage in their life cycle when they enter the phase as larvae and are taken out to sea on the same spring tide. This adaptation to remain within a school/shoal when swimming upstream and spawning helps them to survive within this environment. It provides inanga the ability to reproduce successfully without having to find a mating partner.</p> <ul style="list-style-type: none"> - Physiological: Inanga have a range of internal systematic responses that they use in order for spawning and reproduction. This includes their adaptation to smell water from faraway places through their nares (nostrils), such as freshwater required for spawning. Through the sensory cells, inanga can then locate the salt water wedge required for spawning and reproduction. <ol style="list-style-type: none"> 1. Animal 1 2. Animal 2 3. Animal 3 <p>Information from Bio 2.1 may be used where relevant.</p> <ul style="list-style-type: none"> • A description of one adaptation that enables the animal group to: <ul style="list-style-type: none"> - survive in their physical habitat, or - relate to other organisms e.g. food web, competition, predation, mutualism, parasitism. <p>For example: Inanga</p>	<p><i>Please Note: The examples above are indicative samples only.</i></p>	
--	--	--

Inanga have a varied physical habitat where they begin their reproduction stages amongst vegetation in a stream or river where the salt wedge is found. The structural adaptation of their slime coating helps them to survive in this habitat from a young age. This coating is developed through the epidermis and dermis layers of the skin. Due to the absence of water as they begin their hatching process, the temperature is warmer and at times there can be less moisture. This mucoprotein coating allows them to adapt to these changes and provides a layer of protection through producing a cocoon type formation around the embryo. This is where a shell of its body slime is used for hibernating while the reproduction stages are taking place. This avoids desiccation, and if they survive all other outside threats such as grazing and trampling by cattle, it should increase their chances of survival throughout this period.

1. **Animal 1**
2. **Animal 2**
3. **Animal 3**

Information from Bio 2.1 may be used where relevant.

Please refer to the diagrams on pages 15-17 that can be used as evidence where appropriate.

Please Note: The examples above are indicative samples only.

Please refer to the diagrams on page 15-17 that can be used as evidence.

Please note: these are diagrams referring to the examples outlined in this achievement standard, therefore, are indicative samples only and others may be used for assessment

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the achievement standard.

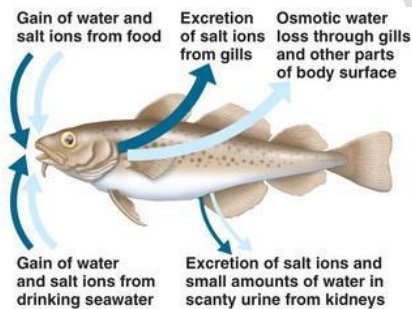
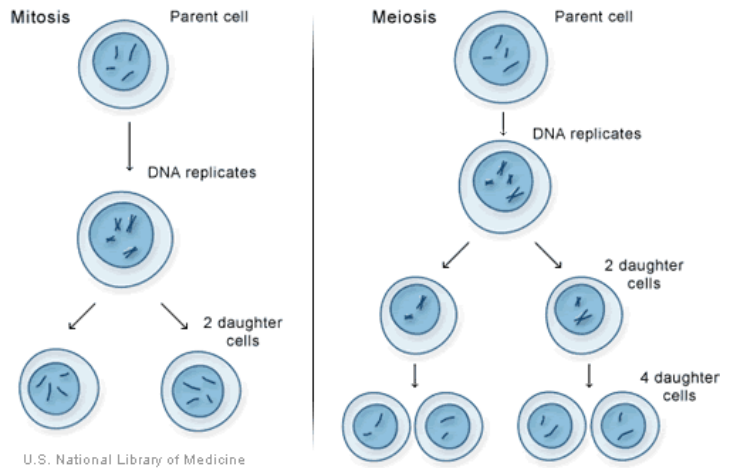
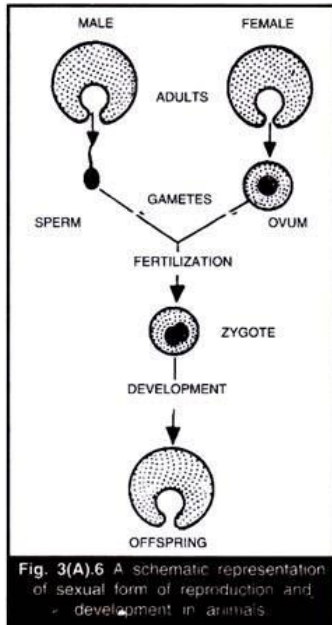
Please Note: *The examples provided are simply a guideline, therefore, the criteria for each assessment level should be adapted and considered for the students learning context and timeframe. i.e. the examples may include 4 factors being considered where a pass for that level can be 2 or more of those factors (or similar) identified by the student.*

In addition, any information and data from the students Bio 2.1 report may be used in this report as evidence. Referring to their report should not be restricted and all information should be available for all answers. Therefore, when referring to their findings in their Bio 2.1 investigations, they will need to reference their individual report.

DRAFT

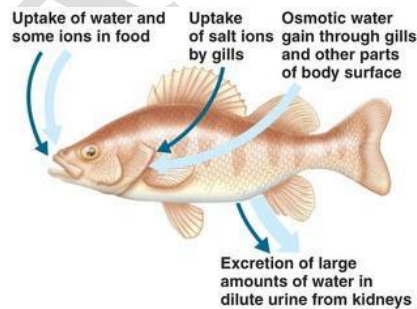
Diagrams that may be used as evidence:

Please note: These are not limited, therefore, other annotations may be used for assessing this achievement standard and not all diagrams shown are expected.

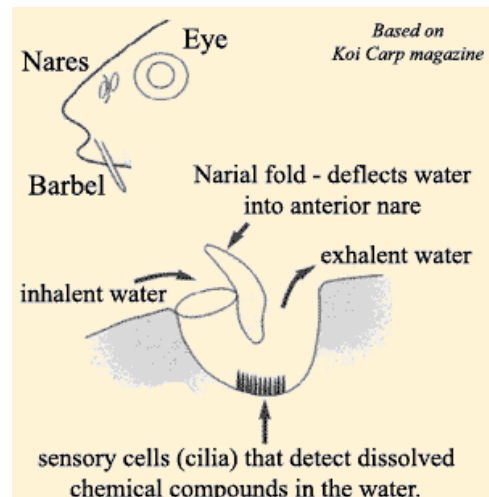
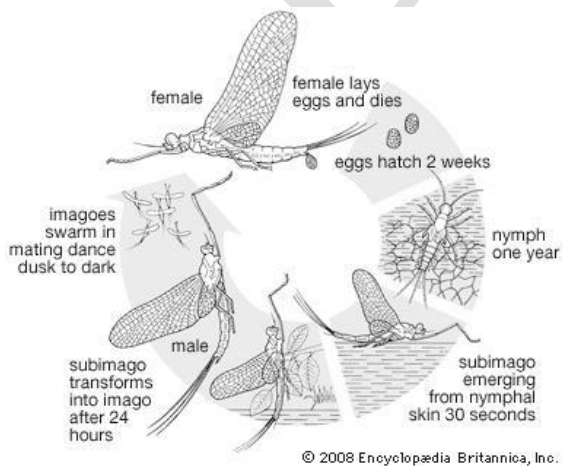


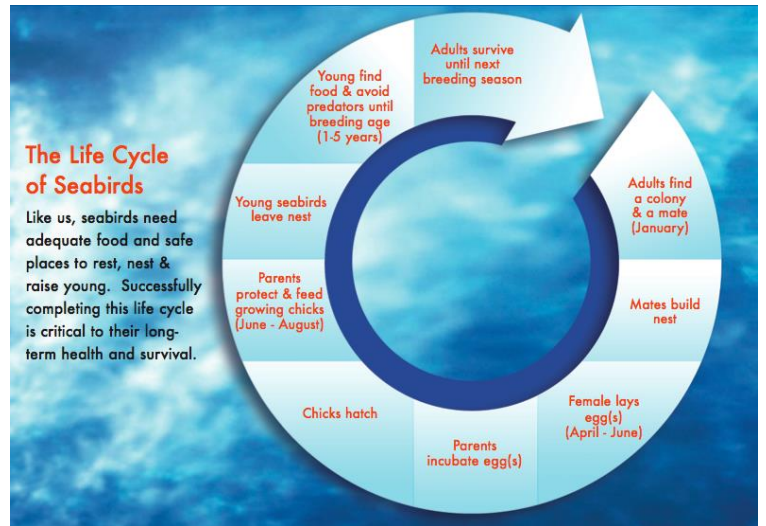
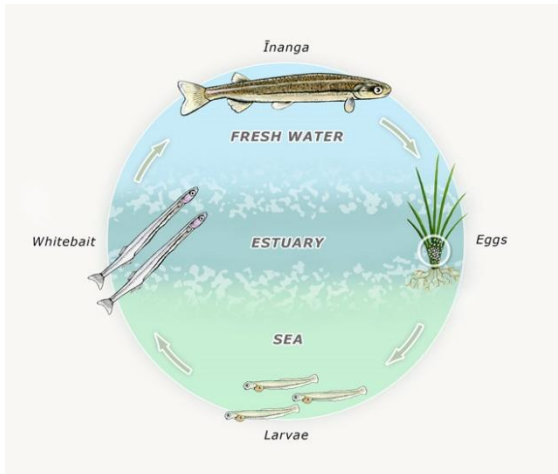
(a) Osmoregulation in a saltwater fish

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

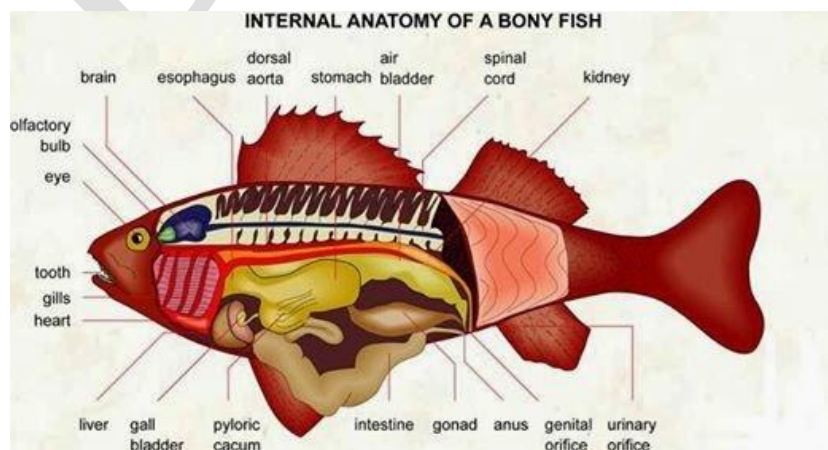
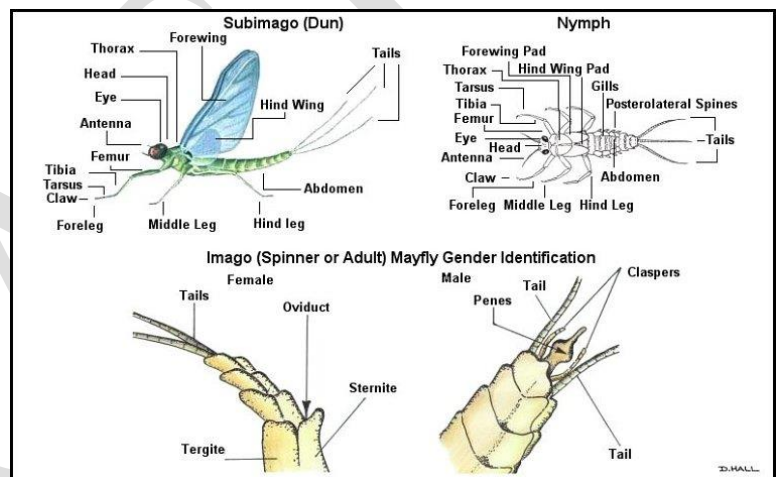
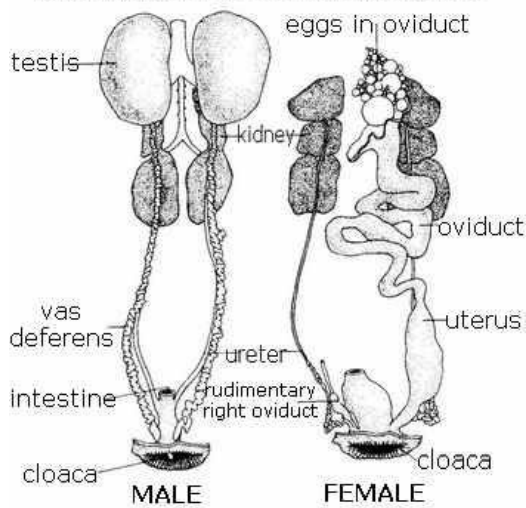


(b) Osmoregulation in a freshwater fish





Reproductive & Excretory Systems



Example: *Photos and evidence taken from a site visit (from Bio 2.1) to explain and annotate the different habitats for some of the animal groups reported on:*

