National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Exemplar for Internal Achievement Standard

Biology Level 3

This exemplar supports assessment against:

Achievement Standard 91601

Carry out a practical investigation in a biological context, with guidance

An annotated exemplar is an extract of student evidence, with a commentary, to explain key aspects of the standard. It assists teachers to make assessment judgements at the grade boundaries.

New Zealand Qualifications Authority

To support internal assessment

	Grade Boundary: Low Excellence
1.	For Excellence, the student needs to carry out a comprehensive practical investigation in a biological context, with guidance. This involves: • justifying the choices made throughout the investigation by evaluating either the validity of the method or the reliability of the data. • discussing biological ideas relevant to the investigation and either the findings of others, scientific principles, theories, or models This student has explained and discussed biological ideas based on the student's own findings (1) and findings from other source(s) (2). Some choices made throughout the investigation are justified by evaluating the validity of the method (3). For a more secure Excellence, the student could provide further justification of the choices made in the investigation by giving more reasons for the steps carried out to reduce bias and sources of error.

Student 1: Low Excellence

NZQA Intended for teacher use only

Purpose: To investigate the distribution of *Potamopyrgus antipodarum* in the Waihopai River.

Hypothesis: The distribution pattern of the fresh water snail *Potamopyrgus antipodarum* population will be greater on the south edge of the Waihopai River than in the middle or north edge because there is more light on the south side for its food source, the periphyton (slime and algae found on the beds of streams and rivers).

Number of *Potamopyrgus antipodarum* in the Waihopai River

	South Side (30cm in from the south bank)	**Middle (4m form the South Bank)**	**North Side (30cm in from the north bank)**
Water velocity (m/s)	0.8	1.10	.8
Substrate	Pebbles/gravel, algae present (most algae present, more than middle and north side)	Mud, very fine gravel	Pebbles/gravel, algae present
Average no. in $6250cm^3$ of top layer substrate	19	2	13

Conclusion:
The data shows a pattern, that there was a far greater *Potamopyrgus antipodarum* population on the edges of the river than in the middle. The average population on the north side of the river was 13, on the south side 19, while the average population in the middle of the river was only 2. The pattern also shows that the greater the velocity of the water in the middle of the river, the smaller the snail population. On average, there were also more fresh water snails on the south edges in all sites sampled, which get more light than the north edges. (1)

Discussion:
The driving force of a stream is the current. It is necessary for the respiration of many benthic invertebrates and reproduction of some fish species (Hynes 1970). Water currents distribute nutrients and food down a river system. This includes detritus for invertebrates and drifting insects for fish and birds. (2)

The substrate in the middle of the river was mainly mud and gravel, whereas on the edges it was consistently pebbles and gravel/small stones. This affects the periphyton (algal growth) which grows on the small stones and slower moving water. The algae cannot survive in mud because this doesn't provide enough nutrients for the algae to carry out its life processes, especially photosynthesis. (1)
Potamopyrgus antipodarum mainly feed on the periphyton, and this shows in the pattern of distribution found across the width of the Waihopai River between the Waihopai Dam and the Queens Drive Bridge, proving my hypothesis correct.

Periphyton is essential for the function of healthy river ecosystems (Quinn and Hickey, 1990). It is composed predominantly of algae and cyanobacteria (previously called 'blue-green algae'). These algae capture the energy of sunlight via their chlorophyll molecules, absorb carbon dioxide and other nutrients such as phosphorus and nitrogen from the surrounding water, and then synthesise organic carbon in the form of new or enlarged cells. The algae can live in fresh waters between 0°C - 30°C, so the Waihopai River is a perfect place for it to live as I tested the water temperature at 7.3°C. A change in benthic invertebrate community structure with increasing periphyton biomass has been a common observation in New Zealand streams (Towns, 1981; Quinn and Hickey, 1990; Quinn et al, 1996, 1997), because of the vital first trophic level they occupy in the rivers food chain and providing nutrients and a food source to the benthic community. ②

Quinn and Hickey (1990) state that is the quality of the habitat that is provided by the flow that is important to stream life, not the magnitude of the flow per se. The flows that provide good habitat will vary with the requirements of the species and with the morphology of the stream; water velocity is probably the most important characteristic. Without it, the stream becomes a lake or pond. An average velocity of 0.3 m/s tends to provide for most stream life and will prevent the accumulation of fine sediment. Velocities lower than these are unsuitable for a number of fish species and stream insects and allow the development of nuisance growths of periphyton. In large rivers, water depth of more than 0.4 m provide habitat for adult brown trout, but in small streams depths in excess of 0.05 m are adequate for most stream insects and native fish. The flow at which these limiting conditions occur varies with stream morphology. Generally, minimum flow increases with stream size, because stream width increases with stream size. However, the relationship is not linear. Small streams require a higher proportion of the natural stream flow to maintain minimum habitat than do large streams. ②

My findings are similar to those of student X, who had average counts of 23 snails in the north edge, 15 in the middle and 27 in the south edge. More light is available on the south side which increases the biomass of the periphyton, and thus provides a habitat with more food source for the snails. Quinn and Hickey (1990) also found that the relative abundance of invertebrate snail groups were found more commonly and abundantly in eutrophic gravel/cobble NZ streams. These streams have a high value of chlorophyll *a*/m^2 which contributes to a high periphyton biomass, and ultimately the food source of the snails. ②

Factors such as sampling bias and sources of errors were considered by collecting sufficient samples across the river over the 4 sites, which were then averaged to show the pattern. Other factors considered were that the river between the Waihopai Damn and the Queens Drive Bridge was artificially straightened by farmers in 1949, so along this stretch of river there is very little bio-diversity. This means that the normal river behaviour of 'pool, ripple and run' were non-existent. Thus, I did not collect any samples (i.e. place any of my samples sites) in this area. Also, the river's depth was on average between 0.4m – 0.6m across all areas between the Waihopai Damn and the North Road Bridge, so depth was unlikely as a factor that could have had an influence on results. The temperature was measured using the same thermometer at the same time of day. As this was constant it did not influence the distribution of *Potamopyrgus antipodarum* across the Waihopai River in my investigation. ③

	Grade Boundary: High Merit
2.	For Merit, the student needs to carry out an in-depth practical investigation in a biological context, with guidance. This involves: • using a valid method that describes a valid collection of data • collecting, recording, and processing reliable data to enable a trend or pattern (or absence) to be determined • stating a valid conclusion based on the processed data related to the purpose • explaining biological ideas based on both the findings from the investigation and those from other source(s). This student has used a valid method to collect, record and process reliable data to enable a pattern to be determined (1). A valid conclusion is stated based on the processed data and relates to the hypothesis (2). The biological ideas relating to the investigation are explained based on the student's own findings (3) and the findings from other source(s) (4). An attempt is made to justify some choices made during the investigation by evaluating the validity of the method (5). To reach Excellence, the student could: • state a conclusion that discusses biological ideas relevant to the investigation and either the findings of others, scientific principles, theories or models • justify the choices made throughout the investigation more thoroughly by evaluating the validity of the method or the reliability of the data.

Student 2: High Merit

NZQA Intended for teacher use only

Purpose: To investigate the distribution of *Potamopyrgus antipodarum* in the Waihopai River.

Hypothesis: The distribution pattern of the fresh water snail *Potamopyrgus antipodarum* population will be greater on the south edge of the Waihopai River than in the middle or north edge because there is more light on this side for its food source, the periphyton (slime and algae found on the beds of streams and rivers).

Number of *Potamopyrgus antipodarum* in the Waihopai River

	South Side (30cm in from the south bank)	Middle (4m form the South Bank)	North Side (30cm in from the north bank)
Water velocity (m/s)	0.8	1.10	0.8
Substrate	Pebbles/gravel, algae present (most algae present, more than middle and north side)	Mud, very fine gravel	Pebbles/gravel, algae present
Average no. in 6250cm^3 of top layer substrate	19	2	13

(1)

Conclusion:

The data shows a pattern, that there was a far greater *Potamopyrgus antipodarum* population on the edges of the river than in the middle. (2) The average population on the north side of the river was 13, on the south side 19, while the average population in the middle of the river was only 2. The pattern also shows that the greater the velocity of the water in the middle of the river, the smaller the snail population. (3) On average, there were also more fresh water snails on the south edges in all sites sampled, which get more light than the north edges.

Discussion

The current of the stream is necessary for the respiration of many benthic invertebrates and reproduction of some fish species (Hynes 1970). (4) Water currents distribute nutrients and food down a river system. This includes detritus for invertebrates and drifting insects for fish and birds.

The substrate in the middle of the river was mainly mud and gravel, whereas on the edges it was consistently pebbles and gravel/small stones. This affects the periphyton (algal growth) which grows on the small stones and slower moving water. The algae cannot survive in mud because this doesn't provide enough nutrients for the algae to carry out its life processes, especially photosynthesis. (3)

Potamopyrgus antipodarum mainly feed on the periphyton, and this shows in the pattern of distribution found across the width of the Waihopai River between the Waihopai Dam and the Queens Drive Bridge.

Periphyton is essential for the function of healthy river ecosystems (Quinn and Hickey, 1990). It is composed predominantly of algae and cyanobacteria (previously called 'blue-green algae'). These algae capture the energy of sunlight via their chlorophyll molecules, absorb carbon dioxide and other nutrients such as phosphorus and nitrogen from the surrounding 4
water, and then synthesise organic carbon in the form of new or enlarged cells. The algae can live in fresh waters between 0°C - 30°C, so the Waihopai River is a perfect place for it to live as I tested the water temperature at 7.3°C. A change in benthic invertebrate community structure with increasing periphyton biomass has been a common observation in New Zealand streams (Towns, 1981; Quinn and Hickey, 1990; Quinn et al, 1996, 1997).

Quinn and Hickey (1990) state that is the quality of the habitat that is provided by the flow that is important to stream life, not the magnitude of the flow per se. The flows that provide good habitat will vary with the requirements of the species and with the morphology of the stream; water velocity is probably the most important characteristic. Without it, the stream becomes a lake or pond. An average velocity of 0.3 m/s tends to provide for most stream life 4
and will prevent the accumulation of fine sediment. Velocities lower than these are unsuitable for a number of fish species and stream insects and allow the development of nuisance growths of periphyton. Generally, minimum flow increases with stream size, because stream width increases with stream size. However, the relationship is not linear. Small streams require a higher proportion of the natural stream flow to maintain minimum habitat than do large streams.

My findings are similar to those of student X, who had average counts of 23 snails in the north edge, 15 in the middle and 27 in the south edge. More light is available on the south side which increases the biomass of the periphyton, and thus provides a habitat with more food source for the snails. 4
Quinn and Hickey (1990) also found that the relative abundance of invertebrate snail groups were found more commonly and abundantly in eutrophic gravel/cobble NZ streams. These streams have a high value of chlorophyll a/m^2 which contributes to a high periphyton biomass, and ultimately the food source of the snails.

Potamopyrgus antipodarum is an algae grazer (stated on the Landcareresearch.co.nz website), so it is more likely to live in an area with a higher amount of its desired food source. On the south side there is no restriction of sunlight and therefore more algae can carry out photosynthesis, grow and reproduce, leading to more snails in the area because of the plentiful food source.

Factors such as sampling bias and sources of errors were considered by collecting samples across the river over the 4 sites, which were then averaged to show the pattern. Other factors considered were that the river between the Waihopai Damn and the Queens Drive Bridge was artificially straightened by farmers in 1949. I did not collect any samples (e.g. 5
place any of my samples sites) in this area. Also, the river's depth was on average between 0.4m – 0.6m across all areas between the Waihopai Damn and the North Road Bridge, so depth was unlikely as a factor that could have had an influence on results. The temperature was measured using the same thermometer at the same time of day. The data was reliable. because other students in the class found similar results in their investigations and the data fitted trends from sites such as the NZ Periphyton Guideline.

	Grade Boundary: Low Merit
3.	For Merit, the student needs to carry out an in-depth practical investigation in a biological context, with guidance. This involves: • using a valid method that describes a valid collection of data • collecting, recording, and processing reliable data to enable a trend or pattern (or absence) to be determined • stating a valid conclusion based on the processed data • explaining biological ideas based on both the findings from the investigation and those from other source(s). This student has used a valid method to collect, record and process reliable data to enable a pattern to be determined (1). A valid conclusion is stated that is based on the processed data and that relates to the hypothesis (2). Some biological ideas relating to the investigation that are based on the student's findings (3) and those from other sources (4) are described and explained. For a more secure Merit, the student could elaborate further on the biological ideas based on the findings by explaining them and those from the other source(s) in more depth.

Purpose: To investigate the distribution of *Potamopyrgus antipodarum* in the Waihopai River.

Student 3: Low Merit

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Hypothesis:
The distribution of the fresh water snail *Potamopyrgus antipodarum* from the Waihopai River dam to Queen's Drive will not significantly change down the river, but will change across the river because of the speed of the current and the amount of periphyton (the algae food source found on the beds of streams and rivers).

Raw Data – Population of *Potamopyrgus antipodarum* at each sample site in the Waihopai River

	Site 1	Site 2	Site 3	**Average**
North sample	22	23	21	22
Middle sample	9	11	13	11
South sample	20	18	19	19
Average	17	17	18	17.3

1

Fig. 1 – Population number of *Potamopyrgus antipodarum* in the Waihopai River

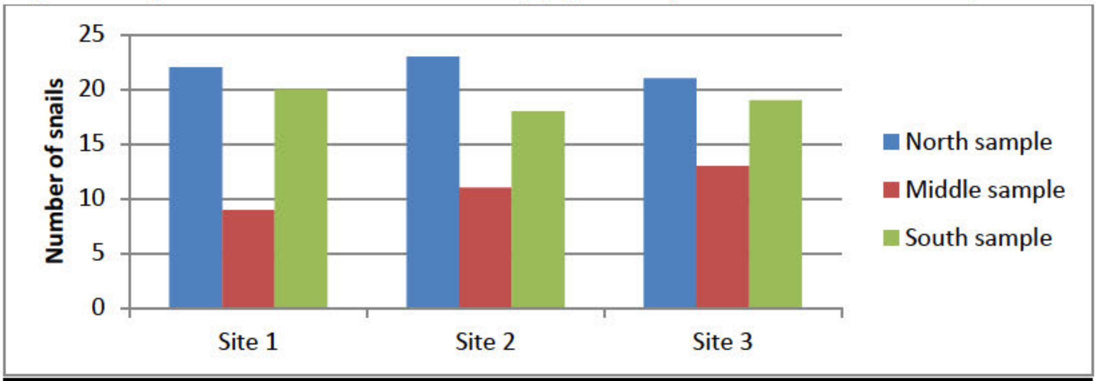

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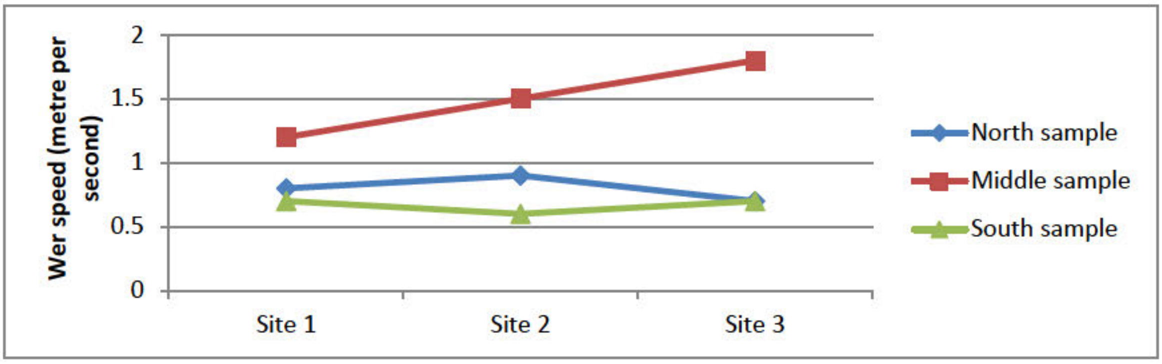
Fig. 2 - Waihopai River current (ms-1) at each sample site



1

Conclusion:
Fig. 1 shows that the population number of *Potamopyrgus antipodarum* does not change significantly along the river between the Waihopai dam and Queen's Drive. A similar pattern of distribution was found on the north and south sides and the middle, collected at all three sites. The data concurs that the population numbers do change across the river's width; the

2

north and south sides had similar numbers of snails on average. The middle had the least (2)
number of snails.

<u>Discussion:</u>

This pattern is related to the speed of the water and the amount of periphyton on the rocks.
Where the investigation was carried out, the Waihopai River was modified by human (3)
intervention to run straight some years ago. Therefore the distribution of *Potamopyrgus*
antipodarum across the river must be affected by the abiotic factor of the current in the
different sample sites, and the biotic factor of the growth of the periphyton food source of the
snails.

The current is necessary for the respiration of many benthic invertebrates and reproduction
of some fish species (Hynes 1970). Currents distribute oxygen, nutrients and food down a (4)
river system – detritus for invertebrates and drifting insects for fish and birds.

The Waihopai River where the investigation was carried out runs east to west and is
reasonably straight. This means the north side has shading from the bank whereas the south
side does not. The data in Fig. 1 show that there were slightly more snails on the north side (3)
of the river than the south side. This was not expected as the shading from the bank on the
north side restricts photosynthesis in algae, and would cause less of it to grow.

Potamopyrgus antipodarum is an algae grazer (stated on the Landcareresearch.co.nz
website), so it is more likely to live in an area with a higher amount of its desired food source.
On the south side there is more sunlight and therefore more algae can carry out
photosynthesis, grow and reproduce. This would normally lead to more snails in this area
because of the plentiful food source. These ideas are also backed up in the *NZ Periphyton*
Guideline where it states that "heavy shading does have the potential to prevent (4)
proliferations of green filamentous algae and the effects of removing this cover on periphyton
growth has been widely documented." It is possible that substrate differences on the north
and south sides at the three sites where the samples were taken had an effect on the algal
growth and therefore snail numbers.

This trend along and across the river is also seen in student Y's data. The samples taken
measuring current showed similar trends across the three river sites; the middle had the
higher water speed compared with both sides (Fig. 2). The trend of the snails' distribution (4)
(Fig. 1) shows a relationship with the river speeds collected - where the current is slower at
either side there is a greater number of *Potamopyrgus antipodarum* found compared with the
middle of the river.
The speed of the water also plays a large part when it comes to the algae growth, where the
river is fast its growth is disrupted and where it is slow its growth is not affected.

Quinn and Hickey (1990) state that it is the quality of the habitat that is provided by the water
flow that is important to stream biota. Without good flows the stream becomes a lake or (4)
pond. An average velocity of 0.3 m/s tends to provide the quality for most stream life and
prevent the accumulation of fine sediment.

	Grade Boundary: High Achieved
4.	For Achieved, the student needs to carry out a practical investigation in a biological context, with guidance. This involves: • stating the purpose, linked to a scientific concept or idea and written as a hypothesis • using a method for a that describes the data that will be collected (pattern seeking activity), range of data/samples, and consideration of some other key factors • collecting, recording, and processing data relevant to the purpose of the investigation • interpreting the processed data and reporting on the findings of the investigation • identifying relevant findings from another source • stating a conclusion based on interpretation of the processed data which is relevant to the purpose of the investigation. This student has developed a hypothesis that is linked to a scientific concept (1). A valid method for a pattern seeking investigation is used to collect, record and accurately process data to enable a pattern to be determined (2). A conclusion is stated that is based on interpretation of the processed data and relevant to the purpose of the investigation (3). Some biological ideas relating to the investigation, based on the student's findings (4) and those from other sources (5), are described and explained. To reach Merit, the student could: • state a valid conclusion based on the processed data in relation to the purpose • give a more in-depth explanation of biological ideas based on both the findings from the investigation and those from other source(s).

Student 4: High Achieved
NZQA Intended for teacher use only

Purpose: To investigate the distribution of *Potamopyrgus antipodarum* in the Waihopai River.

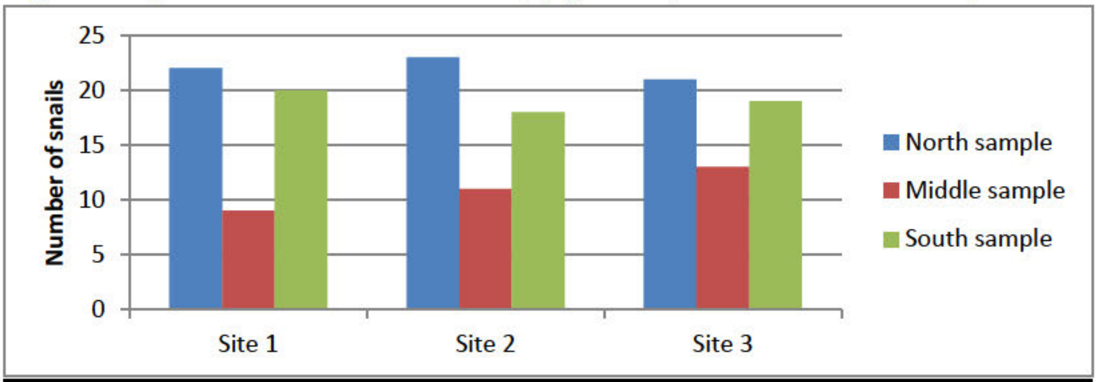
Hypothesis:
The population of the snail *Potamopyrgus antipodarum* from the Waihopai River dam to Queen's Drive will not significantly change down the river, but will change across the river because of the speed of the current and the amount of periphyton (the algae food source found on the beds of streams and rivers). (1)

Raw Data – Population of *Potamopyrgus antipodarum* at each sample site in the Waihopai River

	Site 1	Site 2	Site 3	**Average**
North sample	22	23	21	22
Middle sample	9	11	13	11
South sample	20	18	19	19
Average	17	17	18	17.3

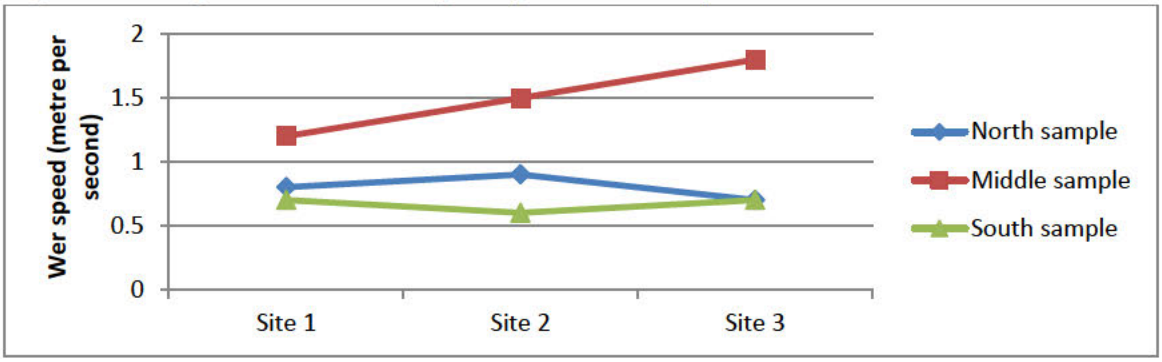
(2)

Fig. 1 – Population number of *Potamopyrgus antipodarum* in the Waihopai River



(2)

Fig. 2 - Waihopai River current (ms-1) at each sample site



(2)

Conclusion:
Fig. 1 shows that the population number of *Potamopyrgus antipodarum* is similar along the river between the Waihopai dam and Queen's Drive. The population numbers change across the river's width; the north and south sides had similar numbers, while the middle had the least. (3)

Discussion:

This pattern was linked to the speed of the water and the amount of algae on the gravel. The
Waihopai River was modified by human intervention to run straight some years ago. 4
Therefore the distribution of *Potamopyrgus antipodarum* across the river must be affected by
other factors like the speed of the current in different sample sites across the river, and the
growth of the algae (periphyton food source of the snails).

The current is necessary for the respiration of many benthic invertebrates and reproduction
of some fish species (Hynes 1970). Currents distribute oxygen, nutrients and food down a 5
river system – detritus for invertebrates and drifting insects for fish and birds.

The Waihopai River where the investigation was carried out runs east to west and is
reasonably straight. This means the north side has shading from the bank whereas the south 4
side does not. However, the data in Fig. 1 show that there were more snails on the north side
of the river than the south side.

Potamopyrgus antipodarum is an algae grazer (stated on the Landcareresearch.co.nz 5
website), so it is more likely to expect snails to live in an area with a higher amount of its
desired food source.

This trend is also seen in student Y's data, along and across the river. The samples taken of
current showed similar trends across the three river sites; the middle had the higher water
speed compared with both sides (Fig. 2). The trend of the snails' numbers (Fig. 1) shows a 5
relationship with the river speeds collected - where the current is slower at either side there is
a greater number of Potamopyrgus antipodarum found compared with the middle of the river.
The speed of the water also plays a large part when it comes to the algae growth, where the
river is fast its growth is disrupted and where it is slow its growth is not affected.

Quinn and Hickey (1990) state that it is the quality of the habitat that is provided by the flow
that is important to stream life. Without good flows the stream becomes a lake or pond. An 5
average velocity of 0.3 m/s tends to provide the conditions for most stream life and will
prevent the accumulation of fine sediment.

Fresh water systems that have a high water velocity do not have a high density population of 5
Potamopyrgus antipodarum (Statzner & Holm, 1989). This may be due the low dissolved
ions concentrations in these waters (Herbst, 2008).

The New Zealand freshwater snail has been shown to display a preference for sediment-
contaminated cobbles and the presence of filamentous green algae (Suren, 2005). This
report also back's up my findings as I found that the fast currents had cleaned most the rocks 5
in the centre of the river and found the least amount of snails, the sides of the river showed
green algae and moss and the most amounts of snails. I feel this is why *Potamopyrgus
antipodarum* population is determined by the river's velocity.

	Grade Boundary: Low Achieved
5.	For Achieved, the student needs to carry out a practical investigation in a biological context, with guidance. This involves: • stating the purpose, linked to a scientific concept or idea and written as a hypothesis • using a method for a that describes the data that will be collected (pattern seeking activity), range of data/samples, and consideration of some other key factors • collecting, recording, and processing data relevant to the purpose of the investigation • interpreting the processed data and reporting on the findings of the investigation • identifying relevant findings from another source • stating a conclusion based on interpretation of the processed data which is relevant to the purpose of the investigation. This student has written a hypothesis that is linked to a scientific concept (1). A method for a pattern seeking investigation is used to collect, record and process data relevant to the purpose (2). The student has made an attempt to interpret the processed data to report on the findings of the investigation (3). A conclusion is stated that is based on interpretation of the processed data and relevant to the purpose of the investigation (4). Some relevant findings from another source are identified (5). For a more secure Achieved, the student could include more detail to: • interpret the processed data and report on the findings of the investigation • identify and describe relevant findings from another source.

Student 5: Low Achieved

Intended for teacher use only

Purpose: To investigate the distribution of *Potamopyrgus antipodarum* in the Waihopai River.

Aim:

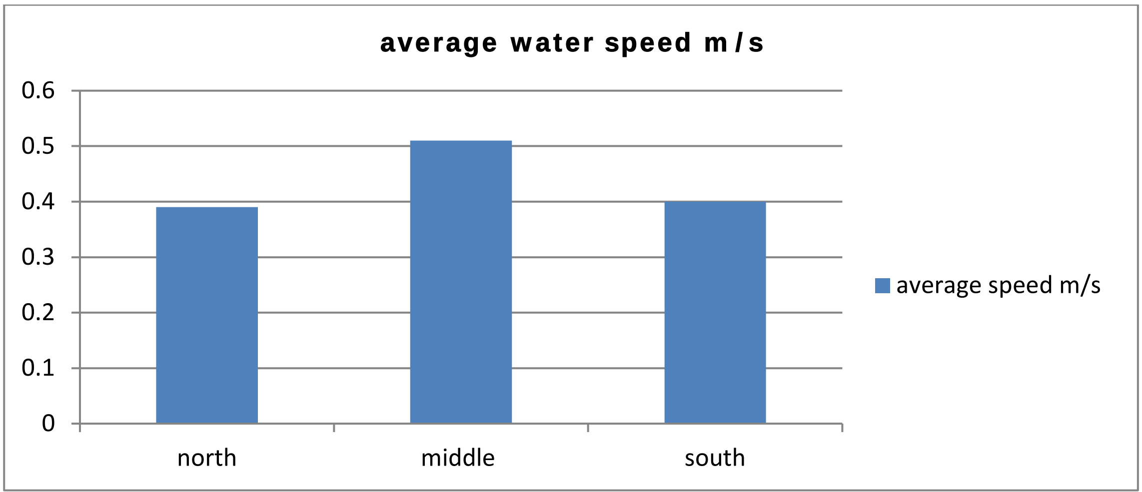
To find out if the speed of the water affects the number of fresh water snails (Potamopyrgus antipodarum) present in a stream bed of the Waihopai River between Queen's drive and the Waihopai Dam.

Hypothesis:

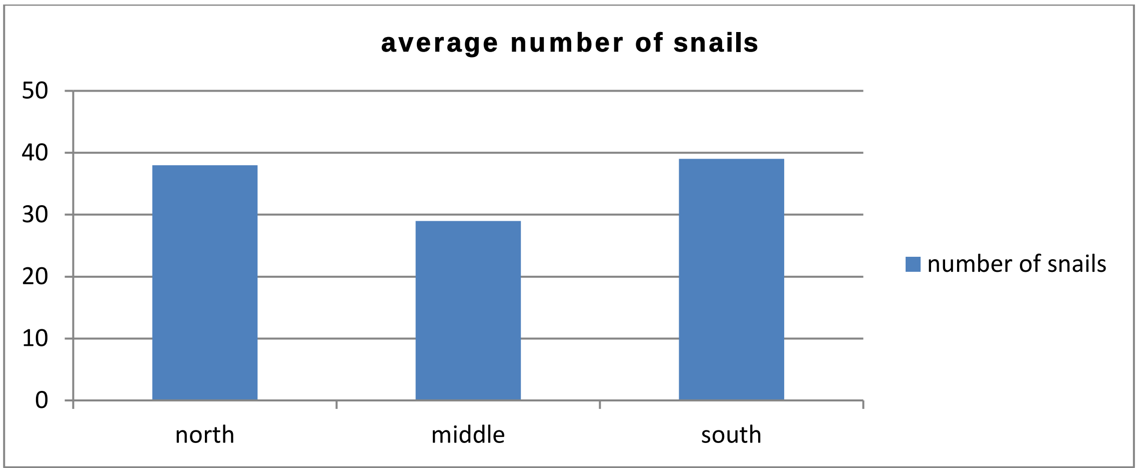
The river edges will have more fresh water snails (Potamopyrgus antipodarum) present than the middle of the river where the speed of the river is faster, because the speed of the current affects the habitat of the snail's algae food source. (1)

Position in river	Average speed (m/s)	Average number of snails
North side	0.39	38
Middle	0.51	29
South side	0.40	39

(2)



(2)



(2)

Conclusion:

The results of my investigation show a clear trend that the speed of the water is fastest in the middle of the stream and the slowest on the edges. There is also a clear trend that there are more snails (Potamopyrgus antipodarum) on the edges of the stream. 3

So my results show that as the speed of the water increases the number of snail's present decrease. This trend is the same as what my hypothesis said would happen. 4

Discussion:
The location of my three sites is on the Waihopai River is between the Queen's Drive Bridge and the dam near Bainfield road. This part of the river has been straightened by humans, so the river is almost a uniform depth and is almost dead straight.

The speed of the water is fastest in the middle and there are more snails present at the sides of the river compared to the middle of the river. There is no significant difference between the number of snails on the south side of the river and the number snails on the north side of the river. The water speed therefore must affect snail distribution; this is because as the water speed of the river increases, it will affect algae growth (periphyton) which will also affect the snails. 3

This trend is similar to what other students in my class found, for example, student A and student B who did similar investigations. 5

The New Zealand freshwater snail has a preference for sediment-contaminated cobbles and the presence of filamentous green algae (Suren, 2005). I feel this is why *Potamopyrgus antipodarum* population is determined by the river's velocity. 5

Potamopyrgus antipodarum found in the Waihopai River is a freshwater snail native to New Zealand. It can inhabit a wide range of ecosystems, including rivers, reservoirs, lakes, and estuaries. P. antipodarum may establish extremely dense populations that can make up over 95% of the invertebrate biomass in a river and compete with or displace native molluscs and macro-invertebrates. They can spread rapidly in introduced areas and are able to withstand desiccation, a variety of temperature regimes, and are small enough that many types of water users could be the source of introduction to new areas.

The Waihopai River has a large amount of algae present. This is because there is a large amount of nutrients flowing through the water due to intensive land use in the waihopai catchment. This provides prime growing conditions to algae so lots of it grows. This means lots of snails. 3

My data is reliable because there was a clear trend found. This trend was clearly seen at all of the sites. If this trend was not seen at every site then another site would have been chosen and the gathering of data would have been repeated. The trend I found is also supported by other students' finds, proving that my data is reliable.

	Grade Boundary: High Not Achieved
6.	For Achieved, the student needs to carry out a practical investigation in a biological context, with guidance. This involves: • stating the purpose, linked to a scientific concept or idea and written as a hypothesis • using a method for a that describes the data that will be collected (pattern seeking activity), range of data/samples, and consideration of some other key factors • collecting, recording, and processing data relevant to the purpose of the investigation • interpreting the processed data and reporting on the findings of the investigation • identifying relevant findings from another source • stating a conclusion based on interpretation of the processed data which is relevant to the purpose of the investigation. This student has written a hypothesis linked to a scientific concept (1). A method for a pattern seeking investigation is used to collect, record and process data relevant to the purpose (2). The student has attempted to interpret the processed data to report on the findings of the investigation (3). A conclusion is briefly considered that is based on interpretation of the processed data and relevant to the purpose of the investigation (4). Some relevant findings from another source are identified (5). To reach Achieved, the student could provide more detailed evidence to: • interpret the processed data to report on the findings of the investigation • identify and describe relevant findings from another source • state a conclusion based on interpretation of the processed data, relevant to the purpose of the investigation.

Student 6: High Not Achieved

NZQA Intended for teacher use only

Purpose: To investigate the distribution of *Potamopyrgus antipodarum* in the Waihopai River.

Aim:

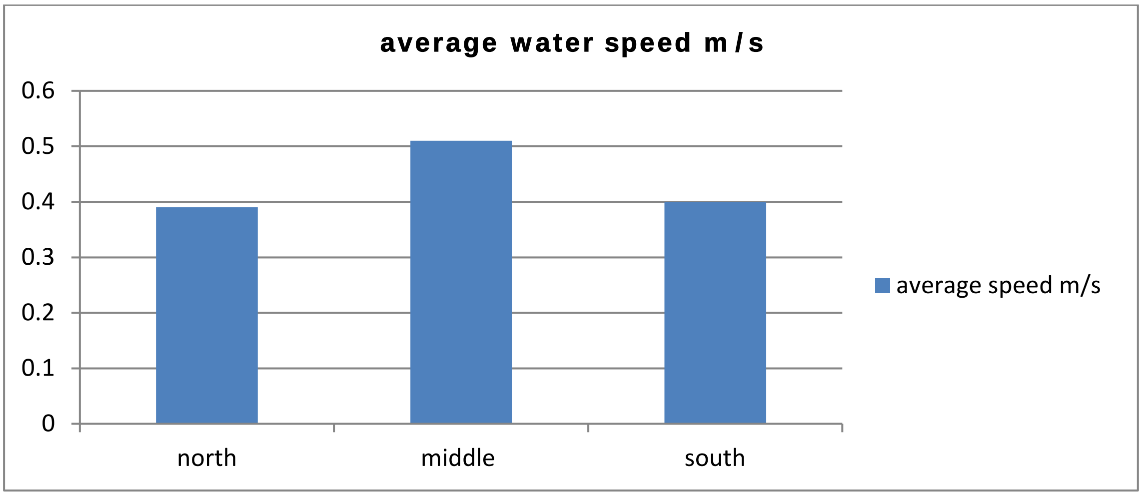
To find out if the speed of the water affects the number of fresh water snails (Potamopyrgus antipodarum) present in the Waihopai River between Queen's drive and the Waihopai Dam.

Hypothesis:

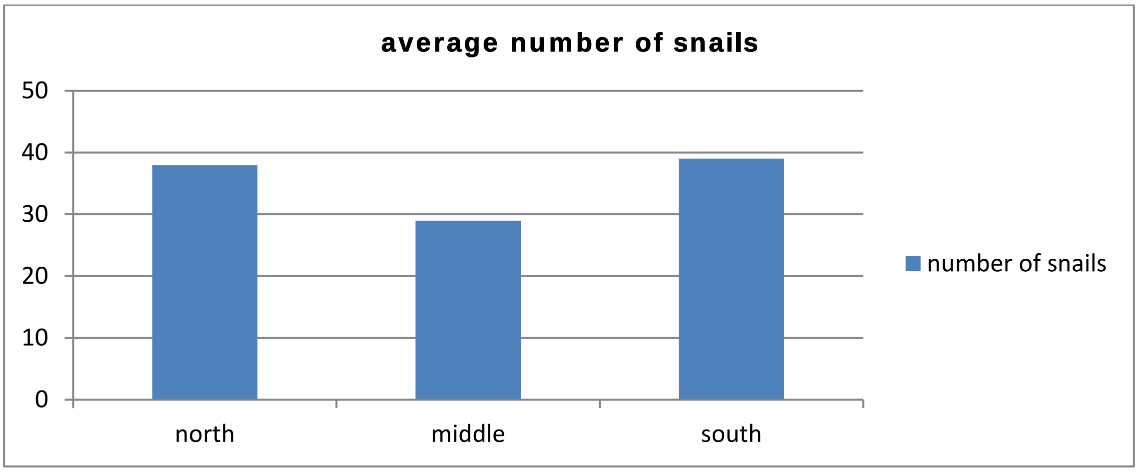
The sides of the river will have more snails (Potamopyrgus antipodarum) present than the middle of the river where the speed of the river is faster, because the speed of the current affects the habitat of the snail's food source. ①

Position in river	Average speed (m/s)	Average number of snails
North side	0.39	38
Middle	0.51	29
South side	0.40	39

②



②



②

Conclusion:

The speed of the water is fastest in the middle of the stream and the slowest on the sides. There are more snails (Potamopyrgus antipodarum) on the edges of the stream. ③

So my results show that as the speed of the water increases the number of snails present decrease. (4)

Discussion:
My three sites are on the Waihopai River between the Queen's Drive Bridge and the dam near Bainfield road. This part of the river has been straightened by humans, so the river is almost dead straight.

There are more snails present at the sides of the river compared to the middle of the river. (3) There is not a huge difference between the number of snails on the south side of the river and the number snails on the north side of the river. The water speed therefore must have the most effect on the snail population.

This pattern is similar to what other students in my class found, for example, student C and student D who did similar investigations. (5)

The New Zealand freshwater snail has a preference for sediment-contaminated cobbles and (5) the presence of filamentous green algae (Suren, 2005). I feel this is why *Potamopyrgus antipodarum* population is determined by the river's velocity.

<u>Potamopyrgus antipodarum</u> found in the Waihopai River is a freshwater snail native to New Zealand. It can inhabit a wide range of ecosystems, including rivers, reservoirs, lakes, and estuaries. They may establish large populations that can make up over 95% of the invertebrates in a river and compete with or displace native molluscs and macro-invertebrates. They can spread rapidly in introduced areas and are able to withstand desiccation, a variety of temperatures, and are small enough that many types of water users could be the source of introduction to new areas.

The Waihopai River has a large amount of algae present. This is because there is a large amount of nutrients flowing through the water due to intensive land use in the waihopai (3) catchment. This provides growing conditions to algae so lots of it grows. This means lots of snails.

My data is reliable because there was a clear trend found. This trend was clearly seen at all of the sites. The trend I found is also supported by other students' finds, proving that my data is reliable