Exemplar for Internal Achievement Standard

Biology Level 2

This exemplar supports assessment against:

Achievement Standard 91158

Investigate a pattern in an ecological community, with supervision

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.

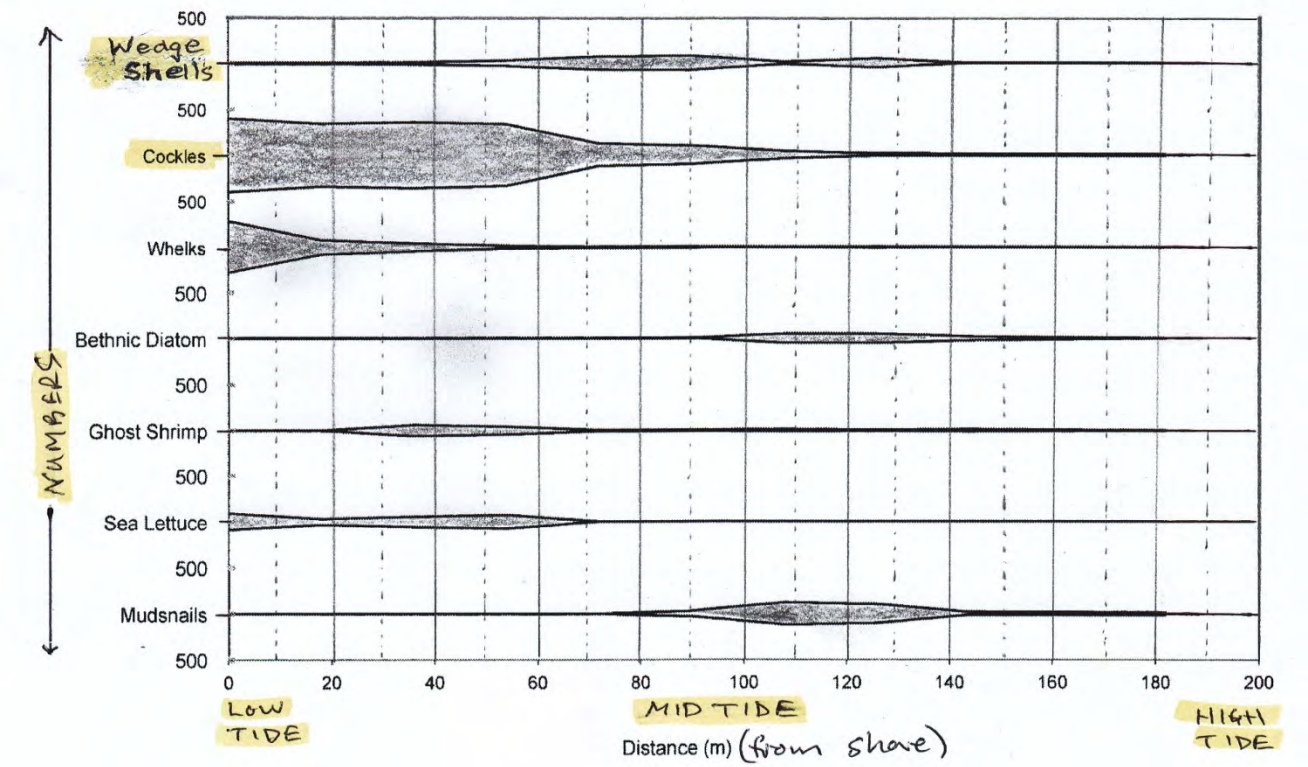
New Zealand Qualifications Authority

To support internal assessment from 2014

	Grade Boundary: Low Excellence
1.	For Excellence, the student needs to comprehensively investigate a pattern in an ecological community, with supervision. This involves using an environmental factor and the biology of interrelated organisms of different species to explain the pattern (or absence of a pattern). The explanation may involve elaborating, applying, justifying, relating, evaluating, comparing and contrasting, and analysing. This student has used information provided in the kite graphs to describe the findings and clearly identify a pattern in the community as zonation (1). The pattern is related to the environmental factor of tidal movement (2). How this environmental factor might affect two chosen species within the community is explained (3). Some reasons for adaptations relating to the pattern (4) and an interrelationship between wedge shells and cockles are explained in some detail (5). For a more secure Excellence, the student could use information in the kite graphs and other data that was provided to explain the pattern more thoroughly. For example, a more thorough explanation could be provided by analysing the data and information provided in more detail, elaborating even more on Gause's principle to show how or why an environmental factor and the biology of interrelated organisms of the two different species are related to the pattern.

Please note – These are extracts from one student's response

Class Results: Kite graphs showing distribution of species from low tide water mark at Mahara Bay Estuary on 26 February 2014



The collated class results came from field work done by 10 groups at Mahara Bay estuary. Transect lines were placed at right angles to the low tide and samples taken at stations every 20m using a 0.5m x 0.5m quadrat. At each station, all organisms on the surface were identified and counted, before digging up the whole quadrat to a depth of 0.1m and counting organisms found in that. We recorded substrate and habitat type at each station.

My investigation focus was to analyse the community pattern within the Mahara Bay ecosystem. Mahara Bay is an estuary formed where freshwater from rivers and streams mixes with salt water and flows into the Pacific Ocean. The habitat is mainly mudflats, coastal wetlands formed when mud is deposited by tides or rivers. The temperature of the water is important because it affects the amount of dissolved oxygen the water can hold. Aquatic organisms are dependent on dissolved oxygen for their survival in this ecosystem. The main abiotic factors include tidal movement (aerial exposure) and the sediment composition within the estuary. 2

1 The community distribution pattern shown by the results in the class kite graphs is zonation. The analysis of the data and information provided shows that there is spatial pattern of distinct horizontal bands of organisms from the low to the high tide. This pattern is shaped mostly by the abiotic factor of daily tidal movement meaning that some organisms living in this community are affected by prolonged periods of aerial exposure. 2

2 Another abiotic factor that we found was the substrate (sediment) composition in different zones of the mudflats. A biotic factor that influenced the pattern was inter- specific

5 competition between species, particularly in the low tide area. For example, cockles, whelks and wedge shells.

Two species I have chosen that show an interrelationship in this community are cockles (*Austrovenus stuchburyi)* and wedge shells (*Macomona liliana*).

1 Cockles were found in the low and mid tidal zones, up to 120 m. They are most abundant from 0 m – 60 m, as this area is covered by sea water longer than the other zones. They live just below the substrate surface in muds of fine sand at the low tide, and sandy silts in the intertidal zone. 2

Cockles are bivalve molluscs. They require oxygen for respiration to provide energy all their life processes, and a source of food for nutrition. 4 They have structural adaptations to carry out gas exchange and feed. Gills have a large surface area, and allow them to carry out gas exchange efficiently underwater by removing oxygen that has been dissolved from the air. They have two similar shells hinged together by a strong ligament that allows them to seal themselves and the water inside the shells, to keep the gills moist at low tide. 3 The gills do two jobs – take in oxygen and filter out fine food particles like diatoms (phytoplankton). Tiny hairs wave the water containing oxygen and direct these food particles towards the mouth.

4 Cockles are filter feeders, found just below the surface of the mud with siphons opening just above. When the tide comes in they draw seawater carrying food in into its outer body cavity through its 'inhalant' siphon. They push the water out through its 'exhalent' siphon. Large particles are removed by palps and redirected to the exhalent stream. When cockles are feeding, their siphons can be seen above the surface sediment. Both siphons are designed to give the cockle structure and direction in the inhaling of water and food and the exhaling of waste. These siphons mean that when the cockle is feeding, it does not have to bring itself out of the mud and risk exposing itself to predators. 3 The siphons mean the process of feeding is efficient, ensuring the cockle can feed as much as possible when it is high tide. These structural adaptations help the cockle to have an efficient system in terms of exchanging gasses, feeding and gaining nutrition to carry out it numerous life processes.

1 Wedge shells are large bivalve molluscs. They are surface deposit feeders that were found from 40 m – 140 m, most abundant between 60 m – 100 m. Wedge shells are also filter feeders, but feed on the organic matter on the mud beds as well. Adults can have a strong effect on many other sediment-dwelling organisms living nearby. Their distribution overlaps with cockles, meaning there is interspecific competition between them with cockles. 5

5 The distribution data shows that wedge shells have a wider zone of tolerance than cockles, as they were found to be more abundant on the mid-tide zone. This is where the cockle distribution became less dense as there is less time to feed and carry out gas exchange. At this upper limit the cockles would be entering a zone of physiological stress. However, wedge shells are better adapted to live and carry out feeding in this zone.

Gause's competitive-exclusion principle states that no two species with identical niches can co-exist for long in the same place. At the Mahara Bay estuary, the cockles' ability to filter feed means that they were more abundant in the low tide zone. Wedge shells also filter feed, but they were found mainly in the mid tide zone as they are able to physiologically tolerate abiotic factors such as aerial exposure due to tidal movements better than cockles. 5

	Grade Boundary: High Merit
2.	For Merit, the student needs to investigate in-depth a pattern in an ecological community, with supervision. This involves providing a reason for how or why the biology of one of the chosen species relates to the pattern (or absence of a pattern). The biology involves structural, behavioural or physiological adaptations of the organism which are related to the environmental factor and to an interrelationship with an organism of another species (e.g. competition, predation, or mutualism). This student has used information provided in the kite graphs to describe the findings and clearly identify a pattern in the community as zonation (1). The pattern is related to the environmental factor of tidal movement (2). How this environmental factor might affect two chosen species within the community is explained (3). Reasons for adaptations relating to the pattern (4) and an interrelationship between wedge shells and cockles are explained in some detail (5). To reach Excellence, the student could use information in the kite graphs and other data that was provided to explain the pattern in more depth. For example, an in depth explanation could be provided by using Gause's principle to further analyse and elaborate on how or why an environmental factor and the biology of the interrelated organisms of the two different species are linked to the pattern.

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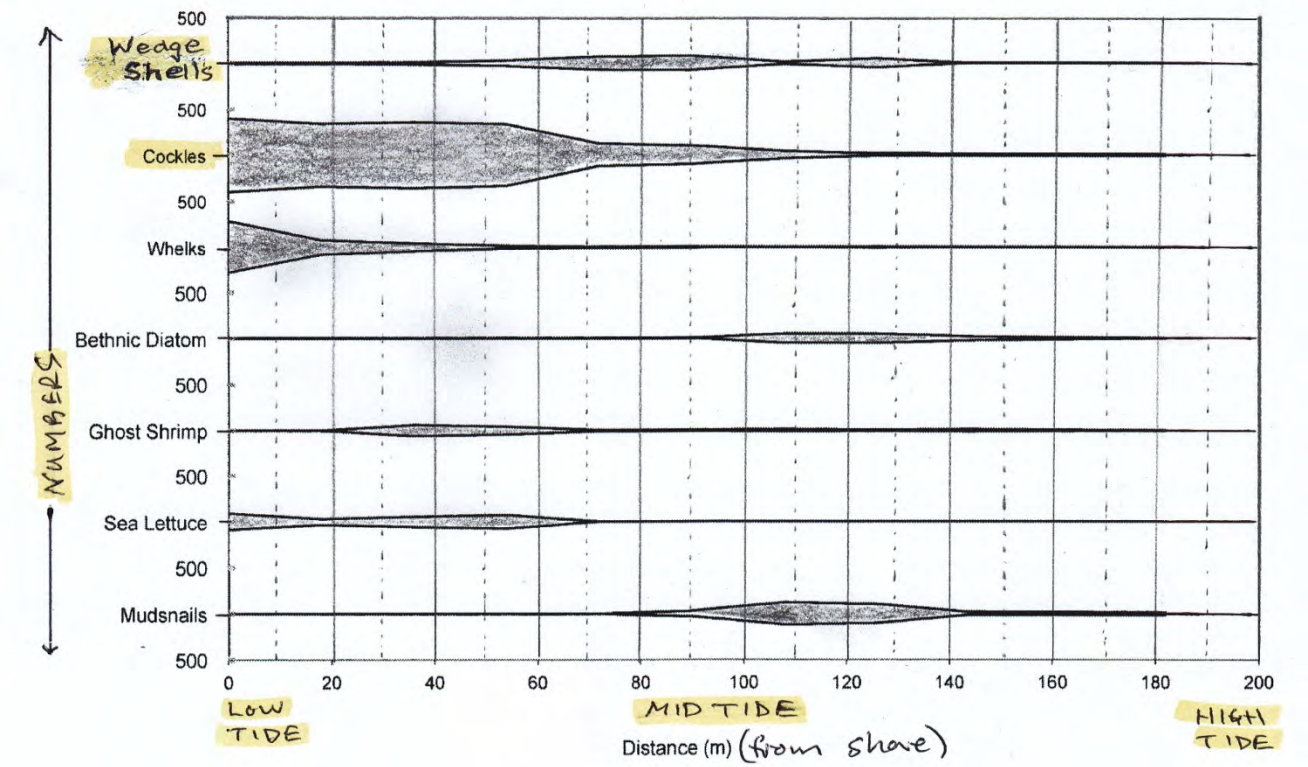

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1 The community distribution pattern shown by the results in the class kite graphs is zonation. The analysis of the data and information provided shows that there is spatial pattern of distinct horizontal bands of organisms from the low to the high tide. This pattern is shaped mostly by the abiotic factor of daily tidal movement meaning that some organisms living in this community are affected by prolonged periods of aerial exposure. 2

2 Another abiotic factor that we found was the substrate (sediment) composition in different zones of the mudflats. A biotic factor that influenced the pattern was inter-specific

5

competition between species, particularly in the low tide area. For example, between cockles, whelks and wedge shells.

Two species I have chosen that show an interrelationship in this community are cockles (*Austrovenus stuchburyi)* and wedge shells (*Macomona liliana*).

1

Cockles were found in the low and mid tidal zones, up to 120 m. They are most abundant from 0 m – 60 m, as this area is covered by sea water longer than the other zones. They live just below the substrate surface in muds of fine sand at the low tide, and sandy silts in the intertidal zone.

2

Cockles are bivalve molluscs. They require oxygen for respiration to provide energy all their life processes, and a source of food for nutrition.

4

They have structural adaptations to carry out gas exchange and feed. Gills have a large surface area, and allow them to carry out gas exchange efficiently underwater by removing oxygen that has been dissolved from the air. They have two similar shells hinged together by a strong ligament that allows them to seal themselves and the water inside the shells, to keep the gills moist at low tide. The gills do two jobs – take in oxygen and filter out fine food particles like diatoms (phytoplankton). Tiny hairs wave the water containing oxygen and direct these food particles towards the mouth.

3

4

Cockles are filter feeders, found just below the surface of the mud with siphons opening just above. When the tide comes in they draw seawater carrying food in into its outer body cavity through its 'inhalant' siphon. They push the water out through its 'exhalent' siphon. Large particles are removed by palps and redirected to the exhalent stream. When cockles are feeding, their siphons can be seen above the surface sediment. Both siphons are designed to give the cockle structure and direction in the inhaling of water and food and the exhaling of waste. These siphons mean that when the cockle is feeding, it does not have to bring itself out of the mud and risk exposing itself to predators. The siphons mean the process of feeding is efficient, ensuring the cockle can feed as much as possible when it is high tide. These structural adaptations help the cockle to have an efficient system in terms of exchanging gasses, feeding and gaining nutrition to carry out it numerous life processes.

3

1

Wedge shells are large bivalve molluscs. They are surface deposit feeders that were found from 40 m – 140 m, most abundant between 60 m – 100 m. Wedge shells are also filter feeders, but feed on the organic matter on the mud beds as well. Adults can have a strong effect on many other sediment-dwelling organisms living nearby. Their distribution overlaps with cockles, meaning there is interspecific competition between them with cockles.

5

5

The distribution data shows that wedge shells have a wider zone of tolerance than cockles. This mid tide is where the cockle distribution became less dense as the cockles would be entering a zone of physiological stress. However, wedge shells are better adapted to live and carry out feeding in this zone.

Gause's competitive-exclusion principle states that no two species with identical niches can co-exist for long in the same place. At the Mahara Bay estuary, cockles were more abundant in the low tide zone. While their distribution overlaps with wedge shells, the wedge shells were found mainly in the mid tide zone, which means they can both co-exist.

5

	Grade Boundary: Low Merit
3.	For Merit, the student needs to investigate in-depth a pattern in an ecological community, with supervision. This involves providing a reason for how or why the biology of one of the chosen species relates to the pattern (or absence of a pattern). The biology involves structural, behavioural or physiological adaptations of the organism which are related to the environmental factor and to an interrelationship with an organism of another species (e.g. competition, predation, or mutualism). This student has used information provided in the kite graphs to describe the findings and clearly identify a pattern in the community as zonation (1). The pattern is related to the environmental factor of tidal movement (2). How this environmental factor might affect two chosen species within the community is briefly explained (3). Some reasons for adaptations relating to the pattern (4) and an interrelationship between wedge shells and cockles are given (5). For a more secure Merit, the student could use the data that was provided to give a more detailed explanation of how and why an adaptation of the organism is related to an environmental factor and to an interrelationship with an organism of another species. For example, the student could provide more detail about predation, inter-specific competition for space, food.

Please note – These are extracts from one student's response

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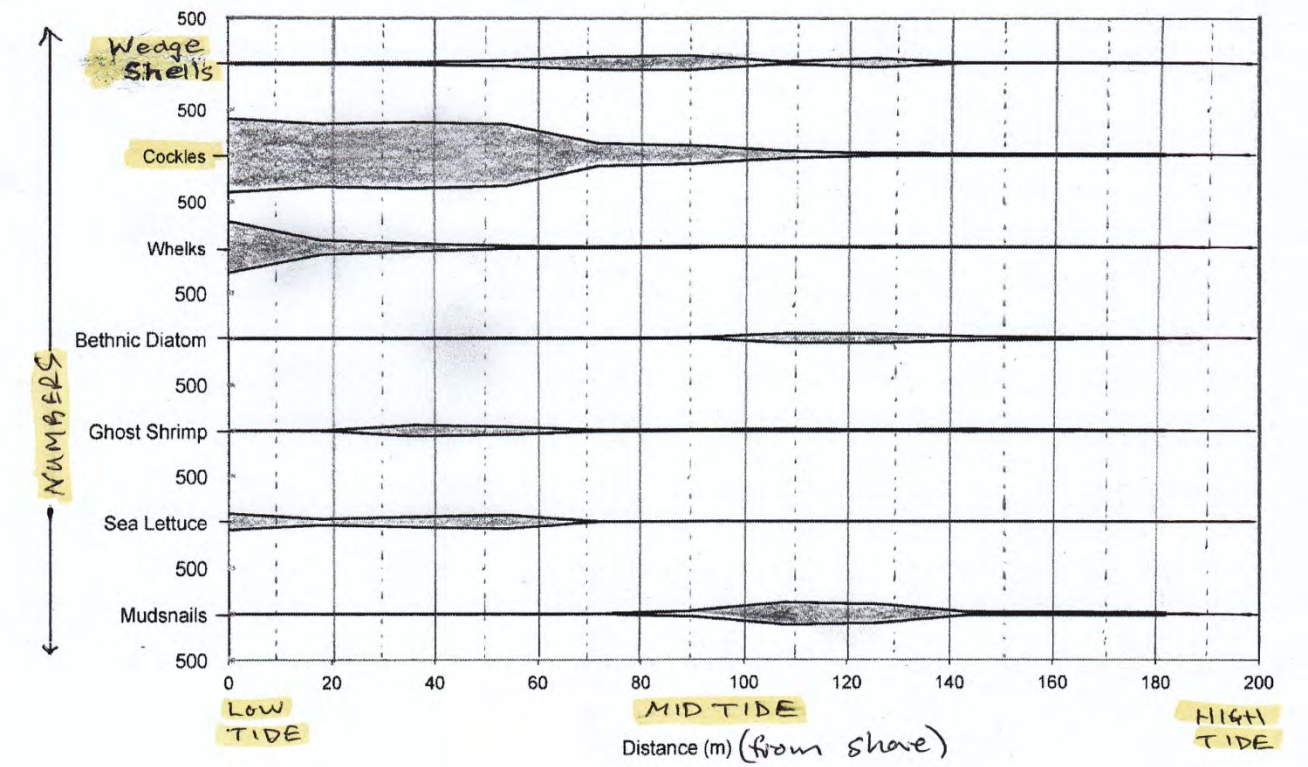

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1 The community distribution pattern shown by the results in the class kite graphs is zonation. The analysis of the data and information provided shows that there is spatial pattern of distinct horizontal bands of organisms from the low to the high tide. This pattern is shaped mostly by the abiotic factor of daily tidal movement meaning that some organisms living in this community are affected by prolonged periods of aerial exposure. 2

2 Another abiotic factor that we found was the substrate (sediment) composition in different zones of the mudflats. A biotic factor that influenced the pattern was competition between species, particularly in the low tide area. For example, cockles, whelks and wedge shells. 5

Two species I have chosen that show an interrelationship in this community are cockles (*Austrovenus stuchburyi)* and wedge shells (*Macomona liliana*).

1 Cockles were found in the low and mid tidal zones, up to 120 m. They are most abundant from 0 m – 60 m, as this area is covered by sea water longer than the other zones. They live just below the substrate surface in muds of fine sand at the low tide, and sandy silts in the intertidal zone. 2

4 Cockles are bivalve molluscs. They require oxygen for respiration and food for nutrition. They have structural adaptations to carry out gas exchange and feed. Gills have a large surface area, and carry out gas exchange by removing oxygen that has been dissolved from the air. They have two similar shells hinged together by a strong ligament that allows them to seal themselves and the water inside the shells. The gills do two jobs – take in oxygen and filter out fine food particles like diatoms (phytoplankton). Like most organisms in the estuary, cockles need water for longer periods of time which is why they are found in the low tide area. 3

4 Cockles are filter feeders, found just below the surface of the mud with siphons opening just above. When the tide comes in seawater carrying food enters its body cavity through a siphon. They push water out through another siphon. When cockles are feeding, their siphons can be seen above the surface sediment. The siphons ensure the cockle can feed as much as possible when it is high tide. These structural adaptations help the cockle to have an efficient system in terms of exchanging gases, feeding and gaining nutrition to carry out its numerous life processes. 3

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5

The distribution data shows that Wedge shells have a wider zone of tolerance than cockles, as they were found to be more abundant on the mid-tide zone. This is where the cockle distribution became less dense with less time to feed and carry out gas exchange. At this upper limit the cockles would be entering a zone of physiological stress. However, wedge shells are better adapted to live and carry out feeding in this zone. 3

5 Gause's principle states species with identical niches cannot co-exist for long in the same place. At the Mahara Bay estuary, the cockles' ability to filter feed means that they were more abundant in the low tide zone. Wedge shells were found mainly in the mid tide zone.

	Grade Boundary: High Achieved
4.	For Achieved, the student needs to investigate a pattern in an ecological community, with supervision. This involves: • describing observations or findings, and using those findings to identify the pattern (or absence of a pattern) in an ecological community • relating this pattern to an environmental factor • describing how the environmental factor might affect chosen species within the community. This student has used information provided in the kite graphs to describe the findings and clearly identify a pattern in the community as zonation (1). The pattern is related to the environmental factor of tidal movement (2). How this environmental factor might affect two chosen species within the community is considered (3). Some reasons for an adaptation relating to the pattern are given (4), and an interrelationship between wedge shells and cockles is briefly considered (5). To reach Merit, the student could use information in the kite graphs and other data that was provided to give a more thorough reason explaining how or why the an adaptation of one of the chosen species relates to the pattern, and explain in more depth the interrelationship with an organism of another species.

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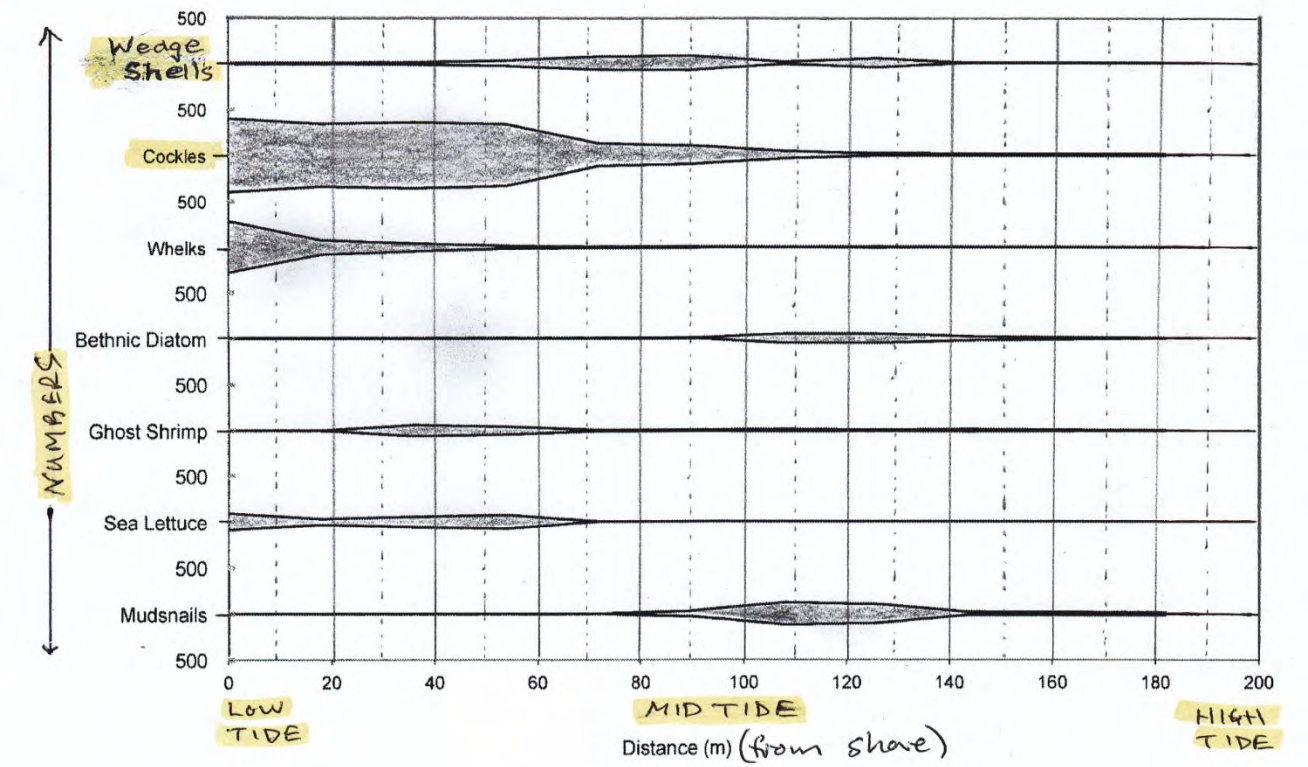

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My investigation focus was to study the community pattern in the Mahara Bay. We observed a variety of life there, including predatory birds like oyster catchers.

2

Mahara Bay is an estuary affected by the tides and consists of mudflats that are covered and uncovered by the tide twice a day. The main abiotic environmental factor affecting organisms found there is this tidal movement and exposure to air when the tide is out as a result.

In the mudflats there were a variety of patterns that I observed from the organisms in this community.

1

The obvious pattern shown by the living things is zonation. This is because there are distinct horizontal bands of living things as go from the low to the high tide. Things such as tidal movement, aerial exposure, mud/sand composition and temperature all influence the mudflat and organisms that live in it. There are also biotic factors such as competition for food and space, and predation.

2

While there were lots of other species, the two species that I chose to study in this community were cockles (*Austrovenus stuchburyi)* and wedge shells (*Macomona liliana*).

Other interesting species that showed the zonation were mud snails, sea lettuce and whelks. All the organisms were related in some way in a food web. They are interrelated as they need each other to live.

In general, as you get closer to the low tide the number of organisms and different species increase. Cockles were found in the low and mid tidal zones, up to 120 m as this area is covered by sea water longer than the other zones. They can be found mostly in the area from 0 m – 60 m, just below the mud/sand surface. They live just below the surface in muds of fine sand at the low tide, and sandy silts in the mid tide. The deepest we found them was 10 cm.

1

2

Cockles need food and oxygen to carry out their life processes to survive. They have adaptations to carry out gas exchange and feed. They are adapted by having gills that carry out gas exchange underwater when the tide is in. The gills do two jobs – take in oxygen and filter out fine food particles. Tiny hairs wave the water containing oxygen and direct food particles towards the mouth. Like most organisms in the estuary, cockles need water all the time which is why they are found in the low tide area.

4

3

Cockles are filter feeders, found just below the surface of the mud with siphons opening just above. The Oyster catchers prey on cockles for their food. To stay away from predators the cockle has a muscular foot which it uses to bury downwards in the mud.

4

5

Wedge shells were found from 40 m – 140 m in the mid tide zone, mainly between 60 m – 100 m. They are surface deposit feeders (and filter feeders like cockles) as they feed on the organic matter on the mud beds as well. Their distribution overlaps with cockles, so there is competition between them.

1

5

Wedge shells have a wider range of tolerance to physiological stress from drying out than cockles, as they were found in higher numbers in the mid-tide zone. They are better adapted to live and carry out feeding in this zone, which is covered by seawater less of the time than for those organisms in the low tide.

3

Gause's principle states that no two species can co-exist for long in the same place. At the Mahara Bay estuary, cockles and wedge shells can live together because they have different ecological niches.

5

Overall my group concluded that there was a zonation community pattern present at Mahara Bay. The two animals we chose to study were prime examples of this occurring on the mudflat. The cockle used a variety of adaptive features and interrelationships to live in its zone at the estuary. It needs enough water to filter feed and that is why it is found in the low tide area. The cockle has to compete for space and food with other species like the edge shells, so that is why some cockles were found in the mid tide area as well.

3

This distribution pattern occurs because of the tides combined with abiotic factors such as aerial exposure, sunlight, salinity, sediment composition and temperature. Biotic factors also affect the zonation pattern. These include competition for space, predators and parasites. Zones are created because organisms can only live in a range that they can tolerate.

4

	Grade Boundary: Low Achieved
5.	For Achieved, the student needs to investigate a pattern in an ecological community, with supervision. This involves: • describing observations or findings, and using those findings to identify the pattern (or absence of a pattern) in an ecological community • relating this pattern to an environmental factor • describing how the environmental factor might affect chosen species within the community. This student has used information provided in the kite graphs to describe the findings and identify a pattern in the community as zonation (1). The pattern is related to the environmental factor of tidal movement (2). How this environmental factor might affect wedge shells and cockles within the community is briefly considered (3). For a more secure Achieved, the student could use information in the kite graphs and other data that was provided to include more specific details in describing the pattern by showing where the two species were abundant, and describing more thoroughly how one environmental factor might affect both chosen species within the estuary community.

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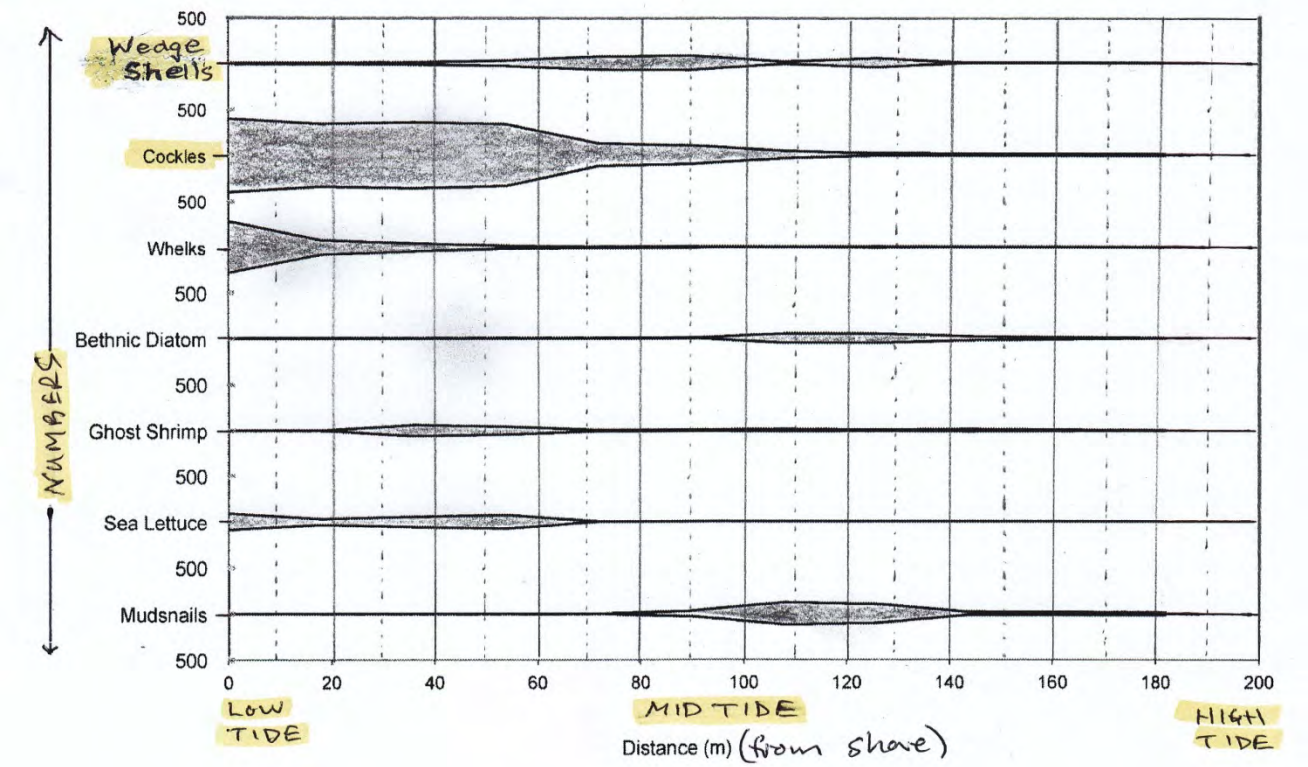

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My investigation focus was to study the community pattern in the Mahara Bay. We observed a variety of life there, including predatory birds like oyster catchers.

2

Mahara Bay is an estuary affected by the tides and consists of mudflats that are covered and uncovered by the tide twice a day. The main abiotic environmental factor affecting organisms found there is this tidal movement.

In the mudflats there were a variety of patterns that I observed from the organisms in this community.

1

The obvious pattern shown by the living things is zonation. This is because there are distinct horizontal bands of living things as go from the low to the high tide. Things such as tidal movement, aerial exposure, mud/sand composition and temperature all influence the mudflat and organisms that live in it. There are also biotic factors such as competition for food and space, and predation.

2

While there were lots of other species, the two species that I chose to study in this community were cockles (*Austrovenus stuchburyi)* and wedge shells (*Macomona liliana*).

Other interesting species that showed the zonation were mud snails, sea lettuce and whelks. All the organisms were related in some way in a food web. They are interrelated as they need each other to live.

1

In general, as you get closer to the low tide the number of organisms and different species increase. Cockles were found in the low and mid tidal zones, up to 120 m as this area is covered by sea water longer than the other zones. They live just below the mud/sand surface. The deepest we found them was 10 cm.

Cockles need food and oxygen to carry out their life processes to survive. They have adaptations to carry out gas exchange and feed. They have gills that carry out gas exchange underwater when the tide is in. The gills do two jobs – take in oxygen and filter out fine food particles. Cockles are filter feeders, found just below the surface of the mud with siphons opening just above. Oyster catchers prey on cockles for their food. To stay away from predators the cockle has a muscular foot which it uses to bury downwards in the mud.

3

1

Wedge shells were found mainly from 40 m – 140 m in the mid tide zone. They are surface deposit feeders (and filter feeders like cockles) as they feed on the organic matter on the mud beds as well. Their distribution overlaps with cockles, meaning there is competition between them.

Wedge shells have a wider range of tolerance than cockles, as they were found in higher numbers in the mid-tide zone. They are better adapted to live and carry out feeding in this zone, which is covered by seawater less of the time than the low tide.

3

Overall my group concluded that there was definitely a zonation pattern present at Mahara Bay. The two animals we chose to study were good examples of this. The cockle has a variety of adaptations to live in its zone at the estuary. It needs enough water to filter feed and that is why it is found in the low tide area. The cockle has to compete for space and food with other species like the wedge shells, so that is why some cockles were found in the mid tide area as well.

3

	Grade Boundary: High Not Achieved
6.	For Achieved, the student needs to investigate a pattern in an ecological community, with supervision. This involves: • describing observations or findings, and using those findings to identify the pattern (or absence of a pattern) in an ecological community • relating this pattern to an environmental factor • describing how the environmental factor might affect chosen species within the community. This student has used information provided in the kite graphs to briefly describe the findings and a pattern in the community as zonation (1). The pattern is related to the environmental factor of tidal movement (2). How this environmental factor might affect wedge shells and cockles within the community is briefly considered (3). To reach Achieved, the student could use information in the kite graphs and other data that was provided to include more specific details in the description of the pattern and how an environmental factor might affect both chosen species within the estuary community.

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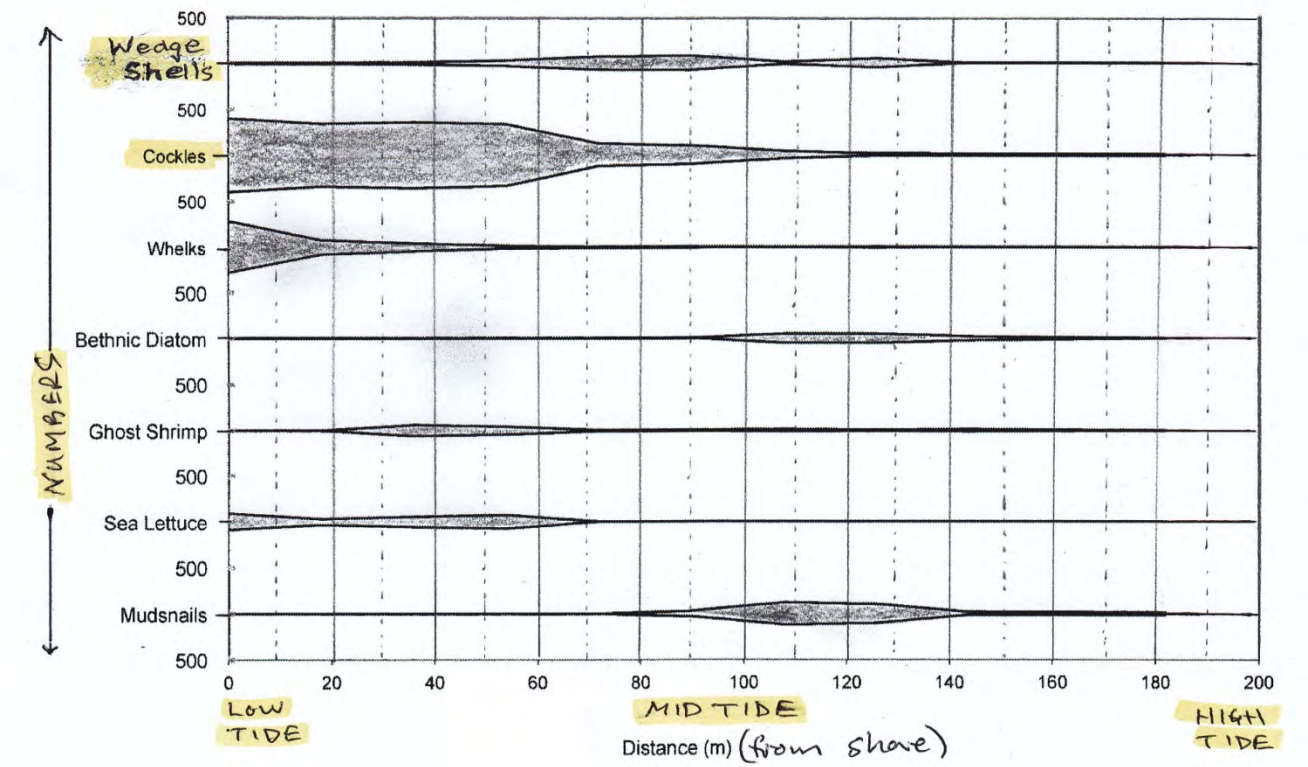

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My investigation focus was to study the community pattern in the Mahara Bay. We observed a variety of life there, including predatory birds like oyster catchers.

2

Mahara Bay is mainly mudflats that came from when mud was deposited by tides or rivers. The main environmental factor affecting life there is the tidal movement.

In the mudflats there were a variety of patterns that I observed from the organisms (living things) in the estuary.

1

The obvious pattern shown by the living things is zonation. This is because there are clear areas of living things from the low to the high tide. Things such as tide and exposure affect the mudflat and things that live in it. There are also things like competition for food and space.

2

While there were lots of other species, the two species that I chose to study in this community were cockles (*Austrovenus stuchburyi)* and wedge shells (*Macomona liliana*). Other interesting species that showed the zonation were mud snails, sea lettuce and whelks. All the organisms were related in some way in a food web. They need each other to live.

In general, as you get closer to the low tide the number of organisms increase.

1

We found a very small number of cockles in the high tide. As you head towards the low tide, the number of cockles rapidly increases. Cockles were found in the low and mid tide. They mainly live below the surface in muds in the mid tide, as shown by the graph.

Cockles need food and oxygen to survive. They have adaptations to carry out gas exchange and feed. They have gills that carry out gas exchange underwater when the tide is in. The gills do two jobs – take in oxygen and filter out fine food particles. Cockles are filter feeders, found just below the surface of the mud with siphons opening just above. Oyster catchers prey on cockles for their food. To stay away from predators the cockle has a muscular foot which it uses to bury downwards in the mud.

3

1

Wedge shells were found mainly in the mid tide. Wedge shells are also filter feeders, but feed on the organic matter on the mud beds as well. Their distribution overlaps with cockles, meaning there is competition between them.

Wedge shells have a wide range of tolerance, as they were found in higher numbers in the mid-tide. They are better suited to live and feed in this area as it is covered by seawater less of the time.

3

Overall my group found that there was a clear pattern present at Mahara Bay. The two animals we chose to study showed this. The cockle has special features to live in its area. It needed heaps of water to filter feed and that is why it is found in the low tide. The cockle had to fight for space and that is why some cockles were found in the mid tide area.

3