Marine Studies 2004

Sample assessment instrument and student responses

Field trip report: Marine biology

This sample is intended to inform the design of assessment instruments in the senior phase of learning. It highlights the qualities of student work and the match to the syllabus standards.

Criteria assessed

- Knowledge and understanding
- Information processing and reasoning
- Skills

Assessment instrument

The response presented in this sample is in response to assessment tasks.

Time

- 2-day field trip to collect data
- 2 lessons in laboratory time to complete water analysis
- 1 lesson for report writing

Conditions

- Group and individual work for data collection in the field and laboratory
- Individual workbooks and written report
- Written report under test conditions, notes and work books allowed

Task A — Food webs

1. Draw a mangrove food web representing the species that are typically present in the mangrove system.
2. Annotate your diagram to show the feeding levels: producers, consumers (1st, 2nd, 3rd order), decomposers.
3. Using the organisms in your food web, complete the table to identify each organism as an autotroph, herbivore, carnivore, omnivore, detritivore or saprotroph.
4. Which feeding level is the most abundant?
5. Water ecosystems often have a food web described as an “inverted pyramid” (greater biomass of consumers than producers). Explain how this can be a functioning ecosystem.
6. Describe any associations that may exist between the organisms found in the mangrove. Examples of associations could include: predator–prey, mutualism, competition, commensalism, parasite–host.
7. Choose two organisms you have observed in the mangroves and describe the features that help it survive in this environment. You may include diagrams in your explanation.
8. The popularity of hermit crabs for hobbyists and pet owners has seen large numbers of hermit crabs being taken from the mangroves. Predict the impact this will have on the mangrove ecosystem. Refer to your food web to support your claims.

Task B — Keys

9. Locate the three mangrove species and draw sketches of the features of each. Use the key to identify the species to which they belong.
10. Using the key in appendix A as a model, and your observations in the field, develop a dichotomous key that can be used in the field to identify the three mangrove types, including any extra features you have observed.

Task C — Distribution

11. Explain any patterns you have identified for the distribution of the three mangrove types.
12. Sketch the area from the road to the sea to represent the distribution of mangrove species and other vegetation. Include a key to represent the species identified. Indicate the location of your transect and three quadrats.
13. Choose three locations along your transect and sketch a quadrat for each. Mark the location of your quadrats on your transect. Indicate the size of the quadrat and include a key.

Task D — Zonation

14. Draw a profile diagram from the low-water mark to the high-water mark. Label the zones that can be seen, using the correct terminology.
15. Describe the features you have used to distinguish each zone.
16. Choose a rock pool and sketch the distribution of organisms within and around it. Use the information in appendix B to identify any unfamiliar organisms. Include a key.
17. Describe the adaptations (structural, functional or behavioural) that influence the distribution of the organisms identified.

Task E — Abiotic factors

18. For each of the five crab-pot sites, measure or describe the abiotic factors. Complete the table.
19. Explain two potential problems caused by using crab pots for collecting data.

Task F — Report (in-class task)

On the field trip, you recorded information about a range of abiotic factors. Water samples were collected and analysed in the laboratory to measure salinity, nitrogen and phosphorus levels, and total solids.

From this information write a report relating the pot sites to aspects of water quality, and the chances of finding crabs in the area.

Your report should:

- relate your field data to the chances of finding crabs at particular pot sites
- determine the most likely factor/s that affect crab numbers at particular sites
- suggest a reason for changes (if they occur) in the abiotic factors at the different depths.

Instrument-specific criteria and standards

Student responses have been matched to instrument-specific criteria and standards; those which best describe the student work in this sample are shown below. For more information about the syllabus dimensions and standards descriptors, see http://www.qsa.qld.edu.au/1956.html.

	Standard A	Standard C
Knowledge and understanding	The student work has the following characteristics: • Recalling and comprehending subject matter: – recalling a range of marine biology subject matter in all sections of the course – explaining simple and complex relationships among marine biology ideas and concepts.	The student work has the following characteristics: • Recalling and comprehending subject matter: – recalling simple marine biology subject matter – identifying and describing relationships among marine biology ideas and concepts.
Information processing and reasoning	The student work has the following characteristics: • Planning and conducting investigations – collecting and organising data in forms appropriate to the task. • Interpreting and evaluating information and ideas – critically analysing to establish relationships in marine biology field data and observations • Communicating information and ideas – coherently and effectively, using and exploiting a range of generic structures for communicating field observations - using vocabulary and language conventions effectively and with discrimination	The student work has the following characteristics: • Planning and conducting investigations – collecting data within identified categories. • Interpreting and evaluating information and ideas – identifying simple relationships and in marine biology field data and observations • Communicating information and ideas – coherently, following prescribed generic structures for communicating field observations – using vocabulary and language so that meaning is clear.
Skills	The student work has the following characteristics: • Performing manipulative skills in integrated tasks: - performs a range of integrated task sequences safely, efficiently and accurately, modifying procedures where necessary to complete activities without significant faults.	The student work has the following characteristics: • Performing manipulative skills in integrated tasks: - performs a range of integrated task sequences safely, making straightforward modifications to procedures where necessary to complete activities.

Note: Colour highlights have been used in the table to emphasise the qualities that discriminate between the standards.

Key: Qualitative differences across the standards
Cognitive processes demonstrated in the response

Indicative response — Standard A

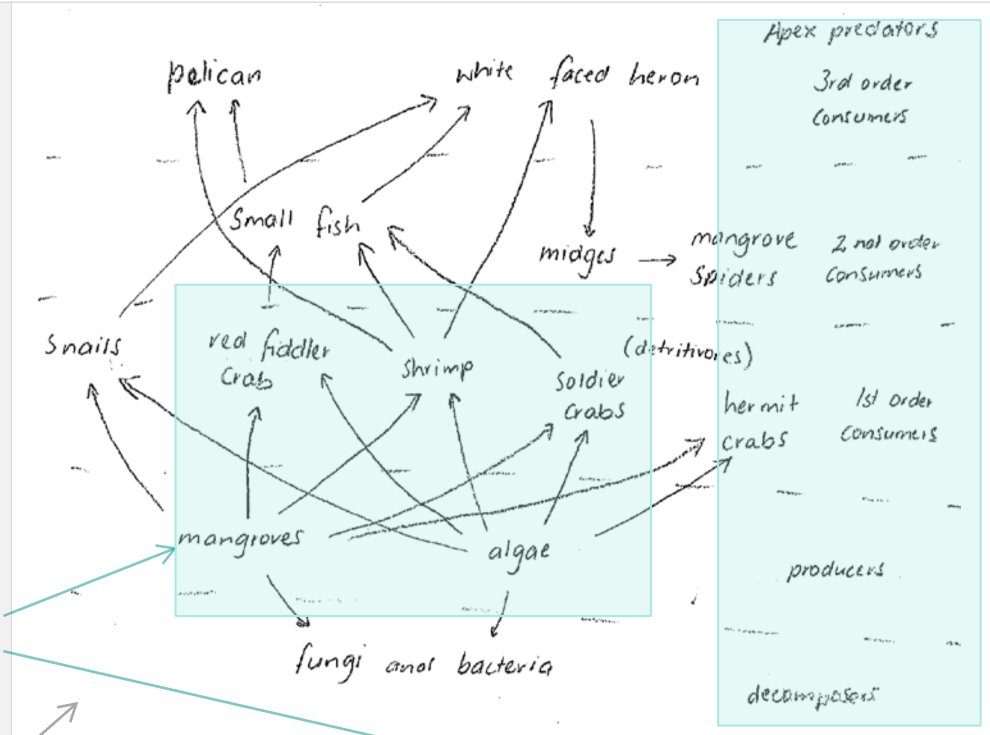
The annotations show the match to the instrument-specific standards.

Comments

Some sections of the student response are highlighted to identify where aspects of the criteria might be found, but this does not demonstrate the only instances where the standard is demonstrated within the response.

Explaining simple and complex relationships among marine biology ideas and concepts

Collecting and organising data in forms appropriate to the task



Organism	Type of feeder
pelican	carnivore
white faced heron	carnivore
fish	omnivore
crabs	detritivore
prawns / shrimp	detritivore
mangroves	autotroph
algae	autotroph
spiders	heterotroph (?)
midges	carnivores
fungi	saprotroph
bacteria	saprotroph

4. Which feeding level is the most abundant?

mangroves – producers.

Comments	
Explaining simple and complex relationships among marine biology ideas and concepts	5. Water ecosystems often have a food web described as an "inverted pyramid" (greater biomass of consumers than producers). Explain how this can be a functioning ecosystem. producers like algae can reproduce quickly so food doesn't run out if there are lots of consumers. If some algae are left when the consumers have eaten they can replenish their stocks quickly
Recalling a range of marine biology subject matter in all sections of the course	6. Describe any associations that may exist between the organisms found in the mangrove. Examples of associations could include predator-prey, mutualism, competition, commensalism, parasite-host. Pelican (predator) Small fish & mud crabs (prey) Predator-prey. commensalism · barnacles and oysters grow on the shell of hermit crabs. As the hermit crab moves around the barnacles and oysters can filter feed. They don't hurt or benefit the hermit crab. Midges feed on the blood of herons and pelicans but they don't live "in or on" them So they are predators not parasites. Mud crabs, shrimp and hermit crabs all compete for algae and decaying matter from the mangrove trees. 7. Choose two organisms you have observed in the mangroves and describe the features that help it survive in this environment. You may include diagrams in your explanation. Herons have very long legs with a small amount of webbing on their feet. They are able to walk in shallow water and spear fish with their long pointed beaks. pelicans feet are more webbed so they can swim and catch food at the same time. Some mangroves have glands on there leaves to excrete salt. This helps them to survive in salt water. Other plants dehydrate and die in the salt

Comments

Explaining simple and complex relationships among marine biology ideas and concepts

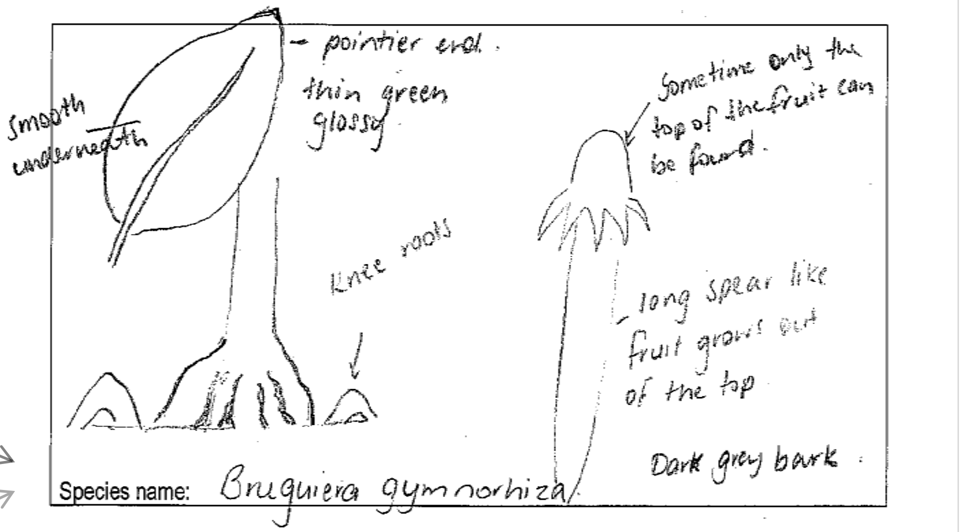
8. The popularity of hermit crabs for hobbyists and pet owners has seen large numbers of hermit crabs being taken from the mangroves. Predict the impact this will have on the mangrove ecosystem. Refer to your food web to support your claims.

Hermit Crabs support barnacles and oysters which would need other hosts, otherwise their ability to filter feed may not be as good and their population might decrease. Hermit crabs are detritivores that help recycle the large amounts of decaying plant matter in the ecosystem. Less hermit crabs means more detritus and the mangroves might have less nutrients returned by bacteria. The extra food (detritus) not eaten by hermit crabs could lead to a population growth in other detritivores because of less competition.

Only one diagram was included to demonstrate student response.

Interpreting and evaluating information and ideas.

Collecting and organising data in forms appropriate to the task



Leaves excrete salt through glands
Avicennia
round seeds
peg roots
grey bark

Leaves don't excrete salt

Knee roots
Brugiera
long fruit

arching roots
Rhizophora.
long fruit
brown/red bark

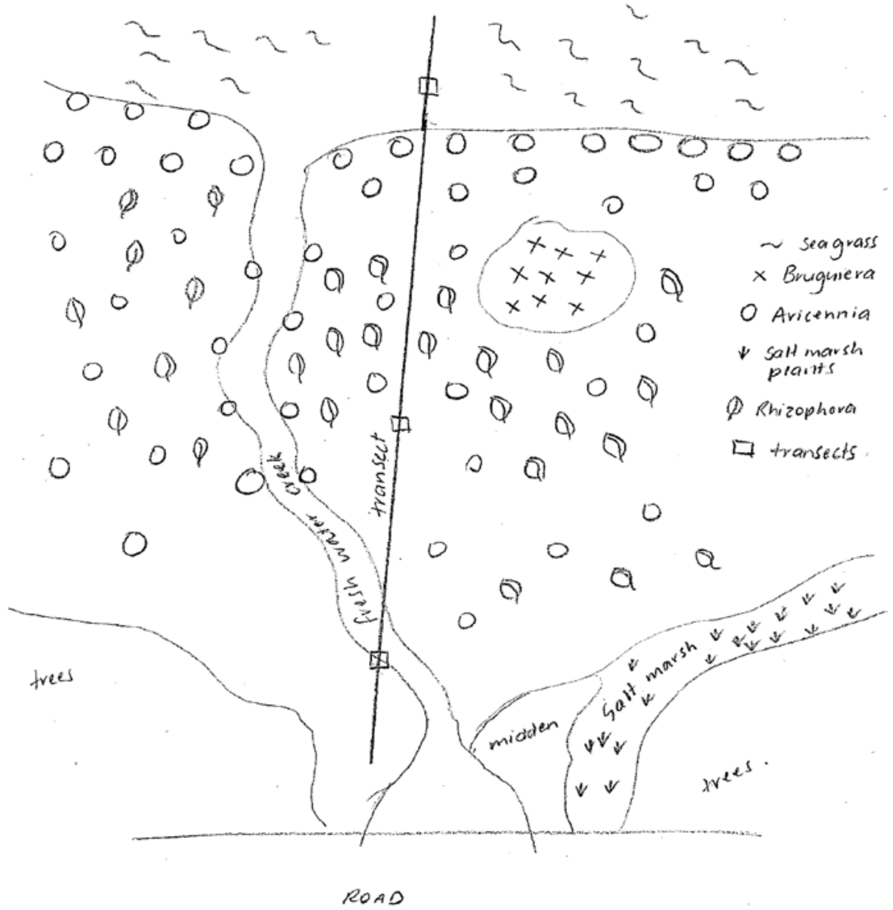
Comments

Critically analysing to establish relationships in marine biology field data and observations

The Bruguiera were only found in a small section in the mangroves where the mud was very deep and soft. Avicenna grew all over but were the closest to the margin because seeds roll out with the tide and they germinate there. Bruguiera and the Rhizophora formed clusters because their fruits spear into the ground below the parent plant and grow there. Their fruits germinate on the trees.

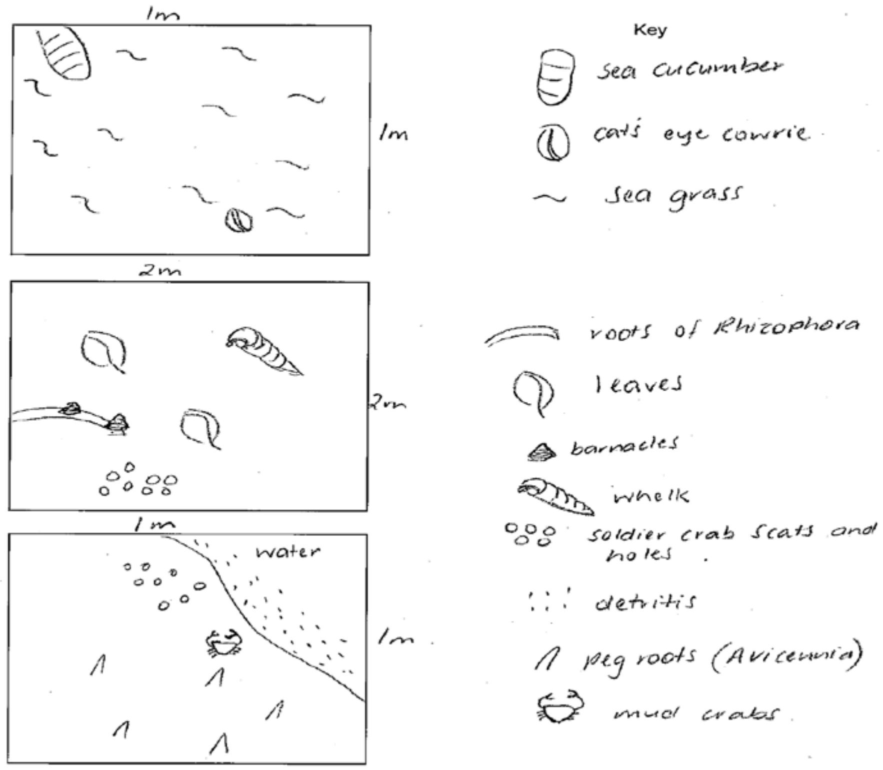
Collecting and organising data in forms appropriate to the task

12. Sketch the area from the road to the sea to represent the distribution of mangrove species and other vegetation.
Choose a location to place your transect and 3 quadrats (along your transect line) and indicate these on your sketch.
Include a key to represent the species identified at

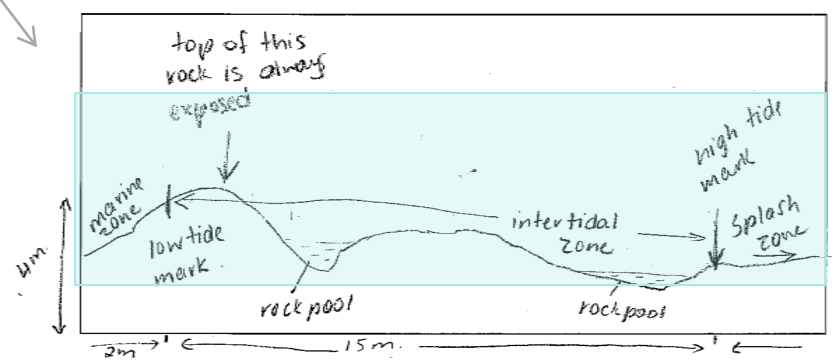


Comments

Collecting and organising data in forms appropriate to the task



Recalling a range of marine biology subject matter in all sections of the course



2. Describe the features you have used to distinguish each zone.

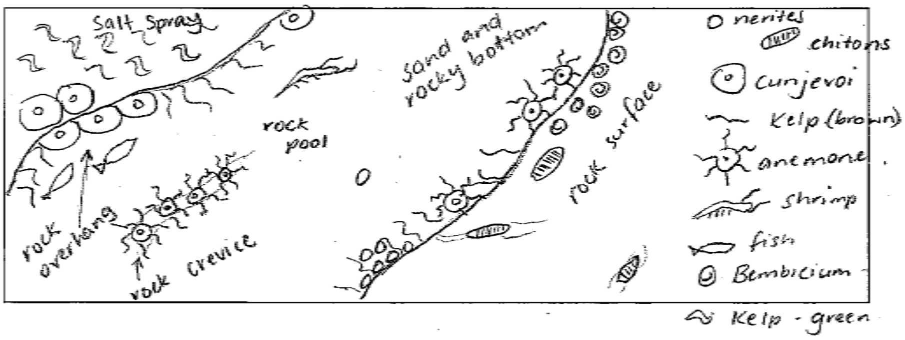
The low tide mark is where the water line was (at low tide). The part under water at this time is the marine zone. The section between the low tide mark and high tide mark (debris showed the edge) is the intertidal zone. Beyond the high tide mark is the splash zone only salt water spray travels beyond this line. There are 2 permanent rock pools.

Explaining simple and complex relationships among marine biology ideas and concepts

Comments

Collecting and organising data in forms appropriate to the task

Explaining simple and complex relationships among marine biology ideas and concepts



4. Describe the adaptations (structural, functional or behavioural) that influence the distribution of the organisms identified.

Fish hide under ledges when the rock pools are exposed They feed on crustaceans and algae trapped in the rock pool.

Chitons bore crevices into the rock as they scrape of algae. They have a strong muscular foot for attaching to the rock and prevent beig washed away with strong waves and currents. Their amour protects them from predators and drying out. They are found in water and rock surfaces.

Bembicium have shells to stop them drying out but they prefer to stay nearer the water. They have a strong muscular foot for attachment. Their shell pattern provides camouflage.

Cunjevoi squirt stored water at predators if they are disturbed. They have a tough outer skin for protection against the sun and drying out but cannot be out of the water long. Algae that grows on their surface provides further camouflage to their rocky appearance.

Anemones have stinging tentacles for catching prey and taking them to their mouth. When the water recedes the tentacles are drawn inwards to stop them drying out and reduce the surface exposed to the sun. They live close to the rock pools or in the marine zone to reduce their exposure to the sun.

Comments

Collecting and organising data in forms appropriate to the task

	Site 1	Site 2	Site 3	Site 4	Site 5
pH surface	6.8	6.7	6.8	6.9	6.8
pH 1m	6.7	6.7	6.8	6.7	6.8
Temperature surface	23°	24°	24°	25°	25°
Temperature 1m	22°	24°	23°	23°	23°
Dissolved oxygen surface	6.8mg	6.2	6.4	5.95	6.02
Dissolved oxygen 1m	6.82mg	6.3	6.5	6.3	6.3
Turbidity surface	12	15	10	15	25
Turbidity 1m	10	15	10	15	25
Tidal conditions	tide running in 5-10 knots	high tide	high tide very slow	tide running out 5-10 knots	tide running out 10-15 knots
Weather conditions	Sunny wind 30knots 24° temp 65% humidity	Sunny wind 20 knots 24°C 66% humid.	Slight cloud no breeze 25°C 68%	Sunny protected 28°C 68% humid.	Sunny wind 30 knots 28°C 73%
Other observations	Some scum on water	Some floating plastic in area	Pots quite close to the shore.	Water is shallow, flat	quite muddy substrate

Recalling a range of marine biology subject matter in all sections of the course

2. Explain two (2) potential problems caused by using crab pots for collecting data.

Potential to trap other marine life. Other people could steal the crab pots (and your data) Need to be checked several times. Some crabs being recaptured.

Comments

Critically analysing to establish relationships in marine biology field data and observations

Recalling a range of marine biology subject matter in all sections of the course

Across *all parts* of the field report the student communicates:

- coherently and effectively, using and exploiting a range of generic structures for communicating field observations
- using vocabulary and language conventions effectively and with discrimination.

When performing field and laboratory activities the student:

- performs the integrated task sequences safely, efficiently and accurately, modifying procedures where necessary to complete activities without significant faults.

Your report should:

1. Relate your field data to the chances of finding crabs at particular pot sites
2. Determine the most likely factor(s) that affect crab numbers at particular sites.
3. Suggest a reason for changes (if they occur) in the abiotic factors at the different depths.

The site with the highest catch was site 3 followed by site 1, site 4 and 5. Site 2 recorded no catches.

Site 3 had the least turbidity (10 NTU), followed by site 1 (10 – 12 NTU). These 2 sites also had low water temperatures and higher dissolved oxygen than the other sites (6.8 and 6.5 mg/L). Salinity at these 2 sites was about in middle of the range (35 g/L at site 3, 37 g/L at site 1) and nitrogen (0.003 mg/L; 0.002) (0.015 mg/L site 3; 0.017 mg/L site 1)

Crabs are most likely to be found in areas of high oxygen, low turbidity and total solids. They can tolerate some nitrate and phosphorus which is found where there is decaying plant matter, which is what they eat.

There was not a lot of difference in our data across the pot sites and we only sampled once. So this data (crab catch) might not be the most reliable data and needs repeating a few more times. Pots close to the shore (site 3) might be more important factor.

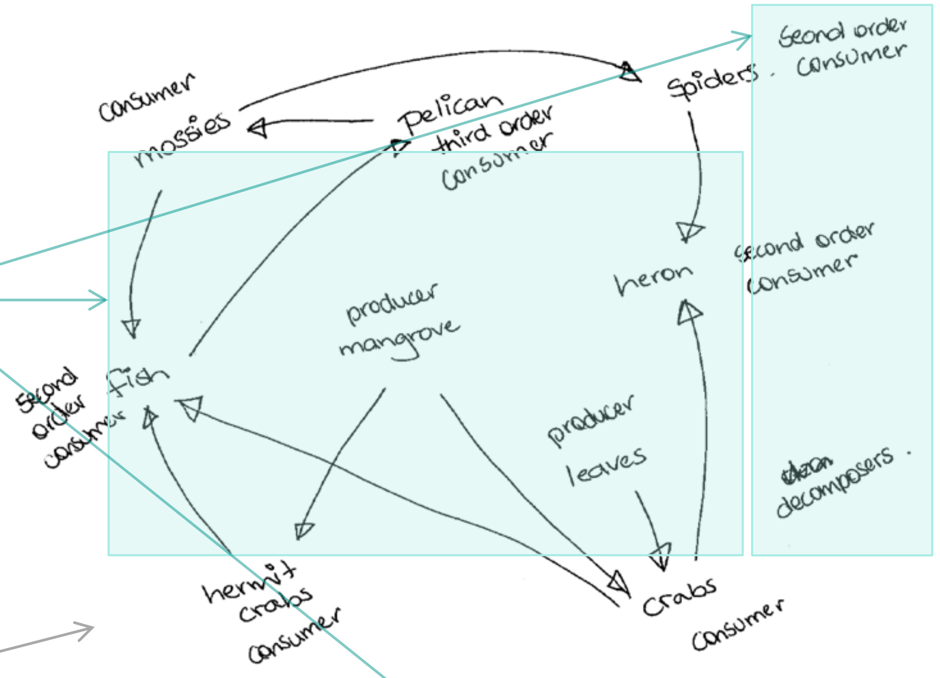
The differences in abiotic factors were not significant at different depths. The temperature was a little cooler below the surface because heat has to conduct downwards through the water. The biggest change in dissolved oxygen was at site 4 which went from 5.95 to 6.3 mg/L because of the 2°C temperature drop. Colder water can hold more oxygen than warm water.

Indicative response — Standard C

The annotations show the match to the instrument-specific standards.

Comments

Identifying and describing relationships among marine biology ideas and concepts



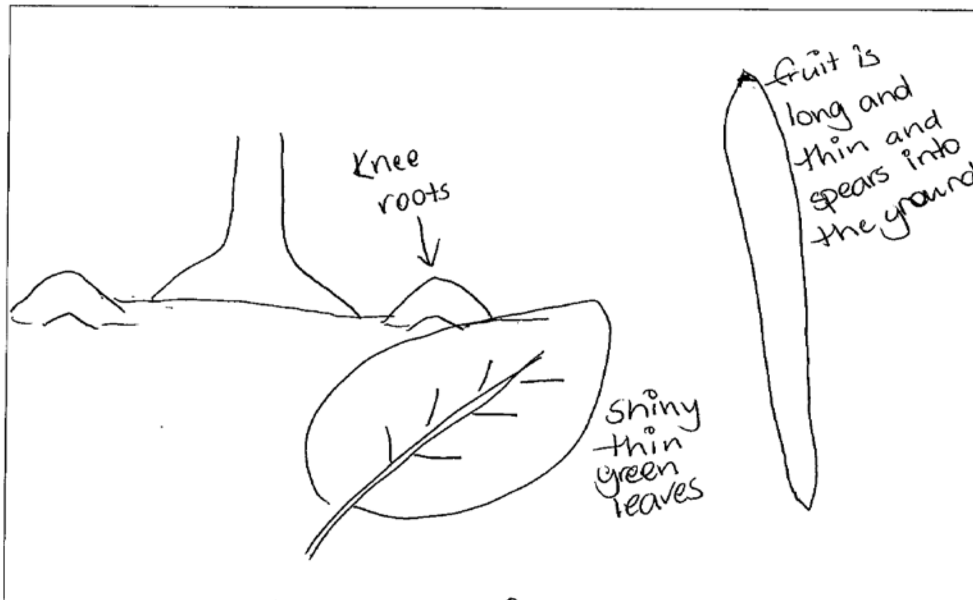
Collecting data within identified categories

Organism	Type of feeder
mozzies	carnivore
pelican	carnivore
crabs	carnivore
fish	carnivore
Spiders	carnivore
hermit crabs	herbivore
mangroves	producer
leaves	producer
bacteria	decomposer

Comments	
	4. Which feeding level is the most abundant? First order consumer - lots of crabs and mosquitoes.
Identifying and describing relationships among marine biology ideas and concepts	5. Water ecosystems often have a food web described as an "inverted pyramid" (greater biomass of consumers than producers). Explain how this can be a functioning ecosystem. One mangrove tree can feed a lot of consumers so you don't need as many.
	6. Describe any associations that may exist between the organisms found in the mangrove. Examples of associations could include predator-prey, mutualism, competition, commensalism, parasite-host. Pelicans are predators and fish are there pray. Mozzies are parasites that feed on any animals that live around the mangroves (like people) Fish and crabs compete for food from the mangrove trees.
Recalling simple marine biology subject matter	7. Choose two organisms you have observed in the mangroves and describe the features that help it survive in this environment. You may include diagrams in your explanation. Crabs have a hard shell to protect them from predators that would try to eat them and some have a big claw for breaking up hard foods. Pelicans have webbed feet for swimming in the water
Identifying and describing relationships among marine biology ideas and concepts	8. The popularity of hermit crabs for hobbyists and pet owners has seen large numbers of hermit crabs being taken from the mangroves. Predict the impact this will have on the mangrove ecosystem. Refer to your food web to support your claims. Hermit crabs feed on dying leaves and mangroves. Without mangroves the mud would start to build up with leaves, sticks etc and the decomposers would have a hard time breaking down large pieces. Things that eat hermit crabs would have no food.
	Task B - Keys Appendix A contains a dichotomous key that allows identification of seven types of mangroves in the field: "milky mangrove", "grey mangrove", river mangrove", "spotted mangrove", "yellow mangrove", "orange mangrove", & "black mangrove". This key uses information on leaves & roots to identify mangroves in the field. 9. There are 3 species of mangrove found at . Locate the three mangrove species and draw sketches of the features of each, and use the key to identify the species to which they belong.

Comments

Collecting data within identified categories



Species name: Brugiera gymnorhiza .

10. Use the key in appendix A as a model, and your observations in the field, to develop a dichotomous key that can be used in the field to identify the **three** mangrove types at including any extra features you have observed.

fruit is long and thin

- tree has arching roots
  - Rhizophora stylose .
- tree has Knee roots
  - Brujiera gymnorhiza .

fruit is round

- avicenna marina .
  light grey bark
  ~~salt~~ crystals .

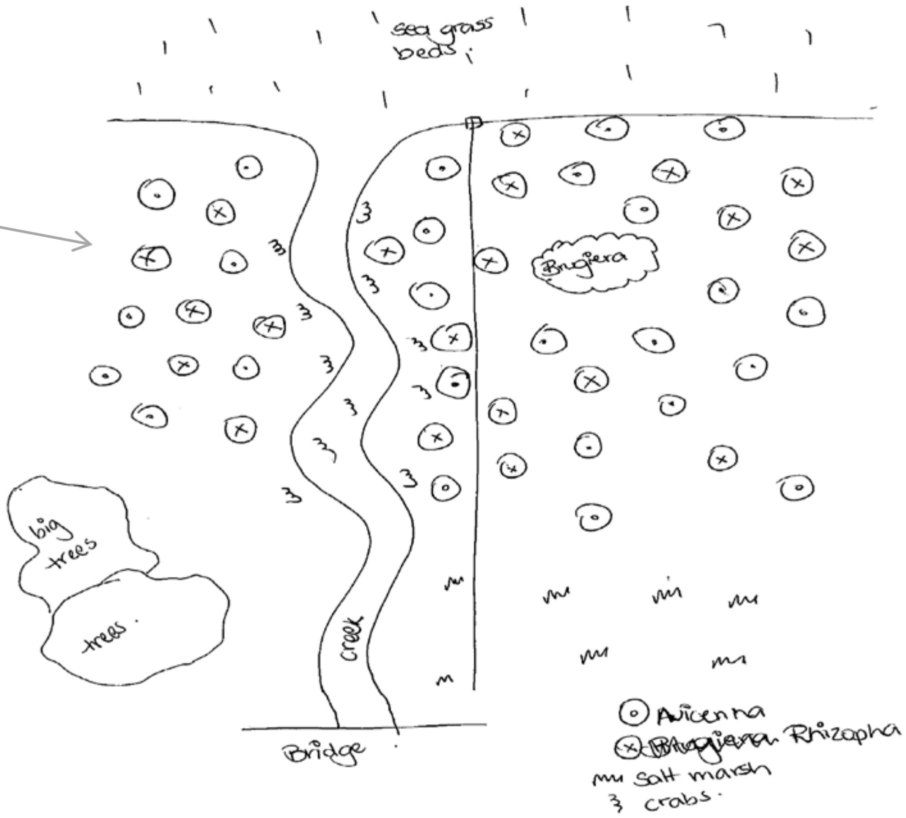
Comments

Identifying simple relationships and in marine biology field data and observations

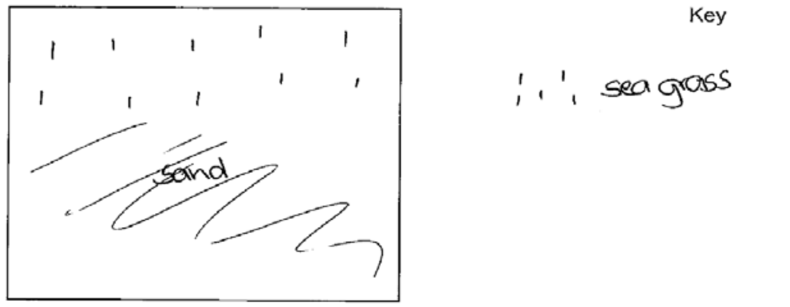
Collecting data within identified categories

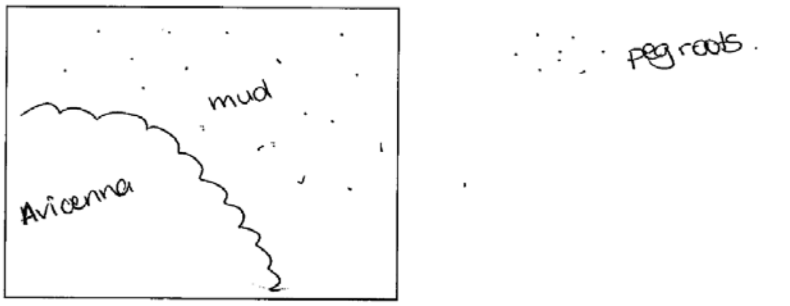
11. Explain any patterns you have identified for the distribution of the three mangrove types.

The Rhizophora and Avicerma grow together all over the mangrove but the Brugiera only grow in one small patch where the mud is very ~~[illegible]~~ soft



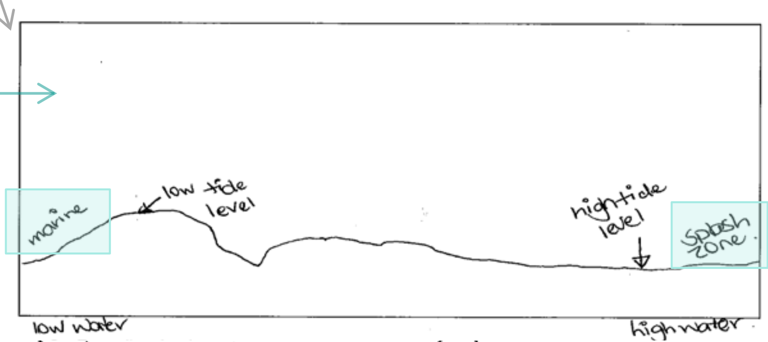
Comments





Collecting data within identified categories

Recalling simple marine biology subject matter



Identifying and describing relationships among marine biology ideas and concepts

Marine Zone is always underwater.

low tide level is only visible at low tide.

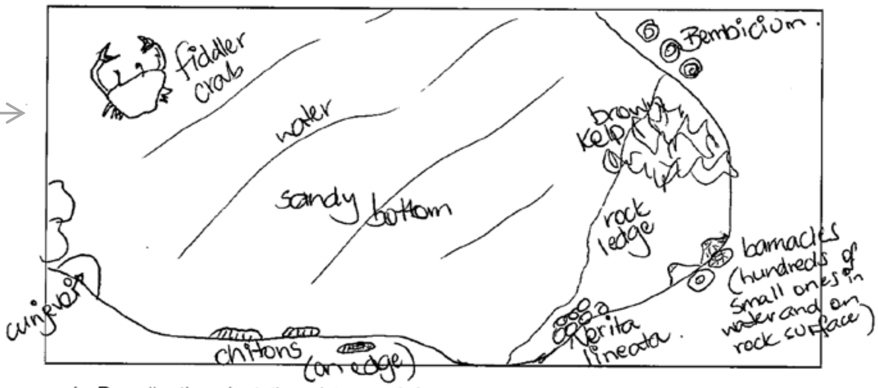
high tide level is where the tide comes to. It can be found because of the left over debree.

Splash zone is where spray and splash reaches.

Comments

3. Choose a rock pool and sketch the distribution of organisms within and around it. Use the information in appendix B to identify any unfamiliar organisms. Include a key.

Collecting data within identified categories



4. Describe the adaptations (structural, functional or behavioural) that influence the distribution of the organisms identified.

There are hundreds of barnacles on the rock around the rockpool. There shells protect them from drying out when the tide is out.

Identifying and describing relationships among marine biology ideas and concepts

Chitons have a strong muscle attaching them to the rock so waves can't wash them away and armor to protect them from predators.

Crabs hide in crevaces for protection from predators and waves. Cunjevois spirt water at predators. They have to stay attached near the water because they don't have a shell for protection only tough skin.

Collecting data within identified categories

		Site 1	Site 2	Site 3	Site 4	Site 5
pH	surface	6.8	6.7	6.7	6.9	6.8
	1m	6.7	6.7	6.8	6.7	6.9
Temperature	surface	23	24	24	25	25
	1m	22	24	23	23	23
Dissolved oxygen	surface	6.8	6.2	6.4	5.95	6.02
	1m	6.82	6.3	6.5	6.3	6.3
Turbidity	surface	12	15	10	15	25
	1m	10	15	15	15	25
Tidal conditions		tide running in	high tide	high tide	tide running out	tide running out
Weather conditions		breezy sunny 24°C 65%	light breeze sunny no clouds 66% 24°C	warm 25°C 68%	warm sunny 28°C no clouds 68%	warm breezy 28°C 73%
Other observations		wind from south east. tide is moving slowly.		close to the shore	water is shallowest	tide is moving fastest at this place.
Crabs caught		1 male 2 females	0	3 females 1 male	1 male	1 female.

Comments	
Recalling simple marine biology subject matter	2. Explain two (2) potential problems caused by using crab pots for collecting data. You sometimes catch other animals The crabs might not go into the pots even through there are crabs around.
Identifying simple relationships and in marine biology field data and observations Recalling simple marine biology subject matter. **Across *all parts* of the field report the student communicates:** • coherently, following prescribed generic structures for communicating field observations • using vocabulary and language so that meaning is clear. **When performing field and laboratory activities the student**: • performed integrated task sequences safely, making straightforward modifications to procedures where necessary to complete activities.	Your report should: 1. Relate your field data to the chances of finding crabs at particular pot sites 2. Determine the most likely factor(s) that affect crab numbers at particular sites. 3. Suggest a reason for changes (if they occur) in the abiotic factors at the different depths. The most crabs found at site three which was closest to the shore and had the second highest oxygen in the water. This pot site also had the clearest water with only 10NTU at the surface and 15 at 1m down. The total solids was also low due to the turbidity. The salinity was about middle at this pot site, like the nitrogen and phosphorus. Because Blue Swimmer crabs can tolerate high nitrate levels. they feed at high tide this might explain why we found the most at site 3. The readings for temperature, oxygen, nitrates ect didn't change a lot. Dissolved oxygen a site 4 changed the most in deeper water, with the temperature change. Turbidity was highest at site 5 with the muddy bottom.