A LEARNING RESOURCE

Unit Standard 20305 v2

Biology of Kina

(Evechinus chloroticus)

SEAFOOD INDUSTRY TRAINING ORGANISATION

The New Zealand Seafood Industry Council Ltd

Contents

This resource has been developed for SITO by Phil James, NIWA

Introduction

This book gives provides support information to prepare for:

Unit standard 20305 (version 2)
Describe the biology of the sea urchin (Level 3, Credit 5)

In this learning resource the sea urchin described is the New Zealand sea urchin, or kina.

The learning resource and unit standard covers:

1. A description of the NZ sea urchin (Kina) & its natural habitat:
   (a) the scientific name of Kina
   (b) the distinguishing features of Kina
   (c) the habitat & geographical distribution in NZ of Kina.

2. The location and identification of anatomical features of Kina:
   (a) The location and name of external anatomical features: test, spines, tube feet, anus, mouth
   (b) The location and name of internal anatomical features: aristotle lantern, gonad or roe, stomach.

3. A description of the life cycle, reproduction and feeding patterns of Kina:
   (a) an outline of the stages of the life cycle
   (b) an outline of the stages of the reproductive cycle, including gonad development, triggers for natural spawning & fertilisation
   (c) the feeding method and food sources of Kina.

4. A description of four main factors that influence growth:
   (a) the factors that can affect the growth of kina, for example: water temperature, water quality, weather patterns, food availability, habitat, stress, predators
   (b) the impact of each factor on growth rate.

5. A description of abnormal features and/or behaviours that could indicate a potential New Zealand sea urchin health issue:
   (a) a description of two abnormal features and/or behaviours that could indicate a potential Kina health issue
   (b) the action to take if abnormal features and/or behaviours are identified
   (c) the reasons why it is important to take this action.

This learning resource is designed to accompany a course that includes examination of live kina.

Here is some information about how the book is set out:

- Each section matches a separate element of the unit standard. So, for example, Section 1 of the book covers all of element 1 of the unit standard.

- Activities to assist in learning are presented throughout the text in *blue italics*. So if you see writing in blue italics, you know that it is something that you have to do.

- **Key words or phrases** have been marked in **bold.** This is to help you revise the information easily.

- Self test questions are included at the end of each block of learning, covering the knowledge required for the unit standard.

- Throughout the text the sources of information are referenced using superscript numbers in square brackets – like this: [5]. These numbers refer to a list of references that is presented in the back of the book. So if you want more detail about a particular subject, note the number in the bracket, and then use the number to find the reference from the "References" section at the end of the book.

- There is a **Glossary of Terms** at the back of this book. This gives an explanation of technical and scientific terms that are use throughout the book.

1. Description of Kina and its Natural Habitat

A. Naming of Kina

In order to specifically identify a type of kina it is necessary to use the **scientific name**. Every species of animal or plant has its own unique, scientific name. The same scientific names are used throughout the world.

Scientific names contain two parts: first, the name of the genus to which the organism belongs, followed by the species name. (For an explanation of how organisms are scientifically classified into these genus/species groupings, see Appendix I).

If two animals have the same *Genus* name, it indicates that they are very closely related. This part of the name may be shared by close relatives, like a surname. However the two-part name is always unique to just one species.

By scientific convention the scientific name is always written in *italics* or underlined. The '*Genus*' name is always written with a capital letter and the '*species*' name with a small letter.

The scientific name often uses Latin words, which generally have some meaning relevant to the species being named. For example, words may be used which represent the country where the species is found or describe a distinguishing feature. Sometimes the species may be named after the person who discovered it.

Common names however are simply the names by which the animal is "commonly" known and can vary from country to country and even between people. Each sea urchin species may be known by several different common names.

Kina are sea urchins which belong to the group called echinoderms, and are closely related to starfish, brittlestars and sea cucumbers: these are all marine bottom dwelling organisms with a basic five part body symmetry. Unlike other echinoderms, sea urchins have a very simple body structure and are encased in a hard spherical test or shell constructed from calcium carbonate [1].

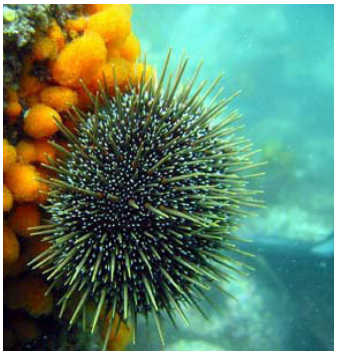
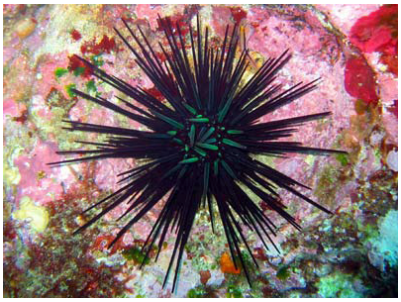
There are approximately 11 species of sea urchin living on shallow rocky reefs in New Zealand but by far the most common sea urchin found in the shallow coastal waters of New Zealand is ***Evechinus chloroticus***. This native species is known by Maori as **kina** and because most people now know them as kina this is also the common name for the species.

B. Distinguishing Features, Habitat & Geographical Distribution of Kina [5 & 6]

Kina are only found in New Zealand [2]. Kina are found from shallow intertidal habitats to depths as great as 60m and are widespread throughout the main islands and on a number of the northern and southern offshore islands.

The other species of sea urchin found in the shallow coastal waters are not abundant and are rarely seen by divers or fishers [1]. Five of these are mostly found in northern waters and are also found in Australia and in the Indian and Pacific Oceans and little is known about their ecology. All of the urchin species found south of the East Cape only occur in New Zealand [1]. The various species are distinctive and five of the most common are shown in the table overleaf.

B. Distinguishing Features, Habitat & Geographical Distribution continued

Native species found only in New Zealand	Distinguishing features	Habitat & Geographical Distribution
Evechinus chloroticus **('Kina', NZ sea urchin)**  Image taken from www.thenewzealandsite.com	• A large urchin growing up to 180-190mm in test diameter • The spines are extremely sharp, dark green and have a white tip • Both short and medium length spines are present • The urchin is a green colour but has a thin reddish brown skin	• Widely distributed around the main islands of New Zealand • Chatham Islands • Snares Island in the south • Three Kings in the north
Pseuechinus novaezelandiae (No photo available)	• A small urchin (max. test diameter approx. 30mm) • The test and spines are dull grey green	• Found south of east cape in the north island
Pseudechinus huttoni (No photo available)	• A small urchin • The test and spines are pink	• Found south of Cook Strait
Pseudechinus albocinctus 	• A small urchin • The test and spines are pink like *P. huttoni* but have white tips	• Found mostly in the Marlborough Sounds and occasionally south of Cook Strait
Native species found in New Zealand and Australia	**Distinguishing features**	**Habitat & Geographical Distribution**
Centrostephanus rodgersii (black sea urchin)  Image taken from www.thenewzealandsite.com	• A medium/large urchin with long spines • The test and spines are purplish black • The spines are hollow and have a rough serrated edges	• Found north of Hawkes Bay • Also found in Australia and are abundant in New South Wales

B. Distinguishing Features, Habitat & Geographical Distribution continued

Activity 1

Using live sea urchins examine the appearance of a Kina and at least one other species of sea urchin.

Identify three differences between the two species of sea urchin:

1.

2.

3.

Self Test Questions 1

1. What is the scientific name of the NZ sea urchin, Kina?
2. Name three features that distinguish Kina from another sea urchin species.
3. Describe the habitat of the Kina.
4. In what areas of New Zealand are Kina found? Is it found overseas?

2. Anatomical Features of Kina

A. External Features of Kina – location, identification & function[3].

(see photos next page)

External feature	Function
'Test' (spherical shell of calcium carbonate)	Skeleton made up of fused plates that make up the solid protective shell Provides space for internal organs
Spines long (primary) and short (secondary)	Provides protection from predators Can be used to assist movement
Tube feet (seen when the living animal is submerged)	Used for movement Attaching to substrate Collecting drift food Moving food items to mouth Used by juveniles to attach debris and stones for camouflage
Mouth (bottom side of the animal)	Grazing on algae and other food items
Anus (topside of the animal)	Terminal part of gut where faeces are expelled from body

NOTE:

The gills of sea urchin are situated externally but are not visible. They consist of simple extensions of the body wall where gas exchange (respiration) takes place [3].

The gonadal pore is situated externally but is not visible. It is used for expelling eggs and sperm during spawning.

Activity2

Look at a live Kina.

1. Locate the following features:

Test
Spines
Tube feet
Anus
Mouth.

A. External Features of Kina - continued

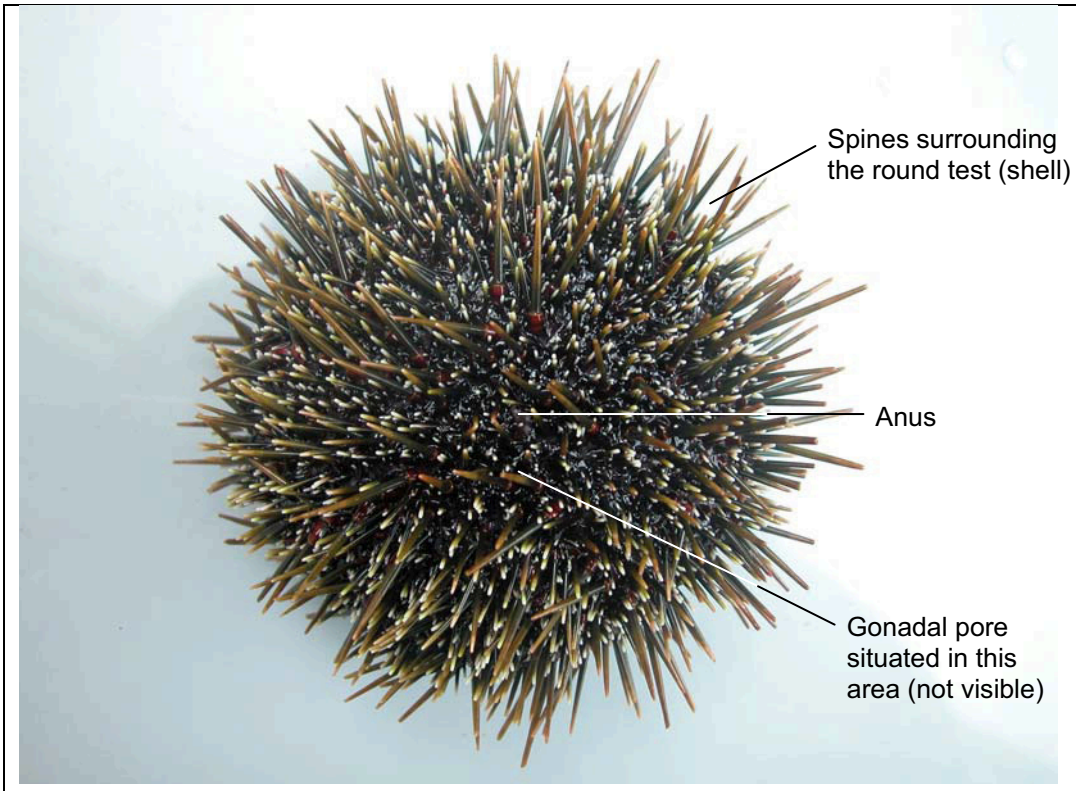


Figure 1: Dorsal (topside) view of kina.
[Photos: P James]

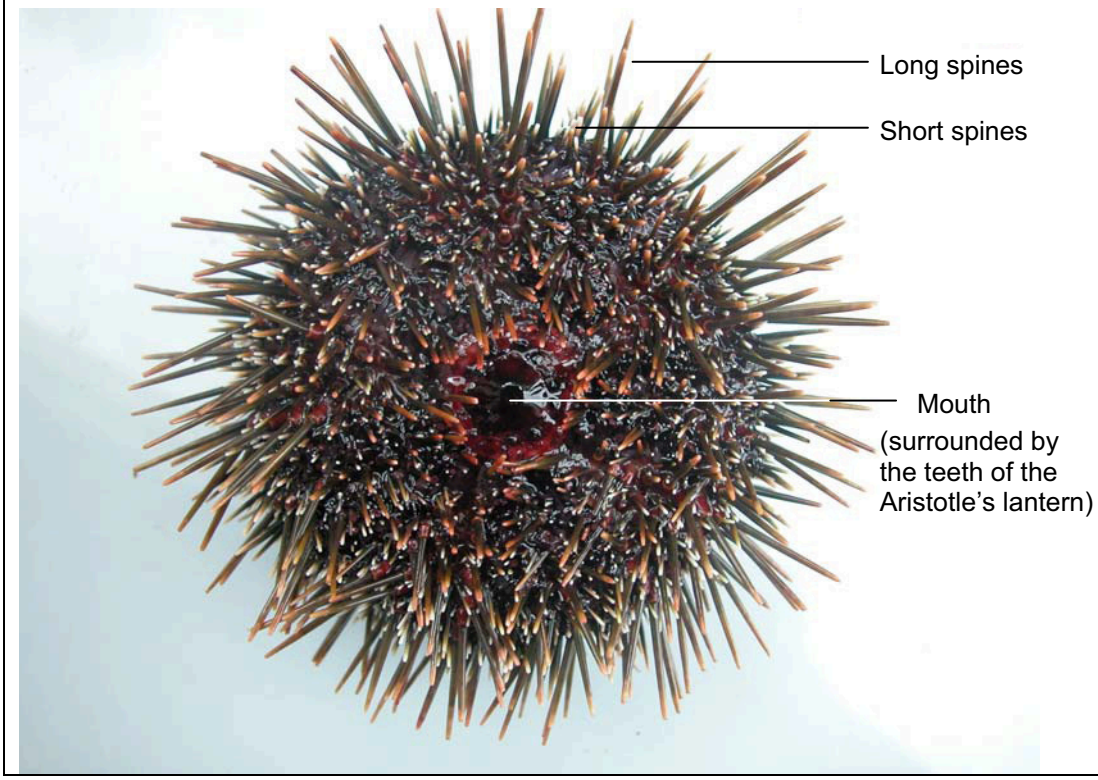


Figure 2: Ventral (bottom side) view of kina.
[Photo: P James]

B. Internal Features of Kina – location, identification & function [1 & 3]

(see diagram & photo next page)

Internal feature	Function
Gonad 'roe' (five in total)	Five reproductive organs situated evenly around the interior of the test Produce eggs and sperm that are expelled through the gonadal pore vent
'Test' (spherical shell of calcium carbonate)	Skeleton made up of fused plates that make up the solid protective shell Provides space for internal organs
Chewing apparatus, mouth & 'Aristotle's lantern' (found in the mouth on the bottom side of the animal)	Scrape food particles into the mouth Opened & closed to chew and form balls of food that are then passed into the gut Breaking down food items for digestion Forming food pellets to pass on to the gut
Intestine 'gut or stomach'	Used for food storage and digestion Directly connected to the anus at the top of the animal
Radial canal	Site where tube feet originate and where the hydraulic system to drive tube feet is situated
Anus (topside of the animal)	Terminal part of gut where faeces are expelled from body
Gonadal pore (not visible externally)	Used for expelling eggs and sperm during spawning
Sexes (male and female)	The male and female urchins cannot be distinguished externally The sexes can only be distinguished when they are in spawning condition The gonads of male animals exude milky coloured sperm The gonads of female animals exude golden coloured eggs

NOTE: Kina have a basic nervous system but no brain.

Sex Determination

The sexes can only be distinguished when they are in spawning condition. By looking internally [1]:

- the gonads of male animals look milky coloured
- the gonads of female animals look golden coloured

Activity 3

Are you able to decide whether the Kina you are looking at is a male or a female?

B. Internal Features of Kina - continued

Activity 4

To complete this section it is helpful to actually look at a Kina as you work through the book. Look at your Kina carefully and see if you can locate the features labelled below.

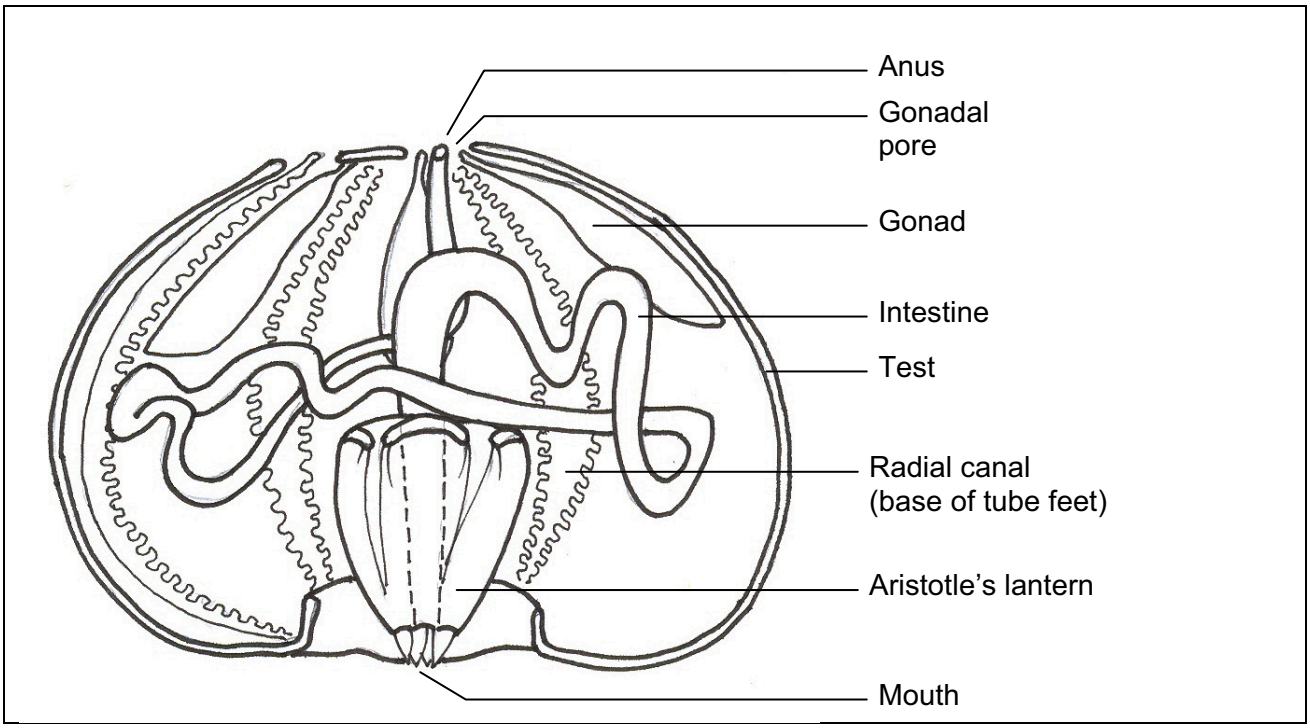


Figure 3: Internal view of kina. [Picture by: P James]

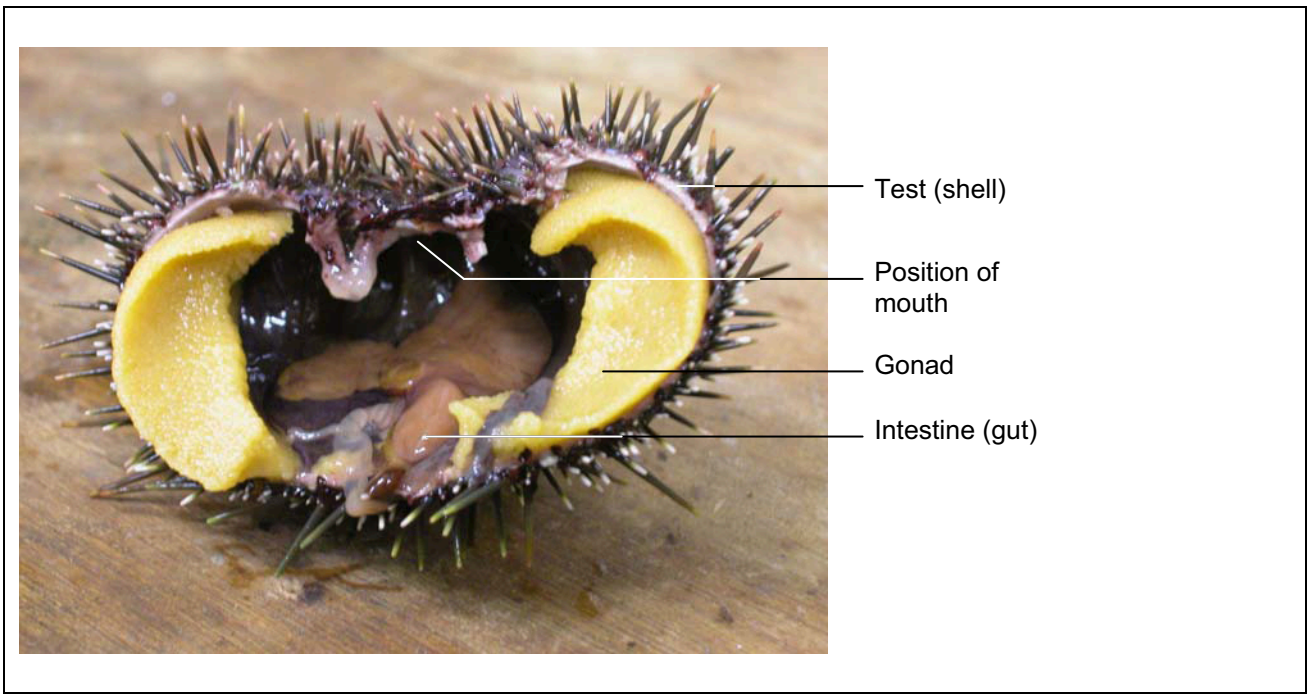


Figure 4: Internal view of kina that has been opened and is lying upside down. [Photo: C. Woods]

B. Internal Features of Kina - continued

Activity 5

1. Open a live Kina. Locate the following parts:

Aristole's Lantern
Gonad (Roe)
Intestine

2. What sex is the Kina that you are looking at? How can you tell?

Self Test Questions 2

1. Identify the function(s) of each of the following parts of a Kina:

Feature	Function
Test	
Spines	
Tube Feet	
Anus	
Mouth	
Aristole's Lantern	
Gonad (Roe)	
Intestine (Gut)	

3. Life cycle, Reproduction & Feeding of Kina

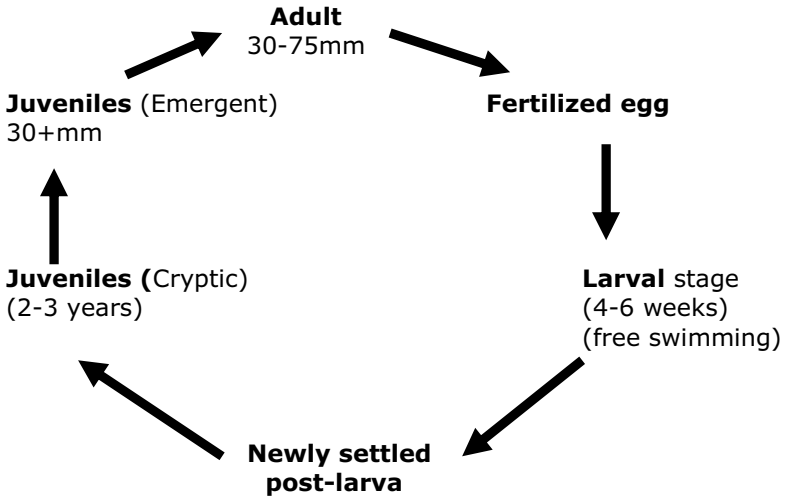
A. Lifecycle Stages

Larval Stages: The first stages in the life cycle of Kinas are the **larval** stages. The larval stages of a Kina have different body shapes from adult kina. **Kina larvae** (kina in the larval stages) are also different from later stages because they are pelagic (free swimming) drifting with the tides. This enables Kinas to disperse to areas some distance away from the parent populations[1].

Juvenile Stage: After the larval stages, Kinas **change in body shape** (this process is called "**metamorphosis**", pronounced "met-a-morf-o-sis") and become **juveniles**, which are **similar to miniature adults except that not all their organs are fully developed**.

Adult Stage: Juvenile Kinas grow and mature to become adults. Kinas are regarded as being **adult** when they are **sexually mature** – that is, they are **able to produce eggs or sperm**.

Summary of Kina Lifecycle:



Adult kina

- The size that kina reach sexual maturity varies markedly, depending on their geographic location, food availability and a host of other environmental conditions and ranges from 30-75 mm test diameter [1]
- Adult kina are either male or female and both are broadcast spawners, meaning that they broadcast their sperm and egg into the sea when the environmental conditions are suitable (late summer/autumn).

Spawning & Fertilisation

- Spawning (release of sperm, and eggs) normally occurs once per year
- Once released into the water column the animals rely on natural mixing to fertilize the eggs. The eggs and sperm meet in the water column by chance and for this reason spawning is synchronized so that as many animals as possible spawn simultaneously.

Larval stages

- The larvae are free swimming for 4-6 weeks and they feed on microscopic plants and animals in the plankton as they drift with the tides[1].

A. Lifecycle Stages - continued

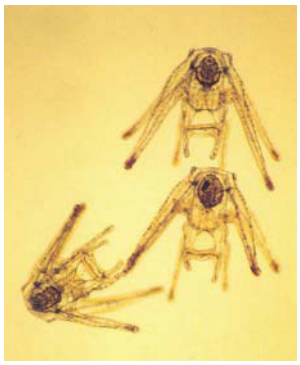


Figure 5: Larvae (enhinopluteus stage) of Evechinus chloroticus.

Settlement & juvenile growth

- The larvae settle onto a suitable substrate and are then cryptic for the first 2-3 years of their life.
- The survival of the animals during this period is thought to depend mainly on the type of habitat in which it settles.
- Juveniles emerge, becoming 'Juveniles (Emergent)', when they are larger than 30mm or approximately 2-3 years old.

Life expectancy

- The life expectancy of a kina is difficult to determine but it is estimated that some of the largest specimens found (190mm test diameter) could be as much as 50 years old [1]

Self Test Questions 3A

1. Describe the stages of the life cycle of a Kina (include a description of what each stage looks like).

B. Reproduction

The reproductive cycle of kina is complex and is controlled by a number of environmental factors. Wild kina and captive kina are covered in this section.

i. Wild kina

Gonad (roe) development

- The gonad of kina are made up of reproductive cells and specialized storage cells (called nutritive phagocytes) that store nutrients (energy). The percentage of the two types of cells present in the gonad varies throughout the reproductive cycle.
- Following spawning in late summer/autumn the animals go through a dormant stage in winter when the gonad is generally small and in poor condition. In late winter there is a buildup of storage cells in the gonad. In early to mid summer there is a change in the gonad with the number of storage cells in the gonad reducing and being replaced by reproductive cells.
- The cues that stimulate this change are not fully understood but the primary cue is believed to be changing photoperiod [4] (the number of hours of light and dark per day).
- The number of reproductive cells within the gonad builds up over summer until the animal is in spawning condition in late summer to early autumn.

Triggers for spawning

- The cues that trigger spawning are also unclear but the primary cues are believed to be temperature and environmental factors such as storms. Consequently spawning events can vary widely between geographic locations and even within relatively limited areas [2]
- Feed availability also plays an important role in the condition of kina gonad and when food is limited, the condition (size) of the gonad decreases. This may have a negative affect on the reproductive cycle.

Fertilisation

- Adult kina are either male or female and both are broadcast spawners, meaning that they broadcast (i.e. release large numbers at the same time) their sperm and egg into the sea when the environmental conditions are suitable (late summer/autumn). This normally occurs once per year [1&2]
- Once released into the water column the eggs and sperm meet in the water column by chance and for this reason spawning is synchronized so that as many eggs as possible are fertilised by sperm.

ii. Controlled spawning of captive Kina

- Spawning sea urchins in captivity is very simple and for this reason the larvae are often used for environmental and toxicity studies.
- The spawning process involves injecting the test of a mature animal with a 0.5M solution of potassium chloride which immediately induces the release of eggs and sperm in female and male animals respectively.
- The eggs and sperm can be collected separately and mixed in a clean container to imitate fertilization. Once fertilization occurs cell development begins.
- A number of countries are investigating the potential of farming sea urchins from eggs to the juvenile stage, or for reseeding into the wild. Whether this is economically viable is unknown.

Self Test Questions 3B

1. Describe what happens in the gonad at each of the stages of gonad development.
2. What are thought to be the environmental cues that can trigger spawning in Kinas?
3. What does a Kina at the mature stage of the reproductive cycle look like?

C. Feeding Methods & Food Sources

The feeding methods and food sources of wild and farmed kina are covered in this section.

i. Wild kina

Life cycle stage	Feeding patterns
Larvae	Feed on microscopic plants (algae or phytoplankton) and animals (zooplankton) in the plankton
Juvenile Kina (cryptic)	Little is known about their feeding habits at this stage
Adult Kina	mostly herbivorous and feed on a range of seaweeds but they will also feed on any food source that is available, including coralline algae and even the rock substrate if necessary.

- Kina are mobile and can move relatively large distances to forage for food but they often simply rely on catching passing drift algae as a food source.
- At high densities kina are capable of influencing the mix of algae that are present on reefs in shallow waters and consequently can also affect the ecology of other species, such as paua, that are present [1]
- Kina often congregate into dense aggregations known as kina 'barrens' and these aggregations can have significant consequences on the ecology of a reef.
- Aggregations of kina are capable of grazing reef bare and the resulting kina 'barren' may persist for several years despite the subsequent lack of adequate food supply [1]

ii. Farmed Kina

- Because of the potential to manipulate the size and quality of the gonad of wild caught kina, there is intense interest in holding kina and feeding them artificial diets to increase the amount and quality of the kina roe.
- There are a range of artificial feeds that have been produced to accomplish this. These are mostly high protein diets that promote gonadal growth. Commercial pelleted and moist diets have been produced.
- There is some evidence that algae will need to be fed in conjunction with artificial diets to ensure that the taste of the gonad is adequate as well as increasing the size of the gonad.
- Kina prefer the large brown seaweeds but do feed on a range of other algae types [2].

Self Test Questions 3C

1. a) Describe what you know about the feeding requirements of Kina larvae.

   b) What do Kina eat at the other stages of their life cycle?

4. Factors that Impact on Growth of Kina

Growth in kina is measured as growth in **body size (somatic)** or growth in **gonad size (gonadal).** Body size is measured using the **wet weight (greenweight)** and **test (shell) diameter** of individual animals. Gonad size is measured as the wet weight of the gonads once removed from the test. The gonad size is expressed as the **gonad index** which is the percentage of the wet weight of an individual animal that is made up by the gonad.

Factors that impact on growth are given below:

Factors	Impact
Habitat	• The type of habitat that a kina is found in will often determine food and shelter availability and other environmental conditions such as water temperature and the amount of water movement (currents). These factors will have a significant impact on the growth rates and the reproductive cycle of kina.
Weather patterns	• Weather patterns can influence the spawning of kina with anecdotal evidence suggesting that large storms may trigger a spawning response in some kina populations.
Predators	• The numbers of predators present in any given habitat will have a significant impact on kina mortality. Common predators of kina include spiny lobsters (*Jasus edwardsii*), fish species such as snapper (*Pagrus auratus*) and large starfish (*Coscinasterias muricata* and *Astrostole scabra*).
Food availability	• Food availability has a significant impact on kina growth rates and the reproductive cycle. In habitats where food is abundant growth rates will be high and the kina will follow a yearly reproductive cycle as described in **Section 3B, Reproduction**. In habitats where food is scarce kina will have stunted growth and may not follow the annual reproductive cycle. Where food is very scarce kina may utilize the nutrients stored in the gonad for surviving long periods without food and may not produce any reproductive cells.
Food types	• Captive kina can be fed on both artificial feed and/or natural algae • Commercial pelleted and moist diets have been produced • Kina prefer the large brown seaweeds but do feed on a range of other algae types.
Feeding rates	• Feeding rates are primarily dependant on the seawater temperature • Manufactured feeds are fed at a rate of 1-2% wet body weight per day • Feeding rates on algae (wet weight) are significantly higher and range from 0.69-0.88g per individual per day [2].
Feed accessibility	• The feed must be readily accessible to kina and be in a format that is suitable for the mouthparts of kina.
Water temperature	• The exact upper tolerance where the growth of kina becomes restricted by increasing temperature is unknown but is likely to be between 4 - 24^{o}C • Higher temperatures promote both growth in body and gonad size. However, kina tend to be smaller in the north where seawater temperatures are relatively high and larger (up to 190mm test diameter) in the south where the temperatures are cooler • For cultivation it is preferably that water temperatures are stable with minimal daily fluctuations.
Water quality	• There is no specific oxygen consumption data for kina available • Oxygen levels should be maintained above 85% saturation • Salinity should be that of normal seawater (approximately 33 parts per thousand) • The pH should be maintained in the range of 7.8-8.2.

4. Factors that impact on the growth of kina continued

Factors	Impact
Water flow rate	• There is both anecdotal evidence and growing scientific evidence that kina grow better and produce larger quantities of gonad when exposed to high water movement. • Flow rates around captive kina must be sufficient to maintain the water quality around them. The oxygen consumption rates of captive kina must be determined before exact flow rate requirements can be calculated.
Stress	• Capture and transport of kina must be undertaken with extreme care to avoid excessive spine loss and drying of the animals during transport. • Removal of kina from the water for feeding and cleaning can be achieved without causing undue stress but should be kept to a minimum. • Temperature shock and delayed mortality can occur when transferring animals between areas with temperatures that differ more than 2-3^{o}C. • Low water flows will effect the growth and gonad development of captive kina; this is likely due to reduced oxygen levels. • Poor water and high stocking densities will increase the occurrence of bacterial infections in captive kina.
Husbandry techniques	• Disturbance from feeding and cleaning should be kept to a minimum as these will affect growth rates and gonad quality. • Kina produce large amounts of faeces and a cleaning regime (minimum once per week) that will remove the faeces and uneaten food must be implemented. • When handling kina care must be taken to avoid damaging the spines and test and causing excessive spine loss.
Sediments	• Appropriate filtration is required to remove any suspended solids that may occur in the seawater system.
Biological contamination	• Bacterial infections can be controlled by filtration and UV sterilization of the seawater. • Toxic algae can have an effect on survival of kina but this can be controlled by treatment of incoming water by filtration and ozonation.

Self Test Questions 4

1. What kinds of things can you measure to determine Kina growth?
2. Name four factors that can affect the growth of Kina.
3. Describe how each of these factors impact on growth rate.

5. Potential Health Issues

5A. What is disease?

Disease can be defined as **an abnormal condition that affects the performance or vital functions of the affected animal**[8].

Viruses, bacteria, fungi, protozoa, (all of which are organisms that are microscopic in size) and parasites of a variety of types and sizes can cause infectious diseases. Infectious diseases can often be passed directly from one organism to another (e.g. kina to kina, kina to a different organism).

Non-infectious diseases cannot be passed from one organism to another, but are caused by stress-inducing external factors such as transportation, excessive handling, prolonged exposure to air, lowered oxygen levels in holding systems, or reduced ambient seawater temperatures.

5B. How to tell if there are potential health issues with Kina

There are a number of potential health issues with kina: loss of spines; drooping spines; loss of appetite;

i. Loss of spines

There are a number of reasons that could cause kina to loose their spines. These include: stress, bacterial infection, transportation / excessive handling, prolonged air exposure, limited dissolved oxygen in water supply

- When a sea urchin is exposed to stress such as transportation, excessive handling, prolonged exposure to air or lowered dissolved oxygen levels in holding systems the animal will automatically drop its spines.
    - Normally the animal will only drop the long spines but will retain the shorter spines. This also occurs in the wild and kina fishers refer to this as animals 'having had a haircut'.
- If animals loose the long spines in captivity as a result of transportation or excessive exposure to air the animal is capable of re-growing the long spines but requires optimal conditions and feed (see **Section 4, Factors that impact on the growth of Kina**) in order to do this. The energy, nutrients and minerals required to re-grow the spines will mean that the animal will not grow larger during this period and its available energy for reproduction will also be reduced.
- The spines of sea urchins may also be lost due to a bacterial infection of the skin, resulting in complete bald patches through which the 'test' can be seen (see **Figure 6** over page).
    - If the animals are suffering from a bacterial infection resulting in 'bald spot' disease the infection can be treated with antibiotics but they cannot then be eaten for a period of time until the antibiotics are cleared from their system. There are no documented, or anecdotal cases of sea urchins being treated for "balding sea-urchin disease". Usually infected animals are simply removed from the holding system.

Action to take: it is unknown how the disease is spread but the higher incidence of the disease and subsequent mortality of wild animals found at higher densities[2] indicates that the transfer of the organism requires the animals to be physically close to, or in contact with each other. If this occurs in a holding system the best course of action is to remove the infected animal/s and reduce the density of the remaining animals in the holding system.

5B. How to tell if there are potential health issues with Kina – continued.

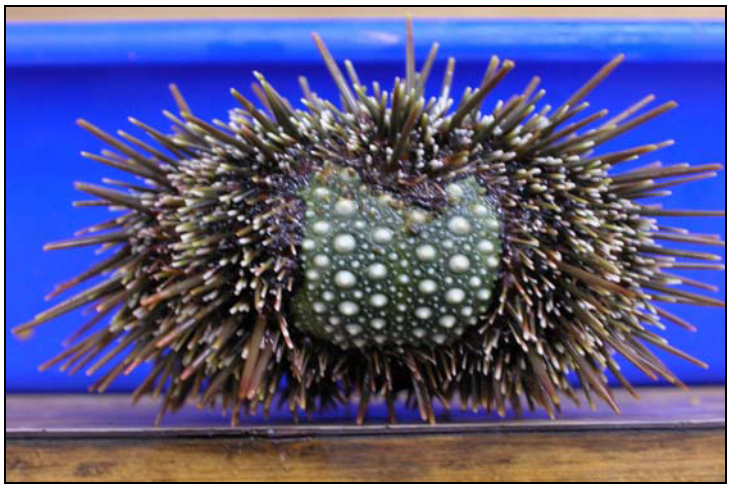


Figure 6: Kina (Evechinus chloroticus) suffering from bacterial infection and consequent spine loss.

ii. Drooping spines

- A loss in hydrostatic pressure within the urchin causes the spines to droop. This may be caused by internal/external damage or disease. There is little or nothing that can be done to help these animals

  best course of action is to remove them from the holding system before they die and contaminate the system.

iii. Reduced feed intake (loss of appetite)

There are a number of reasons that could cause the feed intake of captive sea urchins to drop. These include reduced ambient seawater temperatures, stress associated with sub optimal water quality and handling and/or transportation stress.

- Reduced ambient water temperatures are associated with a comparable reduction in feed intake for a number of species as a result in a reduction in the metabolic rate of the animal at lower temperatures.

  Action to take: temperature control in urchin holding systems is the only method of counteracting this effect.

- When an animal is exposed to sub optimal holding systems that do not have adequate water quality (e.g. low dissolved oxygen or high ammonia levels) the feed intake will be reduced due to stress.

  Action to take: it is critical to regularly monitor, and ensure good water quality in holding systems so that the animals are feeding optimally.

- The stress associated with handling and transportation will reduce the feeding response in animals for various lengths of time after the event. The lowered feeding response associated with these types of stress is normally short term and the animals should begin feeding normally after a period of a few days to a week.

Why it is important to take action: sea urchins can survive for long periods without feeding but if the cause of the reduction in feed intake is not identified the captive animals will not grow or put energy into reproduction.

Self Test Questions 5

1. Choose two abnormal features and/or behaviours that could indicate a potential New Zealand sea urchin health issue and answer the following questions:

   a) Describe two unusual features/behaviours of Kina that would indicate a potential health issue.
   b) Describe the actions that should be taken if these features/behaviours are observed in captive Kina.

c) Describe the effects of NOT taking any action if the features/behaviours are observed; i.e. describe why it is important to take action.

6. Glossary of Terms

Term	Explanation
Aggregations	Large groups of animals in close proximity to one another
Anatomical features	Body structures
Bacterial infection	An infection caused by a bacterial organism
Camouflage	The use of materials to blend into the background of an environment
Calcium carbonate	A chemical ($CaCO_3$) that forms the basis of the test, or shell, of kina (used as chalk)
Captive	Animals held in either land or sea-based holding systems
Cryptic	Lives in cracks and crevices and is well hidden
Desiccation	Drying out of an organism
Disease	Specific illness occurring in an organism
Echinoderm	Marine bottom dwelling organisms (Echinodermata) with bodies that have radial symmetry and can be divided into five parts. This taxanomic group includes sea urchins, sea stars (starfish) and sea cucumbers
Forage	Intentional movement to find food
Gametogenic cell	Specialized reproductive cells in the gonad
Gonadal growth	Growth of the reproductive organ (gonad)
Grazing	Animals consuming the vegetation on an area of seafloor
Habitat	The natural home of an animal or plant
Herbivorous	Animals that eat plants, in this case seaweeds
Inter-tidal	The area on the coast exposed to the air at low tide but covered at high tide
Juvenile	Life stage between larvae and mature animals
Larvae	An animal in its first life stage after coming out of the egg
Metamorphosis	Change in form from one life stage to another
Microscopic	Clearly visible only under a microscope
Mortalities	The number of deaths that occur
Nutritive phagocytes	A specialized cell in the gonad of kina that acts as a nutrient storage cell
Photoperiod	The light cycle (i.e. the number of hours of light and dark per day) that an animals is exposed to
Plankton	The organisms (plants and animals) inhabiting the surface layers of a sea or lake
Potassium chloride	A chemical (KCl) used in a dilute form for the spawning of sea urchins
Reproductive cycle	The cycle of events describing reproduction of an organism
Settlement	The settling of an organism onto a substrate. Normally for free swimming larvae this signifies the end of the planktonic life stages
Somatic growth	Growth in body size
Stress	Physical strain or tension on an organism
Substrate	The layer or stratum that makes up the seafloor

7. Further Reading and References

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