

## LENSscience Senior Biology Seminar Series Ancient Secrets in the Seaweed Questions and Discussion

### Pre-seminar School Discussion

This seminar will take you on a journey with Ceridwen Fraser, a PhD student from the University of Otago whose work has made headlines around the world. Ceridwen has spent the past three years investigating Bull Kelp populations in the Southern Hemisphere. While she set out to find out about how these populations are genetically connected, along the way she has contributed some significant information about understanding of past climate change events. This knowledge will contribute to predictions about the effect of future climate change.

In your programme this year you are challenged to understand processes and patterns of evolution. The work that Ceridwen has done uses understanding of processes and patterns of evolution along with biotechnological techniques to answer questions about the effect of climate cycles on Bull Kelp populations.



Images from a Scientist: Ceridwen Fraser, PhD Student, Allan Wilson Centre and University of Otago

### A Review of Processes and Patterns of Evolution

Use your knowledge of Y12 Biology and the information in the seminar paper to discuss the following questions.

1. Ceridwen's research was investigating populations of the species *Durvillaea antarctica*. *D. antarctica* is a very large algae. What are the defining characteristics of algae.
2. Defining the term species can be problematic. Create a concept map for the terms "species" and "population", and explore with your group why the term "species" can be problematic.
3. A population has a specific gene pool which is defined as the genetic make up of the population. Using a concept map, outline the factors that impact on the stability of a gene pool.

## Vocabulary

Climate Cycles  
Climate Systems  
DNA Extraction  
DNA Sequencing  
Extinction  
Gene pool  
Genetic Diversity  
Glacial Period

Green House Gases  
Habitat  
Haplotype  
Inference  
Interglacial Period  
Invertebrate  
Last Glacial Maximum  
Macro-algae  
Non-glacial Period  
Phylogenetic Tree

Polymerase Chain Reaction  
Population  
Rafting  
Sea level  
Sea-ice  
Selection Pressures  
Speciation  
Species  
Species Distribution Patterns

## Level 3 Achievement Standards linking to this seminar:

- AS 90716 Describe animal behaviour and plant responses in relation to environmental factors  
AS 90717 Describe processes and patterns of evolution  
AS 90718 Describe applications of biotechnological techniques

## Key Concepts from Level 3 Biology that link to this seminar:

Below are selected objectives from the Year 13 biology programme that link to this seminar. THESE ARE NOT A FULL LIST OF THE CONCEPTS IN YOUR COURSE. You may wish to review these concepts before the seminar.

## Processes and Patterns of Evolution

- Define the term species and ways in which speciation occurs
- Define gene and allele frequency, speciation, gene flow, genetic equilibrium.
- Identify sources of genetic variation and agents of change that lead to change in a gene pool.
- Define the terms genetic drift, founder effect and bottleneck effect.
- Explain the role of natural selection in speciation
- Describe patterns of evolution: convergent, divergent (incl. adaptive radiation), co-evolution, and the speed of evolutionary change i.e. punctuated equilibrium, gradualism.



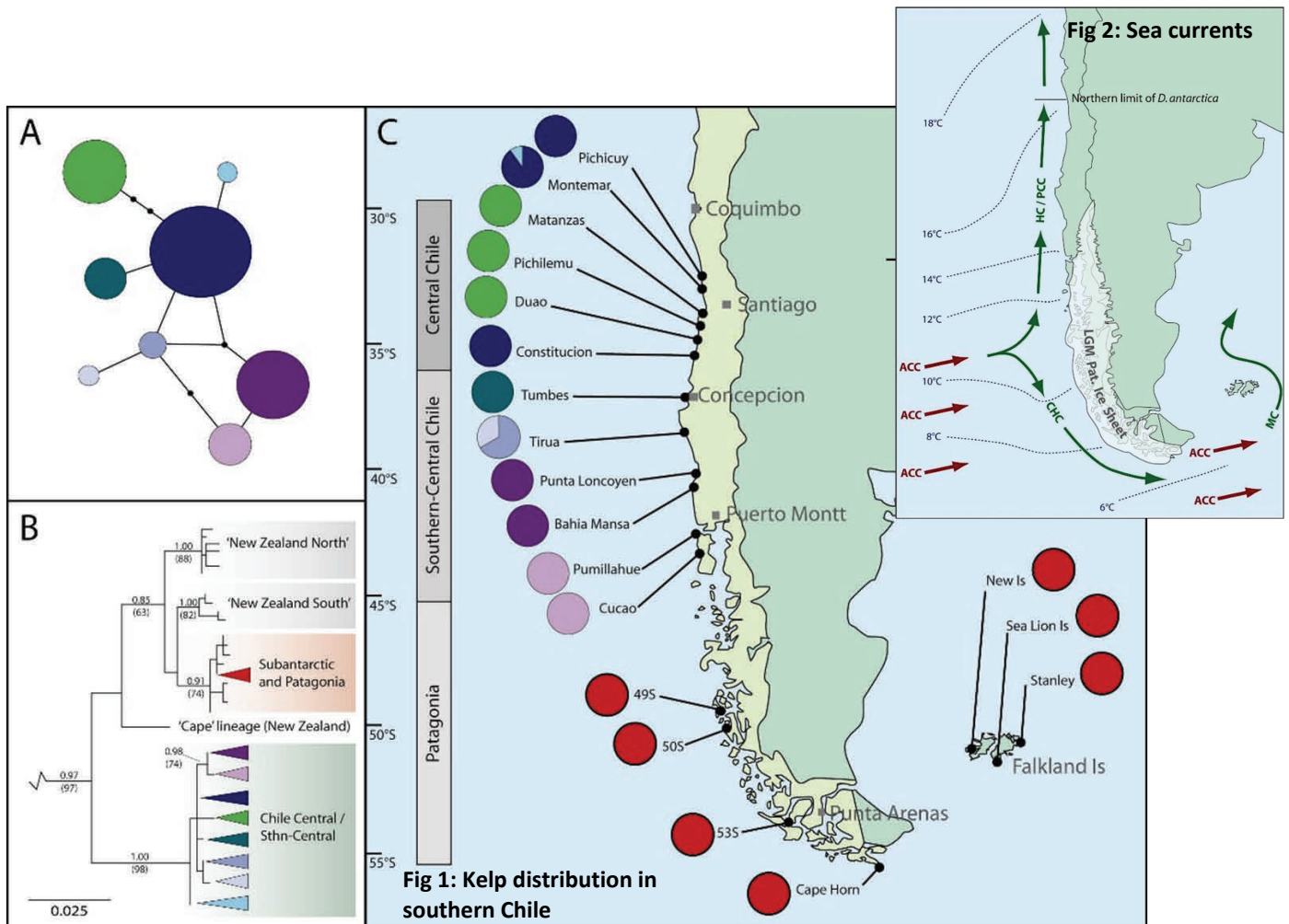
## Biotechnology

- Describe the techniques involved in gene cloning and how gene cloning meets human needs and demands.
- Describe the techniques involved in DNA profiling and how DNA profiling meets human needs and demands.
- Describe the techniques involved in genome analysis and how genome analysis meets human needs and demands.
- Be aware of the differing viewpoints of the use of biotechnological applications.
- Show understanding of applications of biotechnological techniques by using core knowledge to link ideas



## Post Seminar Challenge Questions

1. Ceridwen and the team analysed the samples from the populations using molecular biotechnologies. This evidence allowed them to **infer** what had happened to the populations in the last glacial period. What does the term **infer** mean and why is it used in this context?
2. Explain why the evidence suggests that the populations dominating the subantarctic have colonised this area recently (in terms of geological time).
3. Mitochondrial DNA is used in the analysis of the samples because it is abundant and easily accessible. However there are other advantages of using mitochondrial DNA over using nuclear DNA. Discuss possible reasons for these advantages.
4. Fig 1 below shows data from Ceridwen's study relating to Bull Kelp populations in southern Chile. Fig 2 shows the currents in this area. Using the information in these figures:
  - (a) can you suggest a hypothesis to explain the species distribution pattern
  - (b) what evidence did you use to form this hypothesis?
  - (c) what further questions do you need to answer to support your ideas?



### POST YOUR IDEAS, QUESTIONS AND SUGGESTED ANSWERS AT

[http://lens.auckland.ac.nz/index.php/Climate\\_Change\\_and\\_Evolution\\_Discussion\\_Page](http://lens.auckland.ac.nz/index.php/Climate_Change_and_Evolution_Discussion_Page)