CONNECTED, LEVEL 3 2013, Food for Thought

The Fish Highway

by Adele Jackson

Overview

Fish and eels have been found to be using Wellington's stormwater system as access between streams and the sea. This article clearly shows the links between initial observations, question formation, experimental design and data collection, data representation and analysis, and conclusions in the context of a scientist gathering data on fish, their habitat, and their movement between environments.

A Google Slides version of this article is available at www.connected.tki.org.nz.

Science capability

Students need to develop a set of **capabilities** that support them to ask informed questions if they are to participate as "critical, informed, responsible citizens in a society in which science plays a significant role". The capabilities enable students to meet the achievement objectives in a way that supports the purpose of science in *The New Zealand Curriculum* and the development of the key competencies. These capabilities include being ready, willing, and able to **gather and interpret data**. Students need to understand what counts as evidence in science, the importance of observation, and the difference between observation and inference.

Text characteristics

- Illustrations, photographs, text boxes, diagrams, maps, and graphs that clarify or extend the text and may require some interpretation
- A significant amount of vocabulary that is unfamiliar to the students, including academic and content-specific words and phrases, which is generally explained in the text by words or illustrations.

Curriculum context

SCIENCE

NATURE OF SCIENCE: Understanding about science

Achievement objective(s)

L3: Students will appreciate that science is a way of explaining the world and that science knowledge changes over time.

NATURE OF SCIENCE: Participating and contributing

Achievement objective(s)

L3: Students will use their growing science knowledge when considering issues of concern to them.

LIVING WORLD: Life processes

Achievement objective(s)

L3: Students will recognise that there are life processes common to all living things and that these occur in different ways.

LIVING WORLD: Ecology

Achievement objective(s)

L3: Students will explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

Key Nature of Science ideas

- Science knowledge is based on direct, or indirect, observations of the natural physical world.
- Scientists gather data, using their senses to make observations.
- Making careful observations often involves measuring something.
- Observations are influenced by what you already know.

Key science ideas

- All animals and plants have a life history.
- The stages of growth, development, and reproduction make up the life history.
- Some babies change gradually to look like their parents.
- The life history of some animals can take place in a variety of environments.

ENGLISH

READING

Ideas

L3: Students will show a developing understanding of ideas within, across, and beyond texts.

INDICATORS

- Uses their personal experience and world and literacy knowledge confidently to make meaning from texts.
- Makes meaning of increasingly complex texts by identifying main and subsidiary ideas in them.
- Starts to make connections by thinking about underlying ideas in and between texts.
- Makes and supports inferences from texts with increasing independence.

THE LITERACY LEARNING PROGRESSIONS

The literacy knowledge and skills that students need to draw on by the end of year 6 are described in *The Literacy Learning Progressions*.

Scientific investigation

A science investigation where you change or try something and observe what happens is called an experiment. Not all scientific investigations are experiments; there are many ways of investigating in science. The New Zealand Curriculum science achievement aims indicate that students should experience a range of approaches to scientific investigation including classifying and identifying, pattern seeking, exploring, investigating models, fair testing, making things, and developing systems. Many scientific investigations involve systematic observation over time of an object, an event, a living thing, or a place.

Some important things to remember when you do a scientific investigation are: to be systematic and fair; to make sure that only one thing is changed at a time if you are doing an experiment or fair test so you are sure which changes result in which outcome; to observe and record what happens very carefully; and to be open minded so you notice things you are not expecting.

Sound data is obtained when you are able to get similar outcomes each time you do the same thing, or when data has been collected in the same way and in a systematic manner. No investigation or experiment results in a "wrong" outcome. You may have done something differently from others or the conditions may be slightly different so you don't get the same result as others do, but it is not "wrong".

Thinking about and developing explanations about why things happen the way they do, based on evidence, is an important aspect of science. Another important aspect is critically evaluating methods and ideas. Part of a scientist's work is critiquing and evaluating the methods and ideas of other scientists. They expect their work to be subject to critique. If they are going to be able to make informed decisions about scientific issues as responsible citizens, students first need to experience a range of approaches to scientific investigation and to practise critique and evaluation of scientific methods and ideas – both their own and those of others – just like scientists do!

Meeting the literacy challenges

The following strategies will support students to understand, respond to, and think critically about the information and ideas in the text. After reading the text, support students to explore the key science ideas outlined in the following pages.

TEXT CHARACTERISTICS

- Illustrations, photographs, text boxes, diagrams, maps, and graphs that clarify or extend the text and may require some interpretation
- A significant amount of vocabulary that is unfamiliar to the students, including academic and content-specific words and phrases, which is generally explained in the text by words or illustrations.

TEACHER SUPPORT

Want to know more about instructional strategies? Go to:
http://literacyonline.tki.org.nz/Literacy-Online/Teacher-needs/Pedagogy/Reading#Years5-8
http://literacyonline.tki.org.nz/Literacy-Online/Student-needs/National-Standards-Reading-and-Writing
http://www.literacyprogressions.tki.org.nz/

"Working with Comprehension Strategies" (Chapter 5) from *Teaching Reading Comprehension* (Davis, 2007) gives comprehensive guidance for explicit strategy instruction in years 4–8.

Teaching Reading Comprehension Strategies: A Practical Classroom Guide (Cameron, 2009) provides information, resources, and tools for comprehension strategy instruction.

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INSTRUCTIONAL STRATEGIES

FINDING INFORMATION IN THE TEXT

PROMPT the students to **ASK QUESTIONS** of the text.

- *After reading the title and first sentence, what questions would you ask?*

Have them record their questions and **PROMPT** them to seek answers to their questions as they read.

ASK QUESTIONS to help the students to engage with the text as they read.

- *Why is electrofishing an efficient way of catching and counting fish?*
- *How are the regional and city councils helping the fish and eels that live in the brick-lined pipes? Why?*
- *Why might Māori have so many names for eels?*

USING DIAGRAMS TO CLARIFY THE TEXT

Explain to the students that the numerous diagrams and charts in this text will help clarify their understanding.

- *Read the first paragraph under the heading "Under Wellington".*
- *What is the picture the author creates for the reader? How does the author do this?*
- *How do the diagrams and pictures confirm or change what you visualised?*

PROMPT the students to look closely at the photograph of Frances gathering data.

- *Why does Frances take a buddy with her when she gathers data?*

EXPLAIN that headings in tables or graphs indicate crucial information.

DISCUSS a sequence for reading the information in a graph:

- the heading
- the key
- the labels on the axes
- the data within the graph.

Have the students read the information on page 26 about how scientists survey streams and look closely at the graph. **PROMPT** them to discuss the information conveyed in this graph, using some of the scientific words in the text.

PROMPT the students to look closely at the diagram of the electrofishing unit and draw a quick sketch of their own to show how the electrofishing process works. Have each student explain the process shown in their sketch to a partner, using some of the subject-specific vocabulary.

PROMPT the students to read the information about native fish living under Wellington and about longfin and shortfin eels. Have them complete charts comparing the two different kinds of fish and the two different kinds of eel, organising the information under separate headings for behavioural and anatomical characteristics.

DEALING WITH UNFAMILIAR VOCABULARY

Have the students **SKIM** the text to **IDENTIFY** and list the subject-specific vocabulary. Discuss the meanings of any unfamiliar words before reading, to reduce the amount of explanation required as they read.

PROMPT the students to write a glossary of this vocabulary after reading, using the text as a source for the definitions. Have them share and refine their definitions in groups.

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Teacher support

Frances Forsyth

Frances is finding fish of all sizes and ages in Wellington's streams. For Frances, this is exciting data to find because it means that the fish are completing their life cycle – going out to sea and coming back.

Fish scientist Frances Forsyth has been studying the stormwater system under Wellington since 2003. One night, Frances was standing beside the entrance to a stormwater pipe. She saw fish swimming in and out. She guessed that the fish were using the pipes. She decided to investigate.

Frances knows where to look and what to look for. She looks at waterways and examines them closely for the clues that will tell her that fish will be there. She uses a tape measure to measure 250-metre lengths of streams. These are called "snapshots". Frances looks at the stream **habitat** and makes notes about the plants growing beside the stream. She notes the way the water is flowing, and looks at the bottom of the waterway. Is there a pool along the waterway? Is the water flowing smoothly? Maybe there's a small waterfall? Frances has learned that fish like to live in different places at different times. It depends on whether they're resting or feeding.

Scientists making direct observations of the natural world to observe changes over time.

Making careful observations often involves measuring things.

Living things are suited to their particular habitat.

Most of our native fish are nocturnal. They swim, feed, and breed in streams at night while we are asleep.

When she gathers data at night, Frances takes:

- ✔ a waterproof notebook
- ✔ a pencil
- ✔ a camera
- ✔ a tape measure
- ✔ a motorcycle battery
- ✔ a big, bright light
- ✔ a **GPS**
- ✔ several nets
- ✔ a bucket
- ✔ a large, transparent plastic box to put fish in when she photographs them
- ✔ a buddy – can you think why?

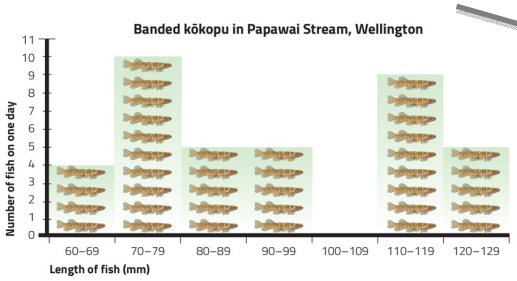
Fish scientists survey streams in 250-metre snapshots. They use GPS to mark out each snapshot's **coordinates**. This makes it easy to find the spot in the future. Snapshots supply the scientists with information about trends over time. The scientists enter the data from their field notebooks into spreadsheets on computers and use it to make graphs and charts. Then the scientists send report cards to the New Zealand Freshwater Fish Database. The scientists also write a report about each snapshot for people and organisations who are interested in the information.

Observations are influenced by what you already know.

Scientists make methodical observations of the natural physical world to collect sound data.

Careful recording of observations and data gathered

A graph based on a survey of a stream



Scientists record and interpret data in different ways to look for patterns and trends.

Exploring the science

Some activities focus directly on the science capability of "gathering and interpreting data" and the Nature of Science strand. Other activities extend student content knowledge. You are encouraged to adapt these activities to make the focus on Nature of Science explicit and to support students to develop the capability to collect and interpret data.

LEARNING FOCUS

Students make observations, gather data, and interpret and discuss outcomes based on their observations.

KEY SCIENCE IDEAS

Key Nature of Science ideas

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LEARNING ACTIVITIES

Activity 1: The importance of measurement

Why does Frances measure the fish and how does she do this? This is a good context for students to practise measuring and to show students that scientists make measurements all the time. Have the students discuss and record their ideas about why people like Frances measure fish and the methods they might use. The students can then check their predictions by looking at some more examples.

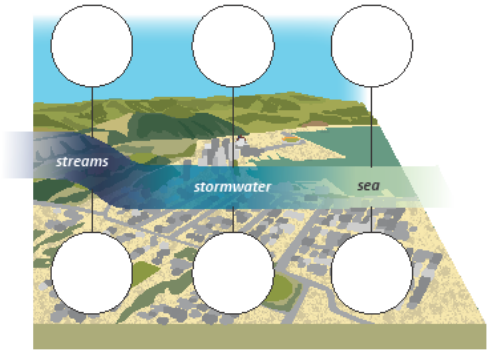
Students could:

- Watch the NIWA video "Fish Tagging – Giant Kōkopu" to find out more about how and why NIWA tags fish. (Note that you can find out more about fish tagging and the equipment that is used by conducting a search of the site.)
- Look at the Department of Conservation's Pōhatu Marine Reserve site to find about the tagging of blue cod and rock lobster.
- View the fishing measurement charts and tools that the Ministry for Primary Industries uses to measure catches for legal size. Guideline brochures for your area are available on the MPI website.
- Download the *Recreational Fishers' Handbook* to find out what is expected of recreational fishers, why, and how they can measure different species.
- Read the *Connected* article "Down for the Count", which describes how important it is to monitor the numbers of endangered species, such as Māui's dolphin.

The students could then make their own measuring tool and use it to measure actual or cardboard fish or shellfish. The purpose could be to help recreational fishers make sure they are not taking undersized fish. The tool will need to be designed for a specific species. The *Recreational Fishers' Handbook* would be useful in making this decision.

Activity 2: Mapping the highway

Have the students use the information in the text to map the use of the fish highway by the native fish and longfin eels. The map should show where the fish and eels can be found at different parts of their life cycles. They could use the cut-away diagram of the fish highway on page 8 to present the information.



Extension

The students may have been intrigued by the ideas of electrofishing and still have questions. To find out more, they could watch the *Meet the Locals* video of Department of Conservation workers in Nelson checking the health of streams and counting fish species in their habitat http://tvnz.co.nz/meet-the-locals/2007-episode-23-video-1501373

Activity 3: More about *Galaxias*

Obtain photographs and descriptions of the five different species of *Galaxias* that live in New Zealand. The students could explore various identification keys as models, and then develop a key that would help other students to identify fish they find in local streams. (An example of a key can be found in Building Science Concepts, Book 6 – *Soil Animals: Diversity Beneath Our Feet*.)

Activity 4: Read and take action

"Pacific Paradise?" is a *School Journal* text that uses mixed text types to examine the effects of environmental change on eels. It would require a shared reading, as it is designed for students in years 7 and 8. Alternatively, "Blue Fish on the Footpath" looks at the danger of what goes down our stormwater drains and the effects on our fish stock.

Students could use these texts to make connections to environmental changes they have noticed in their own area and to speculate on the impact on fish life. They could use a detailed local map to identify streams in their own area. If it is safe and possible, they could visit the streams near their school and make observations about their health and how they might be impacting on the creatures that live in them. If it is not possible, Learnz offers a virtual field trip that provides the opportunity for students to investigate water quality and biodiversity around Lake Taupō.

The students could then design publicity campaigns in their communities to build awareness of the need to keep stormwater systems free from pollutants that can harm fish and eel populations.

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Activity 5: Become a citizen scientist

Use the Science Learning Hub link on citizen scientists to further explore this concept and to find out about citizen science in action.

Local and regional councils often support schools with stream studies, so students could monitor the health of a local stream and survey the presence/absence of native fish and eels in the waterway. They could become involved in riparian planting schemes to make streams more habitable for native fish and eels.

Some examples are suggested below as a starting point.

"Take Action for Water" is a term-long programme of work developed by the Greater Wellington Regional Council. You could use it to lead classroom inquires into health of water catchments and ecosystems in your local area. It investigates the relationships between the living parts of the ecosystem and the impact humans have on it. It shows how we can act to reduce our negative impacts and help to restore the processes and functions of these ecosystems.

"Waterways and Wetlands" is a learning resource developed by Christchurch City Council to be used along with a visit to Travis Wetland, Christchurch's largest freshwater wetland and an important habitat for native wetland plants. The Council has also supported Environment Canterbury to develop a water education programme called Waitaha Wai: Waterways of Christchurch.

Hawkes Bay Regional Council has a resource on the restoration of the Pekapeka Wetland.

Google Slides version of "The Fish Highway" www.connected.tki.org.nz

RESOURCE LINKS

Google Slide version of "The Fish Highway" www.connected.tki.org.nz

Building Science Concepts, Book 4 – *Animal Life Histories: Reproduction, Growth, and Change*

Building Science Concepts, Book 6 – *Soil Animals: Diversity Beneath Our Feet*

Learnz http://www.learnz.org.nz

Science Learning Hub http://www.sciencelearn.org.nz/Science-Stories/Butterflies/Citizen-scientists

NIWA videos http://www.niwa.co.nz/news-publications/videos

NIWA Fish Tagging – Giant Kōkopu http://www.niwa.co.nz/video/niwa-fish-tagging-giant-kokopu

Meet the Locals: Series 1, Episode 23, Electric Fishing http://tvnz.co.nz/meet-the-locals/2007-episode-23-video-1501373

Department of Conservation: Pōhatu Marine Reserve http://www.doc.govt.nz/parks-and-recreation/places-to-visit/canterbury/christchurch-and-banks-peninsula/pohatu-marine-reserve/plan-and-prepare/you-can-help/

Ministry for Primary Industries, guideline brochures
www.fish.govt.nz/en-nz/Recreational/Brochures.htm?WBCMODE=PresentationUnpublished++%23Publications

Recreational Fishers' Handbook
http://www.fish.govt.nz/NR/rdonlyres/FE6FEC6B-8F17-42ED-BC29-27D4FA6C7FFA/0/MFish_Recreational_Handbook.pdf

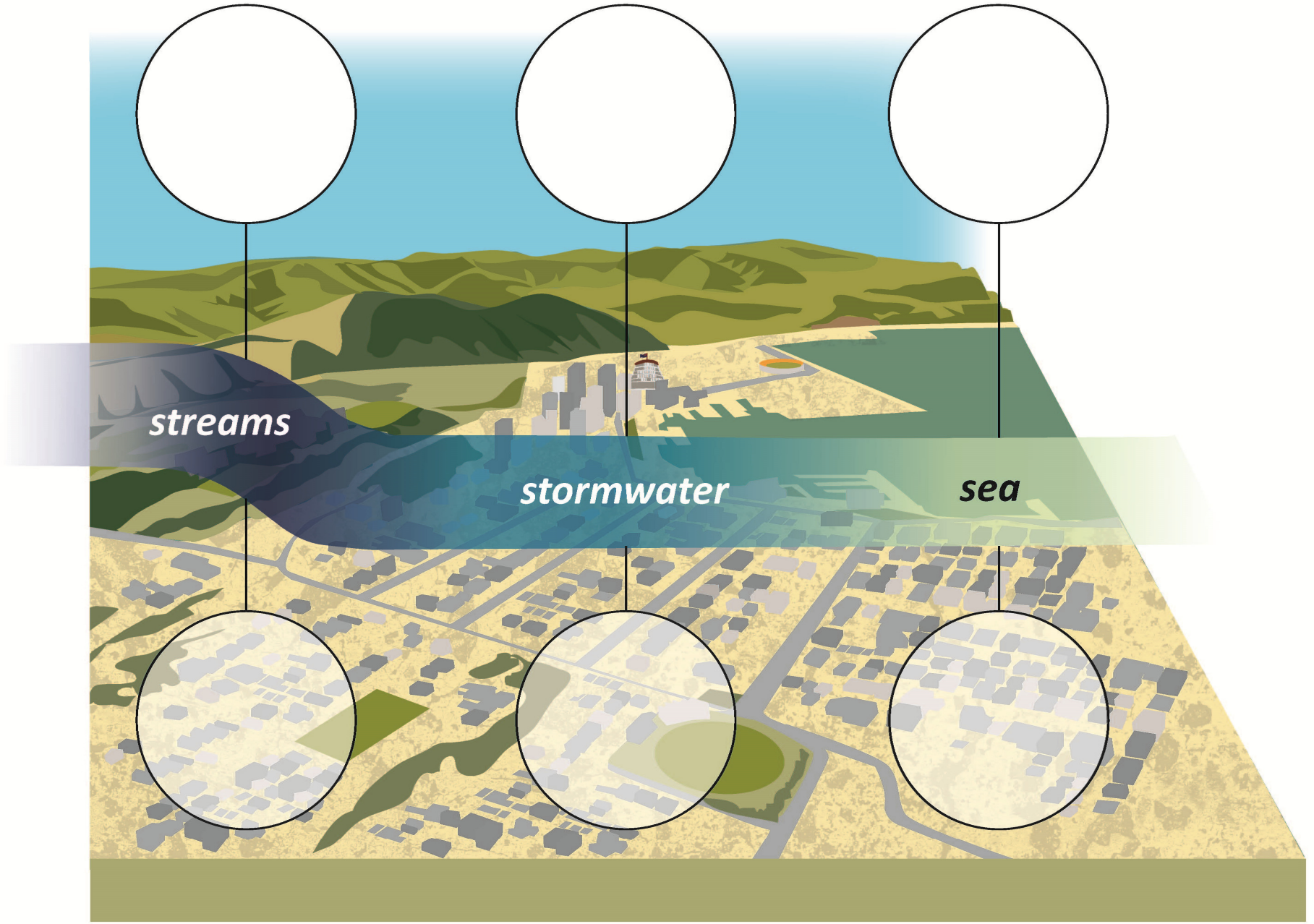
Hawkes Bay Regional Council http://www.hbrc.govt.nz/Services/Education/Education/Pages/Resource-Kits-for-Schools.aspx

TVNZ7 Innovation Stories Iwi Eel Research http://tvnz.co.nz/the-learning-hub/innovation-stories-iwi-eel-research-4807055

"Down for the Count" *Connected* 3, 2004 (pages 15–19). TSM available at:
http://www.tki.org.nz/r/technology/connected/2004/connected3/index_e.html

"Pacific paradise?" *SJ* 4.2.10. See an example of its use at: http://literacyonline.tki.org.nz/Literacy-Online/Student-needs/National-Standards-Reading-and-Writing/National-Standards-illustrations/Year-8/Pacific-Paradise-Reading

"Blue Fish on the Footpath" *SJ* 2.2.92



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