

Academic Reading Paper 05

Eels, Counting and Failure

Time allowed: 1 hour

INSTRUCTIONS TO CANDIDATES

- Do not open this booklet until you are told to do so.
- Write your name and the date at the top of the answer sheet.
- Answer **all** the questions.
- Write your answers **on the answer sheet**, not in this booklet.
- You must transfer your answers within the hour. **No extra time is given for transferring answers in the Reading test.**
- Do not remove this booklet from the examination room.

INFORMATION FOR CANDIDATES

- There are 40 questions in this paper.
- Each question carries one mark.
- There are three passages, with 13, 13 and 14 questions.

These passages were written for this library. They are **not** reproduced from any published past paper. The format, timing and task types follow the published specification for the Academic Reading test so that sitting this on paper feels like the real thing.

You should spend about 20 minutes on Questions 1–13, which are based on Reading Passage 1 below.

The eel that nobody has seen spawn

The European eel is among the most heavily studied animals in Europe and one of the least understood. It is fished commercially, farmed, eaten across the continent and listed as critically endangered, and yet no human being has ever watched two of them breed. Aristotle, who dissected a great many, concluded that they arose spontaneously from mud, on the reasonable ground that he could find no eggs and no organs to make them. He was wrong about the mud and right about the difficulty: an eel caught in a European river has no visible reproductive organs at all, because it does not develop them until it has left.

The question of where they go was settled, or nearly settled, by patience. From 1904 the Danish biologist Johannes Schmidt trawled the Atlantic for the transparent leaf-shaped larvae called leptocephali, and for eighteen years he plotted where the small ones were found. The logic was simple and required only persistence: the smaller the larva, the closer to where it hatched. The trail thinned westward across the ocean and converged, in 1922, on the Sargasso Sea, a still region of the western Atlantic with no coastline, bounded by currents rather than by land. Schmidt never caught an egg or an adult there. He inferred the spawning ground from the size of the young, and that inference has stood for a century on evidence of exactly that kind.

What follows is a life history that would be dismissed as invention if it were not so well documented. The larva drifts eastward on the current for between one and three years and something over five thousand kilometres. Reaching the continental shelf it stops feeding and transforms into a glass eel: eel-shaped now, and so transparent that its spine is visible through it. In fresh water it darkens into a yellow eel and stays there, growing slowly, for anything from five to twenty years — the females longest. Growth is slow because the water is cold and the diet is opportunistic, and an eel taken from a northern lake may be older than the person who catches it.

Then it changes again, and the changes are not cosmetic. The eyes enlarge and their pigments shift towards the blue of deep water. The flanks turn silver. The gut degenerates until the animal cannot eat, which means that the return journey of five thousand kilometres is made entirely on fat laid down in the river. Reproductive organs develop only during that crossing. A silver eel leaving a European river is, in a strict sense, not yet an adult.

The reason nobody has seen the end of the journey is that the ocean is large and the animals are neither numerous nor conspicuous. The Sargasso is roughly the area of the continental United States, and a silver eel is a metre of dark animal moving at depth, at night, on its own. In 2022 a team fitted satellite tags to silver eels released from the Azores and tracked several of them into the Sargasso, which is the first direct evidence that mature European eels arrive there at all. It confirmed Schmidt. It did not show anybody spawning, and no adult European eel has ever been recovered from the Sargasso Sea.

The practical consequence of all this is severe. Because the life cycle cannot be closed in captivity — nobody has raised a European eel from egg to egg at any useful scale — every farmed eel in the world begins as a wild glass eel, caught as it arrives at a coast. The animal is therefore fished at the point in its life when it has not yet reproduced, which is the worst possible point at which to remove it. Arrivals of glass eels on European coasts are now around five per cent of what they were in the early 1980s. Nor can the shortfall be made up by moving animals about. Glass eels are restocked into rivers across Europe every year, but a restocked eel is one that was caught somewhere else, and the number arriving from the Atlantic is not changed by it.

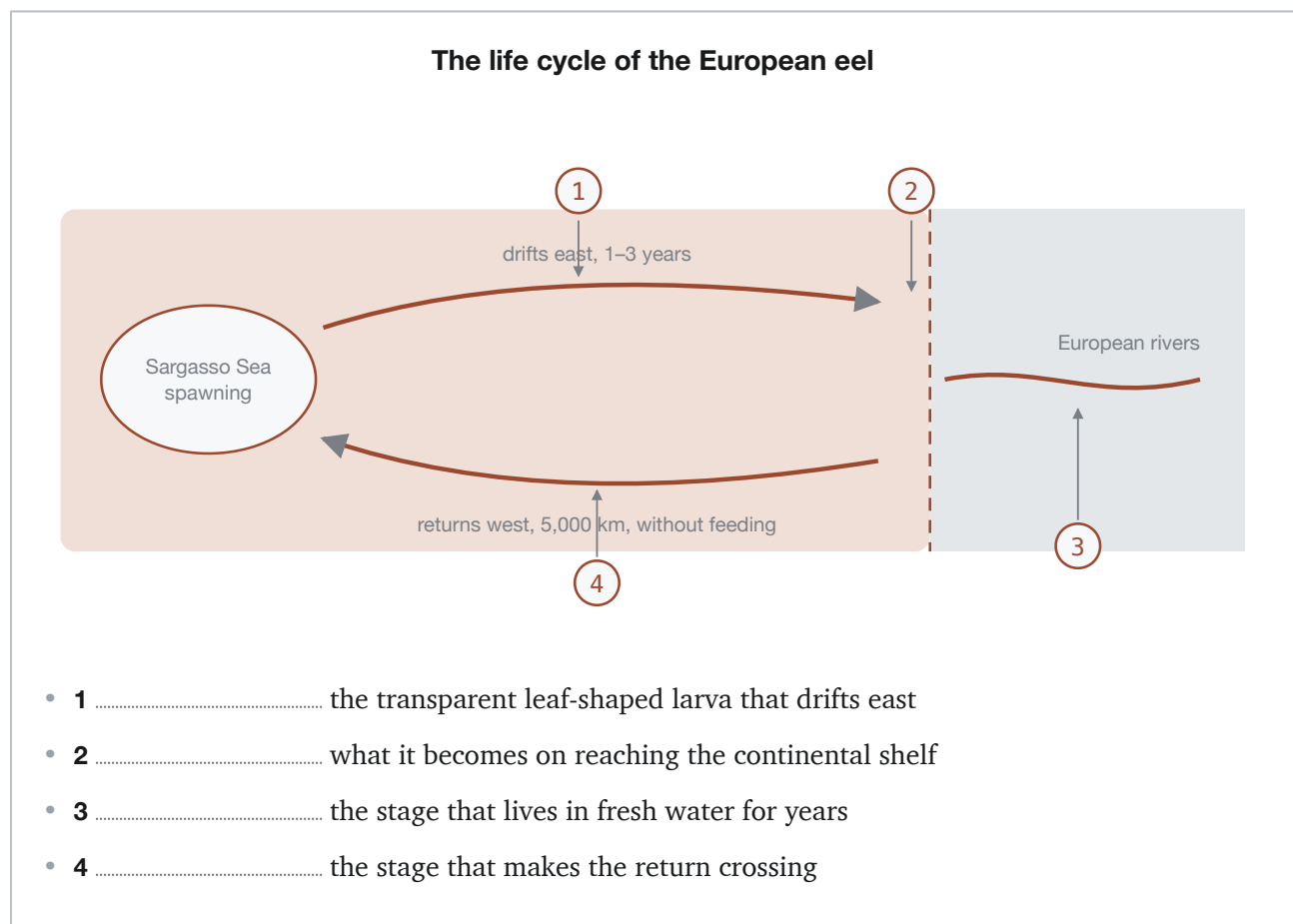
There is a certain irony in the position. A species can be cheap in a market and critically endangered at the same time, and this one is. What makes the eel hard to protect is precisely what made it interesting to Aristotle: the part of its life that matters most is the part that nobody has ever seen.

leptocephalus (plural leptocephali): the flat, transparent larval form of an eel
continental shelf: the shallow sea floor bordering a continent

Questions 1–4

Label the diagram below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.



Questions 5–9

Complete the notes below.

Choose **NO MORE THAN TWO WORDS AND/OR A NUMBER** from the passage for each answer.

Finding the spawning ground

Schmidt's method

- Trawled the Atlantic for eel larvae from 1904 onwards.
- He recorded where the **5** larvae were caught, on the principle that these lay nearest the hatching ground.
- The trail converged on the Sargasso Sea in **6**
- The Sargasso Sea has no coastline and is bounded by **7** instead.

What is still missing

- In 2022 eels released from the Azores were followed into the Sargasso using satellite **8**
- No adult European eel has ever been recovered from the **9**

Questions 10–13

Do the following statements agree with the information given in Reading Passage 1?

Write **TRUE** if the statement agrees with the information, **FALSE** if the statement contradicts the information, or **NOT GIVEN** if there is no information on this.

- 10** Arrivals of glass eels in Europe have fallen by about ninety-five per cent since the early 1980s.
- 11** Aristotle's explanation was accepted for centuries after his death.
- 12** An eel caught in a European river has already developed reproductive organs.
- 13** Every farmed eel began life as a wild-caught glass eel.

You should spend about 20 minutes on Questions 14–26, which are based on Reading Passage 2 below.

How children learn to count

- A** Ask an adult how many objects are on a table and, if there are three or four, no counting happens. The answer is simply available, immediately and without effort, in the way a colour is available. Past about four the effortless answer disappears and something slower takes over. This boundary, called subitising, is the first clue that what we call number is not one ability but at least two, and that only one of them has to be taught. Most people are surprised to be told that they cannot see five, and then, watching themselves do it, find that they cannot.
- B** The older of the two is shared with animals and present in human infants long before speech. It is approximate: it represents quantity as a fuzzy magnitude rather than an exact count, and its accuracy depends on ratio rather than on size. A six-month-old will notice the difference between eight dots and sixteen and will not notice the difference between eight and ten, and the same ratio limit turns up in rats, pigeons and undergraduates prevented from counting. Stanislas Dehaene has argued that this approximate system is the inherited foundation on which everything else about number is built. It is fast, automatic and available without instruction, and for any purpose that requires an exact answer it is useless.
- C** That infants also handle very small numbers exactly was shown in an experiment of great simplicity. Karen Wynn showed five-month-olds a doll placed on a stage, raised a screen, and visibly added a second doll behind it. When the screen dropped to reveal two dolls the babies looked away quickly. When it dropped to reveal one, or three, they stared. Something in a five-month-old expects one and one to make two, and objects when it does not. The design has since been repeated in other laboratories, with different objects and with subtraction as well as addition, and the effect has held.
- D** None of this is counting, and the distance between the two is the part adults consistently underestimate. Rochel Gelman set out what counting actually requires: that each object receives exactly one number word, that the words always come in the same order, and — the hard one — that the last word said is not merely the label of the last object but the answer to how many there are. A child can recite one to ten fluently, point accurately at each of five toys, and still, asked how many toys there are, begin the recitation again.
- E** The last of those principles arrives late and in stages. For roughly a year after learning the count words, a child is what researchers call a subset knower: able to give exactly one object when asked for one, then some months later exactly two, then three, each level acquired separately, while for any larger request the child simply hands over a handful. Then the whole thing generalises at once, and the child who has understood that the last word answers the question can produce any number in their count list. The generalisation, not the memorisation, is the moment learning happens. Nothing in a child's behaviour before it arrives predicts when it will.

- F** How much of this depends on having the words at all was tested where the words are absent. Peter Gordon worked with the Pirahã of the Brazilian Amazon, whose language has terms for one, two and many and no exact numerals beyond that. Adults asked to match a line of objects performed accurately for very small sets and then degraded in exactly the pattern the approximate system predicts: the error grew with the size of the set, and the responses were ratio-dependent. The inherited system was intact. What was missing was the technology for making it exact. Gordon's result has been argued over since, mostly about how the task was explained to the participants, and the argument has never touched the central observation: the errors carried the signature of the approximate system rather than of a system that had gone wrong.
- G** The conclusion the field has converged on is worth stating plainly, because it cuts against a common assumption. Exact number is not a deeper form of the number sense we are born with. It is a cultural invention, learned in a particular order over several years, that runs on top of an inherited approximate machinery it does not resemble. Counting is closer to writing than to seeing.

Questions 14–18

Reading Passage 2 has seven sections, **A–G**.

Choose the correct heading for sections **B**, **D**, **E**, **F** and **G** from the list of headings below.

Write the correct number, **I–IX**.

List of Headings	
i	A system shared with other animals
ii	A system unique to human infants
iii	What counting actually demands
iv	What counting is commonly assumed to demand
v	A skill that arrives in stages, then all at once
vi	A skill that arrives all at once, then in stages
vii	Evidence from a language without numerals
viii	Evidence from a language with unusual numerals
ix	Where the field has arrived

- 14** Section B
- 15** Section D
- 16** Section E
- 17** Section F
- 18** Section G

Questions 19–22

Look at the following findings and the list of researchers below.

Match each finding with the correct researcher, A–D.

NB You may use any letter more than once.

List of Researchers

- A Stanislas Dehaene
- B Karen Wynn
- C Rochel Gelman
- D Peter Gordon

- 19** He proposed that an inherited approximate system underlies all later number ability.
- 20** She showed that infants react when a small sum comes out wrong.
- 21** She specified the conditions a child must meet before it can be said to count.
- 22** He found the inherited system working normally where the words for it did not exist.

Questions 23–26

Complete the summary using the list of words, A–H, below.

List of Words

- A ratio
- B order
- C size
- D invention
- E instinct
- F memorisation
- G generalisation
- H speech

Two systems, not one

The number sense a child is born with is approximate, and its accuracy depends on

23 rather than on how many objects there are. Exact counting is different in kind. It is learned in a fixed **24** over several years, and the moment a child can be said to have learned it is not the **25** of the words but the

26 that follows it. Exact number is best described as a cultural technology rather than a deeper form of the inherited sense.

You should spend about 20 minutes on Questions 27–40, which are based on Reading Passage 3 below.

The uses of failure

A scientific result that finds nothing is not usually published. It is written up badly if at all, rejected if submitted, and filed. Robert Rosenthal gave this the name it still has in 1979, calling it the file-drawer problem, and pointed out its awkward consequence: if only the studies that found an effect appear in print, the printed record will show an effect whether or not one exists. The literature is not a sample of the research done. It is a sample of the research that worked, and nobody selected it deliberately.

The scale of the distortion took another quarter of a century to become visible. In 2005 John Ioannidis published a paper with the deliberately unhelpable title 'Why Most Published Research Findings Are False', arguing from the statistics of small studies, flexible analysis and publication bias that a substantial fraction of the published literature in several fields should be expected to be wrong. It was an argument from first principles rather than a survey, and it was widely misread as a survey. The title was a provocation and it worked, at the cost of being quoted for twenty years by people who had read no further than it.

The survey came in 2015. The Open Science Collaboration, a group of some two hundred and seventy researchers, repeated a hundred psychology experiments drawn from three leading journals, following the original methods and, where possible, consulting the original authors. Rather more than a third of the replications produced a statistically significant result in the same direction, and the average effect size was about half the original. The word crisis attached itself to the finding immediately and has not come off. The collaboration published its methods and its data alongside the result, which is why the disagreements that followed could be conducted about numbers rather than about impressions.

What was drawn from this, in a great many newspaper columns, was that science is broken. That conclusion is worth resisting, and not out of loyalty. Consider how the problem was found. It was not exposed by journalists or by philosophers or by the funders. It was exposed by scientists running replications, publishing the results, and arguing about the statistics in public — which is to say, by the machinery working. A field capable of measuring its own error rate is in a considerably better position than one that has never looked.

There is also a question the pessimistic reading never asks: compared with what? Every human institution that makes claims — courts, journalism, medicine, government — has an error rate, and almost none of them can tell you what it is. The interesting fact about the replication crisis is not that psychology has a false-positive problem. It is that psychology is the only one of those institutions that has bothered to find out.

None of which makes the problem small, and the diagnosis matters because it determines the remedy. The failure is not one of honesty. Very few of the studies that failed to replicate were fraudulent; almost all were produced by people following the ordinary practices of their field in good faith. The failure is

structural. A journal that publishes surprising results and a hiring committee that counts publications together create an incentive to keep analysing a dataset until something appears, and the people who respond to that incentive are behaving exactly as the system asks. A researcher who publishes a careful null result has, under the ordinary rules, produced nothing that counts for anything.

The most promising reform follows directly from that diagnosis. In a registered report, a study is peer-reviewed before the data are collected: the reviewers assess the question and the method, and if they approve it the journal commits to publishing the result whatever the result turns out to be. Chris Chambers was the main architect of the format, and around a hundred and fifty journals now offer it. The effect on what gets published is dramatic. Somewhere near sixty per cent of registered reports find no effect, against a single-figure percentage in the conventional literature — which tells you, more clearly than any argument, how much was being filed away. The format also removes the reason for the practice that caused the problem: there is nothing to be gained by analysing a dataset until it yields, if the paper is going to appear either way.

The lesson is not that we should trust science less. It is that a discipline is only as honest as its publication rules allow it to be, and that the fix for a bad incentive is a better one rather than an appeal to better people.

Questions 27–31

Do the following statements agree with the claims of the writer in Reading Passage 3?

Write **YES** if the statement agrees with the claims of the writer, **NO** if the statement contradicts the claims of the writer, or **NOT GIVEN** if it is impossible to say what the writer thinks about this.

- 27** Ioannidis's 2005 paper reported the results of a survey of published studies.
- 28** The writer believes the replication findings show that science is failing.
- 29** The writer thinks other professions would show worse error rates than psychology if they were measured.
- 30** The writer regards dishonesty as the main cause of the replication failures.
- 31** The writer considers registered reports the most encouraging of the proposed remedies.

Questions 32–35

Complete each sentence with the correct ending, A–G, below.

Endings

- A means the published record over-represents the studies that found something.
- B shows that a field can measure an error rate that other institutions never attempt.
- C proves that most published psychology is fraudulent.
- D reverses the usual order of peer review and data collection.
- E rewards researchers who keep analysing until a result appears.
- F was retracted after the 2015 replications.
- G depends on persuading researchers to behave better.

- 32 The file-drawer problem
- 33 The combination of journal preferences and hiring practices
- 34 The willingness of psychologists to run replications
- 35 The registered report format

Questions 36–40

Choose the correct letter, A, B, C or D.

- 36 In the 2015 replication project,
 - A a hundred experiments were repeated and rather more than a third replicated.
 - B two hundred and seventy experiments were repeated.
 - C a third of the original authors were consulted.
 - D the average effect size doubled.
- 37 Why does the writer describe how the replication problem was discovered?
 - A To show that journalists had understood it first.
 - B To argue that the discovery is itself evidence the system works.
 - C To explain why the funders withdrew support.
 - D To establish that psychology is worse affected than other fields.
- 38 According to the passage, what proportion of registered reports find no effect?
 - A A single-figure percentage.
 - B About a third.
 - C About sixty per cent.
 - D About half.

- 39** What does the writer say about the researchers whose studies failed to replicate?
- A Most had manipulated their data.
 - B Most were responding rationally to the incentives they faced.
 - C Most had refused to share their methods.
 - D Most worked outside psychology.
- 40** Which of the following best expresses the writer's conclusion?
- A Scientific claims should be treated with more suspicion than they are.
 - B Fraud in science is more common than is generally admitted.
 - C The remedy for a bad incentive is a better incentive, not better intentions.
 - D Replication studies should replace original research.