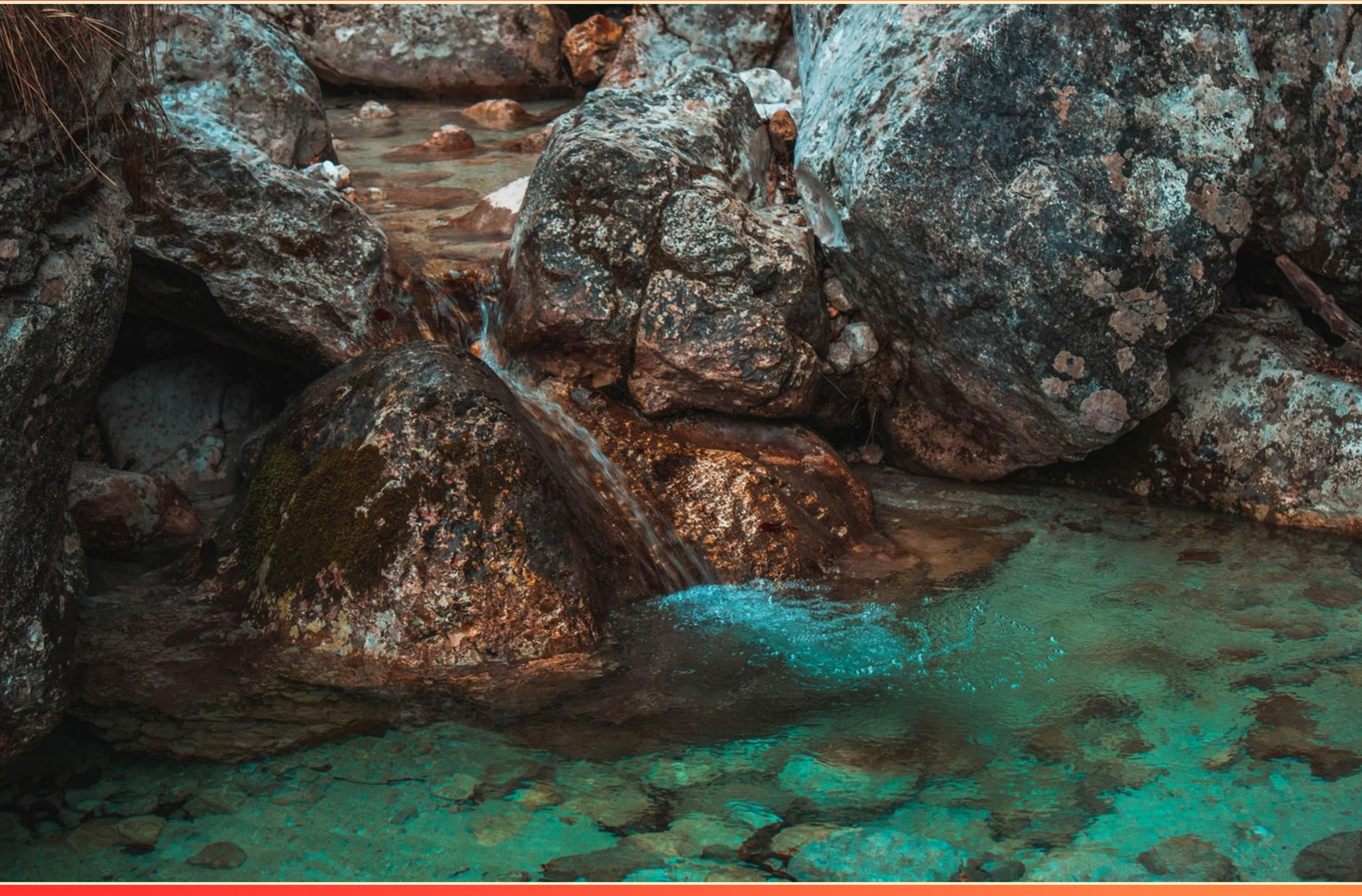
# STICKLEBACK PRACTICE TEST (SAMPLE)

## STUDY GUIDE



## SAMPLE STUDY GUIDE WITH LIMITED QUESTIONS

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https://stickleback.examzify.com

Notice: Examzify makes every reasonable effort to obtain accurate, complete, and timely information about this product from reliable sources.

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# Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:

- Practice answering questions under realistic conditions,
- Improve accuracy and speed,
- Review explanations to strengthen weak areas, and
- Approach the exam with greater confidence.

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

Remember: successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let's begin.

# How to Use This Guide

This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:

### 1. Start with a Diagnostic Review

Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.

### 2. Study in Short, Focused Sessions

Break your study time into manageable blocks (e.g. 30 – 45 minutes). Review a handful of questions, reflect on the explanations.

### 3. Learn from the Explanations

After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.

### 4. Track Your Progress

Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.

### 5. Simulate the Real Exam

Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.

### 6. Repeat and Review

Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.

There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!

# Questions

**1. Which laboratory techniques are commonly used to genotype the Eda locus in sticklebacks?**

A. PCR amplification of the Eda region followed by sequencing or SNP genotyping assays.

B. Whole-genome sequencing in all individuals.

C. Visual phenotyping of armor plates only.

D. Southern blotting of random genomic regions.

**2. What is one key rationale for using sticklebacks as a model for studying rapid adaptation?**

A. They show repeated, predictable evolutionary responses in multiple independent populations within short times, making them a powerful system for evolution in action.

B. They have a simple genome that makes all analyses trivial.

C. They do not respond to selection, making them a control species.

D. They are only found in lab settings.

**3. Why is the stickleback a model organism for studying evolution?**

A. They show repeated recent evolution in postglacial lakes

B. They show ancient fixed traits

C. They have no genetic variation

D. Their evolution cannot be traced in fossils

**4. What would be a basic experimental approach to test if Eda variation causally affects plate number?**

A. Compare plate numbers across natural populations that differ in Eda alleles.

B. Create individuals with swapped Eda alleles using genome editing and compare their plate numbers.

C. Knock out Eda and observe phenotypic consequences on plate number.

D. Cross species to transfer Eda.

**5. What is a 'ghost of selection' concept in evolutionary genetics?**

A. It refers to phenotypic traits that disappear.

B. Ghosts cause spurious signals in DNA sequences.

C. Past selection leaves detectable signatures in the genome, such as elevated allele frequencies or reduced diversity, even after selection ends.

D. It explains why selection cannot leave any genomic signature.

6. **Which is NOT a commonly cited mechanism contributing to stickleback adaptive radiation?**
   A. Natural selection on standing variation
   B. Major-effect loci such as EDA and Pitx1_Pel
   C. Ecological opportunity
   D. Random genetic drift as the sole driver

7. **What is the purpose of a morphometric analysis in sticklebacks, and what data are collected?**
   A. To map mutations in protein-coding genes.
   B. To measure metabolic rate.
   C. To quantify body shape and armor traits; data include plate counts, plate lengths, spine lengths, body proportions, and overall size from images or measurements.
   D. To assess diet composition in stomach contents.

8. **Which statement best describes the distribution of effect sizes among loci that control adaptive traits in sticklebacks?**
   A. All loci have equal effect sizes.
   B. Environmental factors determine all variation.
   C. A few large-effect QTL and many small-effect loci.
   D. A single gene controls all adaptive traits.

9. **How did ancestral sea-run sticklebacks come to live exclusively in freshwater?**
   A. They moved into freshwater due to river barriers
   B. They were born in freshwater and never returned
   C. They became trapped in lakes from the ice age
   D. They were introduced by humans

10. **Name two ecological factors that differentiate marine and freshwater stickleback habitats and influence morphology.**
   A. Predator communities and dietary resources.
   B. Altitude and soil moisture.
   C. Moon phase and tides.
   D. Pollination patterns.

# Answers

1. A
2. A
3. A
4. B
5. C
6. D
7. C
8. C
9. C
10. A

# Explanations

## 1. Which laboratory techniques are commonly used to genotype the Eda locus in sticklebacks?

A. PCR amplification of the Eda region followed by sequencing or SNP genotyping assays.

B. Whole-genome sequencing in all individuals.

C. Visual phenotyping of armor plates only.

D. Southern blotting of random genomic regions.

*Genotyping a single gene locus like Eda is most efficiently done with targeted DNA analysis: amplify the Eda region by PCR and determine the genotype from the amplicon either by sequencing to read the exact variant(s) or by using a SNP-genotyping assay that detects known Eda variants. This direct approach zeroes in on the exact genetic differences that influence armor plating in sticklebacks, making it fast, accurate, and scalable to many individuals. Whole-genome sequencing of every sample, while informative, is much more resource-intensive and unnecessary when you only need the genotype at this one locus. Visual assessment of armor plates cannot reveal the underlying DNA sequence, and Southern blotting of random genomic regions isn't a reliable or practical way to call genotypes at a specific locus.*

## 2. What is one key rationale for using sticklebacks as a model for studying rapid adaptation?

A. They show repeated, predictable evolutionary responses in multiple independent populations within short times, making them a powerful system for evolution in action.

B. They have a simple genome that makes all analyses trivial.

C. They do not respond to selection, making them a control species.

D. They are only found in lab settings.

*The main idea here is that sticklebacks are a powerful model for rapid adaptation because they show repeated, predictable evolutionary changes in many independent populations within a short time frame. This parallel evolution occurs when freshwater sticklebacks repeatedly evolve similar traits—like reduced armor plates and pelvic girdles—despite starting from related marine populations. The consistency of these changes across different populations reveals natural selection acting under similar ecological pressures, making it possible to study both the phenotypic shifts and their genetic underpinnings, often in just a few generations. In this system, researchers can link quick changes in visible traits to specific genetic changes, explore how different populations converge on the same solutions, and compare how similar environments drive similar outcomes. The fact that these evolutions happen repeatedly and quickly, across many independent populations, makes sticklebacks an especially informative model for understanding evolution in action. The other statements don't fit because the genome is not simply trivial to analyze, sticklebacks do respond to selection (they are classic examples of rapid adaptive change), and they are not restricted to laboratories—they are found in wild freshwater and marine environments worldwide.*

### 3. Why is the stickleback a model organism for studying evolution?

A. They show repeated recent evolution in postglacial lakes

B. They show ancient fixed traits

C. They have no genetic variation

D. Their evolution cannot be traced in fossils

*This question is about showing evolution in action through repeated natural experiments. Sticklebacks are powerful model organisms because they undergo rapid, repeated evolutionary changes after shifting from marine to freshwater environments in postglacial lakes. In many independent lake populations, they converge on similar traits—like reduced armor plating and changes in pelvic structures—despite being geographically separate. This parallel evolution provides a clean, natural setup to compare how selection acts and how genetic variation is used to produce adaptive traits, all within short timescales that we can study directly. The repeated, predictable patterns across many populations make them ideal for uncovering how evolution proceeds in response to ecological change.  Regarding the other statements: sticklebacks do have genetic variation and do not rely on ancient fixed traits; their ongoing adaptation is well documented. Fossil records exist for the lineage, but the strongest evidence for their use as a model comes from contemporary populations and genetic data showing repeated, parallel evolution.*

### 4. What would be a basic experimental approach to test if Eda variation causally affects plate number?

A. Compare plate numbers across natural populations that differ in Eda alleles.

B. Create individuals with swapped Eda alleles using genome editing and compare their plate numbers.

C. Knock out Eda and observe phenotypic consequences on plate number.

D. Cross species to transfer Eda.

*This question is about proving causality by directly manipulating the genetic variant and watching the effect on the trait. The strongest way to test if a variation in Eda causes changes in plate number is to swap the Eda allele between individuals using genome editing and then compare plate numbers in a shared genetic background. By editing only the Eda allele and keeping all other genes and the environment the same, any difference in plate number can be attributed to the specific Eda variant. If the swapped allele leads to a different plate count, that provides direct evidence that Eda variation drives the trait.  Observing natural populations or comparing knockouts alone introduces confounds. A cross between species or transferring Eda across backgrounds brings many uncontrolled genetic differences and environmental factors, muddying the link between Eda variant and plate number. A knockout shows whether Eda is necessary for the trait, but it doesn't test how natural allelic differences influence plate number in a controlled background.*

### 5. What is a 'ghost of selection' concept in evolutionary genetics?

A. It refers to phenotypic traits that disappear.

B. Ghosts cause spurious signals in DNA sequences.

C. Past selection leaves detectable signatures in the genome, such as elevated allele frequencies or reduced diversity, even after selection ends.

D. It explains why selection cannot leave any genomic signature.

*The main idea is that historical selection can leave lasting traces in the genome that stick around even after the selective pressure has ended. When a beneficial allele sweeps through a population, nearby variants can hitchhike with it, creating a sweep that reduces genetic diversity and creates extended regions of linkage. After selection ends, recombination gradually erodes these patterns, but remnants—like unusually high frequencies of certain alleles and lower diversity in the surrounding region—can persist as a "ghost" of the past selection. Those genomic signatures let us infer that adaptation occurred in the past, even though the current conditions no longer favor that allele. So the best description is that past selection leaves detectable signatures in the genome, such as elevated allele frequencies or reduced diversity, even after selection ends. The other options don't capture this idea: phenotypic changes disappearing isn't about lingering genomic traces, the notion that ghosts cause spurious signals misstates the concept, and it's false to say selection leaves no genomic signature at all.*

### 6. Which is NOT a commonly cited mechanism contributing to stickleback adaptive radiation?

A. Natural selection on standing variation

B. Major-effect loci such as EDA and Pitx1_Pel

C. Ecological opportunity

D. Random genetic drift as the sole driver

*The main idea is how stickleback adaptive radiations arise through selective and genetic influences in new environments. The strongest drivers are natural selection acting on existing genetic variation and the action of major-effect loci, within the context of ecological opportunity provided by new habitats. Random genetic drift as the sole driver is not a commonly cited mechanism because drift alone is unlikely to produce the repeated, directionally adaptive changes seen across many populations. Drift can shift allele frequencies, but the parallel shifts toward reduced armor or altered pelvic fins point to selection acting on standing variation and on large-effect genes like EDA (armor plating) and Pitx1_Pel (pelvic spine). Ecological opportunity explains why diversification happens in the first place—new lakes or habitats create niches that selection can exploit. So, drift isn't considered a primary mechanism driving the adaptive radiation; the other factors together better account for the patterns observed in sticklebacks.*

7. **What is the purpose of a morphometric analysis in sticklebacks, and what data are collected?**

A. To map mutations in protein-coding genes.

B. To measure metabolic rate.

C. To quantify body shape and armor traits; data include plate counts, plate lengths, spine lengths, body proportions, and overall size from images or measurements.

D. To assess diet composition in stomach contents.

*Morphometric analysis in sticklebacks focuses on quantifying how the fish's form varies, especially in body shape and armor features, so we can compare populations and understand how morphology relates to environment and evolution. This approach collects precise measurements that describe size, shape, and the extent of armor. The data include counts and measurements of armor plates, lengths of plates, and lengths of spines, along with measurements that describe body proportions and overall size. Commonly, researchers measure standard length or total length, body depth, head measurements, and fin positions, often using calibrated images or direct measurements. Sometimes they use landmark-based methods to capture body shape more holistically. By compiling these data, scientists can analyze patterns of morphological variation, study how shape correlates with ecological factors (like habitat differences or predation), and explore allometric relationships between size and form.*

8. **Which statement best describes the distribution of effect sizes among loci that control adaptive traits in sticklebacks?**

A. All loci have equal effect sizes.

B. Environmental factors determine all variation.

C. A few large-effect QTL and many small-effect loci.

D. A single gene controls all adaptive traits.

*Adaptive traits in sticklebacks are shaped by a mix of genetic effects across many loci: a few major-effect loci drive large, quick changes, while a larger number of loci contribute smaller effects that fine-tune the phenotype. This combination creates a distribution where big shifts can arise from a handful of QTL, and the rest of the genome lines up subtle adjustments to fit the environment. That's why the best description is that there are a few large-effect QTL and many small-effect loci. The other ideas don't fit this real pattern: not all loci contribute equally, environment isn't the sole driver of these genetic effects, and a single gene cannot account for the diversity of adaptive traits observed.*

## 9. How did ancestral sea-run sticklebacks come to live exclusively in freshwater?

A. They moved into freshwater due to river barriers

B. They were born in freshwater and never returned

C. They became trapped in lakes from the ice age

D. They were introduced by humans

*The key idea is how geographic isolation from glacial events can push a population from the sea into freshwater and keep it there. During the last ice age, advancing glaciers carved out and connected or blocked waterways, creating new freshwater lakes and separating fish from their marine populations. Sea-run sticklebacks that found themselves in these isolated freshwater habitats faced very different conditions. With limited or no opportunity to return to the ocean, natural selection favored traits suited to freshwater life, and gene flow back to the marine populations diminished. Over time, these freshwater populations persisted and spread, resulting in lineages that live exclusively in freshwater.  Other scenarios don't fit the big-picture pattern as well. River barriers alone don't account for the long-term isolation and broad freshwater colonization seen after glaciation, being born in freshwater and never returning isn't the usual explanation for how sea-run ancestors ended up there, and human introduction doesn't explain the widespread, ancient freshwater lineages formed by natural processes.*

## 10. Name two ecological factors that differentiate marine and freshwater stickleback habitats and influence morphology.

A. Predator communities and dietary resources.

B. Altitude and soil moisture.

C. Moon phase and tides.

D. Pollination patterns.

*Ecological factors that distinguish marine from freshwater environments drive the kinds of selective pressures that shape stickleback morphology. Predator communities differ between these habitats, so the need for protection varies. In marine settings with a broader and sometimes stronger set of predators, sticklebacks tend to retain more armor and longer spines as defense, and their body shape can reflect adaptations to avoid predation. In many freshwater systems, predator pressure is different—often with fewer large piscivores—leading to reduced armor and shorter spines over generations, a pattern seen in lake populations.  Dietary resources also differ between these habitats, influencing feeding-related traits. The types and abundance of prey in marine versus freshwater environments select for different mouth structures and gill raker configurations, shaping how efficiently fish can capture and process their food. Increased or altered demands for processing certain prey types in one habitat versus the other help drive changes in jaw morphology, gill raker length and spacing, and related features.  Other options don't directly capture the main ecological differences that link habitat type to stickleback morphology. Altitude and soil moisture are terrestrial factors; moon phase and tides are not the primary drivers of the enduring morphological divergence seen between these aquatic habitats; pollination patterns are irrelevant to fish morphology.*

# Next Steps

Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.

As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.

If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at hello@examzify.com.

Or visit your dedicated course page for more study tools and resources:

https://stickleback.examzify.com

We wish you the very best on your exam journey. You've got this!