**INSTRUCTOR EDITION — NOT FOR STUDENT DISTRIBUTION**

CARIBBEAN REEF FISH FOUNDATION

# Teacher Answer Key

Lionfish Education Collection — Instructor Edition

**INSTRUCTOR NOTE**

This key provides complete answers, discussion guidance, and extension suggestions for every activity in the Student Activity Pack. Answers marked with * indicate open-ended responses — evaluate based on the criteria provided, not exact wording.

## ACTIVITY 01 — Food Web Builder

**Correct food web connections:**

Algae → Sea Urchin, Parrotfish, Damselfish; Coral → Sea Urchin; Shrimp → Damselfish, Juvenile Grouper; Parrotfish → Larger Grouper; Juvenile Grouper → Larger Grouper → Shark; Lionfish → Damselfish, Parrotfish, Juvenile Grouper, Shrimp.

**Q1 — Species lionfish eats:**

Accept: Damselfish, Parrotfish, Juvenile Grouper, Shrimp. Award full credit for any 3 or more.

**Q2 — What happens to coral if parrotfish disappear:**

Parrotfish are primary grazers that remove algae from coral surfaces. Without them, algae grows unchecked, outcompetes coral for light and space, and coral growth slows or stops. *Award credit for any answer that identifies the parrotfish-algae-coral connection.

**Q3 — Invasive species:**

Lionfish. Different because: not native to the Caribbean, no natural predators here, native prey have no instinct to avoid it. *Look for "no natural predator" or "not native" in student responses.

## ACTIVITY 02 — Anatomy Labeling

**Correct labels:**

1 = Dorsal spines (13) · 2 = Pectoral fins · 3 = Anal spines (3) · 4 = Pelvic spines (2) · 5 = Eye · 6 = Jaw/mouth · 7 = Tail fin · 8 = Color banding

**Q1 — Total venomous spines:**

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18 (13 dorsal + 3 anal + 2 pelvic)

**Q2 — Fin used to herd prey:**

Pectoral fins

**Q3 — Lionfish sting fatal:**

FALSE. Painful and requiring medical attention, but rarely fatal to healthy adults. Venom is a protein-based toxin injected through grooved spines. Hot water immersion (as hot as tolerable, ~110°F) helps denature the protein. Seek medical attention.

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## ACTIVITY 03 — Timeline

**Correct years:**

1985 → First Florida sighting · 1992 → Hurricane Andrew · 2000 → North Carolina & Bermuda · 2004 → First Caribbean (Bahamas) · 2008 → USVI expansion · 2026 → CRFF founded

**Timeline discussion:**

From ~1985 to 2004 = approximately 19 years. Key teaching point: a marine invasion spreads via larval drift on ocean currents — not active swimming. By the time it is confirmed in a new region, it is already too late for eradication. Management (not elimination) is the only realistic goal.

## ACTIVITY 04 — Population Math

**Part A — Lionfish Year 1:**

2,000,000 eggs × 1% = 20,000 new adults. Total population = 20,002 (include original pair).

**Part B — Lionfish Year 2:**

20,000 females × 2,000,000 eggs × 1% = 400,000,000 new adults. Total ≈ 400,020,002. (Note for advanced students: real populations self-limit through density dependence and food scarcity before reaching these numbers, but the exponential principle is accurate.)

**Part C — Nassau Grouper Year 1:**

100,000 eggs × 0.1% = 100 new grouper. Lionfish/grouper ratio: 20,000 ÷ 100 = 200×. Lionfish produce 200 times more surviving offspring per female per year.

**Part D — Graph:**

Accept any graph correctly representing Year 1 (~20,000 lionfish vs ~100 grouper), Year 2 (~400M vs ~10,000 grouper). Key feature: exponential curve for lionfish vs near-flat for grouper. Grade on accuracy of relative proportions, not exact values.

**Part E — Discussion:**

*Open-ended. Key concepts to reward: (1) Removal must be continuous because mesophotic populations constantly resupply shallow reefs. (2) One year of no removal allows exponential recolonization. (3) The math makes the case for citizen science and diver networks — no single agency can maintain coverage at the needed scale.

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## ACTIVITY 05 — Field Observation

**Grading approach:**

No fixed answer key. Evaluate based on completeness, accuracy of species identification, and quality of observational notes.

| Criterion | Full Credit (3) | Partial Credit (1–2) | No Credit (0) |
|---|---|---|---|
| Site data | All 6 fields complete | 4–5 fields complete | 3 or fewer fields |
| Species counts | 5+ species recorded with estimates | 3–4 species | Fewer than 3 |
| Lionfish noted | Presence/absence clearly marked | Noted but unclear | Not addressed |
| Reef health notes | 3+ specific observations | 1–2 vague observations | Left blank |
| Data submitted | Confirmed submitted to reef.vi | Attempted | Not submitted |

## Extension Activity Suggestions

**Grades 4–6:** Have students draw a "before and after" reef showing what the reef looked like before lionfish vs. now. Pair with research on what fish were historically abundant in USVI waters.

**Grades 7–9:** Assign each student one of CRFF's 27 target native species. Each student presents: the species' ecological role, why it has declined, and what its recovery would mean for the reef food web.

**Grades 10–12:** Design a removal program for a hypothetical reef patch. Students specify: diver-hours per month, removal rate needed to prevent net population growth, and a monitoring protocol. Present as a proposal.

**Cross-Disciplinary:** Partner with math teacher for population modeling. Partner with art teacher for reef ecosystem mural. Partner with media teacher for citizen science documentation video using the Field Observation Sheet as a script.