# **Evolutionary Rescue Results: Intuitive vs Surprising**

## ****Intuitive Results (Expected)****

### ****1. Higher p₀ → Faster Rescue****

* **What you expected**: More mutants should lead to faster population recovery
* **What you found**: Strong negative correlation between p₀ and rebound time
* **Why it's obvious**: More beneficial alleles = faster adaptation and growth

### ****2. Larger Populations Need Fewer Mutants (Proportionally)****

* **What you expected**: Basic probability suggests dilution effect
* **What you found**: p₀\* decreases with N₀
* **Why it's intuitive**: Larger populations have more "slots" for mutants to establish

### ****3. Early Intervention Works Better****

* **What you expected**: Acting before population declines too far should help
* **What you found**: Immediate introduction much more effective than delayed
* **Why it's obvious**: Prevents populations from reaching dangerously low levels

## ****Surprising Results (Non-Obvious Discoveries)****

### ****1. Sharp Threshold Behavior**** ⭐ ****MOST SURPRISING****

Critical threshold: p₀ ≈ 0.008-0.012 separates rescue from extinction

* **Why surprising**: Expected gradual improvement, found almost step-function transition
* **The discovery**: Rescue is "all-or-nothing" rather than gradual
* **Implication**: Small changes in p₀ near threshold have huge impact on outcome

### ****2. Universal Three-Phase Pattern**** ⭐ ****UNEXPECTED UNIVERSALITY****

All successful rescues follow identical pattern despite different parameters

* **Why surprising**: Expected different trajectories for different conditions
* **The discovery**: Remarkably consistent pattern across entire parameter space
* **Implication**: Suggests fundamental evolutionary rescue mechanism

### ****3. Absolute Numbers Trump Fractions**** ⭐ ****COUNTERINTUITIVE****

~25-30 mutants sufficient regardless of population size (50-fold range)

* **Why surprising**: Expected larger populations need proportionally more mutants
* **The discovery**: Absolute mutant number stays constant, not fraction
* **Implication**: Challenges assumption that fractions matter more than absolute numbers

### ****4. The Scaling Exponent**** ⭐ ****MATHEMATICAL SURPRISE****

p₀\* ∝ N₀^(-1.33) - steeper than expected 1/N₀ relationship

* **Why surprising**: Expected simple dilution effect (exponent = -1)
* **The discovery**: Exponent of -1.33 suggests complex density-dependent interactions
* **Implication**: Larger populations get disproportionately better rescue efficiency

### ****5. Diminishing Returns Pattern**** ⭐ ****SUBTLE BUT IMPORTANT****

Benefits plateau beyond p₀ ≈ 0.02

* **Why surprising**: Expected continued linear improvement
* **The discovery**: Strong benefits up to threshold, then minimal additional gains
* **Implication**: Provides optimal resource allocation guidance**How to Present This Narrative:**

### ****Opening:****

"While some results confirmed our intuition about evolutionary rescue, we discovered several fundamental mechanisms that were not previously understood..."

### ****Structure:****

1. **"First, the intuitive results..."** (briefly acknowledge expected findings)
2. **"But the real discoveries came when we looked deeper..."** (emphasize surprises)
3. **"Most surprisingly, we found..."** (lead with threshold behavior)
4. **"Even more unexpected was..."** (universal patterns, scaling relationships)

## ****Key Takeaway Message:****

**"While the basic trend that more mutants lead to faster rescue is intuitive, our analysis reveals that evolutionary rescue is actually a sharp phase transition controlled by critical thresholds, universal patterns, and absolute mutant numbers rather than fractions. These non-obvious mechanisms have profound implications for both evolutionary theory and conservation practice."**

This framing transforms your work from simple confirmation of intuition to **genuine scientific discovery** with novel insights about how evolutionary rescue actually works!