

# Using the Cushing hypothesis to predict and forecast consumer fitness with climate change

## Test Cushing hypothesis

### Step 1: Test assumptions

**1<sup>st</sup> assumption:** Consumer fitness most determined by resource  
(e.g., not related to density or upper trophic level)

**2<sup>nd</sup> assumption:** Consumer and resource show seasonality (activity vs. dormancy periods)

Both assumptions met?

No

Cushing hypothesis not met

1<sup>st</sup> assumption uncertain?

Yes

### Step 2: Test ultimate mechanisms

Life history strategy examples:  
1. Fitness trade-offs between fecundity & mortality  
2. Breeding strategies

Food web dynamics:  
Bottom up

### Test alternate hypotheses

Examples: 1. Density-dependence 2. Top-down control 3. Size-mediated priority effects 4. Bet-hedging

## Test pre-climate change conditions and cues

### Step 3: Identify pre-climate change baseline

Synchrony  
Asynchrony

Depending on mechanism

### Step 4: Identify proximate cues of consumer and resource

#### Test proximate cues

Consumer and resource share similar environmental cues

Consumer and resource differ in some cues

### Ultimate aim

Accurately forecast match/mismatch with climate change

### Example: Bird limited by nest site availability

**Step 1:** Consumer fitness controlled strongly by density. Thus, assumption 1 violated.

No

Cushing hypothesis does not apply

### Example: Income breeder

**Step 1:** Both assumptions met.

Yes

**Step 2:** Consumer provisions offspring with resources acquired during breeding season

**Step 3:** Pre-climate change baseline was match.

**Step 4:** Consumer and resource have slightly different environmental cues (e.g., to temperature).

Potential for mismatch-related fitness declines