

**Lower Columbia River Ecosystem
Conceptual Model
for the Juvenile Salmonids**

**Richard Mishaga
Port of Portland**

**SEI Science Panel Presentation
August 28, 2001**

TODAY'S PRESENTATION

- REPORT ON OUR PROGRESS
- REVIEW OUR APPROACH
- OVERVIEW OF THE PATHWAYS
- APPLICATION OF THE MODEL

CONCEPTUAL MODEL UPDATE

- **CHARGE from the SEI PANEL:**
 - Develop a Common Understanding of Ecological Relationships
- **METHOD:**
 - The Initial Conceptual Model
- **REFINEMENTS:**
 - Clarify & Simply Relationships
 - Link Pathways

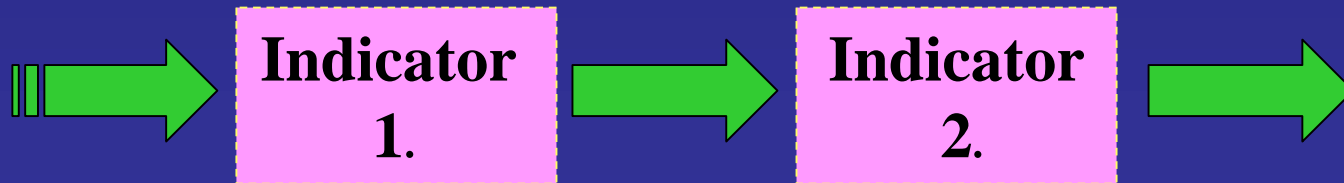
CONCEPTUAL MODEL - SYSTEMS APPROACH

DIAGRAMS:

RELATIONSHIPS AMONG
COMPONENTS AND PROCESSES
WITHIN A SYSTEM

Boxes = Components = Indicators of Function

Arrows = Links or Relationships



CONCEPTUAL MODEL APPROACH - WHY?

FORMULATION

Clarifies Systems Thinking

COMMUNICATION

Shared Vision

Stakeholder Participation

ANALYSIS

Effects

Uncertainties

CONCEPTUAL MODEL OVERVIEW

- **General Form**

Contextual vs. Analytical Approach

- **Ecosystems Approach**

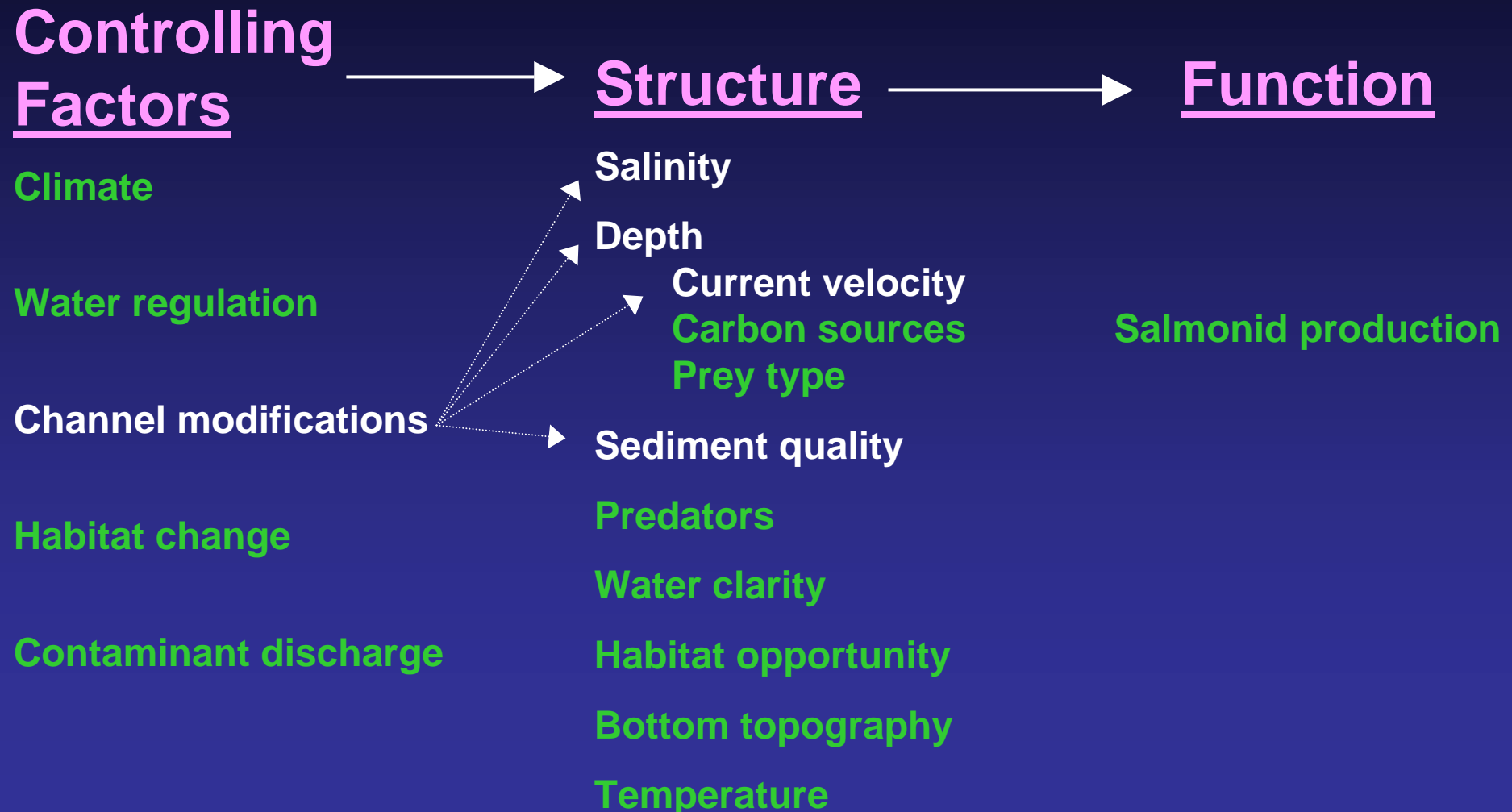
Contextual Relationships

Controlling Factors 

Ecosystem “Structure” 

Ecosystem Function

Factors Controlling Juvenile Salmonid Production

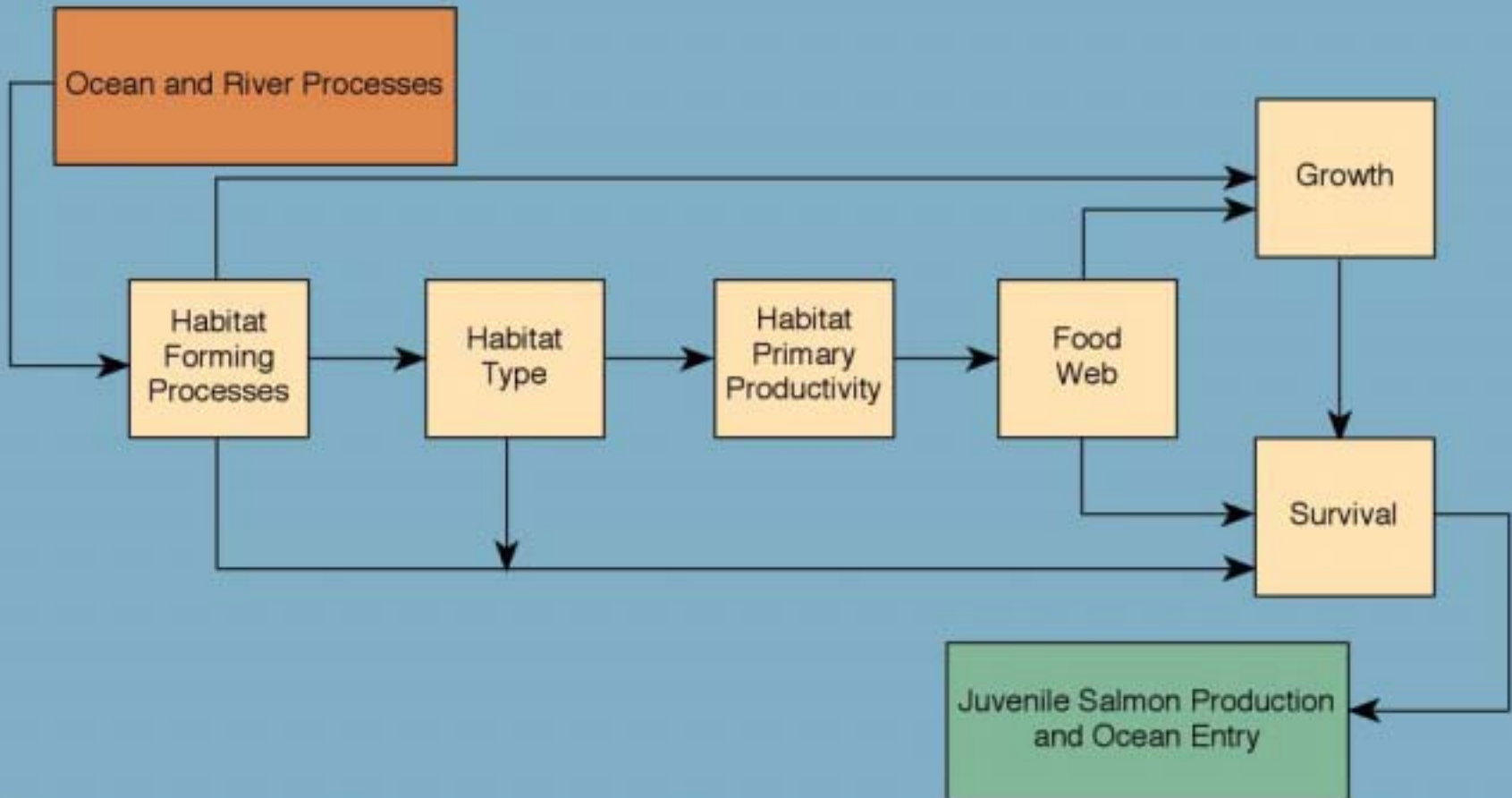


INTEGRATED PATHWAYS: Major Ecosystem Components & Links

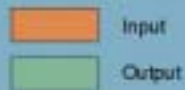
- **Output =**
Juvenile Salmon Production &
Ocean Entry
Depends on
 - Presence of Viable Habitats
 - Production of Food
 - Access & Use of Habitats
 - Rearing & Migration Through Habitats



Integrated Pathways for Juvenile Salmonids



August 27, 2001

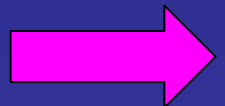


HABITAT FORMING PROCESSES

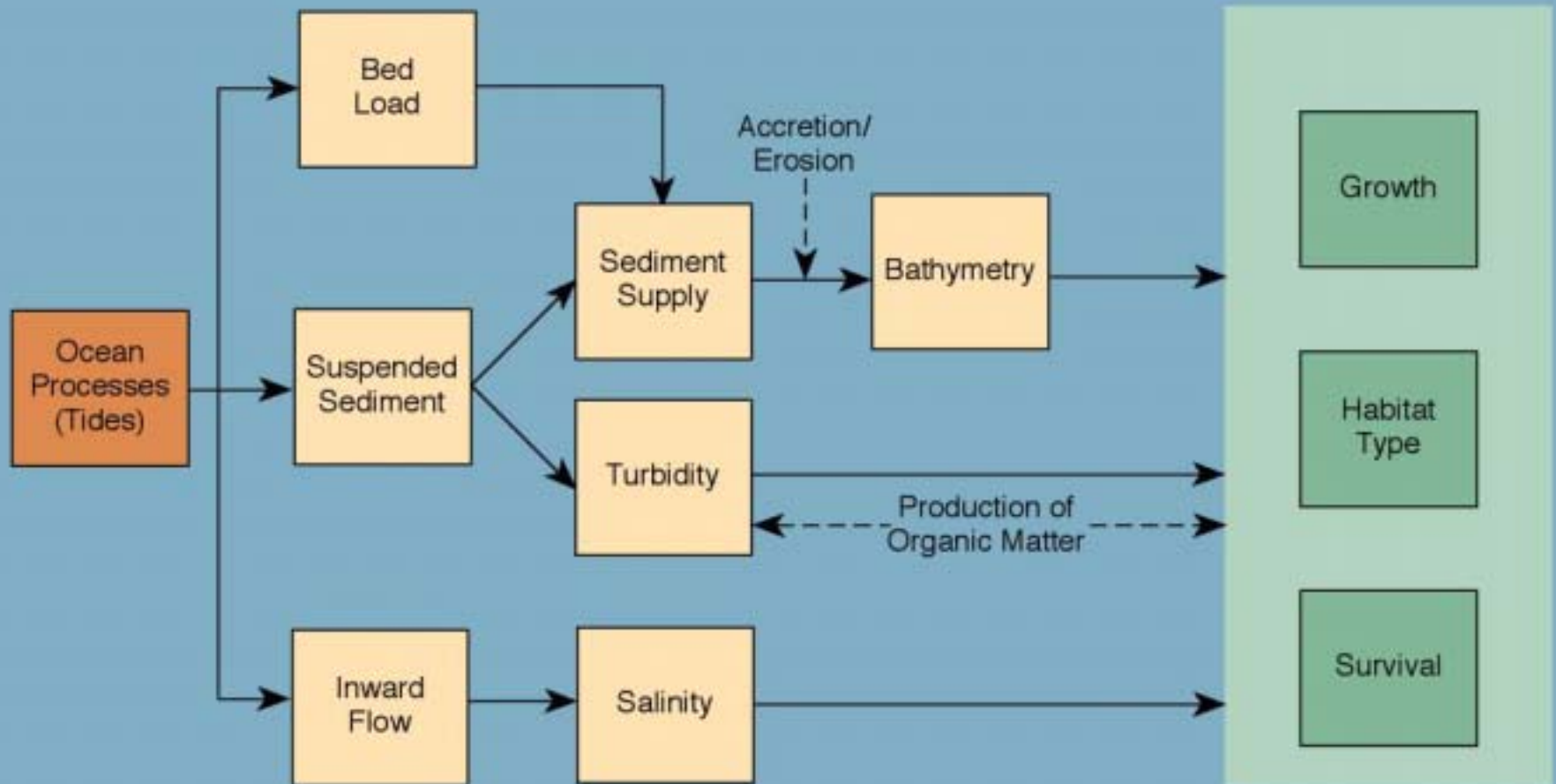
- Integration of Physical Process =
Form & Maintain “Habitat”

Primarily Hydrological Processes

- Ocean Tides & and Waves
- River Flow Rates & Volumes
- Interact & Modify Physical Conditions
 - Salinity, Turbidity, Sediment Supply



Habitat Forming Process Pathway – Ocean



August 27, 2001.

Input

Output

Process Input

Indicator Linkage

Notes: Sediment re-suspension can increase potential for contaminant transport if sediments were contaminated.

Disturbance Regime: 1) Extreme hydrological events, 2) Vertical land movement, 3) Storms

HABITAT TYPE PATHWAY

- **Habitat Types**

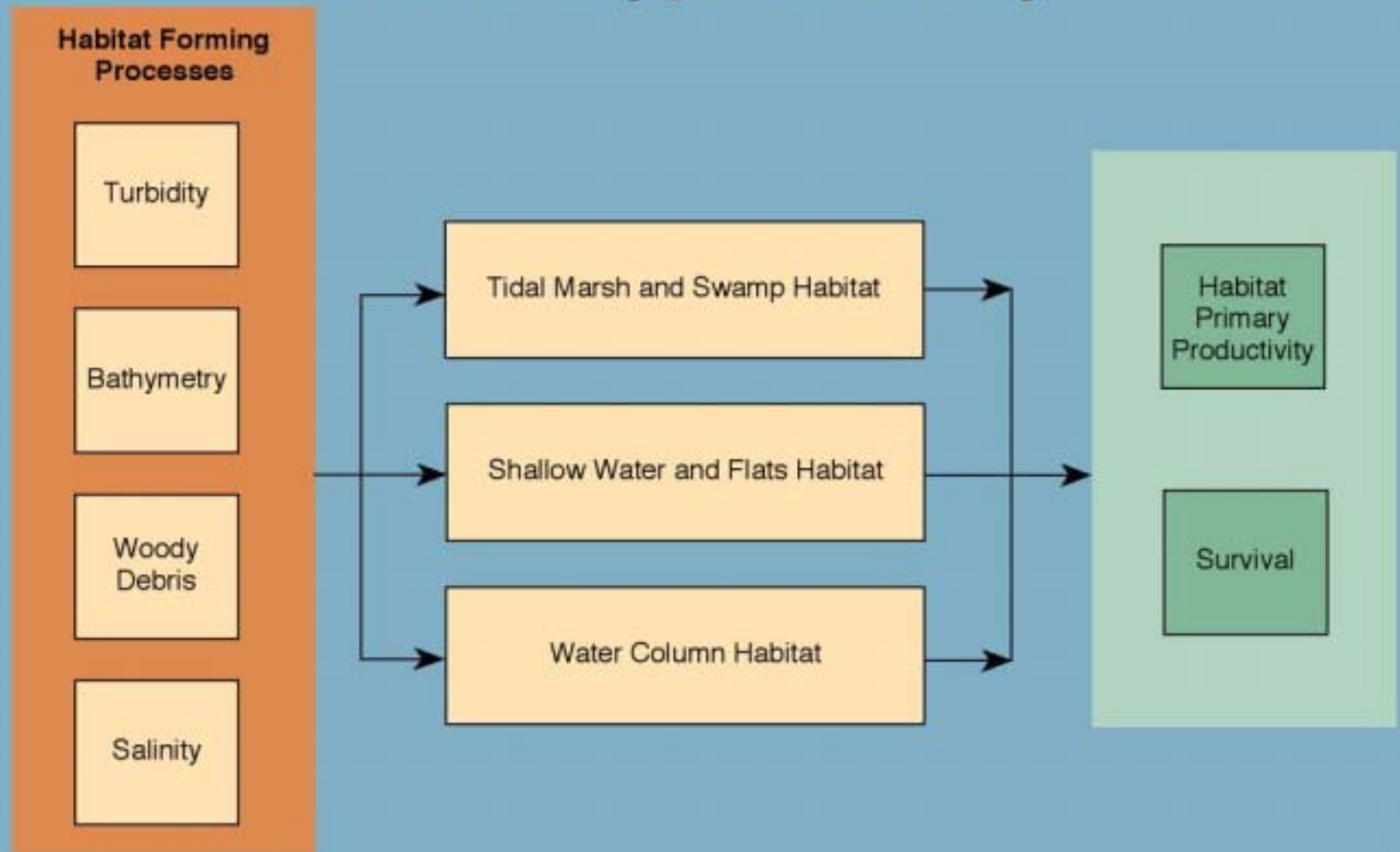
- Active Physical Processes
- Parameters for The Type of Vegetative Growth
 - Salinity, Depth, Light Penetration

- **Juvenile Salmonid Habitats**

- Tidal Marshes
- Shallow Waters & Flats
- Water Column



Habitat Type Pathway



August 27, 2001



HABITAT PRIMARY PRODUCTIVITY:

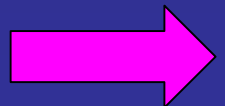
Food Production Driven by Plant Growth

- Major Habitat Function =
Food Production for Ecosystem

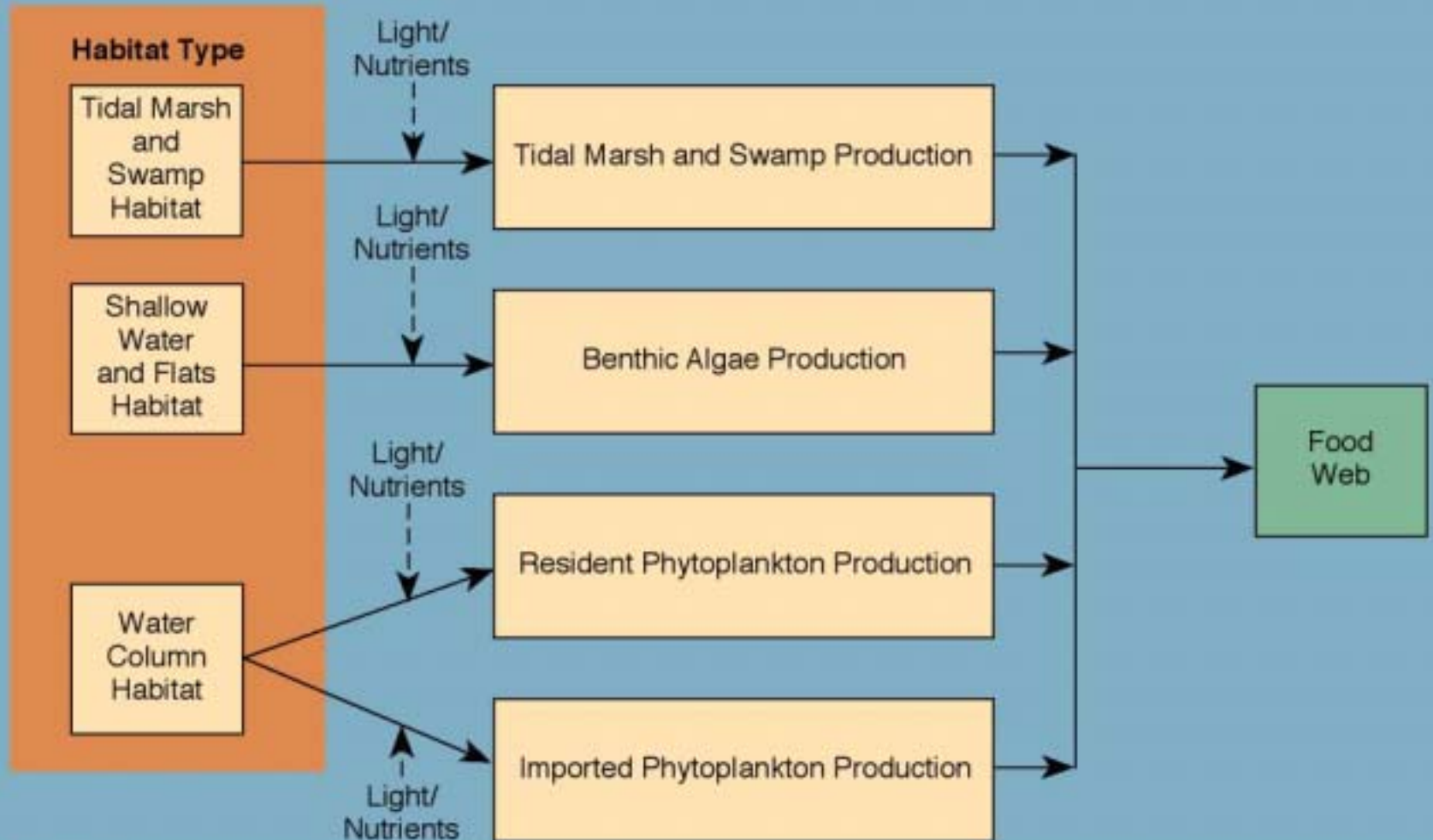
Tidal Marsh → Wetland Hydrophytes

Shallows & Flats → Benthic Algae

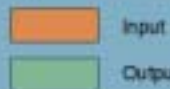
Water Column → Phytoplankton



Habitat Primary Productivity Pathway

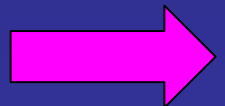


August 27, 2001

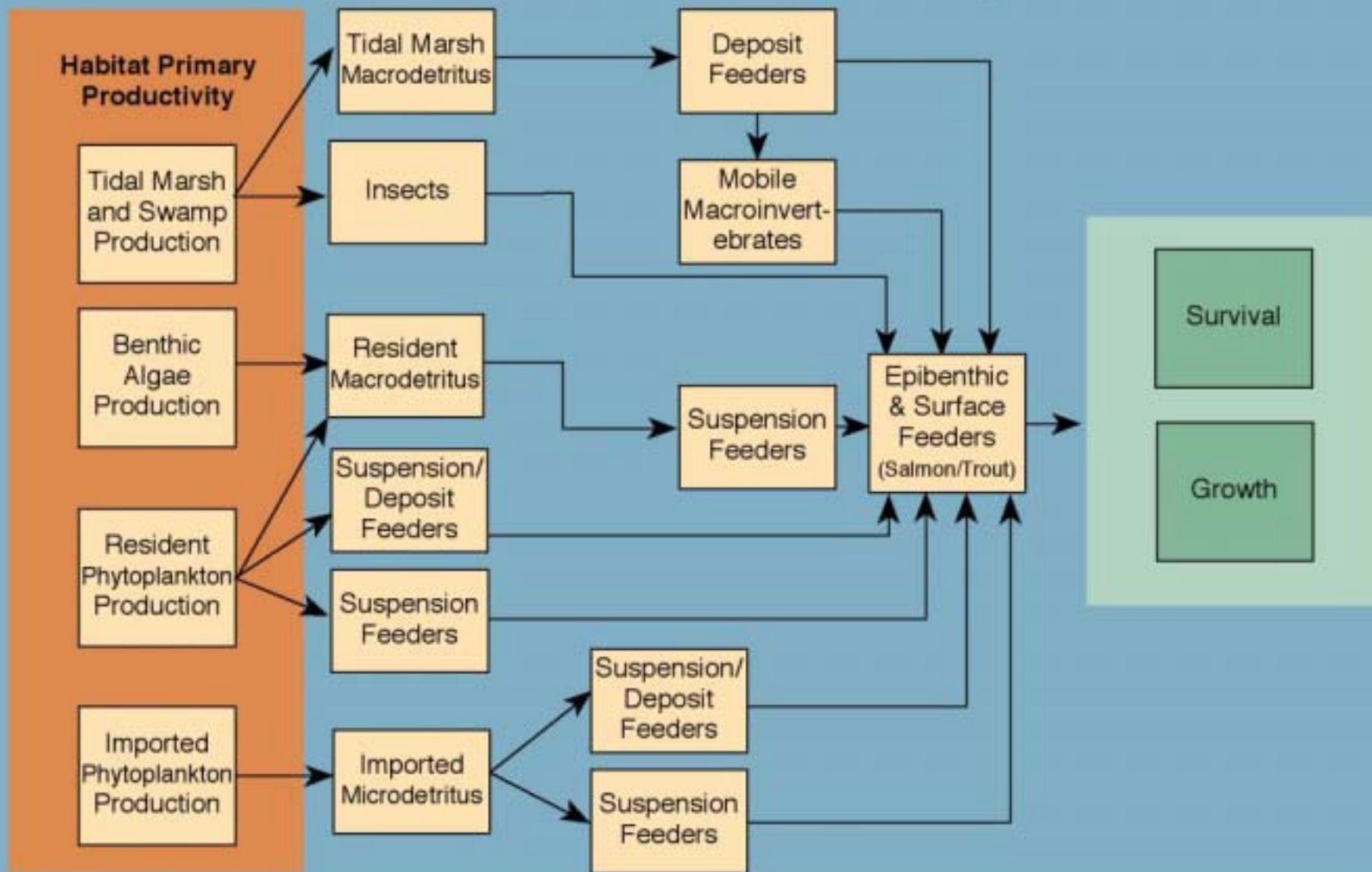


SALMON FOOD WEB

- **Ways that salmon obtain food**
- **Invertebrate prey species**
 - Supported by
 - Resident marsh plants
 - Plankton & Detritus -- Resident
-- Imported
- **Food depends on**
 - Resident Habitat Types
 - Location of Prey Species



Food Web Pathway



August 27, 2001

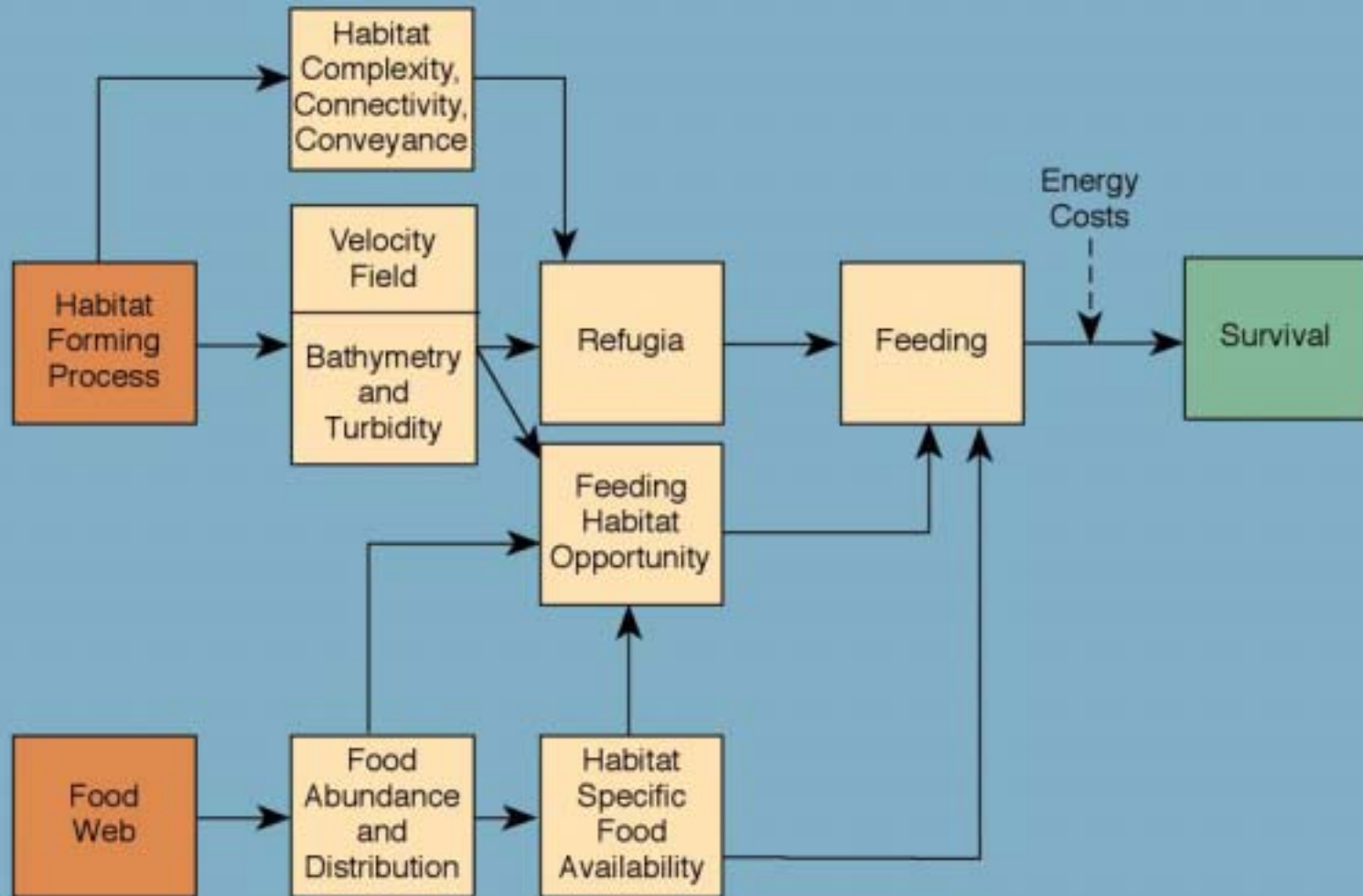


GROWTH PATHWAY

- **Highlights:**
 - Productive Feeding Areas
 - Habitat Mosaic with Structural Complexity
 - Access by Fish to Feeding Areas
 - Location in the Ecoscape
- **Habitat-Specific Food Production + Feeding Opportunity w/i Habitats**



Growth Pathway



August 27, 2001

Orange box: Input
Green box: Output

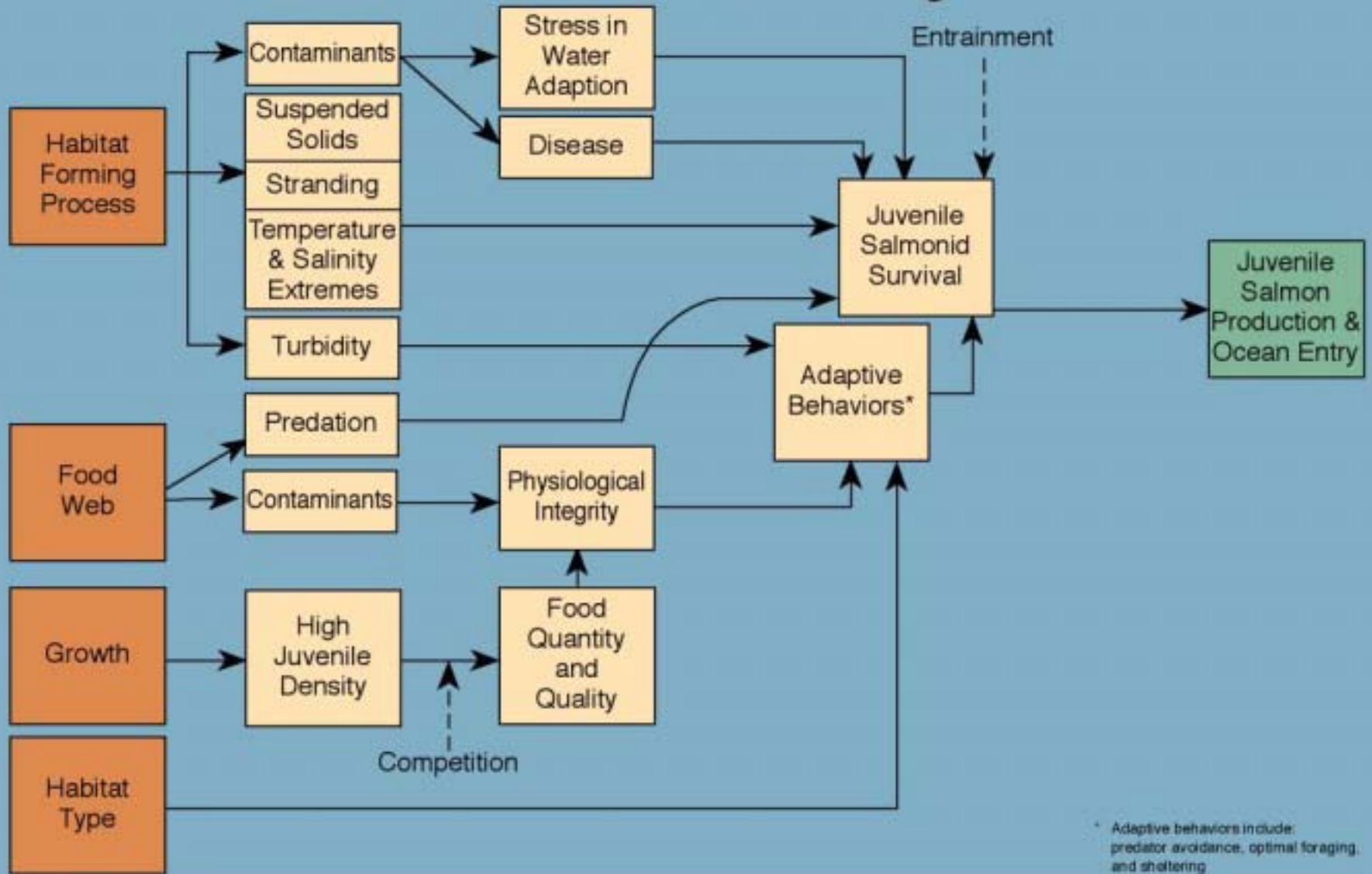
Dashed arrow: Process Input
Solid arrow: Indicator Linkage

SURVIVAL PATHWAY

- Factors that affect
 - Growth & Rearing
 - Out Migration
- Types
 - Physical
 - Biological
 - Anthropogenic



Survival Pathway

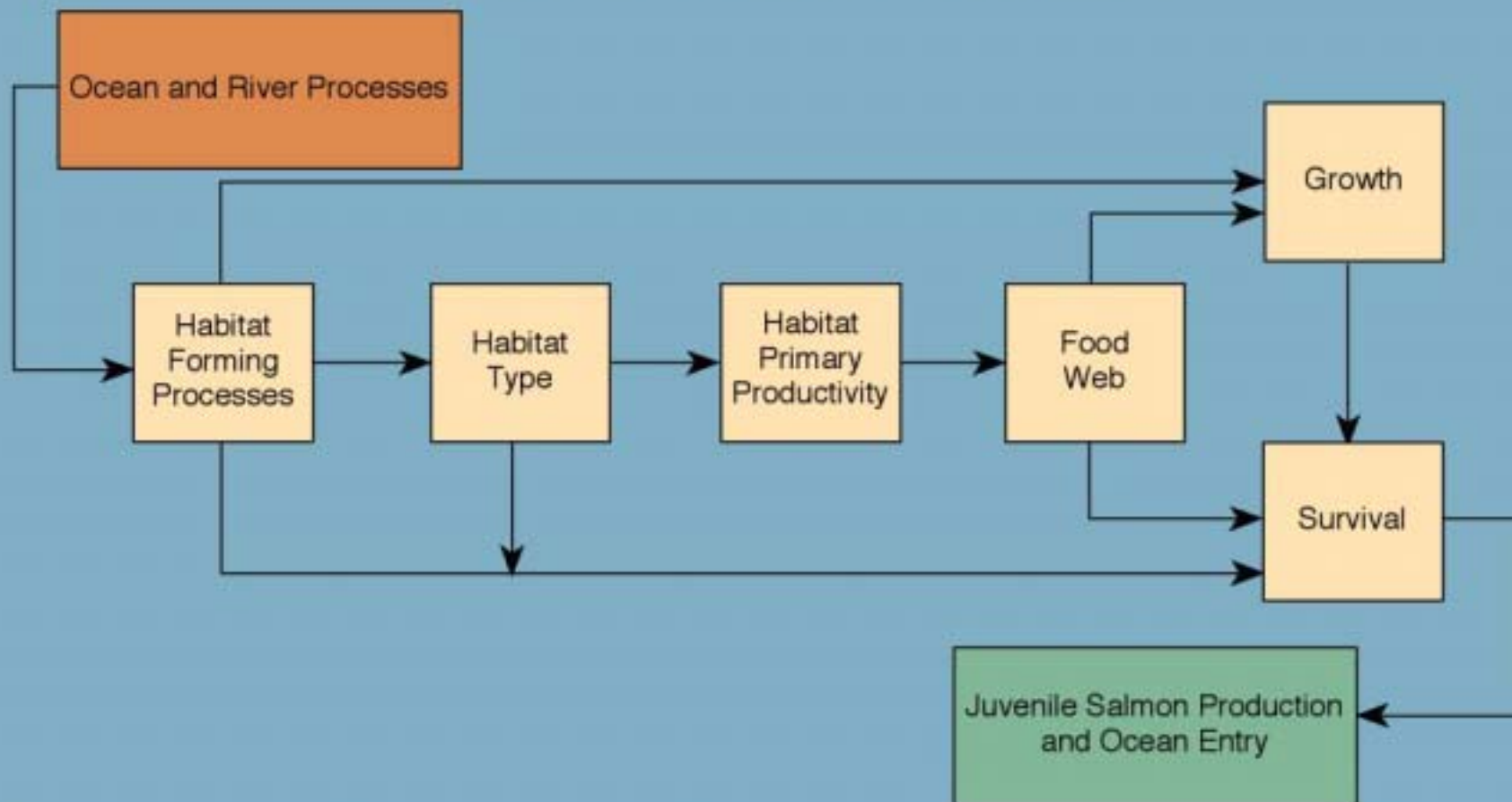


August 27, 2001

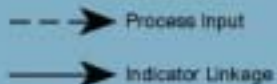
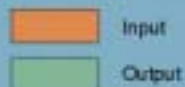
Orange box: Input
Green box: Output

Dashed arrow: Process Input
Solid arrow: Indicator Linkage

Integrated Pathways for Juvenile Salmonids



August 27, 2001



MODEL APPROACH

Controlling Factors →

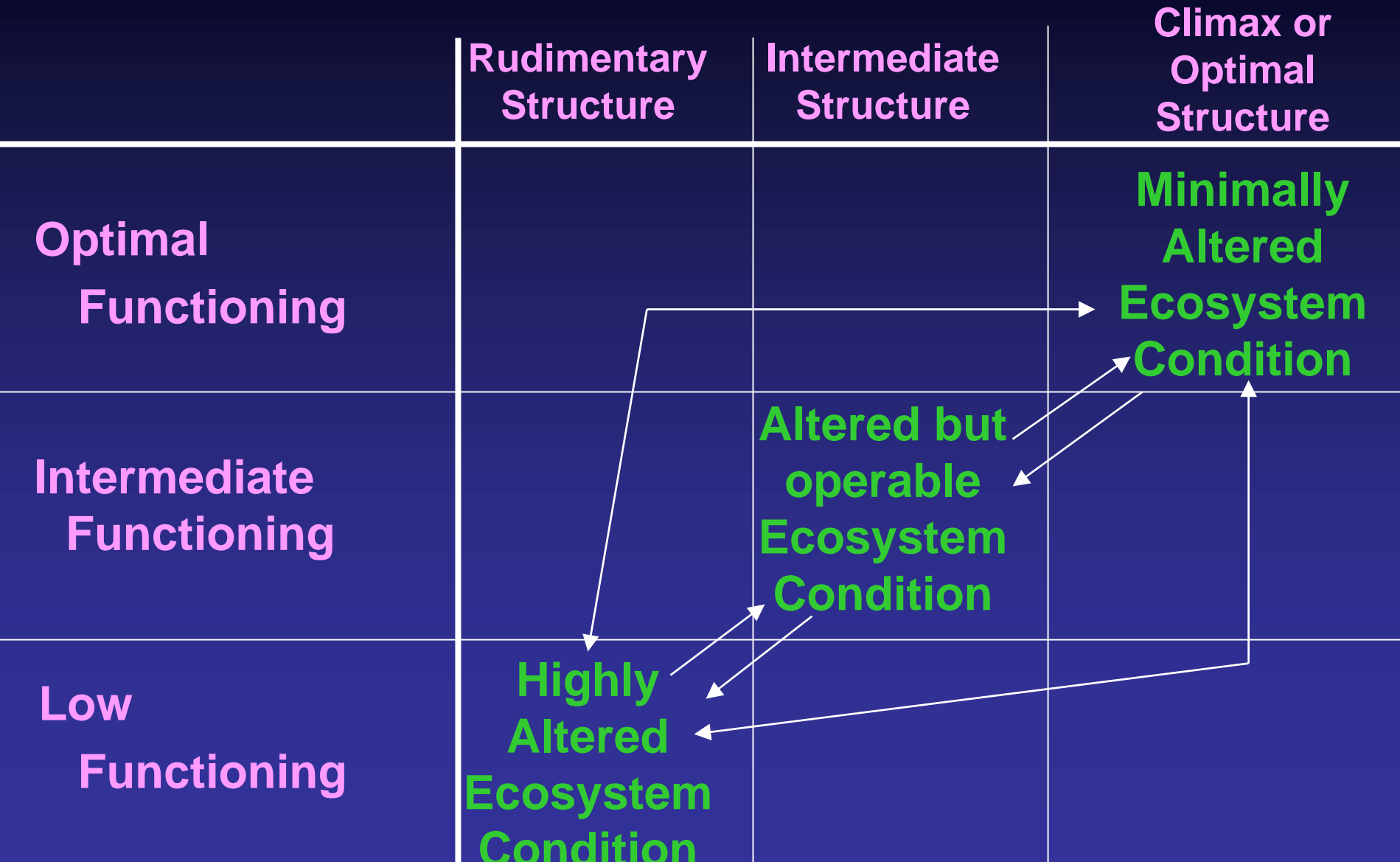
Ecosystem “Structure” →

Ecosystem Function

Implications:

Structure - Function Relationship

General Matrix of Ecosystem Structure and Function



HOW ARE USING THE CONCEPTUAL MODEL ?

- **Checklist for Effects Analysis**
 - Historical Conditions
 - Existing Conditions
 - Conditions with Project
- **Uncertainties & Risks**
- **Monitoring & Adaptive Management**

FINAL CONSIDERATIONS

- **The Conceptual Model is
a “Living” Technical Hypotheses**
- **Represents Shared Effort of the
Reconsultation Team**
- **Provides a Useful Decision
Framework for Determining Effects,
Uncertainties, and Risks**