

Nitrogen and Associated Compounds in Aquaculture

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Aquaculture Boot Camp
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CFAES



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A couple nitrogen extension pubs

Ammonia in Fish Ponds

Robert M. Durborow¹, David M. Crosby² and Martin W. Brunson³

Nitrite in Fish Ponds

Robert M. Durborow¹, David M. Crosby² and Martin W. Brunson³

Managing Ammonia in Fish Ponds

John A. Hargreaves¹ and Craig S. Tucker²

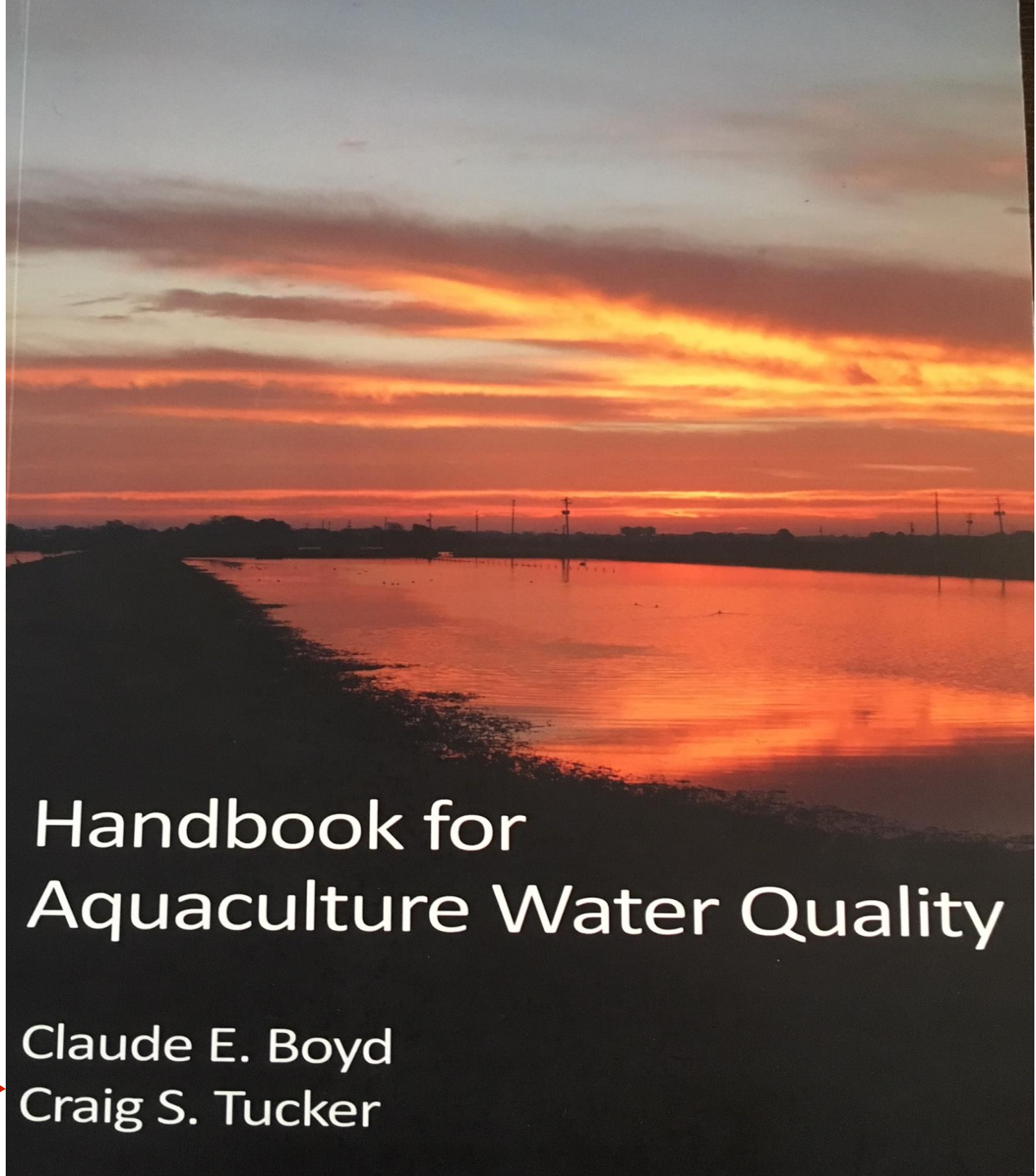
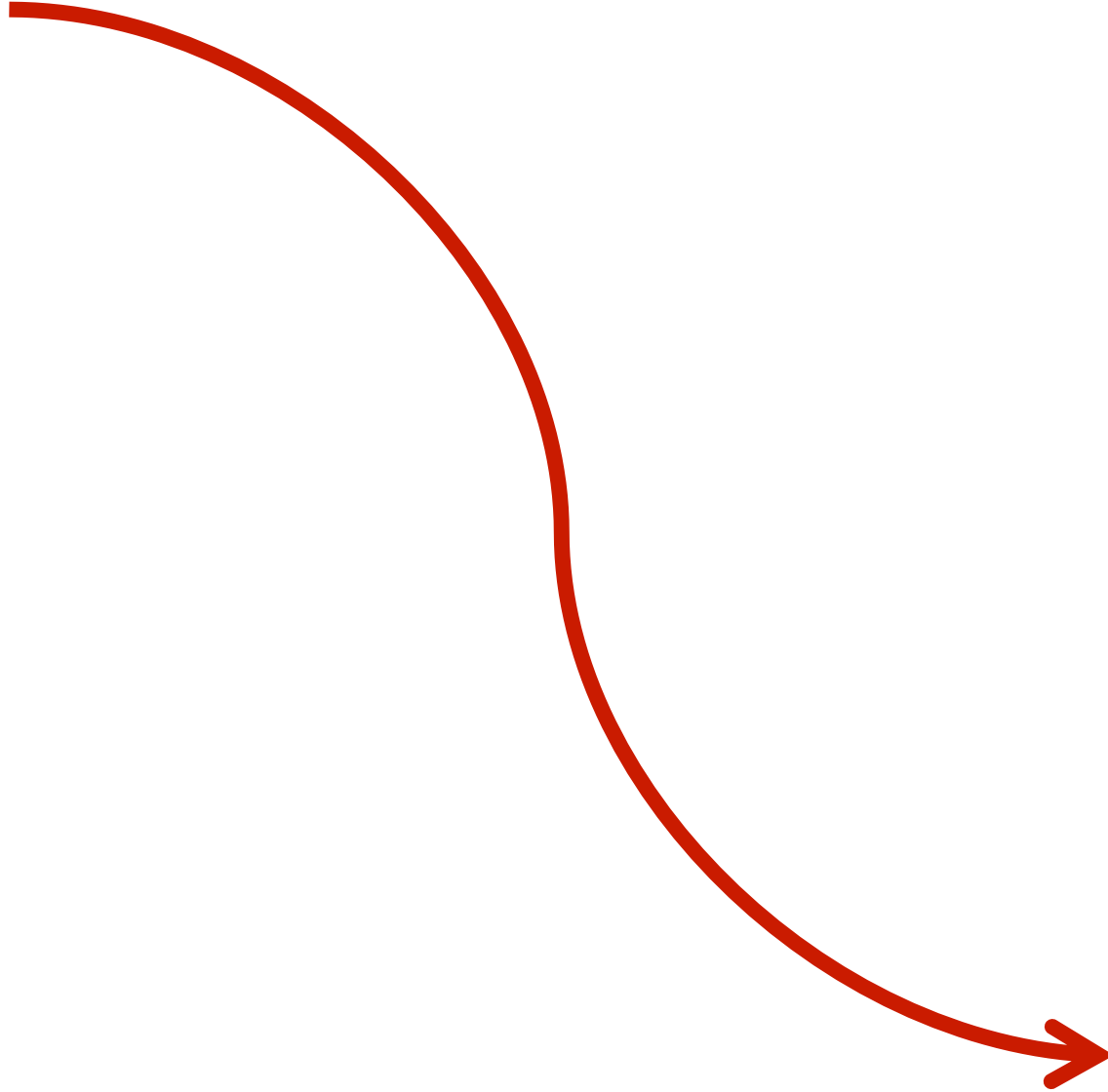


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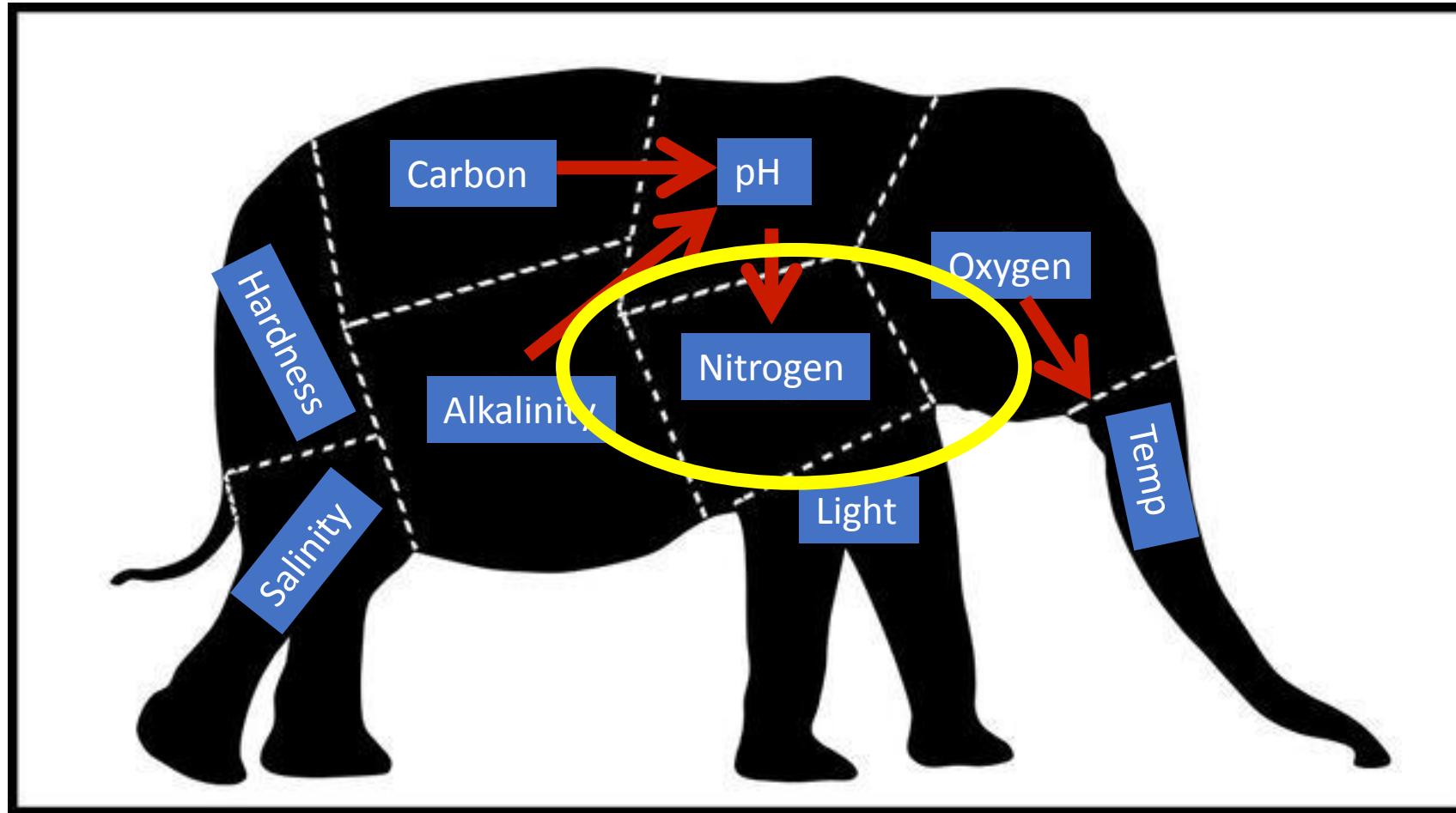
Wonderful chapter on N this is based on

The background of the book cover is a photograph of a sunset or sunrise over a body of water. The sky is filled with horizontal bands of orange, yellow, and grey clouds. The water reflects the colors of the sky. In the distance, there are silhouettes of structures, possibly wind turbines or industrial buildings.

Handbook for Aquaculture Water Quality

Claude E. Boyd
Craig S. Tucker

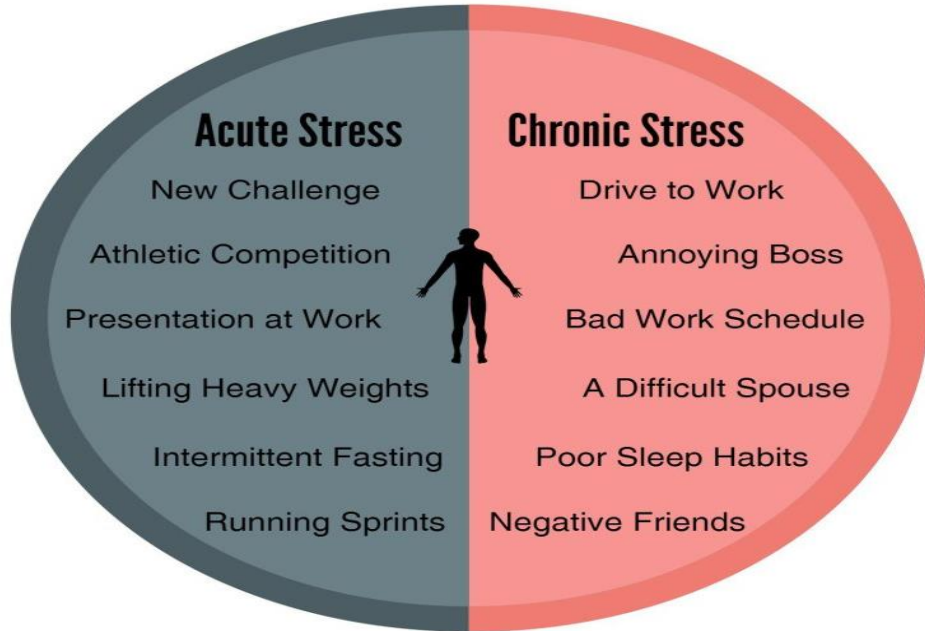
How do you eat an elephant?



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Stress in humans | Acute AND Chronic



Fish are often lost because of a combination of acute and chronic stress related to water quality



Nitrogen

- N = Nitrogen
- N₂ = dinitrogen gas (**nitrogen gas**)
- $\text{NH}_4^+ \rightleftharpoons \text{NH}_3$ (**total-ammonia nitrogen**, or ammonia-nitrogen)
- NH_4^+ (ammonium ion, usually just called **ionized ammonia**)
- $\text{NH}_{3(\text{aq})}$ (dissolved ammonia gas, usually just called **un-ionized ammonia**)
- NO₂⁻ (nitrite)
- NO₃⁻ (nitrate)
- ~78% of atmosphere is Nitrogen and 21% oxygen
- Not really discussing un-ionized and mostly N basics discussed here

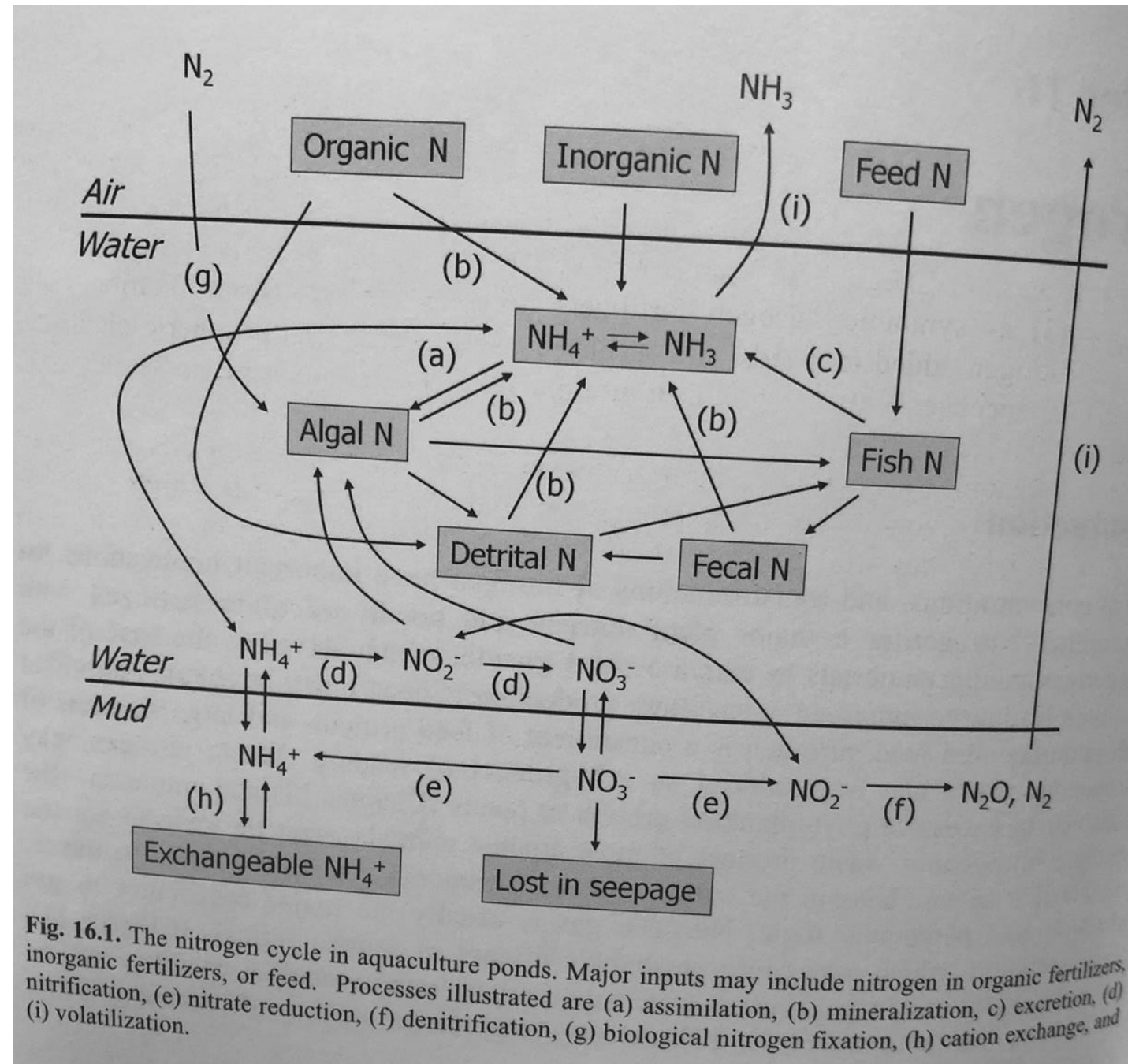


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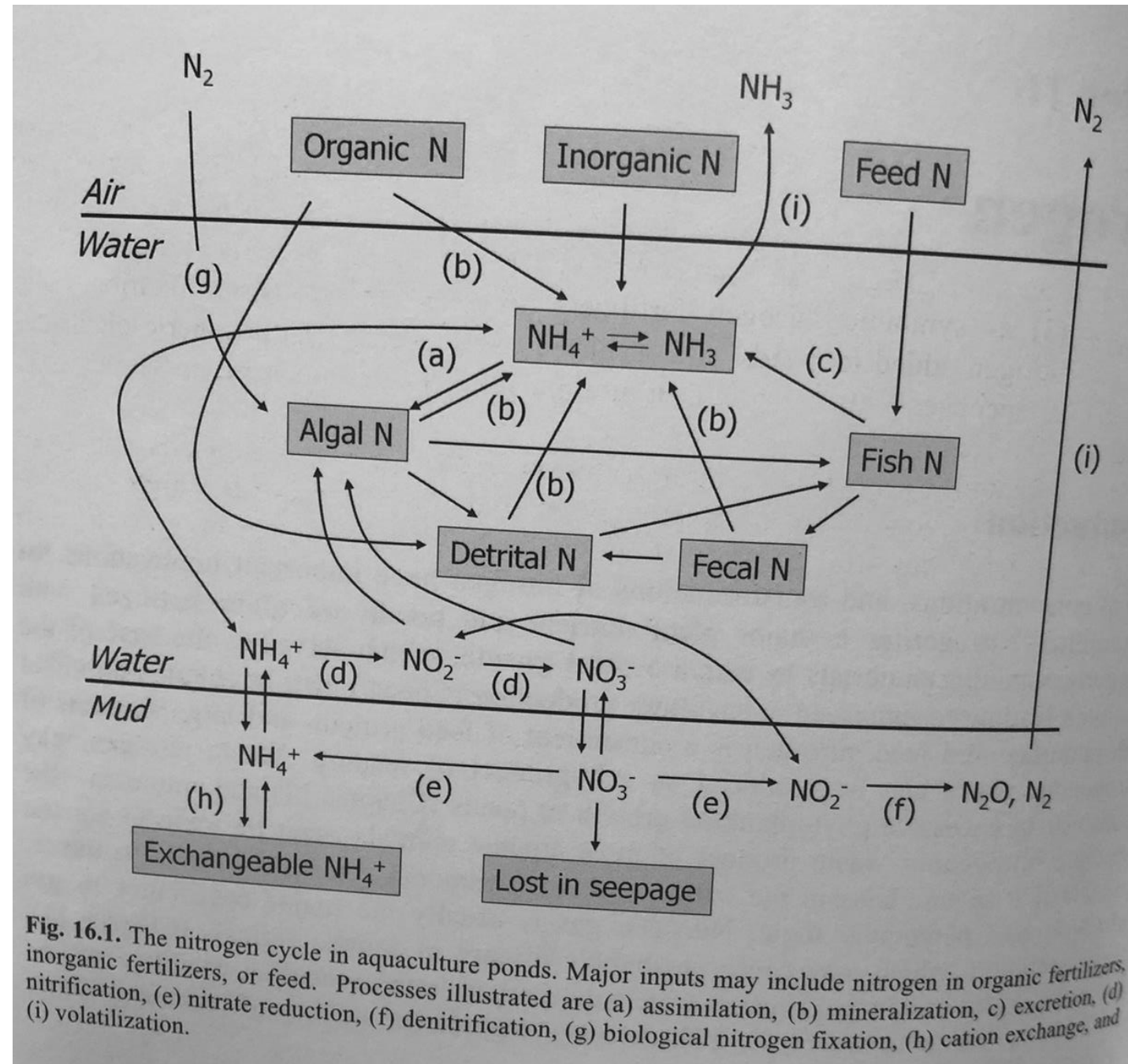
Nitrogen

- Now we start to discuss more in depth with a specific element and how it interacts with other elements and compounds
- Handbook for Aquaculture Water Quality by Drs. Boyd and Tucker
- Inputs common: fert and feed
- **What happens to the N added?**
- Elephant



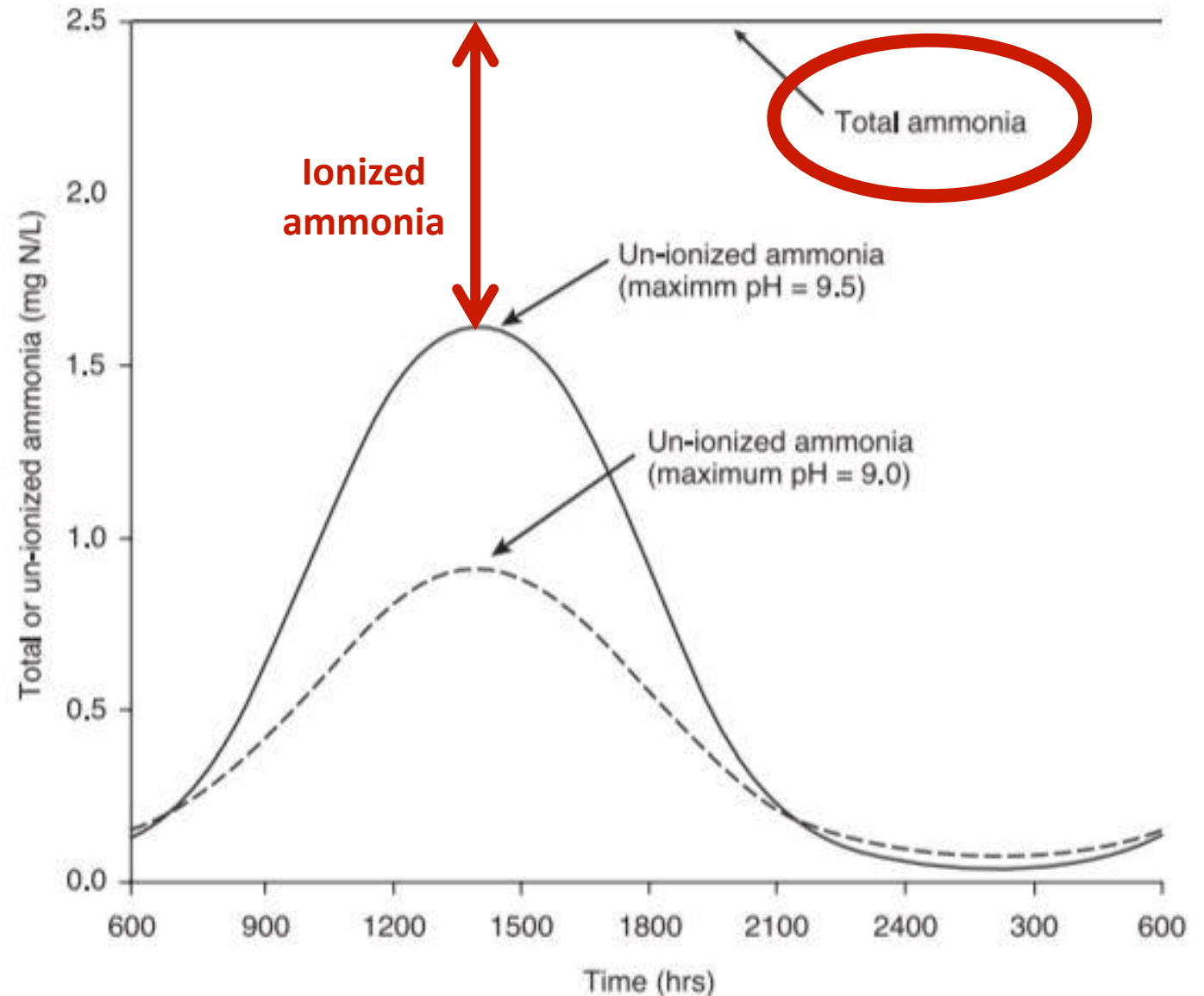
Some nitrogen processes

- (a) Assimilation
- (b) Mineralization
- (c) Excretion
- (d) Nitrification
- RAS/Aquaponics?

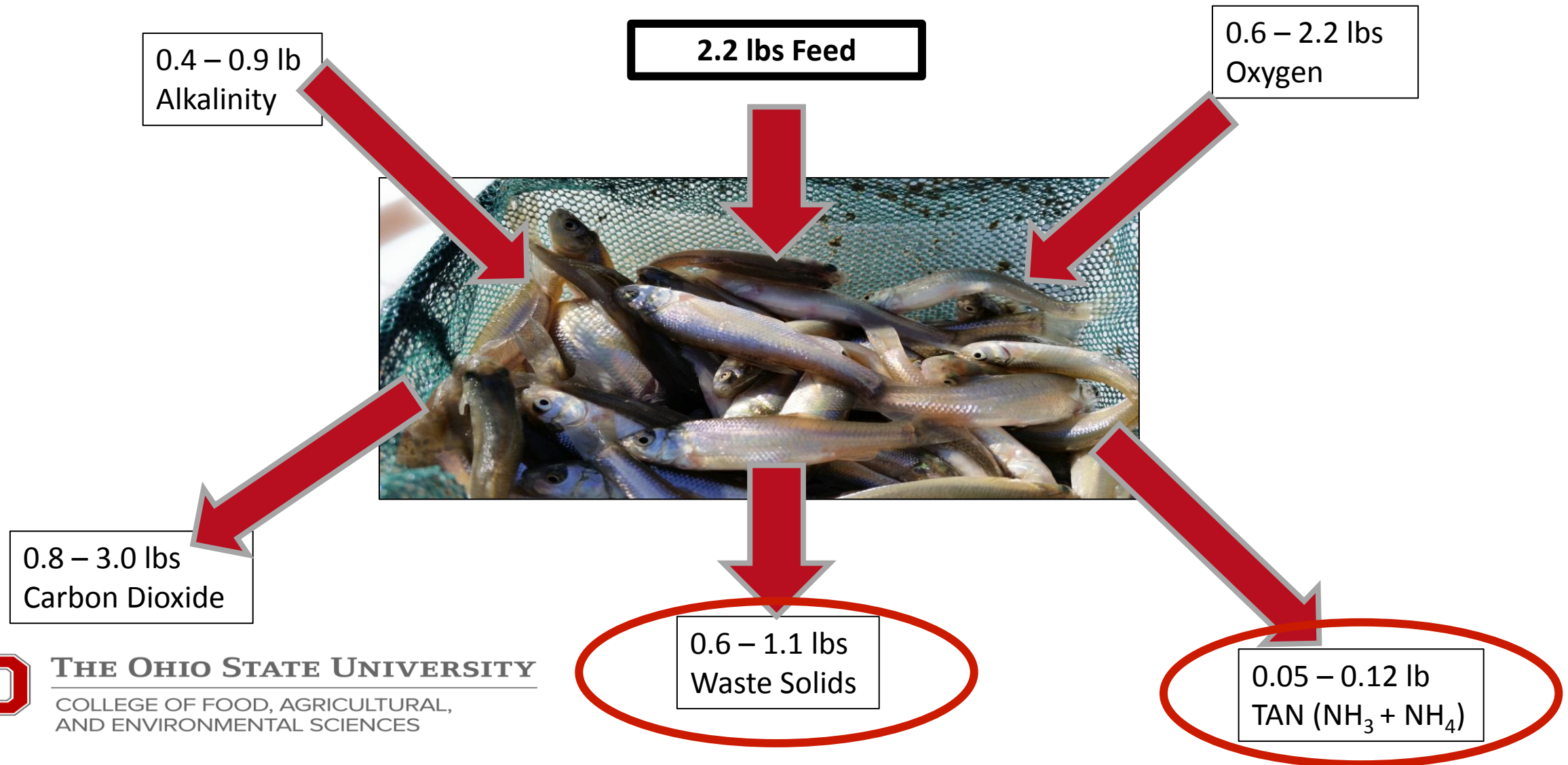


Managing Ammonia SRAC 4603 publication

- Hach FF kits
- Ammonia test
- NH_4^+ and NH_3



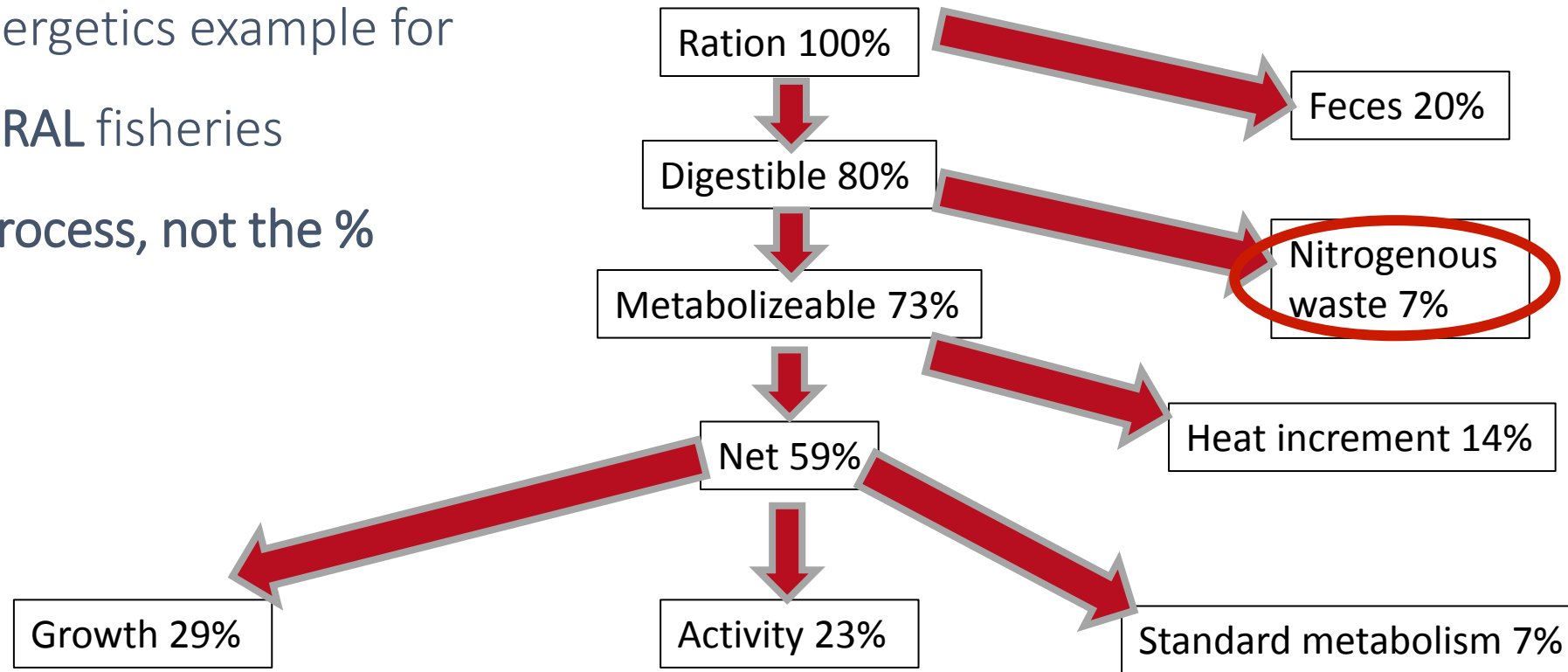
Feeding 2.2 lbs (1 kg) of feed



Nitrogen

- Most nitrogen enters the pond as ammonia (primary waste product)
- Nitrogen is needed for aquatic animal production, however only so much (usually <50%) is going to be retained by the fish
- Bioenergetics example for **NATURAL** fisheries

See the process, not the %



Avoiding and managing high ammonia levels

- Prevention by limiting stress
- Appropriate feedings and farm management
- Test and record to see trendlines
- Salt (for the chloride)
 - nitrite toxicity
- Winter? After a plant crash?
- Fresh water
- HABs?
- SRAC 4603 – a lot of “options” & prevention is best



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Quick thoughts on plants in aquaculture ponds

- Certainly beneficial and non-beneficial plants in aquaculture
- Obvious negative plants are those that have the potential to overtake the system; increasing management and pulling down oxygen
- With nitrogen... phytoplankton are usually the first to uptake the nitrogen added (by feed) to the system



Managing indoors

- In RAS, depends on the pH but might not be a problem
- In Aquaponics, if held at the recommended pH of approx. 7 then not a problem
- Why? % percentage. More in the un-ionized talk



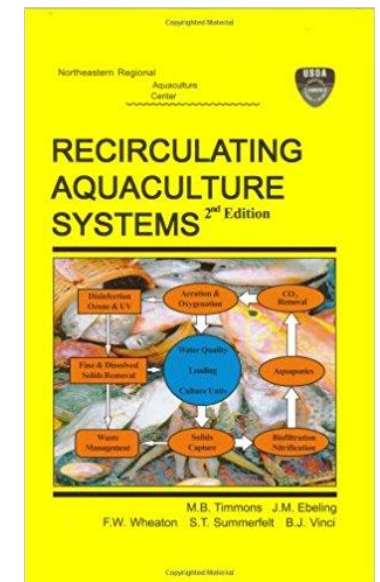
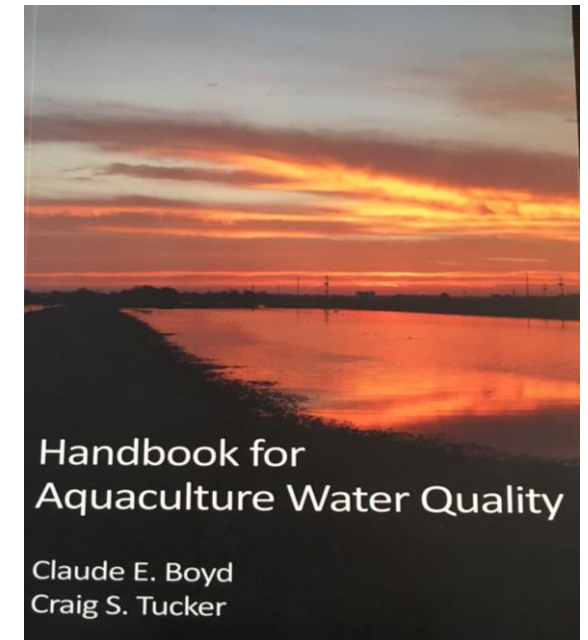
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Readings

Southern Regional Aquaculture Center

Fact Sheets » Water Quality (460-471; 4600-4699)

- [SRAC 0460: Control of Clay Turbidity in Ponds](#)
- [SRAC 0461: Water Quantity and Quality Requirements for Channel Catfish Hatcheries](#)
- [SRAC 0462: Nitrite in Fish Ponds](#)
- [SRAC 0463: Ammonia in Fish Ponds](#)
- [SRAC 0464: Interactions of pH, Carbon Dioxide, Alkalinity and Hardness in Fish Ponds](#)
- [SRAC 0466: Algae Blooms in Commercial Fish Production Ponds](#)
- [SRAC 0467: Cost of Alternative Effluent Treatments for Catfish Production](#)
- [SRAC 0468: Carbon Dioxide in Fish Ponds](#)
- [SRAC 0469: Fertilization of Fish Fry Ponds](#)
- [SRAC 0470: Characterization and Management of Effluents from Aquaculture Ponds in the Southeastern United States](#)
- [SRAC 0471: Fertilization of Fish Ponds](#)
- [SRAC 4600: Toxicities of Agricultural Pesticides to Selected Aquatic Organisms](#)
- [SRAC 4601: Measuring Dissolved Oxygen Concentration in Aquaculture](#)
- [SRAC 4602: Pond Mixing](#)
- [SRAC 4603: Managing Ammonia in Fish Ponds](#)
- [SRAC 4604: Managing High PH in Freshwater Ponds](#)
- [SRAC 4605: Algal Toxins in Pond Aquaculture](#)
- [SRAC 4606: Interpretation of Water Analysis Reports for Fish Culture](#)



Aquaponic System Design Parameters:

Basic System Water Chemistry

Wilson Lennard PhD



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