

# INSECTS AS A COMPANION TO SUSTAINABLE AQUACULTURE

USING INSECTS, (AND OTHER INVERTEBRATES) TO  
MAKE AQUACULTURE MORE SUSTAINABLE

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# THE FUTURE OF AGRICULTURE IS AQUACULTURE

**It's going to happen, it's already happening, the world's a-changing and we are on the forefront.**

- ❖ **Growing world population**
- ❖ **Dwindling commercial harvests**
- ❖ **Environmental awareness**
- ❖ **World Food and Agriculture Organization of the United Nations (FAO)**

**Forestry Paper 171**



# AGRICULTURAL CONSIDERATIONS

## Feed

- ❖ Conversion
- ❖ Source
- ❖ Nutrition
- ❖ Cost

## Consumer

- ❖ Quality of life
- ❖ Quality of product
- ❖ Sustainability

## Product

- ❖ Health
- ❖ Quality

## Waste

- ❖ Composition
- ❖ Disposal

# YOUR NEW BEST FRIENDS!

*Drosophila hydei* *Drosophila melanogaster*



*Hermetia illucens*



*Tenebrio molitor*



*Eisenia fetida*



# FEED

❖ Conversion

❖ Source

❖ Nutrition

❖ Cost

# PRODUCT

❖ Health

❖ Quality

# WASTE

❖ Composition

❖ Disposal

# CONSUMER

❖ Quality of Product

❖ Quality of Life

❖ Sustainability





# THE FUTURE OF AQUACULTURE IS IN SUSTAINABILITY

## Mimics natural cycles

- ❖ Insects are low trophic order decomposers + nutrient reclaimers.
- ❖ Omnivorous and carnivorous fish are built to process insects.

It's the most logical step forward, and darn near everybody agrees it's the direction to be going.

- ❖ Recirculating Aquaculture Systems + Hydroponics = Aquaponics → Polyculture → Integrated Multi-Trophic Aquaculture
- ❖ Applications for State, Federal, Commercial, Tribal, household and community facilities

If we can save the world WHILE being efficient and cost effective... why the heck wouldn't we?



# OH! THE POSSIBILITIES!

Sustainability!! (It could be one of our considerations, not just a by-product!)

- ❖ Aquatic version of permaculture

Behavior

- ❖ Teach fish to find living food post-release, perhaps leading to improved survival

Improved survival (hatcheries)/Fewer fish released

- ❖ Which in turn leads to changes in behavior, happy bios, happy wild fish fans

Excellent example for community/education and outreach

- ❖ Myriad opportunities to discuss fish culture, habitat and environmental issues regarding salmon

Produce more jobs

- ❖ Really, who's against more jobs?
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# THEY EAT STYROFOAM!



...and they like it!

**Biodegradation and Mineralization of  
Polystyrene by Plastic-Eating Mealworms,  
Yang et. al**

# ADDITIONAL INSPIRATION

- ❖ **FAO Forestry Paper 171**
  - ❖ **FAO Fisheries and Aquaculture Technical Paper 529**
  - ❖ **Fish Hatchery Management, AFS Publication**
  - ❖ **USDA Sustainable Agriculture Research & Education Grants**
  - ❖ **Canadian Integrated Multi-Trophic Aquaculture Network**
  - ❖ **Enterra Feed**
  - ❖ **EnviroFlight**
  - ❖ **UnionPoint Custom Feeds**
  - ❖ **Bitwater Farms**
  - ❖ **DipTerra LLC**
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