Florida Keys Environmental Coalition

June 2013

Cleaning the FL Keys Canals with Filter Feeder Habitats

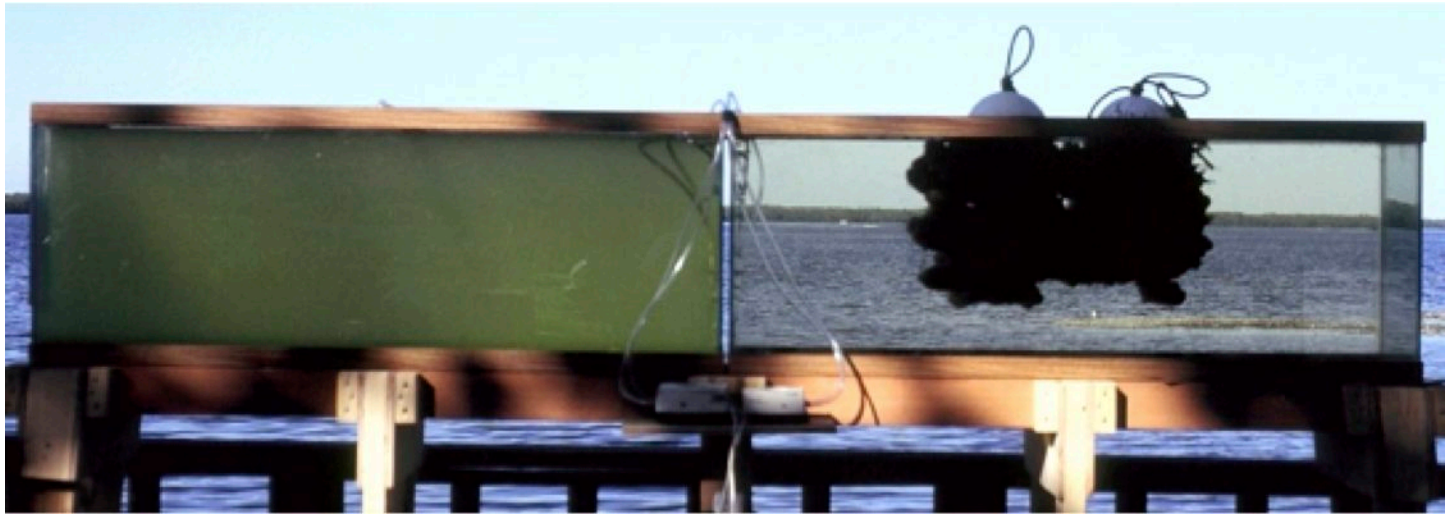
Proposal for Monroe County Pilot Program

FKEC.org: Mission & Goals

- Organized in response to DWH 2010 oil spill
- FKEC.org "unified voice" unanimously endorse by elected officials in Monroe County
- The Mission of the Florida Keys Environmental Coalition is to coordinate and support organizations, businesses and individuals, who work to protect the coral reefs and ecosystems of the Florida Keys and to provide a unified voice for our community.
- Organize and educate citizen to help support EOCs during times of eco-hazards
  - Database of aprox. 4200 historical volunteers
  - Hundreds trained at various Hazwopper levels
  - Relationship with EOC managers
  - National Incident Manager in FKEC.org (Paul Hefner)

Engineered Habitats for Indigenous Filter Feeder

Appling Proven Technologies to Improve Near Shore Water Quality



This is the Bay… ***<u>This is the Bay on Habitat!!!</u>***

ANY QUESTIONS?

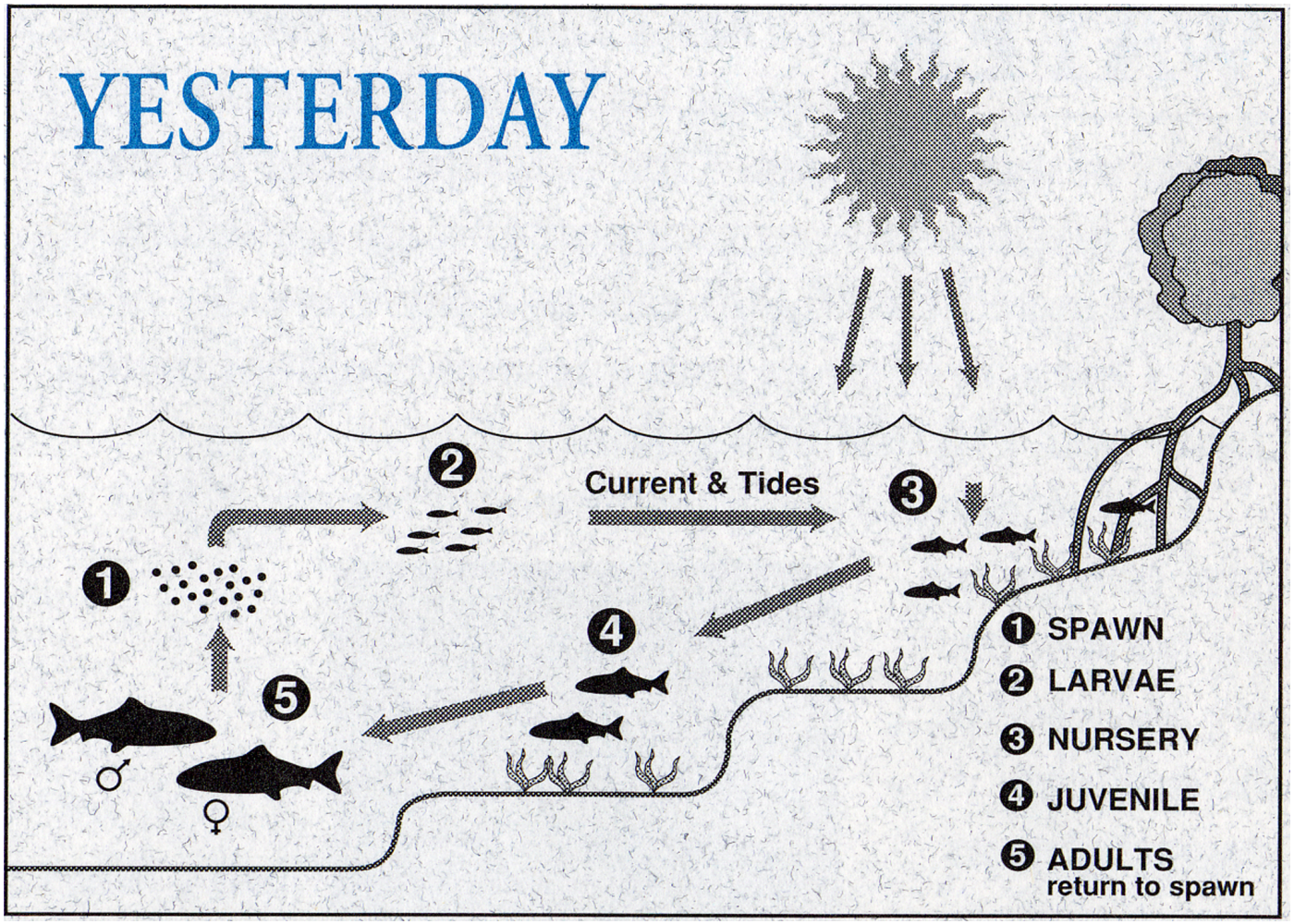
Learning from nature!

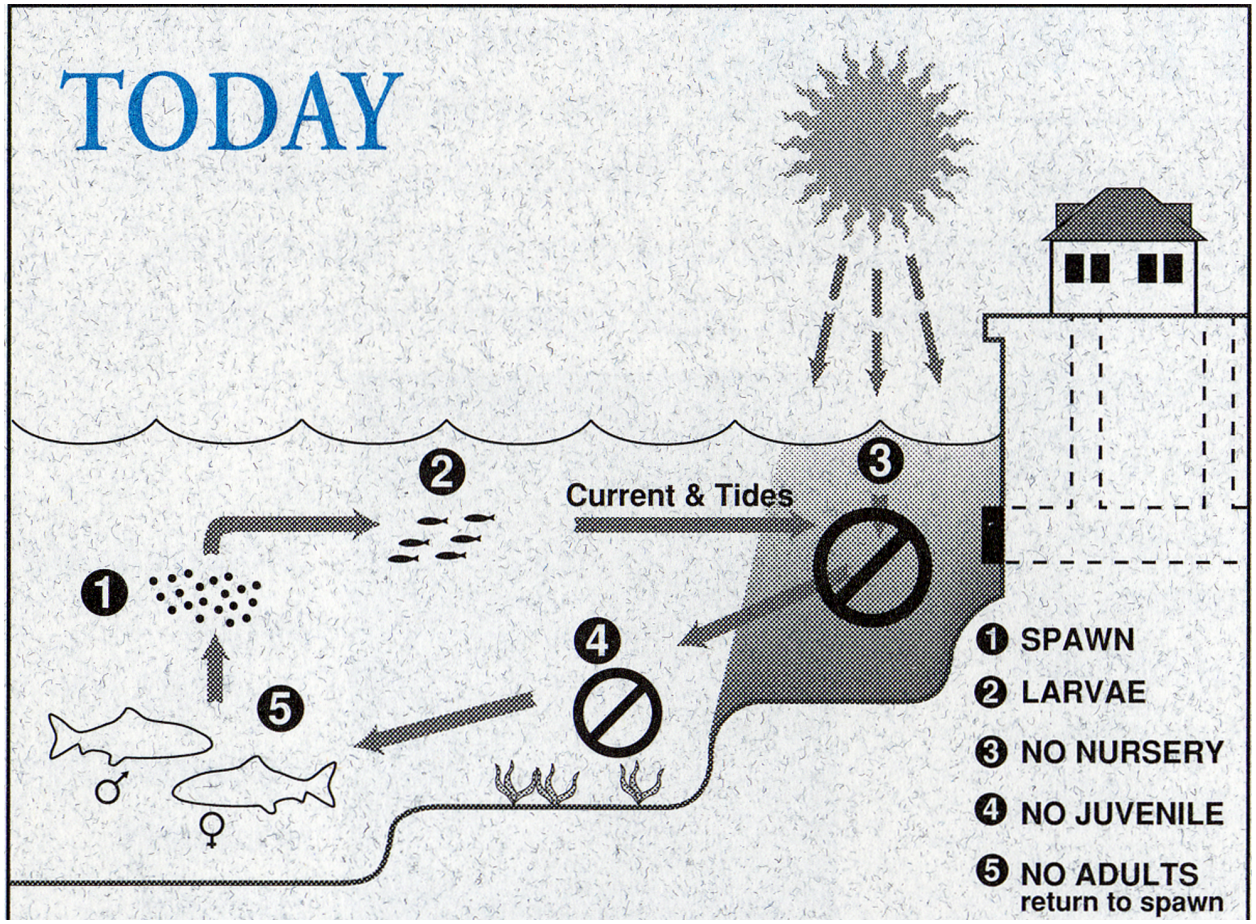
NATURAL SHORELINE & CANAL ECOSYSTEMS

HEALTHY HABITAT

Nursery for Juvenile Fisheries Species

Water Filtering: The Near Shore "Kidneys"





Natural Habitat Void Designed Into Keys & FL Canals

- **KIDNEY FAILURE – NOT ENOUGH FILTER FEEDERS**
- **LIFE CYCLES BROKEN – FEWER FISH, MORE REGULATION**

Habitat Systems Emulate the Missing Natural Shoreline

HABITAT DESIGN & PERFORMANCE

Sampler & Full Scale Units in Test: 1 - 2 years in Keys

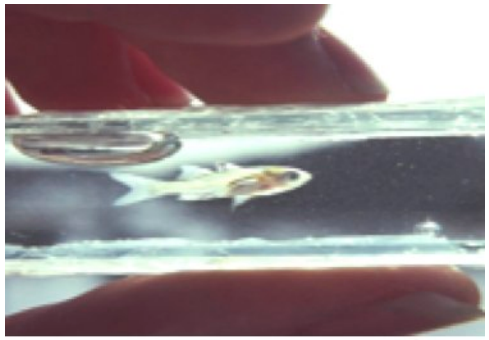
WHAT'S GROWING IN YOUR BACK YARD??

BEFORE **4 MONTHS LATER** (Photos: ORI)

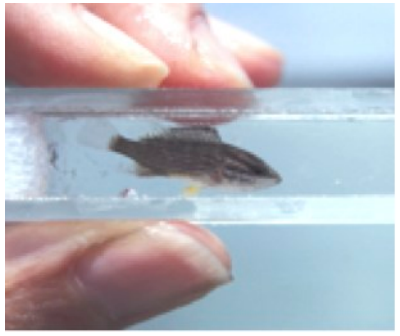
(Photos: ORI)

Engineered Habitat #55

- 50+ year lifespan
- Distance between tiers & substrate attract target ecosystem members
- 10K – 20K gal/day/unit filtered
- Fisheries species survivability improved
- Floats at dock, needs sun
- Garden in the water



SNOOK



SNAPPER

STONE CRAB

SPINY LOBSTER

Habitat Manufacturing

- **Ocean Restoration Corp & Assoc. Licensing**

Materials:

- Tiers—24” X 36” fiberglass, or Marine Board
- Rope— 80’ 1” polypropylene
- Shell substrate—crushed fossilized shells
- Assembly rods, spacers—20 – 5 x 1.5” PVC pipe
- Floats—12” (31 lb. buoyancy) HDPE
- 130 lb. floatation = 250+ lbs submerged biomass
- Volume: 12 ft3 (0.34 m3)

Dimensions:

- Finished Size = 2’ x 3’ x 2’
- Total surface area— 11,045 in2 sq (76.7 ft2 – 7.7 m2)
- Surface-area-to-volume (SAV) ratio: — 6.4:1
- Volume: 12 ft3 (0.34 m3)
- Weight: 43.5 pounds

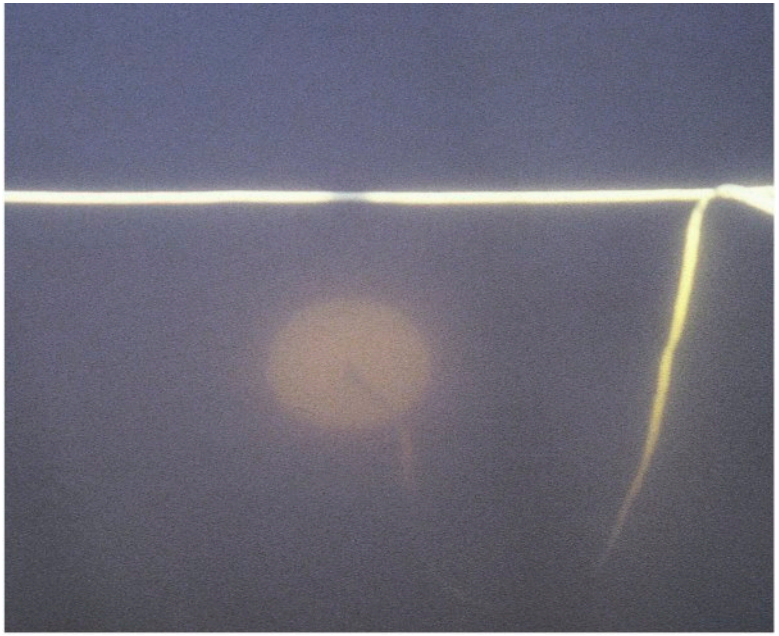
Cost Estimates:

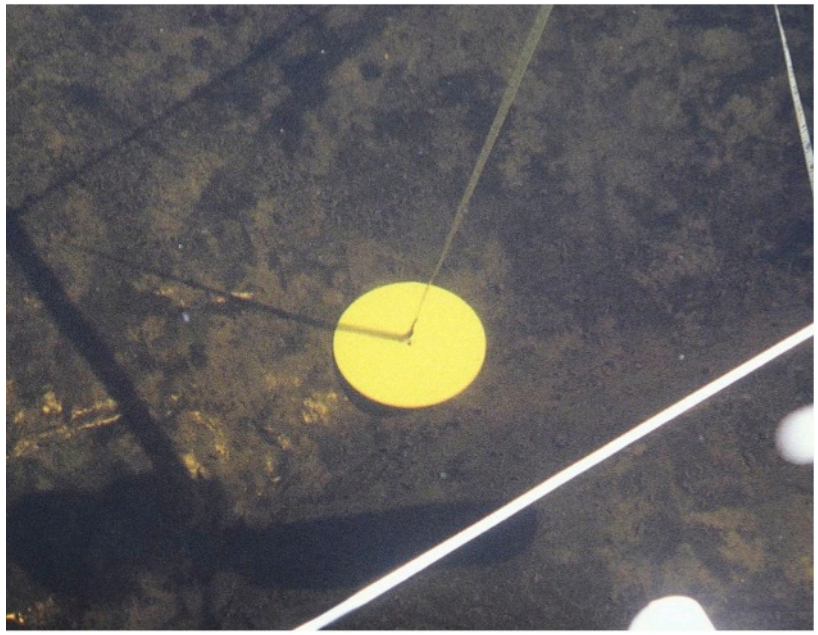
- ORCA = $450; Material & Labor = $300 est.

Finished Habitat

20,000 GALLON/ 24 Hr TEST

(Photos: ORI)

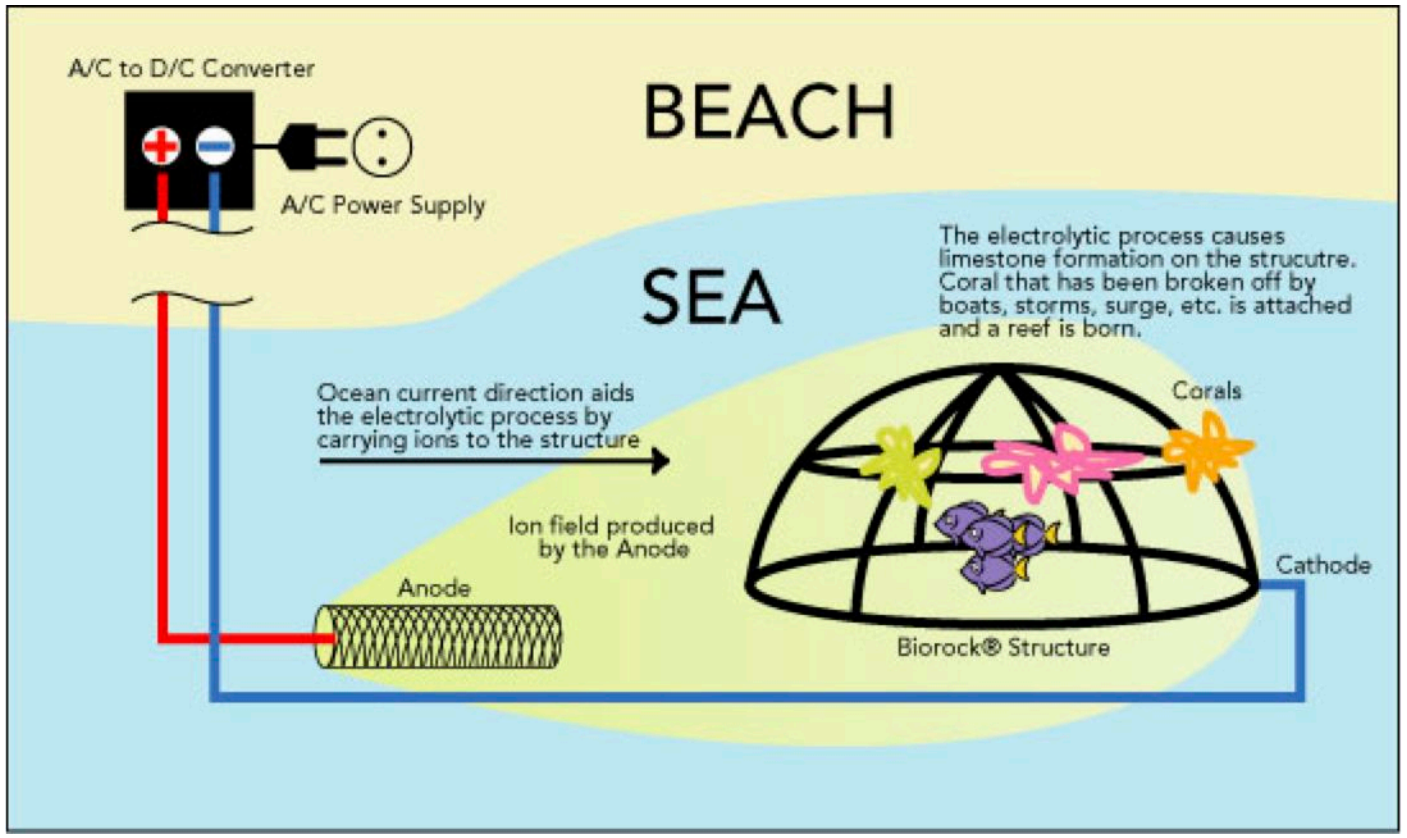




Using Technology to Improve Production and Performance

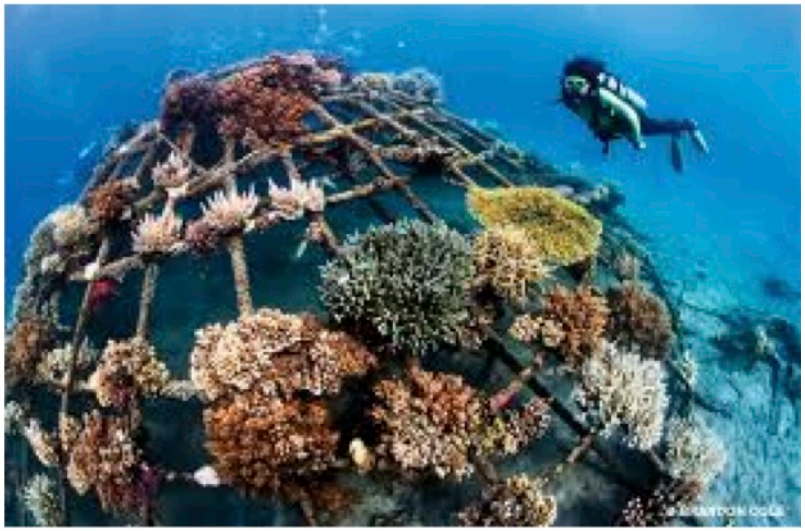
WHAT IN THE WORLD IS A BIOROCK?

Biorock



- Accelerate Production
- Insure Robust Sustainable Filtering
- Pilot Potential Coral Restoration Initiatives

Biorock in Operation



3 years

5 years

Latest photographs of the Pemuteran, Bali Biorock project. 5 Yr taken in May 2012 by EunJae Im

Why Do We Need Biorock

- Achieving Steady State Consumption may require balancing of seasonal effects on habitat performance
- Canal water quality affects habitat performance
- Growth rate in habitat production enhanced
- Ability of habitat ecosystem to survive improved greatly
- Provide data for potential coral restoration projects

The Bottom Layer: Cleaning Sediment and Improving DO

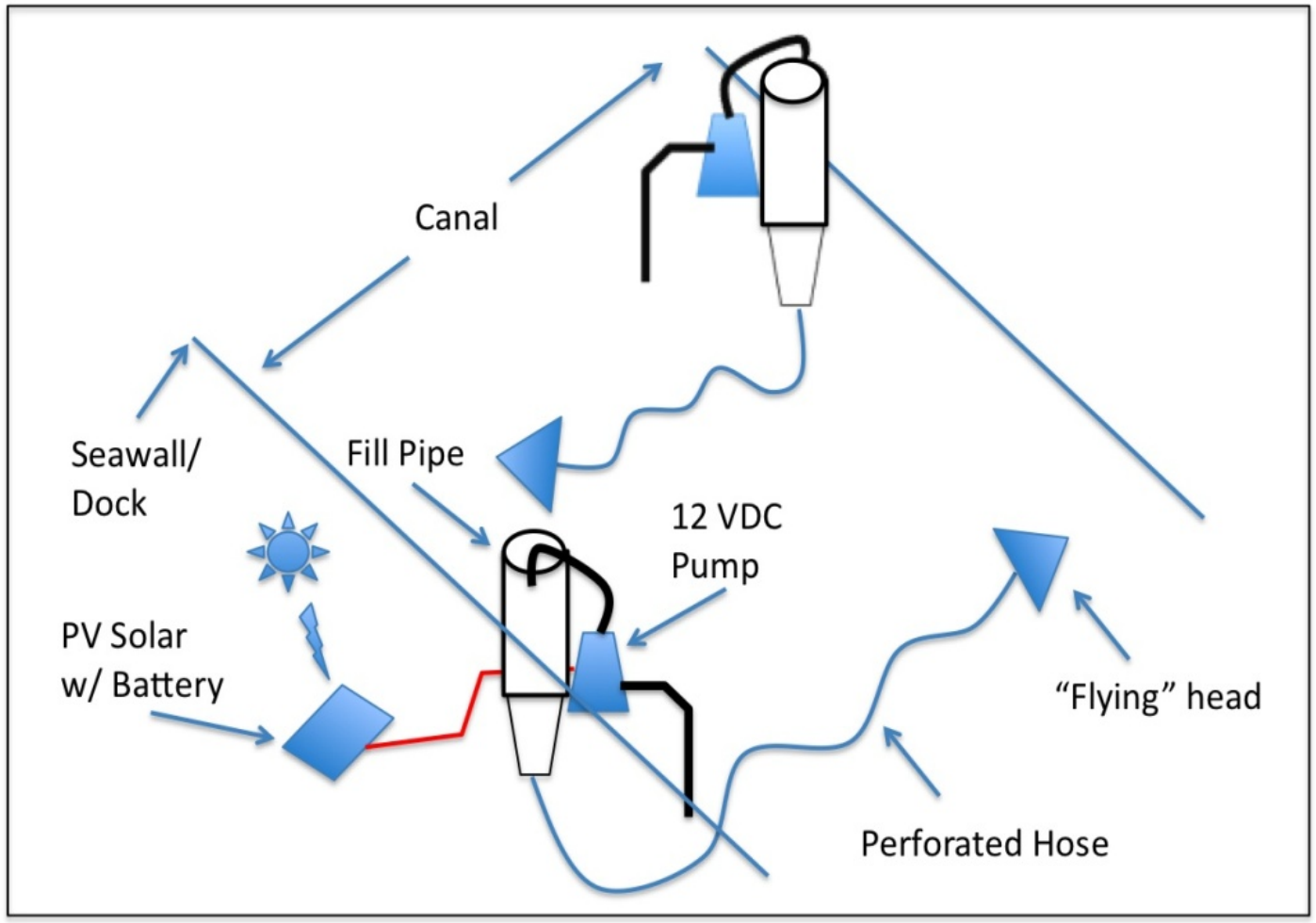
How does this all fit together?

SUPPLEMENTAL SYSTEMS

System Solutions Under Consideration

- Should sediment be disturbed?
  - Input form FDEP, FKNMS and Science Advisors
  - 2013 MC study: Cooper, Arsenic, etc.
- What is most effective way to disturb sediment?
- Most effective means to improve hypoxia?
  - Water turnover must affect stratified layers
- Integration of Biorock into habitat structure
- Power Supply Systems

Circulation: Consume Sediment & Injecting O2



Undisturbed Canal with Sewer Connection in Late 2013

THE INDIAN WATERWAYS PILOT PROJECT: FILTER FEEDER HABITATS W/ BIOROCK ASSIST

Indian Waterways, mm 89.2: Pilot Project Location

Indian Waterways

- Aprox 245 lots 60’ x 110’ = 245 habitats
- 1.6 mile waterway = 34m gal
- 6 to 12 day turnover rate
- Most homes built in mid 1960’s to early 90’s
- Homeowners polled (aprox 30), 100% positive
- 6 “Sampler” units placed in canal Oct 2010
- 5 units remain with various results (See photos)
  - Habitats at low flow canal ends grow poorly
  - Middle of canal grows well
  - Near bay, boat traffic causes too much silt

FF Habitat Program Highlights

- Indian Waterways target pilot – new budget expanded to entire neighborhood (Aprox. 245 lots)
- Reduce Nutrients, Clean Pathogens, Improve Fisheries
- 24 month program from production to final report
- Identify affectivity and establish scalable best practices
- Goal to enable Keys wide application with predictable cost, deployment time and performance
- Comprehensive Community Engagement:
  - Education: High Schools, Data Collection course at FKCC
  - Neighborhood Participation: Citizen Scientist
  - FKEC & NGOs, Monroe County, Islamorada, NOAA, FAU, FIU
  - Potential NSU, FKMNS, FL DEP, FWRI, EPA
- Pilot to Keys improved comprehensive WQM
- Pilot knowledge to Coral Restoration via Biorock techniques

Performance & Practice Questions

- Habitat growth best practices
  - Filtration rates (gal/day) – Best turn-over rate for water (X days)?
  - Will Biorock enable habitats to be grown in place?
  - When do we need Biorock?
  - Is production to semi-mature in control facility best method?
  - Steady State: Habitat density reduction after initial filtration?
  - Can we consume the bottom sediment?
  - What power levels/current for optimum Biorock assist?
  - Various canal locations and canal types may drive methodology
  - Fisheries Improvement Estimates? Is seeding beneficial?
- Cost and production methods for high volume
  - Scale the program
  - Facilities and logistics
  - Durability of units

Water Quality Monitoring (WQM)

- WQM lead by COAST (Dr. Brian Lapointe, FAU HBOI)
- NOAA Parallel & Additional WQ Analysis (C Sinigalliano)
- Test Parameters: Salinity, Turbidity, DO, Total Nitrogen, Phosphorus & Organic Carbon, Chlorophyll A & B, Fecal Coliform
- Algae Stable Isotope ID (FAU database)
- Fecal DNA Profiling, Pathogen Analysis (NOAA database)
- Pre-program baseline
- Monthly, Quarterly, Annual test reports
- 2 year program
- Lessons Learned => Continual MC WQM program

Advisors & Technical Participants

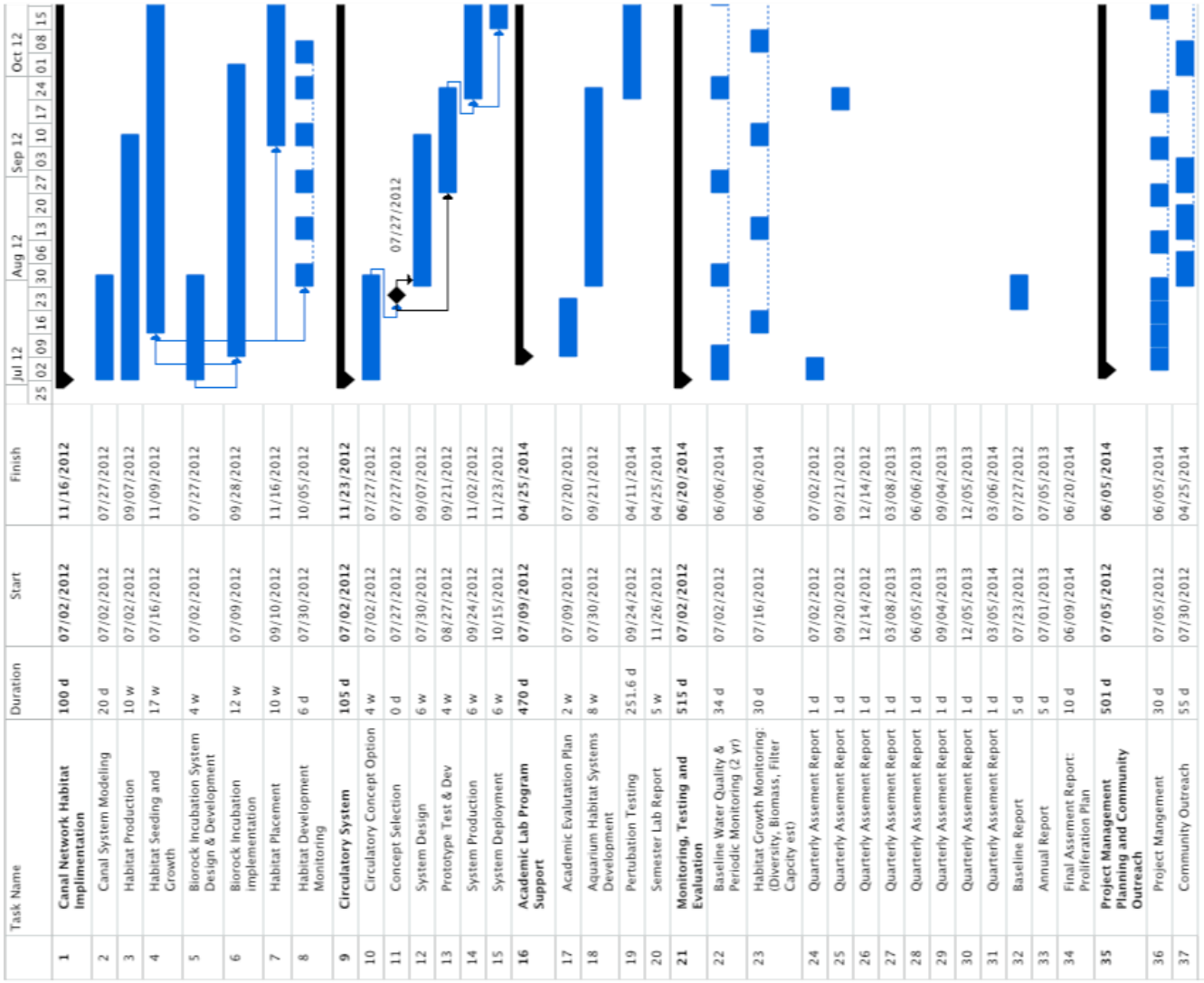
- **Dr. Patrick Rice (Dean of Marine Sciences, FL Keys Community College)**
- **FKCC: Marine Science Data Collection Class**
- **Dr. John Dindo (Dauphin Island Sea Lab)**
- **Dr. Thomas Goreau (Global Coral Reef Alliance)**
- **Dr Brian Lapointe (FAU Harbor Branch Oceanographic Institute)**
- **Dr Craig Downs (The Global Coral Repository)**
- **Dorothy Leonard (Ocean Equities LLC, 20 yrs NOAA Oyster Prgm)**
- **Michael Calinski (Ocean Restoration Initiative)**
- **Dr Chris Sinigalliano (NOAA)**
- **B Wray: CTO Solarbeam International**
- **…and growing!**

Program Participants (Committed)

- FKEC: Program Mgmt (Sr Mgr: B Wray, PM: H Williams)
- FKCC:
  - Technical Program Management (Dr. Patrick Rice)
  - Data Collection Program (Marine Sci Class)
- COAST: WQM, Analysis & Reports (Dr. Brian Lapointe)
- NOAA (Microbiology): WQ Analysis & Reports (C Sinigalliano, Microbiology)
- Aqua Ranch: Habitat Growth/ Production
- Solarbeam International: Systems Engineering
- EcoWorld Energy: Program Communication & Possible Engineering Support
- Atlantic Virtual: IT, Website & Communications Support
- Reef Relief: Program Management, County Outreach & Accounting
- Ocean Restoration Initiative: Habitat Advisory & Mfgr support
- Monroe County and Village of Islamorada
- Monroe Cty High Schools: WQ Data Collection
- TNC, GLEE, Mote, TDC (Tech Support, Peer Review, Funding)
- FDEP (Equip, Advisory, Outreach), NSF (NOAA Support), FIU (NOAA Test Support), FKNMS (Permitting, Advisory), FWC/FWRI (Advisory, Fisheries Est)
- Manufacturing: Local Contracting/ Carpentry Cos, Interns, Students, ORCA Mgmt

Sample Project Schedule

	Task Name	Duration	Start	Finish
1	**Canal Network Habitat Implimentation**	**100 d**	**07/02/2012**	**11/16/2012**
2	Canal System Modeling	20 d	07/02/2012	07/27/2012
3	Habitat Production	10 w	07/02/2012	09/07/2012
4	Habitat Seeding and Growth	17 w	07/16/2012	11/09/2012
5	Biorock Incubation System Design & Development	4 w	07/02/2012	07/27/2012
6	Biorock Incubation implementation	12 w	07/09/2012	09/28/2012
7	Habitat Placement	10 w	09/10/2012	11/16/2012
8	Habitat Development Monitoring	6 d	07/30/2012	10/05/2012
9	**Circulatory System**	**105 d**	**07/02/2012**	**11/23/2012**
10	Circulatory Concept Option	4 w	07/02/2012	07/27/2012
11	Concept Selection	0 d	07/27/2012	07/27/2012
12	System Design	6 w	07/30/2012	09/07/2012
13	Prototype Test & Dev	4 w	08/27/2012	09/21/2012
14	System Production	6 w	09/24/2012	11/02/2012
15	System Deployment	6 w	10/15/2012	11/23/2012
16	**Academic Lab Program Support**	**470 d**	**07/09/2012**	**04/25/2014**
17	Academic Evalutation Plan	2 w	07/09/2012	07/20/2012
18	Aquarium Habitat Systems Development	8 w	07/30/2012	09/21/2012
19	Pertubation Testing	251.6 d	09/24/2012	04/11/2014
20	Semester Lab Report	5 w	11/26/2012	04/25/2014
21	**Monitoring, Testing and Evaluation**	**515 d**	**07/02/2012**	**06/20/2014**
22	Baseline Water Quality & Periodic Monitoring (2 yr)	34 d	07/02/2012	06/06/2014
23	Habitat Growth Monitoring: (Diversity, Biomass, Filter Capcity est)	30 d	07/16/2012	06/06/2014
24	Quarterly Assement Report	1 d	07/02/2012	07/02/2012
25	Quarterly Assement Report	1 d	09/20/2012	09/21/2012
26	Quarterly Assement Report	1 d	12/14/2012	12/14/2012
27	Quarterly Assement Report	1 d	03/08/2013	03/08/2013
28	Quarterly Assement Report	1 d	06/05/2013	06/06/2013
29	Quarterly Assement Report	1 d	09/04/2013	09/04/2013
30	Quarterly Assement Report	1 d	12/05/2013	12/05/2013
31	Quarterly Assement Report	1 d	03/05/2014	03/06/2014
32	Baseline Report	5 d	07/23/2012	07/27/2012
33	Annual Report	5 d	07/01/2013	07/05/2013
34	Final Assement Report: Proliferation Plan	10 d	06/09/2014	06/20/2014
35	**Project Management Planning and Community Outreach**	**501 d**	**07/05/2012**	**06/05/2014**
36	Project Mangement	30 d	07/05/2012	06/05/2014
37	Community Outreach	55 d	07/30/2012	04/25/2014



Sample Project Schedule (Cont)