

ELECTRONIC AND VIDEO COUNTING: HOW TO AND LESSONS LEARNED

RIVER HERRING NETWORK ANNUAL MEETING

THURSDAY NOVEMBER, 2, 2017

BEN GAHAGAN, MASSACHUSETTS DIVISION OF MARINE
FISHERIES

Marine Fisheries
Commonwealth of Massachusetts



WHY COUNT?

- Local knowledge, participation, stewardship
- Harvest (largely in past in MA)
- State and coast-wide management
 - Higher data quality threshold that demands counts that are more accurate than visual extrapolations and typically 10 years in length



BUT FIRST...

- Both video and electronic counters require experience, dedication, and many many hours during field season. This includes weekends and evenings.
- Typically a one to two year learning curve when implementing a counter at a new site
- The larger the area of water to cover, the more difficult to implement
- Number 1 rule of working in water: things will go wrong at some point. Likely quite frequently!



AS A RESULT

- Electronic counters and video methods are generally better suited to state/federal agencies, or a handful of appropriately staffed non-governmental organizations.
- Video requires greater dedication and is most feasible for state or federal agencies or regulated hydroelectric facilities.

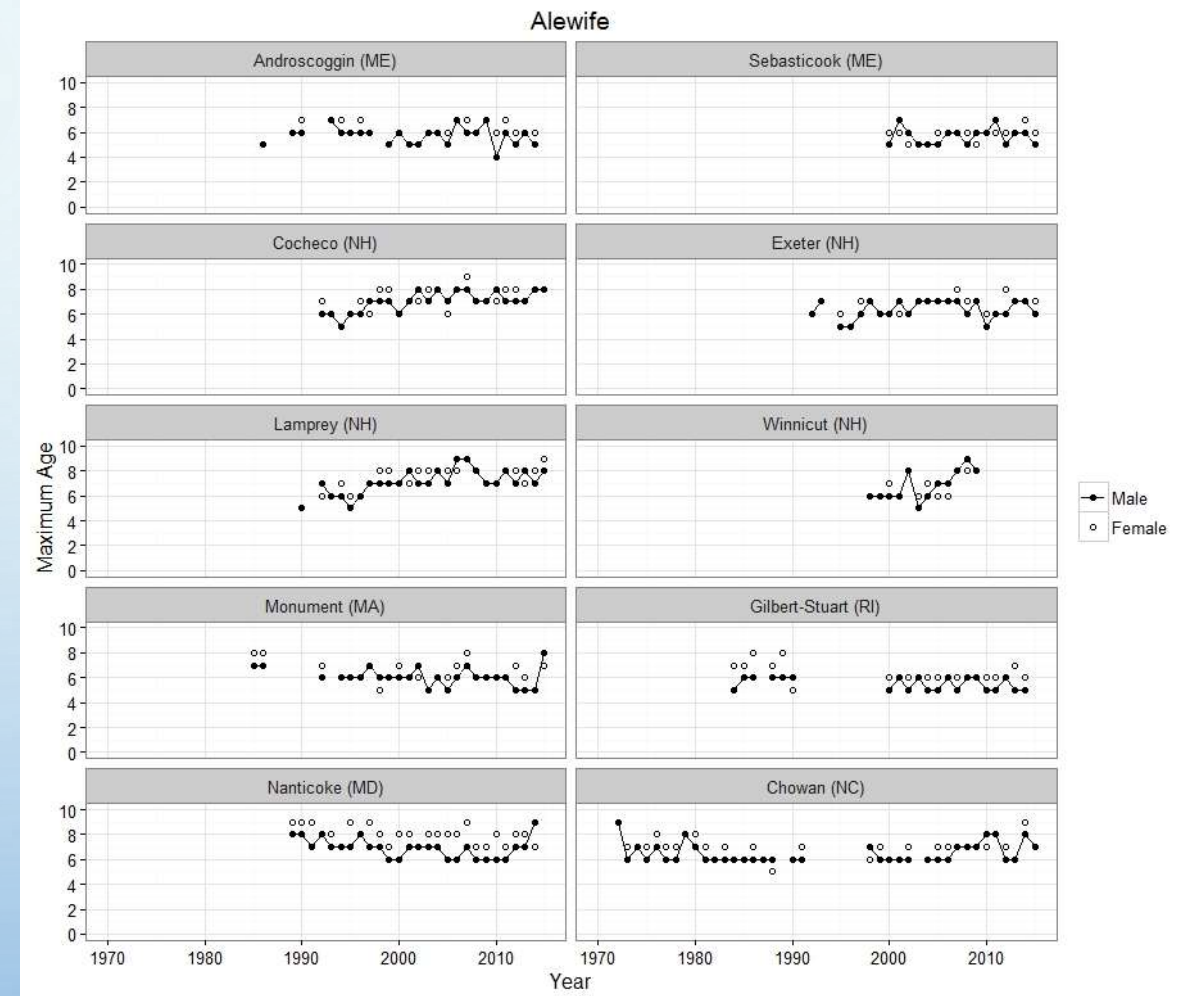
Date: 5/5/15	Time: 6:51	Weather: Nice					
Multiple Tube Counts:	Battery Status:	Air Temp: Water T:					
CT1 199 CT2 81 CT3 97 CT4 191 CT5 70 CT6 59 CT7 64 CT8 73							
Multiple Tube Total: 524	Tunnel water level: fully submerged / wave action issues / partially submerged						
Head Pond Elevation: lower than							
Comments: water isn't flowing over the dam - more debris is around counter							
Date: 5/8/15	Staff: BG/DMF	Time: 11:33					
Multiple Tube Counts:	Battery Status: CHARGED	Weather: Sunny					
CT1 1880 CT2 964 CT3 1021 CT4 1489 CT5 1794 CT6 967 CT7 995 CT8 1599	Air Temp: 15	Water T: 20					
Multiple Tube Total:	Tunnel water level: fully submerged / wave action issues / partially submerged						
Head Pond Elevation:							
Comments: NO PASSAGE OF DEBRIS BUILDUP. DEBRIS ON SURFACE TO TUBES, Several fish							
3 tests @ 113 CENSOR COUNT							
Date:	Staff:	Time:	Weather:				
Multiple Tube Counts:	Battery Status:	Air Temp:	Water T:				
CT1	CT2	CT3	CT4	CT5	CT6	CT7	CT8

MANY WAYS TO SCALE A FISH?



VISUAL COUNTS

- Visual methods, even those based on Rideout or Nelson, are statistical extrapolations of a limited number of observations.
 - Almost never include night observations
 - Limited evidence suggests distribution of herring migratory movements vary among systems
- Visual counts are an appropriate index for local knowledge, limited management, and wonderful tools for community outreach and stewardship.
- Interstate management requires high accuracy, high quality, and long time series



PICKING A TECHNOLOGY: SR-1601 ELECTRONIC RESISTIVITY COUNTER

ADVANTAGES

- Real time count
- 24-hr count
- Adaptable to runs of all sizes
- Low power requirements
- Not affected by turbidity
- Good for outreach
- Low long term costs

DISADVANTAGES

- Cannot determine fish species
 - Good for rivers dominated by river herring without larger fish of concern
- Moderate initial cost (12-15k)
- Sensitive to fluctuations in conductivity, flow
- Can bottleneck migrations if not properly installed and maintained or under high volumes of passage

PICKING A TECHNOLOGY: VIDEO

ADVANTAGES

- 24 hr count (using IR light)
- Can speciate many fish
- Can operate in presence of all species
- Great for outreach
- Should not bottleneck migrations

DISADVANTAGES

- Count 'lag'
- High investment in processing video to produce a count (100s of hours)*
- High power demands
- Sensitive to turbidity
- Difficult to count fish during periods of high passage volume
- Very time consuming to produce high confidence estimate of run size for migrations greater than 100,000 fish*

*Considering current state of technology and study.
Both problems being examined

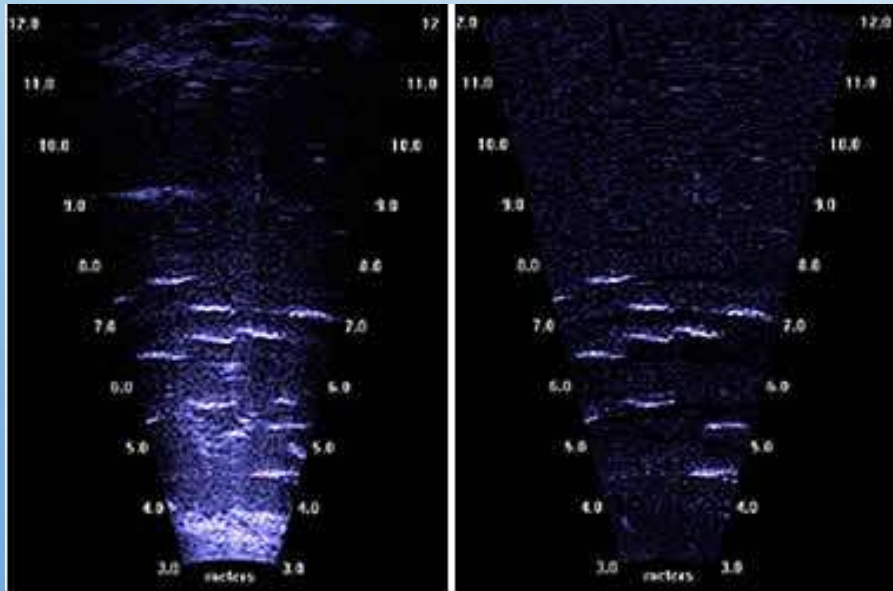
PICKING A TECHNOLOGY: ACOUSTIC/IR

ADVANTAGES

- 24 hr count
- Can speciate some fish
- Can operate in presence of all species
- Should not bottleneck migrations
- Not sensitive to water conditions

DISADVANTAGES

- Massive initial cost (~70k)
- Learning curve
- Count 'lag'
- High investment in processing images to produce a count (100s of hours)
- Difficult to count fish during periods of high passage volume



PICKING A TECHNOLOGY: WHAT IS APPROPRIATE AND FEASIBLE?

- Available staff hours and expertise?
- What species do you want to count?
- Are there larger bodied diadromous or resident species you are worried about blocking?
- How large is your run?
- What power sources are available?
- Water quality?

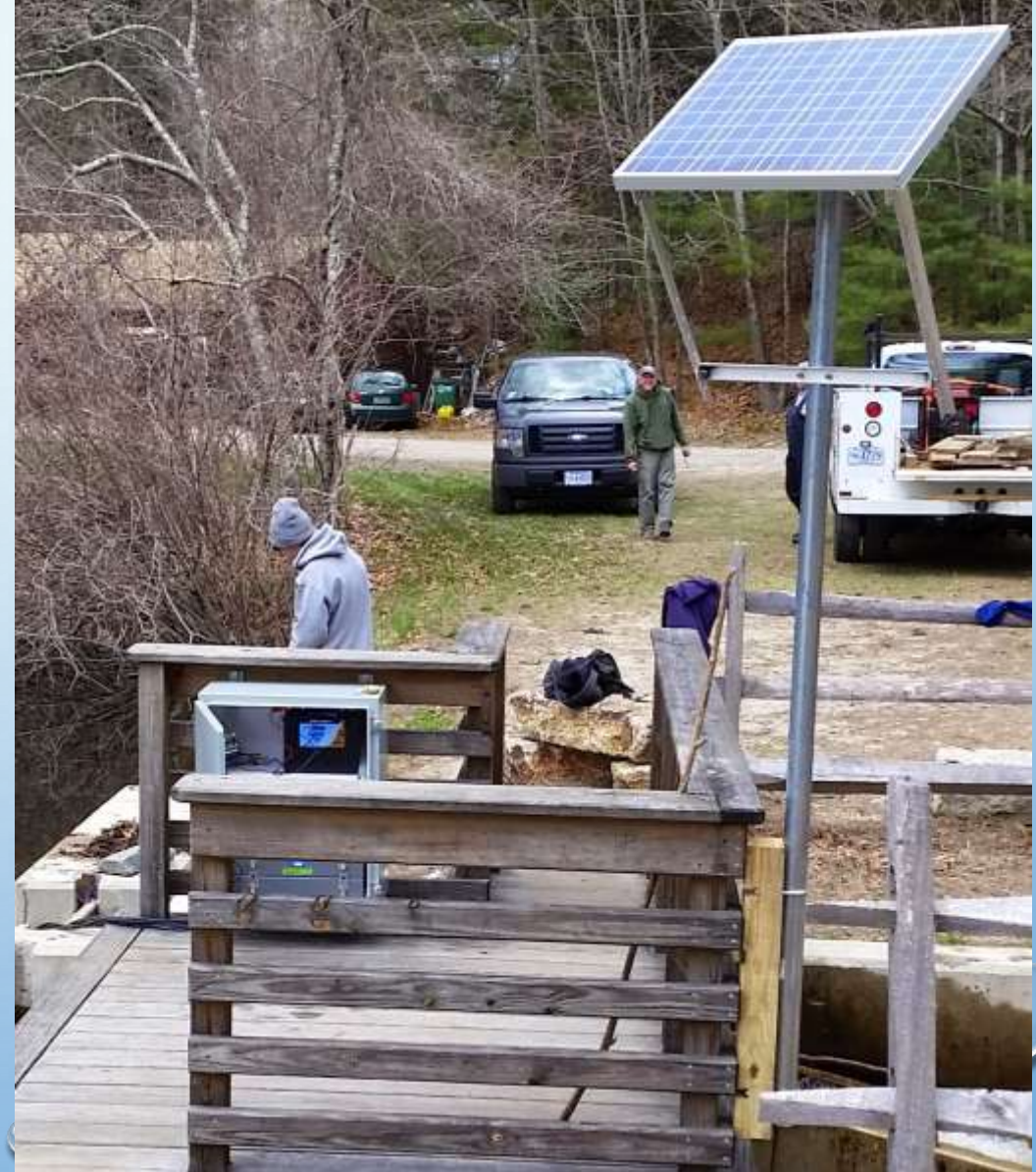
SR-1601 ELECTRONIC RESISTIVITY COUNTER

- Composed of two components:
 - Counter box
 - Array or 'head'
 - 4" PVC, 20" long, with 3 anodes.
- Attached to structure or open stream



SR-1601 ELECTRONIC RESISTIVITY COUNTER

- Can easily be powered by a combination of solar and battery or AC line to battery tender.
 - We recommend Group 24 battery (~75 Ah) and 50 watt panel
- **DO NOT HOOK DIRECTLY TO AC POWER!**



SR-1601 ELECTRONIC RESISTIVITY COUNTER

- The most important factors are linearity and velocity.
 - River herring migration, it is important to have a minimum of 100 fish per second.
 - Counter performance through the range of velocities can be affected by efficiency, accuracy, and velocity.
 - VELOCITY

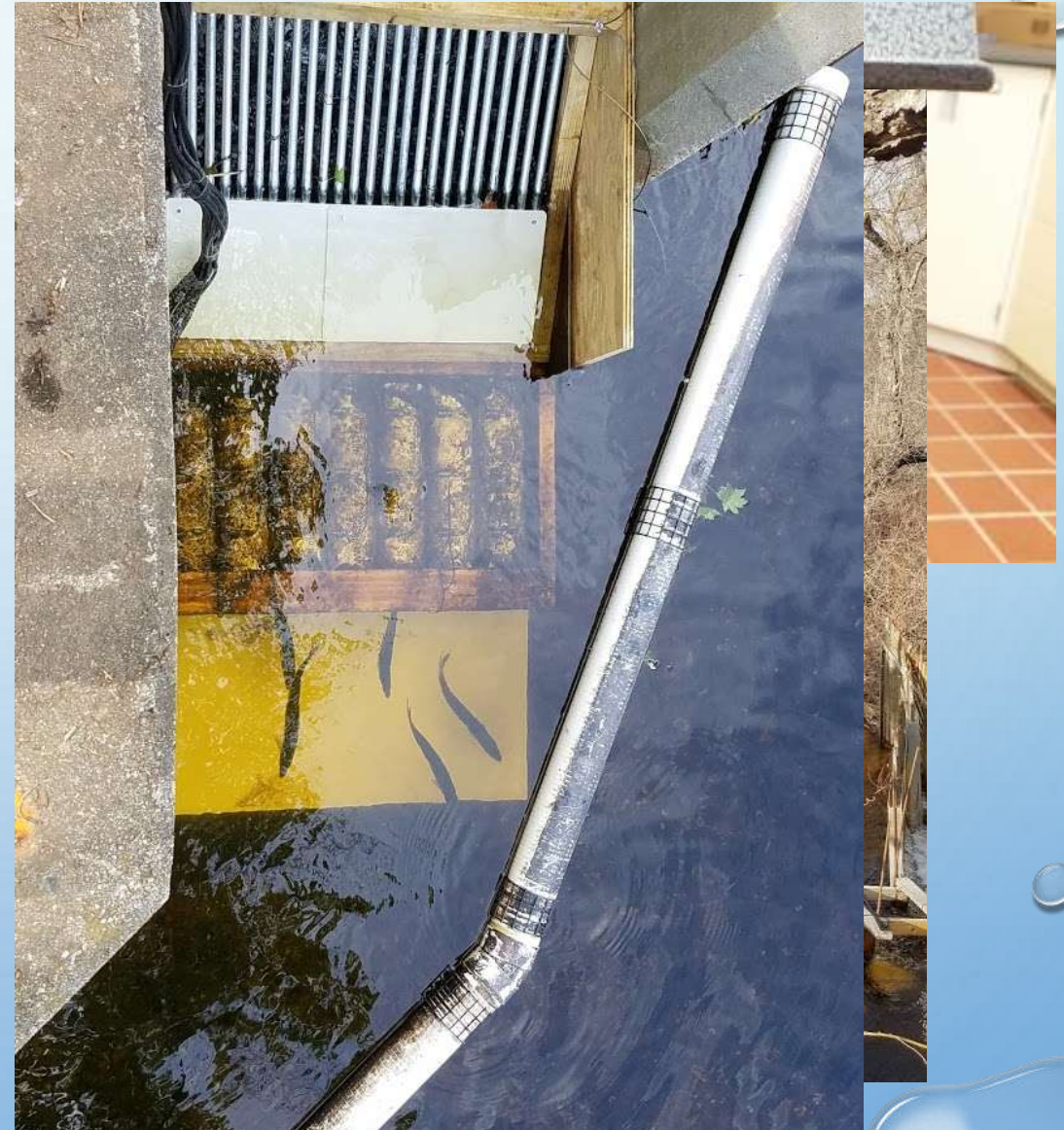


SR-1601 ELECTRONIC RESISTIVITY COUNTER

- Some thoughts on how many tubes should be used...
 - Flow, strong enough but not too strong, attracts and leads to quick passage through tubes.
 - A multitude of tubes will lower flow velocity and lead to many options for herring
 - 4 tube systems, over a decade of use, have been shown capable of passing >50,000 fish in 24hours and >400,000 in a migration season



SR-1601 ELECTRONIC RESISTIVITY COUNTER



VIDEO MONITORING SYSTEMS



VIDEO MONITORING SYSTEMS

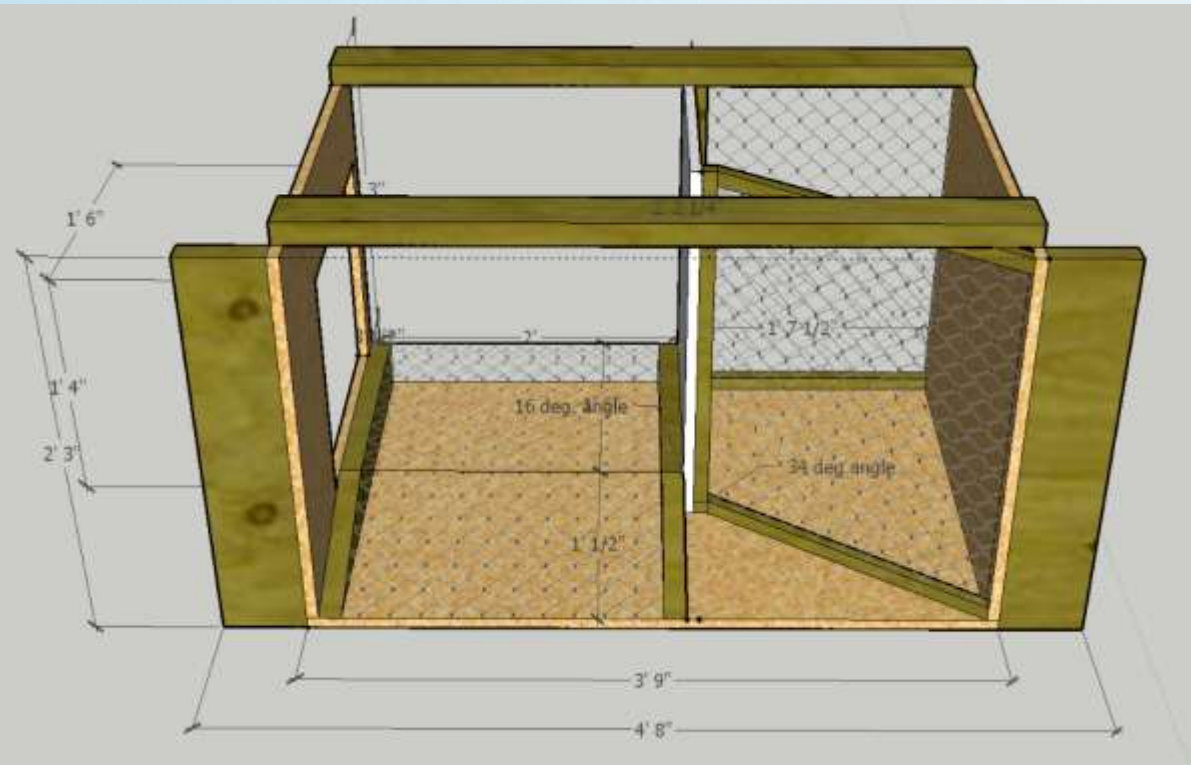
○ A marriage of two components:

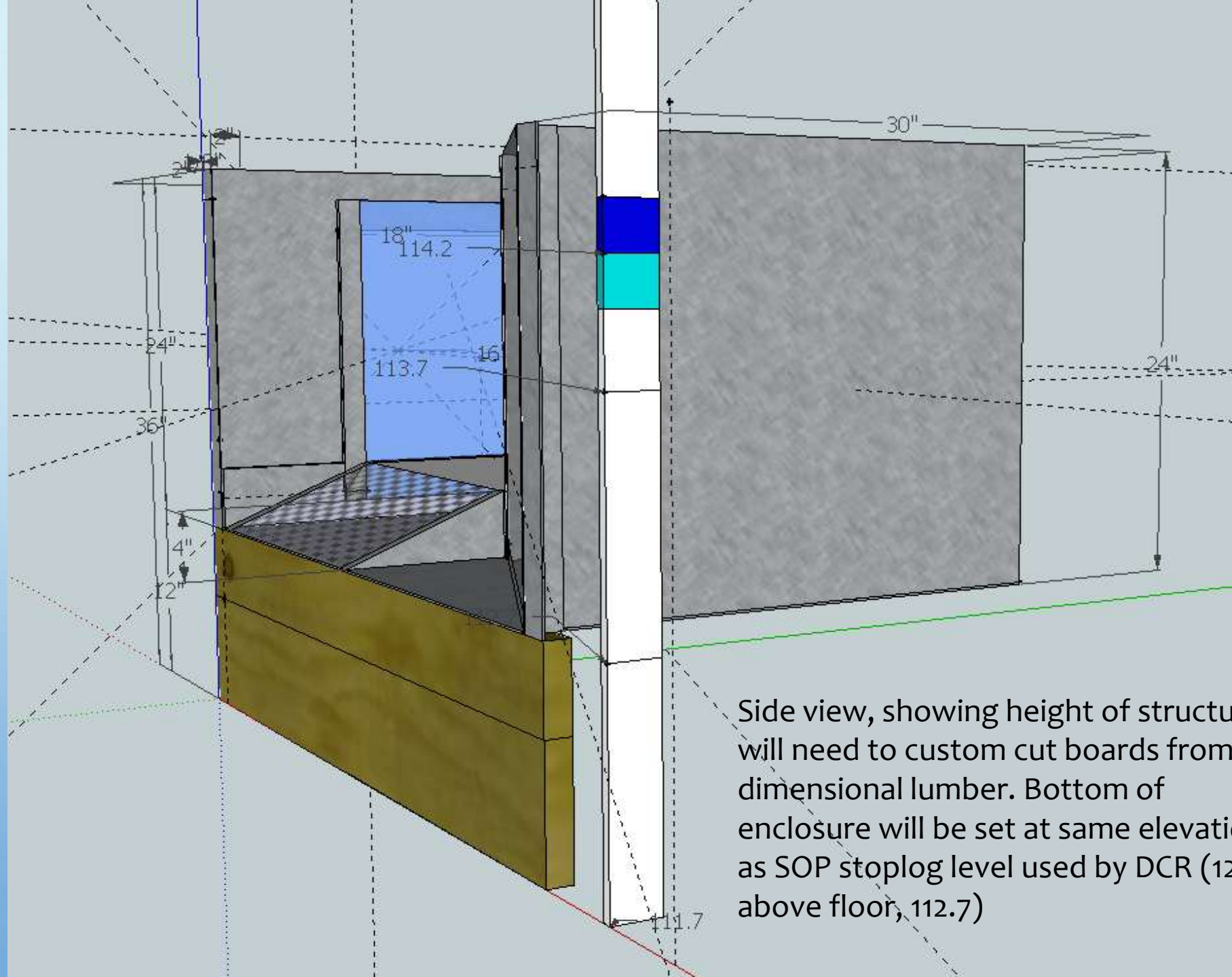
- Video camera and enclosure: Lighting source, dimensions, backdrop, field-of view
- Motion detection software: Salmonsoft or iSpy



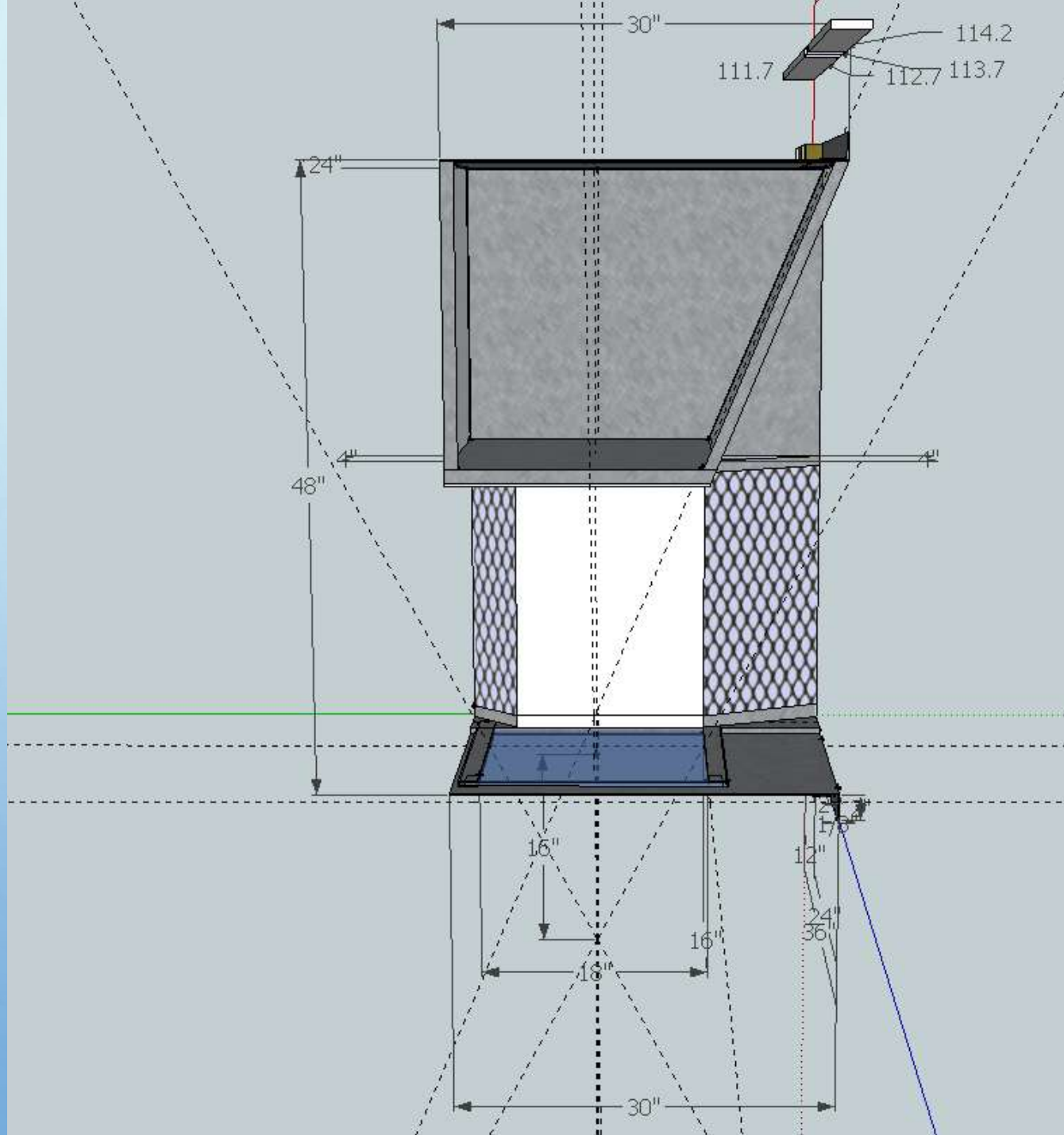
VIDEO MONITORING SYSTEMS: DESIGN

- Sketchup, a free 3-D modeling program, is an integral tool when planning a video install



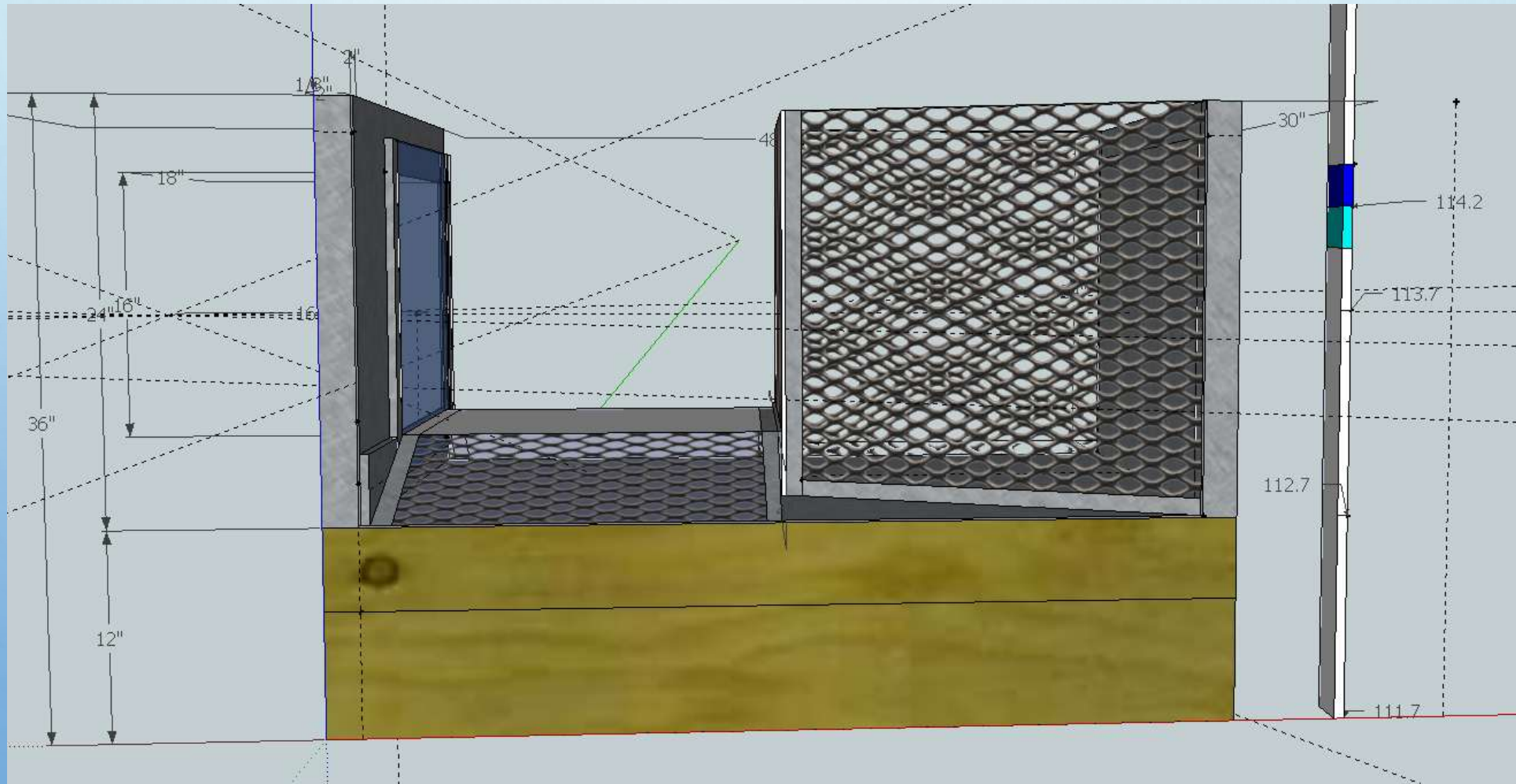


Side view, showing height of structure, will need to custom cut boards from dimensional lumber. Bottom of enclosure will be set at same elevation as SOP stoplog level used by DCR (12" above floor, 112.7)

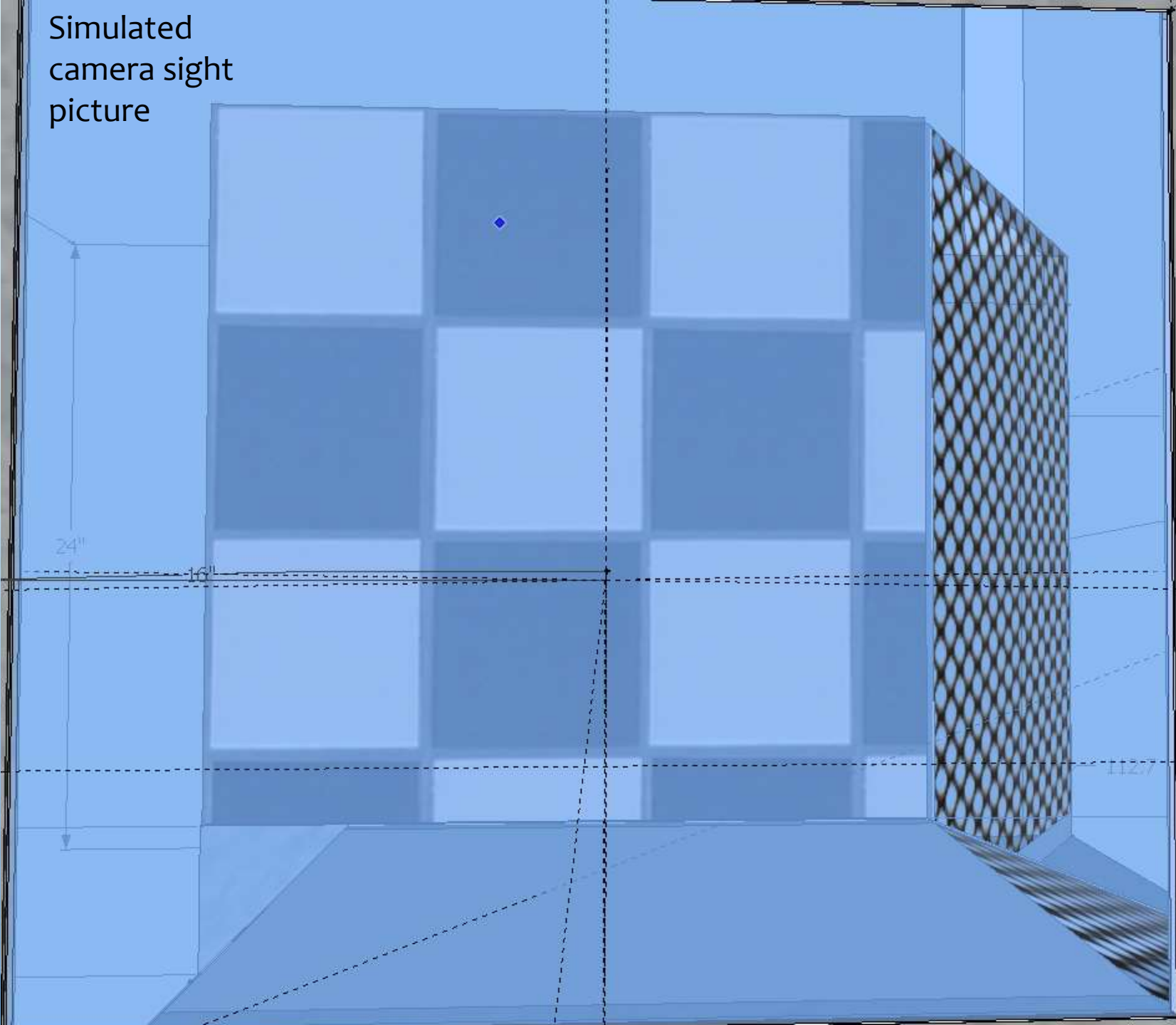


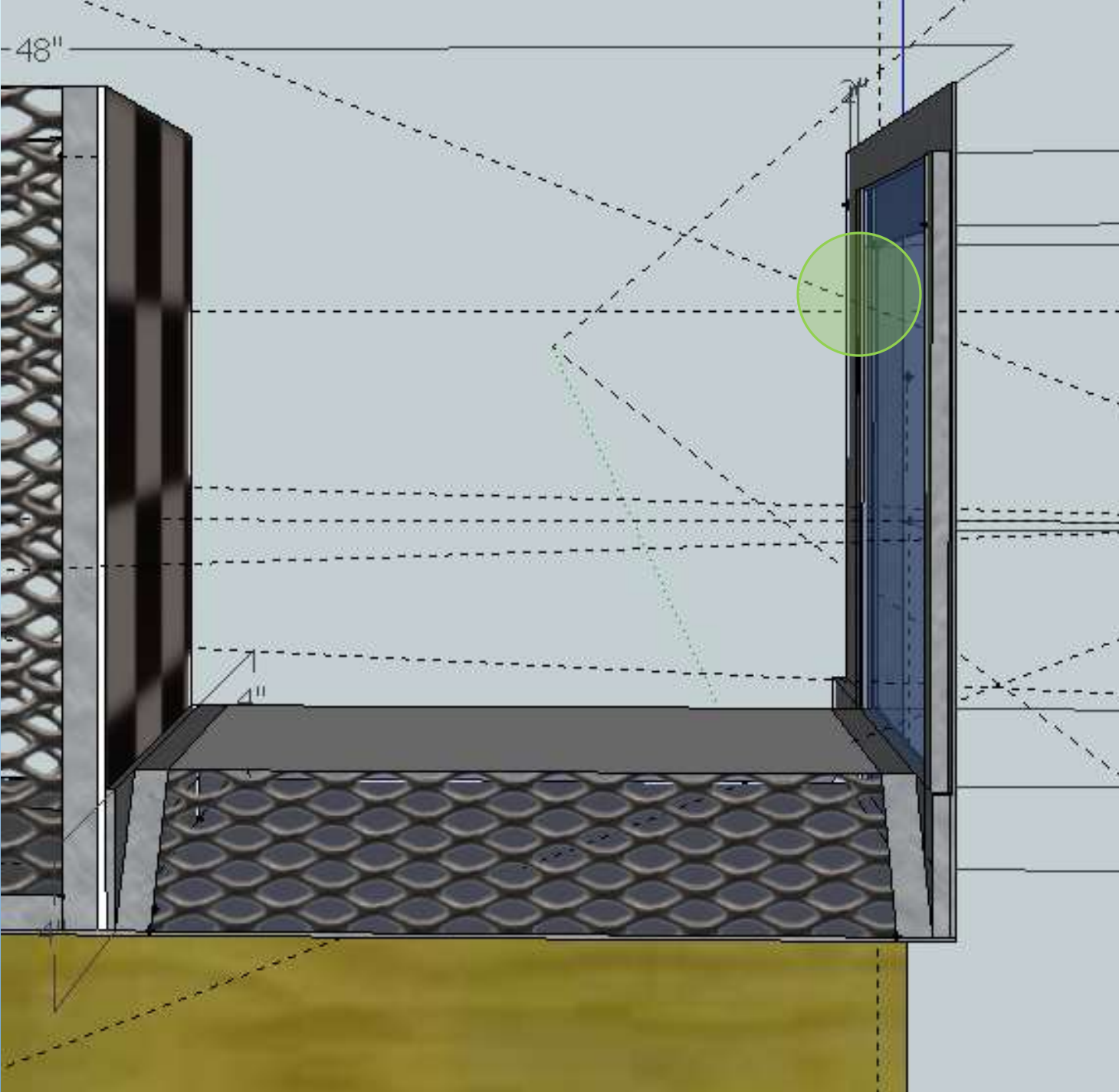
Over head view
 Flow from left to right
 Unit slides into current
 trash rack bracket and is
 completely external of
 fishway

- View looking upstream. Staff gage on right depicts target water elevation of 114.2' and theoretical operating range of 114.0'-114.4'
- Speed bump to bring fish up to camera viewing area/visual count board is 4" high.
- Visual count white board will measure 21" x 16" and have 14" of water over it at target water elevations.



Simulated
camera sight
picture





At target water elevations there would be no detection dead zone, an improvement over proposed design of 3/7/17

VIDEO MONITORING SYSTEMS: DESIGN



VIDEO MONITORING SYSTEMS: ENCLOSURE

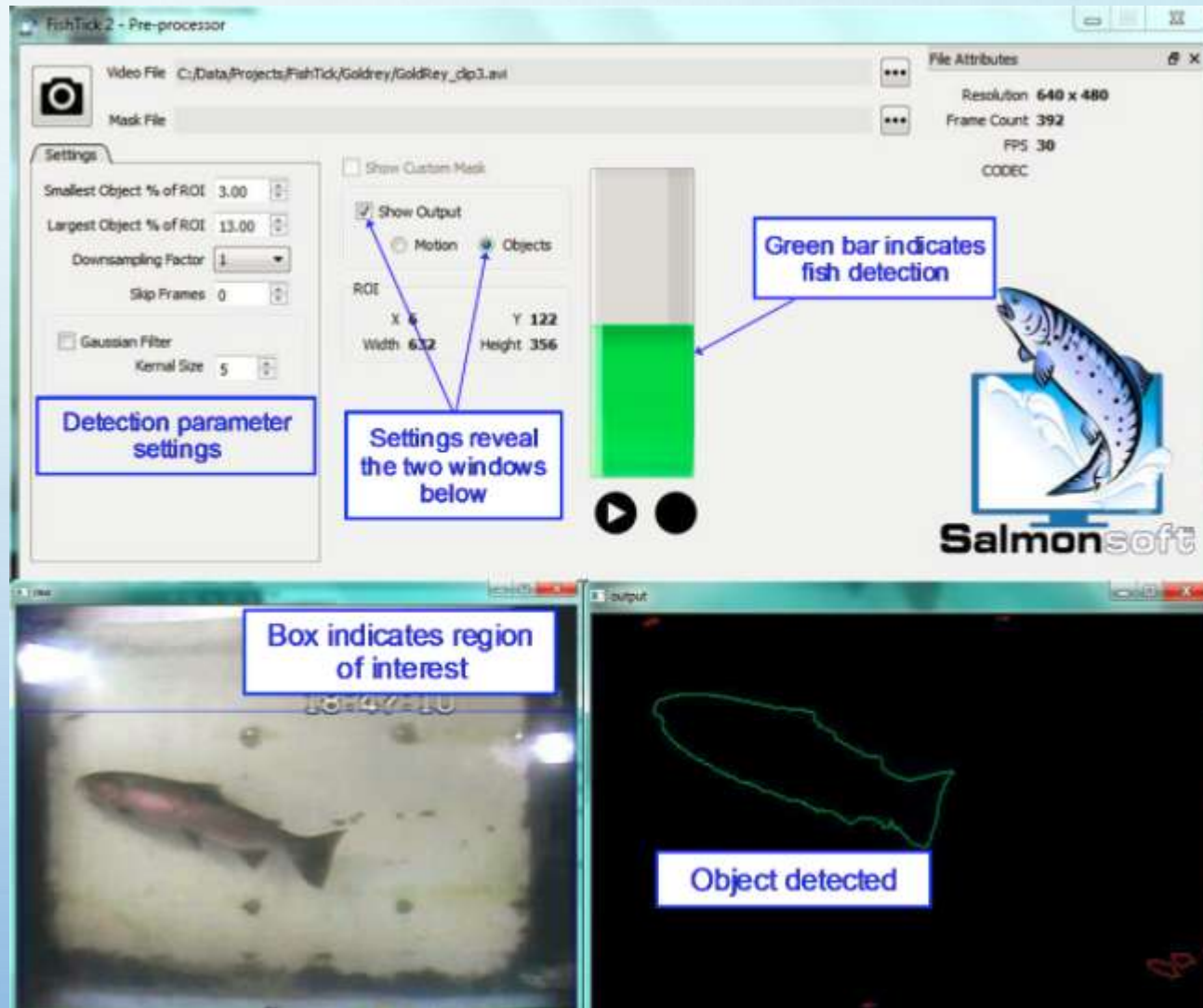
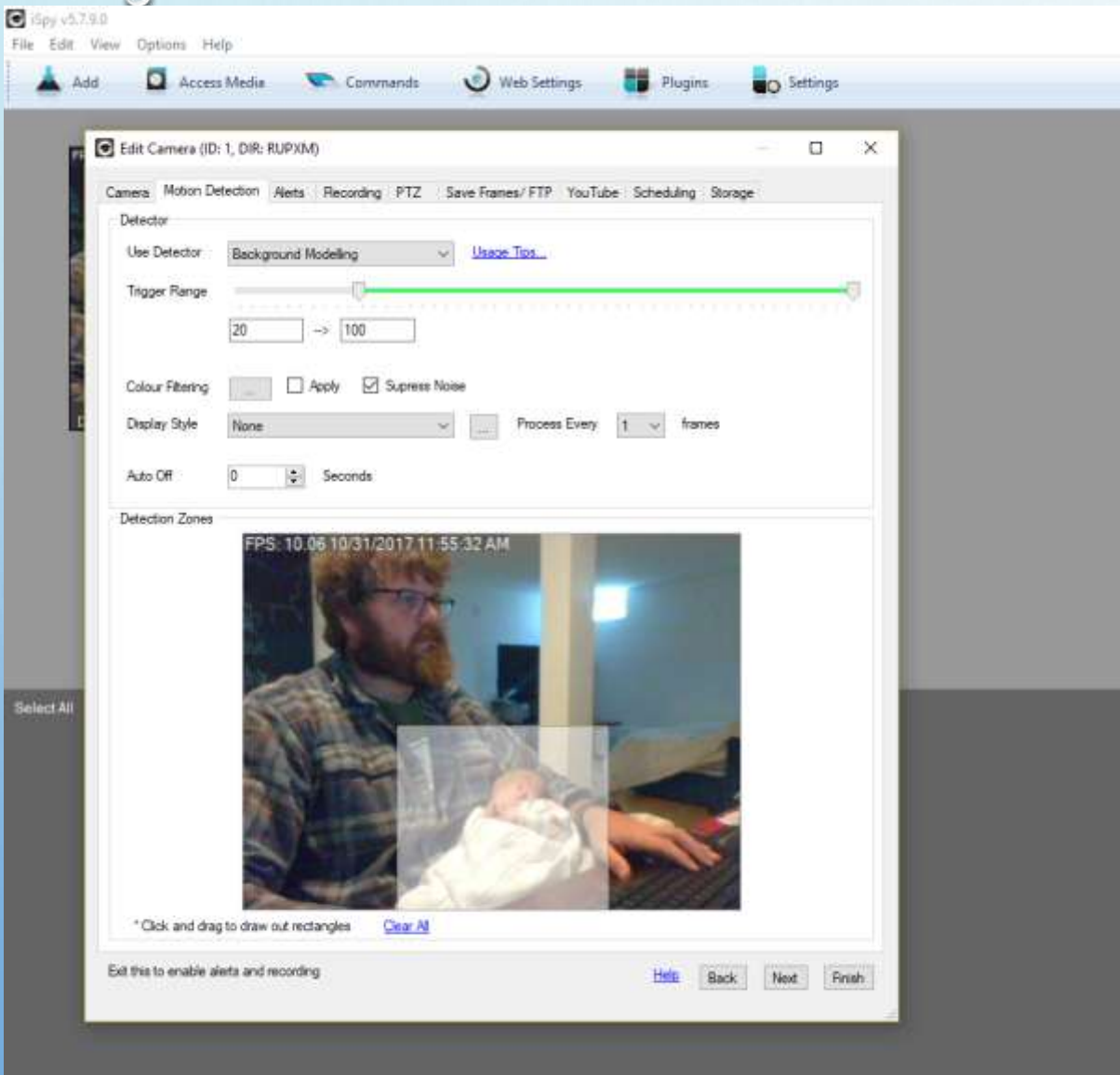
Enclosure checklist:

- Adequate shading, tight covers
- Good accessibility
- Partition between camera and viewing area
- Viewing background (3M 3930)
- Speed bump or riser
- Light source (Should be IR)

DMF CURRENTLY RECOMMENDS THE SEAVIEWER SEAD-DROP 950 (<\$1000)



VIDEO MONITORING: SOFTWARE



VIDEO SOFTWARE

iSpy

- FREE
- Highly customizable
- Low processing demand
- Each detection event gets a unique video
- No post-processing support, requires slightly more work on back end

Salmonsoft

- High cost (~5000?)
- Less customizable
- Low to moderate processing demand
- Creates video that combines independent detection events
- Includes separate program to count fish within, exports to Excel with time stamp and species ID

Neither software solves the need for several hundred hours of video review by trained staff

CONCLUDING THOUGHTS

- Implementing a successful electronic or video count requires a great deal of planning, expertise, resources, and dedication
- Poor location selection, design, or execution can have negative effects on migratory fish passage
 - Not all rivers are appropriate for these counts and poorly maintained counters will be removed and approval rescinded
- When properly designed and executed, can provide counts with >95% accuracy
- In the case of river herring, DMF recommends an ERC-first approach



WHAT, STILL INTERESTED?!?

- Contact myself or Brad Chase
 - DMF will happily provide technical advice and support
 - Any counting installation will need to be reviewed, approved, and permitted by DMF
 - High-value sites for state and inter-state management needs are prioritized
- Planning should begin now!
 - New installations require discussions, site visits, design, potential in river modifications, fabrication, ordering of equipment, etc...
- Guidance Document for all things river herring hopefully arriving in 2018!!!

Marine Fisheries
Commonwealth of Massachusetts



QUESTIONS?



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