Coastal GEMS Fact Sheet: Aquaculture Vulnerability Model

Description

Environmental conditions are not the only factors that affect shellfish aquaculture. Land use and local government zoning can impact current and future water quality conditions that would hamper an aquaculture growing operation. These maps, generated from a GIS based spatial model, illustrate varying degrees of shellfish aquaculture vulnerability based on physical, environmental, and land use practices.

Status The Aquaculture Vulnerability Model was completed in November, 2007

Citation

Berman, M.R. and T. Rudnicky, 2007, Aquaculture Vulnerability Model, Center for Coastal Resources Management, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

This data/tool can is directly accessible at:

http://ccrm.vims.edu/gis_data_maps/data/aquaculture_vulnerability_model.html

Contact Information

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Why should we care

Aquaculture is a multi-million dollar industry in Virginia with Virginia leading the nation in the production of clams grown in cultured environments. Most aquaculture in Virginia is located on the Eastern Shore, however, commercial operations are expanding on the western shore as well.

Aquaculture is an environmentally sensitive industry, which requires good water quality for successful growth and distribution for human consumption. Currently development and agricultural practices present the greatest threats. In the future, the potential conversion of land uses through regulated zoning at the local level poses a significant risk to the future of

aquaculture in Virginia. This project models the vulnerability of aquaculture to these stressors and presents the results in easy to understand maps.

Links for more resource information:

1) USDA Aquaculture Resources: http://afsic.nal.usda.gov/nal_display/index.php?info_center=2&tax_level=2&tax_subject=295&level3_id=0&level4_id=0&level5_id=0&topic_id=1410&&placement_default=0

2) VIMS Shellfish Aquaculture Status Report: http://www.vims.edu/adv/aqua/MRR2006_5.pdf

3) DEQ Position on Aquaculture: http://www.deq.virginia.gov/info/directorscorner.html

How is this resource managed?

For aquaculture, the regulatory structure is comprised of marine fisheries management, subaqueous lands management, terrestrial land use, water quality management, and as the end product is intended for human consumption, human health management. The Aquaculture Development Act (Va. Code §3.1-73.6 thru 3.1-73.8), identifies the Virginia Department of Agriculture and Consumer Services (VDACS) as lead agency for aquaculture. The pragmatic responsibility for aquaculture management has fallen to the agency responsible for the state owned bottomlands and marine fisheries, the Virginia Marine Resources Commission (VMRC). Statutory responsibility for Virginia waters' quantity and quality falls to the Department of Environmental Quality as administrator of the State Water Control Law.

Regulated Resource	**Regulatory Authority**
Commodity	Virginia Department of Agriculture and Consumer Services
Marine fisheries	Virginia Marine Resources Commission
Subaqueous Lands	Virginia Marine Resources Commission
Water quality	Department of Environmental Quality
Human health	Department of Health/ FDA
Land Use	Local Government

Links for more information on management of the resource: *(please include **up to 3** web links to agency regulations, giving each a name as above. Include one for each level of management – federal, state, and local – if possible, or more if there is more than one state or federal law/regulation or managing agency for the resource)*

VMRC: Mr. Jim Wesson jim.wesson@mrc.virginia.gov
http://www.mrc.state.va.us/regulations/regindex.shtm

VDACS: Mr. T. Robbins Buck robins.buck@vdacs.virginia.gov

VIMS: Dr. DuPaul dupaul@vims.edu
Mike Oesterling mike@vims.edu

DEQ water quality standards: Fecal coliform bacteria; shellfish waters
http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC25-260-160

Why was this data created? *(in paragraph form describe the people involved and the project that initiated the development of this data)*

Recent events in Virginia presented significant user conflicts between upland development and shallow water aquaculture to local, and state regulatory agencies. Through this series of events, the Coastal Policy Team (CPT) identified the need to address threats to aquaculture as one element within its strategic plan. Since earlier projects had already assembled baseline GIS data to model aquaculture suitability (VIMS Aquaculture Suitability Model), the CPT elected to use resources to enhance the existing model to reflect the impacts associated with land use and development on aquaculture vulnerability. In this second phase, industry professionals were consulted in the project development and review phases to gain an implementation perspective not previously considered.

Links to projects that funded this data:

1) Department of Environmental Quality – VA Coastal Zone Management Program
http://www.deq.virginia.gov/coastal/description/2006projects/92-01-06.html
2) Virginia Institute of Marine Science - Center for Coastal Resources Management
http://ccrm.vims.edu/gis-data-maps/data/aquaculture-vulnerability-model.html

How was this data created? *(in paragraph form, provide a brief metadata. Discuss incorporated datasets, project partners, basic methodology, and what the final dataset shows)*

A spatial model was developed that considered the following datasets: shoreline, salinity, bathymetry, shellfish condemnation zones (VA Department of Health) as an indicator of water quality, submerged aquatic vegetation (VIMS SAV, 2005), land use (National Land Cover Dataset (2001), and local government zoning for Gloucester, Accomack, and Northampton Counties in Virginia. Criteria were followed which spatially assembled data, scored polygon overlays, and ultimately ranked aquaculture vulnerability. The model considered a maximum depths of 2 meters, and used salinity parameters recommended by the scientific community for disease resistance. Land use and Zoning were ranked for their potential impacts to water quality, with the former reflecting current conditions and the later indicative of possible future scenarios. Buffers were used when appropriate to isolate regions with the greatest potential to impact receiving waters. Processing for the aquaculture models took place using ArcInfo Workstation

version 9.2. The final data sets illustrate the model output for Gloucester County and the Eastern Shore of Virginia. For each region, the shallow water (<2 meters) environment is ranked according to 5 levels of risk; risk level = 0 to risk level = 4. A risk level = 0 indicates no current or impending threats exist. Risk level = 1 indicates there is minimal risk to aquaculture. Risk level = 2 indicates there are existing water quality concerns. These are based on current land use within the designated buffers. Risk level = 3 indicates that local government zoning, if implemented could increase the risk to future or existing aquaculture. Finally, risk level 4 indicates that significant ecological conflicts are present. This include presence of submerged aquatic vegetation, salinity values are < 7 ppt or 15 ppt (for oysters and clams, respectively), or shellfishing is "prohibited" by the Virginia Department of Health's Division of Shellfish Sanitation.

Future Directions

At this time there are no plans to extend this model beyond the three targeted localities. At a minimum, the model should be run for all cities and localities where aquaculture production exists or can be expected to occur in the future. As Virginia begins to revisit policy of public oyster ground, the model will be run to identify vulnerability in the lower Rappahannock River.

Frequently Asked Questions

1) Q. Are there other places where I can view the Aquaculture Vulnerability Model?
   A. Yes, in Blue Infrastructure developed by VIMS (http://ccrm.vims.edu/blueinfrastructure/bi_intro.html)

2) Q. How does the Aquaculture Vulnerability Model (AVM) compare with the Aquaculture Suitability Model (ASM) developed by VIMS a few years ago?
   A. The ASM considered where areas could support aquaculture based on physical and biological parameters only. ASM also considered the conflict with SAV. The new AVM considers these factors but also takes into account the impact that land use and zoning has on the success of aquaculture.

3) Q. Where can I find more information about the impacts of land use on aquaculture?
   A. This Master's Thesis work by Matthew Strickler demonstrates the problems associated with upland development. The document also contains a recent bibliography of sources to review (http://www.vims.edu/library/Theses/Strickler07.pdf)