Research Digest
Issue No. 6 (January - March 2023)

VIMS | WILLIAM & MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE

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Message from the Associate Dean of Research and Advisory Services

The Research Digest has been on hiatus for the past year due to other pressing priorities in the Office of Research & Advisory. We're in the process of reviving the Digest and putting out back issues while gathering information on the latest published research by VIMS authors for future issues.

As with previous issues, the goal of the Digest is to promote broader awareness of the breadth of research conducted at VIMS. This issue contains peer reviewed research published in late 2022 or early 2023 that appeared in the Scopus database between January and March of 2023.

We look forward to highlighting and sharing more of VIMS' technical and scholarly research and hope that this Digest will continue to serve as a valuable source of information for the VIMS community, other researchers, and our external partners.

Mark W. Luckenbach, Associate Dean

Office of Research & Advisory Services
Virginia Institute of Marine Science
William & Mary

Title	Frequent storm surges affect the groundwater of coastal ecosystems
Author(s)	Nordio G., Frederiks R., Hingst M., Carr J., **Kirwan M.**, Gedan K., Michael H., Fagherazzi S.
Journal	Geophysical Research Letters 50(1): e2022GL100191
Link	https://doi.org/10.1029/2022GL100191
Summary	Various processes that regulate the strength of the coastal carbon sink are generally offsetting. For example, salinization of freshwater ecosystems reduces methane emissions, and offsets the loss of carbon sequestration in submerging marshes and forests.

Title	Sensitivity of the relationship between Antarctic ice shelves and iron supply to projected changes in the atmospheric forcing
Author(s)	Dinniman M.S., **St-Laurent P.**, Arrigo K.R., Hofmann E.E., van Dijken G.L.
Journal	Journal of Geophysical Research: Oceans 128(2): e2022JC019210
Link	https://doi.org/10.1029/2022JC019210
Summary	This paper examines how future climate change will modify iron availability for algal photosynthesis in a region known to be a sink of atmospheric carbon dioxide.

Title	Spatiotemporal patterns in the ecological community of the nearshore Mid-Atlantic Bight
Author(s)	**Gartland J.***, Gaichas S.K., Latour R.J.
Journal	Marine Ecology Progress Series 704
Link	https://doi.org/10.3354/meps14235
Summary	Species assemblages inhabiting the nearshore Mid-Atlantic Bight, USA exhibit interannual patterns in relative abundance characterized by three common trends and shaped by winter sea surface temperature. Community spatial structure follows a north-to-south gradient with a distinct area of elevated biomass along Long Island, NY.

Title	Recommendations towards the establishment of best practice standards for handling and intracoelomic implantation of data-storage and telemetry tags in tropical tunas
Author(s)	Leroy B.; Scutt Phillips J.; Potts J.; **Brill R.W.**; Evans K.; Forget F.; Holland K.; Itano D.; Muir J.; Pilling G.; Nicol S.
Journal	Animal Biotelemetry 11(1): 4
Link	https://doi.org/10.1186/s40317-023-00316-3
Summary	Best practices for implanting archival (data-storage) and telemetry (acoustic and radio) tags in the peritoneal cavity of tunas using laparotomy are described in this paper. These tags provide data on the behavior and physiology of fishes and their immediate environment. Specific procedures were developed during multiple tagging programs across the Pacific.

Title	Hard-bottom habitats support commercially important fish species: A systematic review for the North Atlantic Ocean and Baltic Sea
Author(s)	Flávio H., **Seitz R.**, Eggleston D., Svendsen J.C., Støttrup J.
Journal	PeerJ 11: e14681
Link	https://doi.org/10.7717/peerj.14681
Summary	Hard-bottom habitats can include boulders, cobble, and artificial habitats, which can provide ecosystem services. In this study, we systematically reviewed the relationships of various hard-bottom habitats to individual commercially harvested fish species. Hard-bottom habitats were generally better than surrounding habitat types, especially for biomass, density, feeding, and spawning of cod.

Title	Road network analyses elucidate hidden road flooding impacts under accelerating sea level rise
Author(s)	**Mitchell M.**, **Hendricks J.**, **Schatt D.**
Journal	Frontiers in Environmental Science 11: 1083282
Link	https://doi.org/10.3389/fenvs.2023.1083282
Summary	This study showed that inaccessibility of roads and properties due to road flooding increased nearly twice as much as would be suggested by the length of flooded roads. Overall, vulnerability of a locality was primarily dependent on its elevation; however, the redundancy of the road network appears to affect the rate at which properties became inaccessible.

Title	A marsh multimodel approach to inform future marsh management under accelerating sea-level rise
Author(s)	**Mitchell, M.**, **Nunez, K.**, **Herman, J.**, **Tombleson, C.**, **Mason, P.**
Journal	Ecological Solutions and Evidence, 4(4), art. no. e12285
Link	https://doi.org/10.3389/fenvs.2023.1083282
Summary	The proper management of existing marshes and the conservation of lands for marsh migration requires a synthesis of factors affecting future marsh evolution. We worked with local and regional managers to inform the development of an ensemble methodology that uses results from multiple marsh models in conjunction with social, land use and environmental data to inform marsh management, conservation, and restoration under sea-level rise.

Title	pyShore: A deep learning toolkit for shoreline structure mapping with high-resolution orthographic imagery and convolutional neural networks
Author(s)	**Lv Z., Nunez K., Brewer E., Runfola D.**
Journal	Computers and Geosciences 171: 105296
Link	https://doi.org/10.1016/j.cageo.2022.105296
Summary	This study explores the application of deep learning to map shoreline armoring structures, focusing on computationally efficient techniques for semi-automated delineation from high-resolution imagery. The ResNet18-based Pyramid Attention Network (PAN) architecture achieved 72% overall accuracy, with 80% and 94% prediction accuracy for breakwaters and groins, respectively, enabling rapid processing of 1.5 kilometers of shoreline in 1.4 s (GPU) to 2.16 s (CPU) in simulated user environments.

Title	Prioritizing the protection and creation of natural and nature-based features for coastal resilience using a GIS-based ranking framework – an exportable approach
Author(s)	**Hendricks J., Mason P., Herman J., Hershner C.**
Journal	Frontiers in Marine Science 10: 1005827
Link	https://doi.org/10.3389/fmars.2023.1005827
Summary	We present a novel application of the least-cost geospatial modeling approach to generate inundation pathways highlighting landscape connections between natural and nature-based features (NNBF) and vulnerable infrastructure. Inundation pathways are also used to identify target areas for NNBF restoration or creation. Project outputs are available via an interactive map viewer and can be customized for application in any community to identify high-priority NNBF.

Title	Enhancing assessments of blue carbon stocks in marsh soils using Bayesian mixed-effects modeling with spatial autocorrelation – proof of concept using proxy data
Author(s)	**Chiu G.S.; Mitchell M.; Herman J.; Longo C.; Davis K.**
Journal	Frontiers in Marine Science 9:1056404
Link	https://doi.org/10.3389/fmars.2022.1056404
Summary	Organic carbon stored in marsh soils, or blue carbon (BC), makes marshes a critical conservation target. For robust characterization of spatial variability of carbon, we employ Bayesian linear mixed modeling, with spatial autocorrelation, to predict organic matter (a proxy for carbon) by marsh characteristics.

Title	The roles of tidal marshes in the estuarine biochemical processes: A numerical modeling study
Author(s)	**Cai X., Shen J., Zhang Y.J., Qin Q., Linker L.**
Journal	Journal of Geophysical Research: Biogeosciences, 128(2): e2022JG007066
Link	https://doi.org/10.1029/2022JG007066
Summary	A marsh model, which simulates the ecological functions of marshes at tidal, seasonal, and annual time-scales, is embedded inside SCHISM-ICM. This tidal marsh model simulates the growth and metabolism of the tidal marshes and links biological processes to nutrient dynamics in the water column and sediment. The entire coupled modeling system dynamically simulates nutrient recycling and physical transport of the materials between marshes and open water through wetting-drying processes.

Title	Evaluating thin-layer sediment placement as a tool for enhancing tidal marsh resilience: A coordinated experiment across eight us national estuarine research reserves
Author(s)	Raposa K.B., Woolfolk A., Endris C.A., Fountain M.C., Moore G., Tyrrell M., Swerida R., **Lerberg S.**, Puckett B.J., Ferner M.C., Hollister J., Burdick D.M., Champlin L., Krause J.R., Haines D., Gray A.B., Watson E.B., Wasson K.
Journal	Estuaries and Coasts 46: 595-615
Link	https://doi.org/10.1007/s12237-022-01161-y
Summary	Thin-layer placement of sediment (TLP) is an emerging strategy to protect tidal marshes threatened by rising seas. A research team, led by the National Estuarine Research Reserve System (NERRS), tested the use of TLP at eight Reserves and developed guidance to inform future research and restoration projects using this technique.

Topic(s)	**Aquaculture**
Title	Development and evaluation of high-density snp arrays for the Eastern oyster *Crassostrea virginica*
Author(s)	Guo X., Puritz J.B., Wang Z., Proestou D., **Allen S., Jr.**, Small J., Verbyla K., Zhao H., Haggard J., Chriss N., Zeng D., Lundgren K., Allam B., Bushek D., Gomez-Chiarri M., Hare M., Hollenbeck C., La Peyre J., Liu M., Lotterhos K.E., Plough L., Rawson P., Rikard S., Saillant E., Varney R., Wikfors G., Wilbur A.
Journal	Marine Biotechnology 25: 174-191
Link	https://doi.org/10.1007/s10126-022-10191-3
Summary	SNP markers are a type of genetic marker that can track pedigree in a highly efficient and accurate way. As such, SNPs can be used to assist selective breeding. A consortium of laboratories on the east coast has developed this tool for breeding our native species of oyster.

Topic(s)	**Management & Policy**
Title	Clearance of biodegradable polymer and polyethylene films from the rumens of holstein bull calves
Author(s)	Galyon H., Vibostok S., Duncan J., Ferreira G., Whittington A., **Havens K.**, McDevitt J., Cockrum R.
Journal	Animals 13(5): 928
Link	https://doi.org/10.3390/ani13050928
Summary	Cows and other ruminants are indiscriminate grazers and can ingest plastic products such as haybale netting. Plastic ingestion is detrimental to animal health and is a growing concern in the agricultural community. Replacing conventional plastics with biodegradable polymers can decrease plastic accumulation in animals and reduce plastic ingestion health issues.

Topic(s)	**Marine & Estuarine Ecology**
Title	Temporal variability of microbial response to crude oil exposure in the northern Gulf of Mexico
Author(s)	Brock M.L., Richardson R., Ederington-Hagy M., Nigro L., **Snyder R.A.**, Jeffrey W.H.
Journal	Frontiers in Ecology and Evolution 11: 1096880
Link	https://doi.org/10.3389/fevo.2023.1096880
Summary	Shifts in the bacteria community will occur as microbes respond to an oil spill and the system recovers to pre-spill condition. Light exposure is often not included in experiments examining the effect of microbial degradation of crude oil, but chemical alterations from light exposure as would happen in nature can have significant effects on bacteria and their degradation of crude oil.

Topic(s)	Physical Oceanography
Title	Cross-shelf exchange associated with a shelf-water streamer at the Mid-Atlantic Bight shelf edge
Author(s)	Zhang W.G., Alatalo P., Crockford T., Hirzel A.J., **Meyer M.G.**, Oliver H., Peacock E., Petitpas C.M., Sandwith Z., Smith W.O., Jr., Sosik H.M., Stanley R.H.R., Stevens B.L.F., Turner J.T., McGillicuddy D.J., Jr.
Journal	Progress in Oceanography 210: 102931
Link	https://doi.org/10.1016/j.pocean.2022.102931
Summary	Here, we quantify the influence of cross-shelf current flow in the Mid-Atlantic Bight.

Topic(s)	Resiliency
Title	Socioeconomic vulnerability and climate risk in coastal Virginia
Author(s)	Eghdami S., **Scheld A.M.**, Louis G.
Journal	Climate Risk Management 39(7): 100475
Link	https://doi.org/10.1016/j.crm.2023.100475
Summary	Property owners in VA who had applied for a shoreline modification permit were surveyed to understand related motivations and perceptions. While the ecological benefits of living shorelines were widely perceived, results suggest a need for increased education and outreach to communicate the protection and adaptation benefits of living shorelines.

Topic(s)	Shellfish, toxicology
Title	Mortality and histopathology in sheepshead minnow (*Cyprinodon variegatus*) larvae exposed to pectenotoxin-2 and *Dinophysis acuminata*
Author(s)	Gaillard S., Réveillon D., **Mason P.L., Ayache N.**, Sanderson M., Smith J.L., Giddings S., McCarron P., Séchet V., Hégaret H., Hess P., Vogelbein W.K.
Journal	Aquatic Toxicology 257: 106456
Link	https://doi.org/10.1016/j.aquatox.2023.106456
Summary	This study shows the negative effects of *Dinophysis* toxin pectenotoxin-2 (250 nM) on *Cyprinodon variegatu*s gills, leading to respiratory and osmoregulation alterations and mortality. The interaction between pectenotoxin-2 and actin is the potential cause for these damages. This study highlights the risk that *Dinophysis* blooms can cause to marine animals.

Topic(s)   Toxicology

Title   Sorption of representative organic contaminants on microplastics: Effects of chemical physicochemical properties, particle size, and biofilm presence

Author(s)   Cui W., **Hale R.C.**, Huang Y., Zhou F., Wu Y., Liang X., Liu Y., Tan H., Chen D.

Journal   Ecotoxicology and Environmental Safety 251: 114533

Link   https://doi.org/10.1016/j.ecoenv.2023.114533

Summary   Biofilm and size effects of microplastics on pollutants sorption were studied. Sorption isotherm results varied between chemicals or between polymer types. Significant correlations between chemicals' Log K_F and Log K_{ow} were observed. Particle size did not affect sorption isotherms but influenced the maximum sorption. Biofilms on polyethylene particles significantly enhanced contaminant sorption capacity.