

Marine Health Analytics

An AI-Driven Early Warning System to Safeguard Our Oceans and Coastal Economies

The Imminent Threat to Our Oceans

Climate change is accelerating the emergence and spread of marine diseases, threatening biodiversity, food security, sustainable aquaculture, and ultimately human health. Rising ocean temperatures, environmental degradation, pollution, and antimicrobial resistance are reshaping marine ecosystems, creating conditions that enable pathogens to spread more rapidly across wild and farmed populations.

Yet despite these growing threats, our response to marine diseases remains largely reactive. Most outbreaks are identified only after significant ecological or economic damage has already occurred, limiting opportunities for intervention. While advances in genomics, artificial intelligence, and molecular diagnostics have transformed disease surveillance in human medicine, equivalent systems for marine environments remain fragmented and underdeveloped.

Marine Health Analytics was established to close this critical gap. By bringing together researchers, veterinarians, molecular biologists, AI specialists, aquaculture partners, conservation organisations, and public-health experts, the initiative is building an integrated platform capable of detecting disease threats earlier, responding more effectively, and strengthening the resilience of marine ecosystems and coastal industries.

Project Overview

Marine Health Analytics is based within the Kadas Nexus for Blue Solutions at the Leon H. Charney School of Marine Sciences, University of Haifa—Israel's leading marine science institution. The programme brings together molecular biology, veterinary medicine, microbiology, artificial intelligence, environmental monitoring, and marine ecology into a single translational platform dedicated to improving ocean health.

The initiative operates across both wild and managed marine systems, integrating next-generation sequencing, microbiome analysis, antimicrobial resistance surveillance, AI-assisted pathology, and advanced bioinformatics to enable rapid, reliable disease detection and monitoring. Rather than studying individual pathogens in isolation, **Marine Health Analytics adopts a One Health approach that recognises the interconnected health of marine wildlife, aquaculture, coastal ecosystems, and human communities.**

The programme will develop rapid molecular diagnostic workflows for priority aquatic diseases, establish regional surveillance for emerging pathogens and antimicrobial resistance, create AI-assisted diagnostic tools for marine mammals and sea turtles, and generate predictive models linking climate stress, microbial communities, and disease emergence. These activities will support more effective disease management while providing governments, conservation agencies, and aquaculture producers with practical tools for evidence-based decision making.

Implementation will proceed in phased stages over three years, progressing from laboratory development and pilot studies to regional surveillance networks, operational deployment, and long-term monitoring. National and international collaborators will contribute expertise in veterinary medicine, molecular biology, aquaculture, wildlife conservation, artificial intelligence, and environmental health.

Project Impact

Marine Health Analytics will establish the region's first integrated marine disease monitoring and early-warning platform, providing the scientific infrastructure needed to identify and monitor emerging threats before they become ecological or economic crises.

The programme will improve disease surveillance across aquaculture, marine mammals, sea turtles, wild fish populations, and coastal ecosystems, while supporting more sustainable food production and reducing reliance on antibiotics. By combining molecular diagnostics with artificial intelligence and long-term environmental monitoring, the initiative will strengthen biodiversity conservation, improve ecosystem resilience, and advance the implementation of One Health principles throughout the Eastern Mediterranean.

Beyond its scientific contribution, the programme will position the University of Haifa as a regional leader in marine molecular diagnostics, aquatic animal health, and translational environmental research.

Expected Five-Year Outcomes

- Develop more than 20 rapid molecular diagnostic workflows for priority marine pathogens.
- Monitor disease dynamics across more than 25 marine species and aquaculture systems.
- Launch the Eastern Mediterranean's first integrated marine pathogen intelligence platform.
- Build comprehensive genomic and microbiome reference databases for emerging aquatic diseases.
- Train more than 80 graduate students, researchers, veterinarians, and environmental professionals.
- Generate policy recommendations supporting sustainable aquaculture, marine conservation, and One Health management.

Evaluation and Assessment

Programme performance will be evaluated through annual scientific and operational reviews, diagnostic performance metrics, surveillance coverage, research outputs, stakeholder engagement, and policy adoption. Assessment will include the number of diagnostic workflows established, species monitored, pathogens detected, scientific publications produced, partnerships developed, and management recommendations implemented.

External scientific advisors and institutional oversight will ensure rigorous evaluation while supporting continuous programme development and long-term impact.

Academic Leadership – Marine Health Analytics

Dr. Dan Morick – Veterinary Pathologist and Marine Wildlife Health Specialist

Research Interests: Marine wildlife pathology, aquatic animal health, emerging infectious diseases, antimicrobial resistance, marine mammal medicine, sea turtle conservation, and One Health.

Dr. Dalit Meron – Marine Microbiologist

Research Interests: Marine microbiomes, antimicrobial resistance, environmental microbiology, host–microbe interactions, and ecosystem resilience.

The programme is further supported by multidisciplinary teams across the Leon H. Charney School of Marine Sciences and the Kadas Nexus for Blue Solutions, as well as collaborating veterinary laboratories, aquaculture partners, and international One Health research networks.

Why Your Support Matters

Marine Health Analytics is supported by the University of Haifa's world-class research infrastructure and has benefited from competitive research funding across marine biology, microbiology, veterinary medicine, and environmental science. However, traditional research grants rarely support the integrated surveillance systems, artificial intelligence development, long-term monitoring, stakeholder engagement, and translational infrastructure required to transform scientific discoveries into practical marine health solutions.

Philanthropic investment provides the flexible support needed to bridge this gap, enabling the programme to respond rapidly to emerging disease threats while accelerating the deployment of technologies that protect marine biodiversity, strengthen aquaculture resilience, and improve environmental health.

Annual Budget

Item	Details	USD per annum
Personnel	Scientific leadership, veterinarians, molecular biologists, technicians, bioinformaticians, graduate fellowships	\$150,000
Laboratory & R&D	Sequencing, molecular diagnostics, microbiology, AI platform development	\$125,000
Field Operations	Marine wildlife response, aquaculture surveillance, environmental sampling	\$75,000
Communications & Programme Delivery	Stakeholder engagement, workshops, reporting, monitoring and evaluation	\$50,000
		\$400,000
Total		(1.6 million over 4 years)

Annual operating costs are approximately \$400,000, representing a total programme investment of \$1.6 million over four years. As the programme expands into a regional surveillance platform, additional infrastructure investment may be required. Opportunities exist for naming partnerships, endowed fellowships, laboratory sponsorships, surveillance programmes, and diagnostic innovation funds.

Giving Tiers

- \$1.6M Programme Sponsor (with the option to fund an initial one-year pilot)
- \$500K Marine Disease Surveillance Platform
- \$250K Molecular Diagnostics Fellowship
- \$100K Emerging Pathogen Research Fund

Sustainability

Marine Health Analytics will be sustained through institutional integration within the University of Haifa, competitive research grants, strategic partnerships with aquaculture and veterinary sectors, international One Health collaborations, service-based molecular diagnostics, and continued philanthropic investment. Together, these funding streams will support the programme's long-term role as a regional centre for marine disease surveillance, environmental health, and translational marine science.

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