



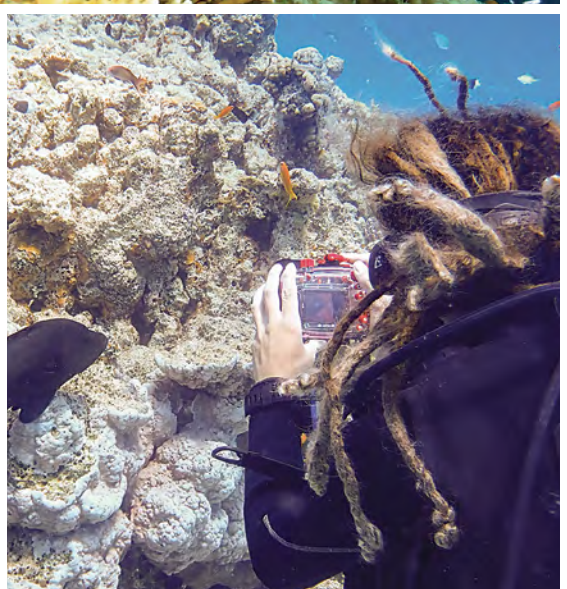
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Report of the National Steering Committee Reviewing the State of Marine Sciences in Israel

Executive Summary of the Committee Report

**Report of the
National Steering Committee Reviewing the
State of Marine Sciences in Israel**





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Expanded Summary of the Committee Report



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Expanded Summary

Background

The sea is a strategic national resource of every coastal state. This is especially true of Israel, whose economic waters (Exclusive Economic Zone – EEZ) are at least as great as its land, and whose geopolitical characteristics are those of an island state. The sea requires special attention in terms of research and exploitation of its resources because it is such a unique medium. Nonetheless, the State of Israel has yet to define and declare itself as a maritime state. As a result, it lacks the infrastructure and resources required for marine research to match the rising needs (food, water, energy, natural materials, and unique natural treasures) and stakeholders (users) in the marine environment. Israel stands unprepared to face the "Blue Revolution" that has already begun throughout the world. One of the UN's 17 Sustainability Development Goals (SDGs) is devoted entirely to "life below water". The sea plays a significant role in at least five other goals (no poverty, clean water, clean energy, climate, innovation). It is no surprise that the UN defined the current decade as the "Decade of Ocean Science for Sustainable Development" and the European Union recently earmarked one billion Euros for programs in which the sea comprises a significant part of sustainability.

According to the OECD (The Organisation for Economic Co-operation and Development) forecast, the ocean economy will grow twice as fast as the general economy. Marine sciences in Israel offer unexploited potential for promoting the state's economy and resilience (energy, food and water, pharmaceuticals, engineering technologies, national security, and more). For example, when natural gas deposits were discovered, it became evident that Israel lacks professional personnel, both in academia and in industry, in the fields essential for developing these deposits. Most of the finance, including for relatively simple tasks, such as monitoring the marine environment, was outsourced abroad. If Israel decides in the near future to build artificial islands, the lack of professional personnel will result in funneling most of the work related to feasibility checks to international companies, which despite their expertise, lack research experience in the eastern Mediterranean Sea and are less committed to sustainability in comparison to Israeli companies. In addition, there is no local investment in securing marine food sources and natural treasures, preventing environmental disasters, or in preparation for addressing incidents involving spills and contamination, as we witnessed in the recent (February 2021) tar spill (See picture in Chapter 1 page 14, Report in Hebrew).

The growing demand for marine resources necessitates innovation and sustainable usage, based on a deep environmental understanding and vision that will protect the sea's natural treasures for future generations. Nonetheless, we know more about the moon's surface than about the bottom of the sea or coastal ecosystems. There are significant knowledge gaps that must be narrowed before a sound, science-based utilization of marine resources is possible. An economic assessment of the benefits of marine sciences is essential, although complex. While assistance for planning, forecasting, and early outlining ways to resolve and handle crises does not yield

immediate profit, its value is enormous. Examples for that include developing models of contaminants' spread in the ocean, developing and building a Tsunami warning network and connecting it to a network of all Mediterranean countries, and preserving the Gulf of Eilat's unique coral reefs as a tourism resource and as a future source of natural materials and pharmaceuticals. It is not easy to measure the direct and immediate gain from such projects. However, their importance for the State of Israel is significant and includes the economic aspect, where billions of NIS are sometimes saved, and the security aspect (water does not recognize borders, and cross border contamination might shake the area's stability).

Based on the above, in January 2020, the Israel Academy of Sciences appointed The National Steering Committee in Marine Sciences with a mandate to map the current situation, assess the opportunities and gaps in marine science in Israel 2021, and formulate a national academic strategic program in the field of marine research.

The current situation in Israel

- * According to a questionnaire distributed by the Steering Committee, there are over 120 active faculty members in Israel whose research is connected to various marine science disciplines, ranging from the natural sciences and engineering to the social sciences and humanities. In this report, the term "Marine Science" encompasses all of these fields.
- * Marine science research is multidisciplinary and employs complex and expensive research infrastructure; marine science researchers work in most faculties at Israeli higher education institutions.

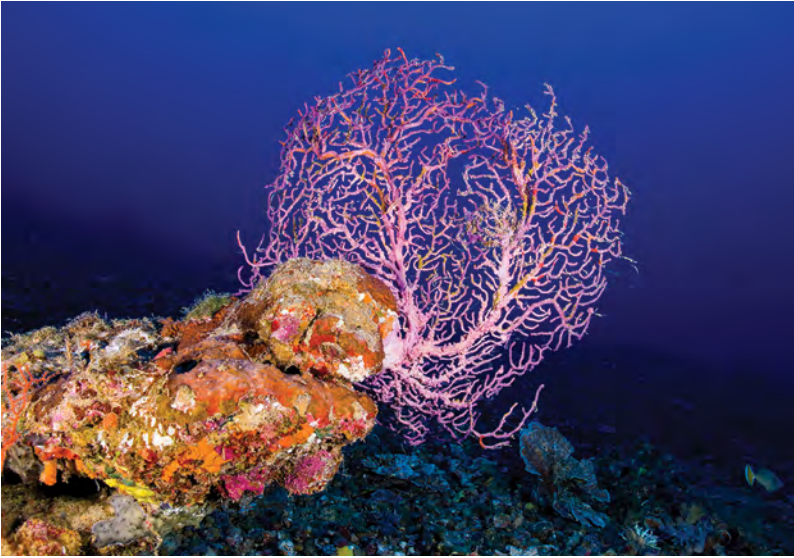
- * A number of institutions offer programs in marine science: the University of Haifa's School of Marine Sciences graduate degrees in marine geosciences, marine biology, marine technology, and marine archeology; the Hebrew University's oceanography graduate program and bachelor's degree in earth sciences / atmosphere-ocean-climate; Ben-Gurion University's marine biology and biotechnology program, and the environmental geology and hydrogeology track in the Department of Earth and Environmental Sciences; the Ruppin Academic Center bachelor's and master's degrees in marine science; and the Technion- Israel Institute of Technology graduate degrees in marine engineering. Other advanced courses for graduate degrees are conducted and offered as intensive courses at the Interuniversity Institute for Marine Sciences in Eilat (henceforth IUI) (about 15 per year, 500 students) and as one-semester courses in the various faculties.

- * The main infrastructure (roughly defined here as equipment costing over \$300,000 each, such as research boats and autonomous underwater vessels) for marine science research – exist at the IUI, at the Israel Oceanographic & Limnological Research Institute (IOLR) (which is not an academic entity), and at the Mediterranean Sea Research Center of Israel (henceforth MERCI) consortium (led by the University of Haifa). The NGO EcoOcean operates the MedEx Research Vessel equipped with a remotely operated vehicle (ROV). The infrastructure at the IUI is antiquated and requires significant upgrading, as evidenced recently in the wake of a strong storm. At MERCI, the lack of professional technical personnel and funds for maintenance and operations is delaying the deployment of marine infrastructure for ongoing activity.

- * The average scientific impact of Israeli researchers engaged in marine science is considerable, and their influence on the field is significant. The contribution of research from the Gulf of Eilat is especially salient in light of the small number of researchers, short coastline, and the increasing output of Mediterranean Sea studies. **In some fields of research, Israeli marine sciences researchers are pioneers and international leaders.**
- * Most of the research in recent decades has been conducted in shallow water (up to ~30 meters depth) due to the lack of infrastructure in Israel for deep-sea research. In recent years there has been more research in Israel's economic waters and beyond, using innovative technologies for deep-sea work.

Main impediments for developing the field in academia

- * Shortage of academic faculty members in marine science.
- * Lack of dedicated research budgets for the use of costly research infrastructures, such as boats, "sea days", and complex marine research.
- * Lack of critical research infrastructure (such as a wet laboratory for Mediterranean shores); there is a need to upgrade advanced research infrastructure in the Mediterranean Sea and the Gulf of Eilat.
- * A dearth of post-doctoral fellows and graduate students, scant exposure to the field in undergraduate studies, and inadequate awareness of employment opportunities.
- * Difficulty in recruiting and retaining top technical personnel due to the significantly lower salaries compared to those offered in the industry, and the lack of employment prospects hand.
- * Low industry involvement due to regulation, which leads to reduced industrial funding on one hand, and difficulty in transferring knowledge and training on the other.



Fan-shaped Gorgonia coral at a depth of about 50 meter in the Gulf of Eilat.
Photo: Hagai Nativ

The proposed vision for the academic development program and its objectives:

- * **Declaring Israel a maritime state** that views its future economic, scientific, and social resilience and development as dependent on understanding the marine environment and sustainable use of its marine resources as an important part of national sustainability programs.
- * Strengthening and sustaining Israel's standing, research capabilities, and academic excellence in the fields of basic and applied marine science.
- * Building leading academic infrastructure and establishing collaborations between government and industry to ensure the economic prosperity and security of the State of Israel in fields that rely on marine sciences.
- * Leveraging marine sciences as an instrument for strengthening international and regional ties (a bridge for peace).

- * Leveraging marine science to promote an innovation-oriented economy in Israel's geographic periphery. The field of marine sciences can serve as a catalyst for economic growth and is supremely important to the State of Israel in energy, food, water, pharmaceuticals, engineering technologies, national security, and more. Therefore, the academic program should be viewed as a first and essential step in developing a comprehensive national plan in collaboration with the Innovation Authority, the TELEM forum for National Research and Development Infrastructure, security forces, relevant governmental ministries (Defense, Economy and Industry, Finance, Energy, Transportation, Agriculture, Sciences and Technologies and Environmental Protection), and relevant industries.

In keeping with the Committee's mandate, the focus was put on the academic program. However, the Committee believes that to exploit the full potential of the sea, an extensive preparedness plan, on a national scale, incorporating other governmental bodies is necessary. The academic program will serve as the foundation for a broad national program encompassing all stakeholders. The success of this program will be a condition for expanding it into a comprehensive national effort. Therefore, the Committee sees an immediate need to support advanced research infrastructure and training programs to foster excellence and scientific leadership in the field.



The national marine research ship "Bat Galim". The equipment installed in it allows mapping, sampling and research of the water column, seabed and underground, and is a strategic asset for Israel. Photo: Dr. Gideon Tibor



Diagram 5.1 shows the levels of the organization and the impact of the National Program for Marine Sciences. It is adapted from Australia's five-year plan: the Integrated Marine Observing System (IMOS).

Diagram 5.1 illustrates the structure, operation, impact, and products of the Program. The National Program for Marine Sciences will be directed by a steering committee (the inner circle) and run in several institutions (universities and research institutes) with relevant expertise. **Users of the information** produced by the various infrastructure entities (institutions of higher education, government research institutes, government ministries, the defense establishment, and industry) will apply it for diverse purposes such as research projects, operative models for forecasting weather and sea conditions, teaching, facilitating inter-institutional and international partnerships, and technological innovation. This is needed for addressing the challenges such as sustainability, innovation, and climate change facing Israel as a maritime state. For more details on the various spheres of influence, see Chapter 5.

The Committee recommends focusing on a number of research topics vital for the State of Israel, which with a relatively small investment, will yield maximal benefit and world leadership:

- * Studying the interactions between the sea and global changes and adaptation to climate changes.
- * Sustainability and the sound use of marine resources are vital for Israel's resilience (biological diversity, food security, water desalination, energy, pharmaceuticals, artificial islands).
- * Characterizing and forecasting natural and anthropogenic risks (such as Tsunamis, contaminants, landslides, earthquakes, invasive species, salination) and their impact on developing sustainable urban shores.
- * Studying national treasures (such as the coral reefs, marine archeology, and the Dead Sea).
- * Studying the deep sea (such as processes, sea beds, and ecology).

With this vision in mind, the national marine academic program was formulated, from which the following recommendations were derived:

1. Broadening and strengthening the scientific and engineering community engaged in basic science and applied academic research in marine science; broadening the community by recruiting new faculty members, partnering with faculty members from other fields, and increasing the number of graduate students and post-doctoral fellows.
2. Expanding training in marine sciences and opening the field to students from advanced technological fields and students from the social sciences and the humanities. The training will also include dedicated technical staff for support in unique areas of technology.
3. Building the research infrastructure required for positioning the State of Israel as a leader in marine science; making this infrastructure available to researchers at higher education institutions and in industry; and offering the resources needed for conducting research that meet the competitive demands of innovation and excellence.
4. Developing academia-industry interfaces of academia and industry: sharing of research infrastructure, promoting collaborative work, knowledge sharing, and transfer, encouraging external investments in academic research in the field – all aimed at boosting the economic development of the State of Israel, as well as creating opportunities for the academic community.
5. Creating dedicated funding tracks (based on scientific excellence) for marine science to support a unique and expensive field of research that operates in a challenging medium.

The Committee recommends that a national steering committee will manage the marine program. In addition to the committee chair, it should include academic experts in the field of marine science (the majority of the committee), representatives of the Council for Higher Education's Planning and Budgeting Committee (PBC), and representatives of the Israel Academy of Sciences, as well as representatives of various relevant entities, such as the Innovation Authority, industry, the TELEM forum, and relevant government ministries.

The steering committee will be responsible for managing all of the large bodies of water around and within Israel (the Mediterranean Sea, the Gulf of Eilat, the Sea of Galilee, and the Dead Sea), thus facilitating the pooling of resources and optimizing coordination. In parallel, evaluation committees will be appointed for the different tracks, which will be detailed hereafter. The Marine Sciences Steering Committee recommends promoting legislation that would allocate a certain percentage of the state's revenues from the tax on gas and oil profits for the long-term development of marine science in Israel, as is customary in many states (for example, Denmark and Norway).



A 3.5 m long female dusky shark suited with an acoustic transmitter by the Apex Predator team of the MKMRS. The shark is swimming at the Hadera stream estuary, at a depth of 0.5 m, nearby the warm water effluent discharged from the Orot-Rabin power plant. Photo Hagai Nativ

Funding of the national marine academic program

In order to achieve these objectives, the Committee has formulated a development program that encourages academic excellence and focuses on a number of key channels. The greatest share of the budget, including funds earmarked for procuring and operating equipment and building new research infrastructure, will be allocated based on scientific excellence or salient public benefit. For additional details on the various channels, see Chapter 5.

- * Absorption academic and technical personnel. The Committee proposes that new personnel be admitted in a track similar to the Alon Scholarship, and after five years, will fill positions at institutions of higher education.
- * Establishing a fund for marine research that won grants in competitive research funding.
- * Establishing a fund for personal equipment for individual researchers who won grants in competitive funding.
- * Establishing a funding track for building and operating long-term (5-10 years) infrastructure (new and existing).
- * Support for the Inter-University Institute in Eilat and MERCI.
- * Establishing a teaching center: coordinating instruction in marine science between the various institutions and research centers; developing training programs and vocational training in collaboration with industry.

The total budget needed to carry out the program is estimated at 250 million NIS for five years, based on the following data. It is expected that the PBC and other sources will support channels B, E, and H. (For additional details, see Chapter 5).

| Channel | Objective/usage | Estimated Cost for 5 Years |
|--|--|----------------------------|
| A. Hiring new staff members | Employment of 25 new faculty members (with establishment of laboratories) | 50 million NIS |
| B. Marine research fund | Funding of "sea days" (research ship, ROV days, AUV days, technical diving, gliders, etc.) | 60 million NIS |
| C. Marine sciences research tracks | Interdisciplinary and long-term research | 10 million NIS |
| D. Personal equipment for personal research fund managed by ISF | Procuring laboratory equipment for personal grant-winning researchers | 10 million NIS |
| E. Long-run funding for heavy equipment, to be operated by a responsible institution for the benefit of all users | Procuring heavy equipment or establishing laboratories for the use of researchers from various institutions (for example: wet laboratory for the Mediterranean and a base for shore research) | 20 million NIS |
| F. The Interuniversity Institute for Marine Sciences in Eilat (IUI) | Upgrading (such as expanding the dorms) and maintenance of outdated infrastructure (sea water systems, drainage, electricity, etc.) | 25 million NIS (one-time) |
| G. The Interuniversity Institute for Marine Sciences in Eilat (IUI) & The Mediterranean Sea Research Center of Israel (MERC) | Day-to-day operation (expanding IUI budget and operational budget for MERC) | 35 million NIS |
| H. National level activities, management and reserve | <ul style="list-style-type: none"> * Increasing the number of leading excellent post-doctorate fellows arriving to Israel * Training of research students from different disciplines * National-level programs in collaboration with the industry/Israel Innovation Authority * Holding international conventions * International cooperation | 40 million NIS |

Total budget proposed for funding the national marine academic program

Timetable

The UN's Decade of Ocean Science for Sustainable Development began this year (2021), and the European Union has adopted the Green Deal plan. In order to achieve the maximal benefit from the program proposed by the Committee, it is essential to start implementing it as soon as possible by **immediately forming the steering committee and determining the allocation of funds in the various tracks.**

The following examples illustrate that strategic foresight and the decision to support academic excellence in the field of marine science in Israel are vital and that it does not require much time to generate a significant improvement in scientific output and its impact on society and the economy.

- * The Red Sea Research Center was established at the King Abdullah University of Science and Technology (KAUST) to utilize marine resources and was based on a strategic decision to become a world leader in this field. Since its inception in 2009, and with the allocation of appropriate resources (including the recruitment of outstanding researchers, students, and infrastructure), it has become a world-renowned center of excellence (#43 in the 2020 Shanghai oceanographic ranking).
- * The Australian Research Council, acting on behalf of the Australian government, established the Center of Excellence for Coral Reef Studies in 2005. Six universities and research institutes are members of the center. Through these universities, the center has mobilized dozens of scientists, post-doctoral students, and other students to become a leader in the field (number of scientific articles) and a hub of knowledge and excellence. Prof. Yossi Loya (IASH member, Tel-Aviv University and member of the Steering Committee) chaired the Scientific and Management Committee of this Center from 2005 to 2014.

- * The king of Jordan recently announced a plan to significantly upgrade the marine laboratory in Aqaba, including constructing a new facility. The plan comes in the wake of studies (most of which were conducted in Israel) on the uniqueness of the coral reef in the Gulf of Eilat. The kingdom plans to build a state-of-the-art laboratory for studying the Gulf of Eilat/Aqaba.

The Committee believes that implementing the national program will propel the field of marine science in Israel from stagnation to innovation and the formation of new partnerships. The Committee believes further that the program will lead to additional financial support from various bodies beyond the first five years of the program and constitute a significant contribution (scientific and economic) to the State of Israel. See Chapter 5 for more details of the program.



Fishy courtship A male (upper one) Bluetail trunkfish wooing the female (lower one) in the Gulf of Aqaba and Eilat, Red Sea. Photo Dr. Tom Shlesinger



