UGOT OCEAN

Excellent multidisciplinary research and coordinated societal collaboration for ocean sustainability

Abstract

The "UGOT Ocean" profile area addresses today's urgent ocean sustainability challenges by providing an excellent and multidisciplinary science base for the transformative governance and management needed to guide an innovative and sustainable use of ocean resources. It aspires to make important contributions to the global roadmap for marine research- and infrastructure development described in the UN Decade of Ocean Science. UGOT Ocean offers unique preconditions to further strengthening existing and emerging nodes of excellent multidisciplinary research, strategic investments in research infrastructure and cross-faculty coordination, as well as broad range of collaborative platforms for inclusive, transdisciplinary research.

Research Plan

The UN Decade of Ocean Science for Sustainable Development 2021-2030 (Ocean Decade) has made a global call for "The science we need for the ocean we want", emphasizing an ambition of an integrated, transdisciplinary, and globally upscaled ocean science for sustainable change. UGOT scholars is already contributing to the Ocean Decade, and the profile area will substantially enhance both the University of Gothenburg's and the Swedish contribution to this UN initiative.

The overarching aim of UGOT Ocean is to strengthen ocean science to address urgent ocean challenges through excellent multi-disciplinary research & transformative societal collaboration (see Box1); achieved through:

(i) **strategic coordination of research environments with high quality and potential** across departments and faculties into three main research themes: global ocean change & resilience; transformative ocean governance and management; innovative and sustainable ocean resource use;

(ii) **Enabling and promoting collaborative platforms and processes of joint knowledge production** with a capacity to deliver socially relevant and legitimate outputs to a diversity of ocean actors and stakeholders, as well as inputs to novel fields of research excellence.

The Current Research Front

The ocean makes up 70% of the planet's surface and is crucial for its life support systems by regulating and distributing temperature, balancing greenhouse gases and the hydrocycle, as well as sustaining life in water and on land (1). The ocean, still largely unexplored, is an interconnected complex system and to describe and understand ocean processes, a massive access of essential ocean variables observations is required. Such critical marine data is both challenging and resource-demanding to obtain, requiring specialized vessels, platforms, sensors and experimental facilities. The ocean also forms a basis for diverse economic, social, and cultural relationships and activities across the world (2). As a growing body of scientific evidence shows, the failure to sustainably manage and govern the continuously expanding human uses and their impacts on marine systems and resources urgently threatens key biophysical functions through biodiversity loss, species extinction, pollution, eutrophication, oxygen depletion, habitat loss, invasive species, and other ecosystem disturbances, as well as climate-related global change such as oceanographic changes, heatwaves and ocean acidification (3). Thus, coordinated collaborative and cross-disciplinary approaches to address priority research questions for human collective action, as outlined in the strategy documents from UN ocean decade, is urgently needed (4).

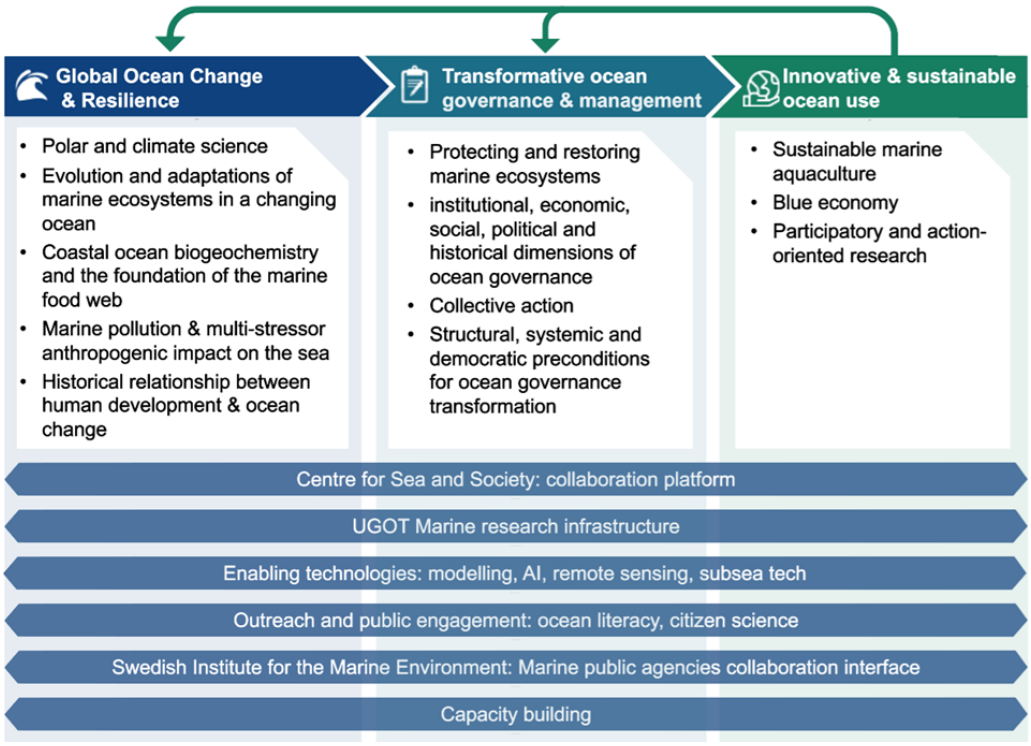
UGOT OCEAN KEY PERFORMANCE INDICATORS
Critical mass of multidisciplinary ocean-related research staff at UGOT OCEAN > 350 (55:45% Male:Female)
Distribution of ocean-related staff: School of Business Economics & Law: 47, SIME: 8, Humanities: 31, IT: 6, HDK Valand: 2, Natural: 238, Sahlgrenska: 14, Social: 25, Education: 3
World leading marine research infrastructure: Tjärnö, Kristineberg, R/V Skagerak
The cross-faculty Center for Sea and Society (formed by the Vice-chancellor 2015)
A multidisciplinary Department of Marine Sciences (formed 2015)
Host organisation for The Swedish Institute for the Marine Environment
Contribution to high level expert panels (examples): IPCC, IPBES, GESAMP, ICES, ICSU, FUTURE EARTH, CCAMLR
MARINE BIBLIOGRAPHY (2016-2021)
Number of Ocean-related publications: WoS: 890, GUP: 1379
46 % above field average (field normalized citations)
89 % of publications internationelly co-authored (WoS)
18 publications among 1 % highest cited, 115 publications among 5 % highest cited
45 % of publications contribute to sustainable development
TRACK RECORD IN ATTRACTING EXTERNAL FUNDING (2015-2022)
Ocean-related PIs acquired on average ~2 times more funding in comparison to other UGOT PIs
8 % of UGOT total funding from VR, (68 VR grants, 288 536 312 SEK)
49 % of UGOT total funding from Formas, (96 VR grants, 338 269 688 SEK)
Excellent indiv. achievements: 1 VR consolidator, 1 Distinguished professor, 1 Wallenberg Academy Fellow

Located at the west coast of Sweden, in a city with the largest port in Scandinavia, students and employees at the University have a strong relationship to the ocean, independent of organizational belonging and disciplinary background. Ocean research at UGOT is today a comprehensive and internationally competitive field that has been built on a 150 year tradition of multi-disciplinary scholarship and more than 60 years of investments in world-class, state-of-the art marine research infrastructures. In addition, recent strategic resource allocation to stimulate problem- and solution-oriented ocean research across the university's eight faculties has substantially enhanced its capacity to contribute with socially relevant knowledge production (Box 1).

Global ocean change and resilience

UGOT research on the ocean, seen as an integrated system with holistic physical, biological, chemical, and geological dimensions, is unique nationally and internationally in the forefront. It includes fundamental understanding of ocean-climate interactions, and marine life from biogeochemistry at the base of the food web, through plankton fish to dispersal and ecosystems.

Life arose in the oceans, which contains most phylogenetic biodiversity on the planet. UGOT Ocean research aims to understand how this diversity arose and how organisms adapt and (5) how species can adapt rapidly to changing conditions, how species' ranges will shift; a knowledge base which is central to creating a sustainable marine ecosystem, e.g. how to mitigate biodiversity and ecosystem function loss from anthropogenic pressures?



The past, present and forecasted ocean states, fluxes and processes are central research components of the research front where UGOT Ocean are strong, as well as research on the relationship between ocean change and human development in a historical perspective (6). Climate and ocean sustainability is intertwined, and reports of changing states and impacts are increasing globally, from the equator to the high latitudes. However, it is in the polar regions where changes are most rapid and may have huge consequences (3). The polar regions have the 'sinking limb' of the global thermohaline circulation, with its associated consequences for the global energy and biogeochemical cycles. The ice-covered environments host unique ecosystems and weak points for the global cryosphere where floating glaciers meet warm, salty ocean currents. Improving our understanding of past and present climate changes will enhance our predictive skills for the associated consequences.

The ocean is taking up a third of the excess anthropogenic CO_2, and at least 90% of excess heat, but not without consequences on the biogeochemical cycles and base of ocean food-web (7). There is overwhelming evidence that ocean acidification – a direct consequence of increased CO_2 – will have significant consequences for marine species, ecosystems, and services (8). The fluxes of carbon, and nutrient elements nitrogen and phosphorous from the photosynthetic upper ocean, through planktonic food-web and microbial biophysical processing of sedimenting materials to the deep sea are critical to understand the role of the ocean in the climate system (9). While the deep sea is still largely unexplored, rapid changes are being documented and increasing deep-sea mining pressures threatens unique habitats. The state of the ocean in the Anthropocene is impacted not only by overfishing and climate change (e.g., marine heat waves and ocean acidification), but also by multiple additional anthropogenic stressors, such as pollution by chemicals and plastics, oxygen-depleting substances, transfer of invasive species, habitat disturbance, and noise.

Transformative ocean governance and management

As a growing body of research across social science and humanities shows, science that reveals and documents ongoing processes of ocean change need to be closely and systematically related to effective and equitable ways of governing and managing human-sea relations (4). Ocean governance and management is comprised of interaction processes between formal and informal rules, policies, laws and institutions designed by governmental and/or non-governmental actors on all levels of decision-making, and which regulate human activities concerning the ocean. As many present approaches, frameworks and methods of ocean governance and management are not equipped to address the complex and dynamic processes of change that oceans are currently facing, present ways of governing and managing the ocean must be transformed (10). Such a transformation requires the consideration of the structural political economy forces that produce unsustainable ocean use (for example the lack of appropriate market incentives and regulations); systemic socio-ecological relations and feedbacks (for example human adaptation to climate change impacts); as well as how to enable the social attributes, or capacities, that empower individuals and communities to contribute to ocean sustainability through decentralized and democratic action (for example participatory management of local marine resources by coastal communities) (11). At the core of transformative ocean governance as a scientific challenge is the identification of theoretically consistent and empirically relevant factors that either hinders or enables collective action for sustainable ocean resource use across scales (12). A case in point that illustrates the need to understand cross-scale collective action mechanisms is the difficult challenges that the collaborative platforms of Arctic international organizations face when they must translate climate change's global regulatory regime into a highly dynamic regional setting (13).

Innovative sustainable ocean resource use

While the formalized knowledge systems of universities and research institutes are evidently important for identifying ocean challenges and potential ways of addressing them, they are also evidently failing in more concretely and practically stimulating the societal changes that are urgently needed (14). A commonly cited explanation behind this failure is the lack of interaction and collaboration between academic knowledge production on one hand, and the societal actors that are supposed to use scientific knowledge in different contexts on the other. However, the scientific literature is often unclear of how this interaction and collaboration should be designed to produce tangible, societal benefits, and solutions. Within the profile area, the question of how to make excellent academic research more effective in stimulating innovative and sustainable marine food and energy production, transport, tourism etc. will be approached based on experience and evidence from existing collaborative platforms that address a diversity of sometimes conflicting, sometimes synergetic ocean uses. Sustainable production of nutritious food and biomass for a growing world population without impacting the marine environment is critically important for sustainable transitions.

Preliminary Results

Global ocean change and resilience

Research areas in marine polar regions have suffered from a great shortage of data against which to calibrate and validate models of varying complexities. The advance of satellite-born sensors has led to a surge of new knowledge in this field, in particular regarding global budgets for the cryosphere, heat flux and CO_2. By using modern infrastructure and state-of-the-art models, UGOT contributes to the international research front in this field, e.g. fine scale (1-100s km) studies of small- and mesoscale processes in polar seas (15) the future of the Antarctic ice shelves (16), and dynamics of the global overturning circulation (17). Due to the large scales of oceans, it is not possible to reproduce the relevant physics of these environments except in computer simulations. In combination with a severe shortage of data this means that it is not unusual that new types of data give rise to new research fields and substantial breakthroughs, a situation almost comparable to planetary explorations. The research undertaken at UGOT builds on several unique data sets from the Arctic Ocean, the Southern Ocean, and from below the Antarctic ice shelves. They have already led to breakthroughs, e.g. the new knowledge that the ice shelf fronts block much of the wind-driven currents but let density-driven currents through (16) that there is a previously unknown connection below Thwaites ice shelf through which warm water flows from Pine Island Bay to Thwaites Ice Tongue (18) and the first pre-satellite era data point of grounding line retreat at Thwaites glacier (19) all with large implications for sea level rise. The UGOT AUV has an unmatched fine resolution (cm scale) multibeam scanning of both the seabed and the ice. The Arctic Ocean carbon-climate system is in rapid transition with important physiological and biogeochemical thresholds already surpassed (3). Future projections and management strategies require observational data and process understanding to be effective, which can only be achieved through joint international and multidisciplinary research initiatives, e.g., Multidisciplinary drifting Observatory for the Study of Arctic Climate (2019-2020), Synoptic Arctic Survey (2020-2022), and North Greenland Earth-Ocean-Ecosystem Observatory (2024). The marine evolution and adaptation research combine mathematical or biophysical models with population genomic approaches to study spatial and temporal dynamics of genetic seascapes of marine species as well as the long-term process of evolutionary change and speciation. Recently, UGOT scholars have developed a novel model system for studies of speciation and identified a chromosomal mechanism that both promotes rapid adaptation to environmental shifts (Koch 2021) and reproductive isolation in the face of gene flow (20). Also, using the North Sea - Baltic Sea transition as a Darwinian laboratory, genetic and demographic mechanisms of rapid adaptation to environmental shifts are being investigated (21), which could be used as proxies for future anthropogenic change. Studies of habitat-forming species will furthermore be critical to conservation efforts worldwide (22).

Ocean acidification is now visible on the science-policy agenda, (e.g. SDG 14.3) (7), and marine heatwaves are also increasing in frequency and their pervasive effects are beginning to be recognised (8). The ecosystem-level effects of combinations of these drivers, (e.g. ocean acidification plus heatwaves, increased water turbidity, and/or pollution), are forecasted to be highly detrimental to tropical coral reefs, temperate kelp-forests, and polar ecosystems. Ocean warming and increased nutrient loads from human activity are also causing loss of oxygen across the world's oceans. Low oxygen areas are intensifying and growing, from stratified shelf seas e.g. the Baltic Sea to wide expanses of the ocean, e.g. the Indian Ocean. Insufficient oxygen affects marine biogeochemical cycles, reduces habitat space, increases the production of potent greenhouse gases, increases mortality of ocean wildlife, which impacts economically and ecologically important species globally. Ocean pollution by chemicals and plastics is also occurring at ever-increasing rates, and a recent assessment concluded that this planetary boundary has been transgressed (23). Understanding the mechanisms by which combinations of multiple factors operate and holistic approaches are essential for transforming assessments and management from single to multiple stressors (24). Current UGOT field, laboratory and modelling research on present and future ocean scenarios of ocean acidification, temperature and chemical pollution (both "chemical substance cocktails", antibiotics (25) and solid pollutants such as microplastics (26) have been transdisciplinary addressed through for example the three UGOT Challenges centres FRAM, CeCAR and CARE.

Transformative ocean governance and management

A broad range of scholars from different disciplines at UGOT have and continues to make substantial contributions to the multidisciplinary ocean governance research field in general, and to the challenge of collective action for ocean sustainability in particular. It as a field of research that includes studied in law, economics, ecology, human geography, and environmental social science. Research in the role of law in relation to activities such as maritime transport, resource extraction, energy generation, and nature preservation is an expanding field within which UGOT researchers have developed legal-ecological frameworks related to conservation and restoration of key marine ecosystem services (27). In economics, there is a longstanding engagement with the development and management of sustainable ocean resource use from a market-based perspective, for example by developing and applying simple, low-cost performance indicators and rapid assessment tools that measure overall status of for example particular aquaculture or fishery activity, and where all dimensions of sustainability are considered (28). From a political science perspective, ocean governance has been studied as a specific empirical context with

ramifications for collective action in terms of government effectiveness, regulatory compliance, and public preference of policy instruments (29). In addition, social and ecological sustainability challenges related to the ocean have been addressed from local to international levels, including how policies and policy- & decision-making processes involve stakeholders, their values, and their knowledge perspectives (30); the role played by socio-cultural values in the management and governance of marine resources, and the relevance of small-scale fisheries for the sustainable development of coastal rural areas (31). Furthermore, ocean policy is becoming increasingly informed by insights into the past. International multidisciplinary collaboration lead by UGOT researchers underpins several new large-scale research projects that promise to change how we understand oceans past – and future (32).

Innovative sustainable ocean resource use

The research area sustainable marine aquaculture is a prominent example of innovative and sustainable use, that transcend traditional boundaries and integrates social, economic, environmental and biological sciences. This research includes novel aquaculture systems and species, renewable feeds and circular systems, increased food safety, legal obstacles and administrative frameworks (28), ocean literacy, and consumer attitudes and behavior. The transdisciplinary and participatory approaches used in relation to marine aquaculture constitute a comprehensive approach that provides a great potential to advance UGOT's multifaceted research excellence beyond state of the art and increase its societal relevance.
The UGOT KIES (Knowledge-intensive innovation ecosystems) Centre explores how entrepreneurship and innovation influence sustainable blue growth from a system perspective, both governance mechanisms and entrepreneurs who act on incentives to generate and commercialize new science and technology that may increase the likelihood of meeting sustainable development goals. Also, as marine and coastal tourism is one of the largest sectors of the Swedish blue economy, scholars within the multidisciplinary field of tourism studies investigates a diversity of tourist practices with the aim to promote behaviors that minimize negative and maximize positive sustainability effects (33).

Research Description

The account above shows how existing strong research environments across the UGOT faculties contribute to the research front in relation to the three proposed themes of the UGOT Ocean profile area. The establishment of ocean research as a UGOT profile area would enable the development of a coherent, long-term strategy for interdisciplinary research focusing on key interconnections between the themes. Our ambition is a common research program where a comprehensive and systematic understanding of key *global ocean change and resilience processes* delivers the science basis for an integrated and applicable approach to *transformative ocean governance and management,* which in turn effectively guides a joint, coordinated knowledge platform for *innovative and sustainable ocean resource use.* In order to do this, UGOT Ocean will draw upon existing nodes of high-quality research across UGOT's eight faculties with the ambition to increase the collaboration between complete research environments within natural sciences with established and emerging ocean research groups at e.g. the School of Business, Economics and Law as well as at the social science and humanities faculties (see Box1).

The UGOT Ocean aims to closely align this research program to the time frame of the UN Ocean Decade as well as Agenda 2030. The research spans across all faculties and include descriptive and normative approaches that spans laboratory, expeditions, mathematical and computational modelling, surveys, and qualitative research methods. A common novel approach here is participatory knowledge creation for collective action needed for ocean and climate transitions (34). This implies intimate collaboration with high-level decision makers, agencies, private sector stakeholders, civil society, and to perpetuate and strengthen the public's engagement with ocean related science as well as attitudes towards human-ocean relations through e.g. through ocean literacy and citizen science projects. The marine social science and humanities research network at UGOT is well-equipped to apply and develop this framework in a systematic way with other disciplines, by engaging with the diversity of stressors and conducive pre-conditions for collective action that ocean governance is facing.

International and National Cooperation

UGOT Ocean research is highly international on project level. 89% of all publications are internationally co-authored (see Box1). UGOT is also engaged in a large number of bilateral collaborations with several universities in Scandinavia and internationally (e.g. Kiel University, Chile), and locally with Chalmers. UGOT Ocean researchers are also involved in international networks of ocean focused universities (e.g. EuroMarine and European Marine Board), and participate in many high level international research networks and programs (see prominent examples in Box1).

Ethical Considerations

UGOT Ocean will promote diversity and equality in all dimensions. To support the profile area in following UGOT equal treatment procedures and participate fully in JiGU, an administrative support function will be established. Research conducted in the profile area will also receive support to correctly prepare and address ethical issues (e.g. human and animal research).

Equipment and research infrastructure in the short and long term

UGOT is host to three large infrastructure units: Kristineberg Center for Marine Research and Innovation, and Tjärnö Marine Laboratory, as well as a new state-of-the-art research vessel Skagerak, and several smaller boats. In addition UGOT also owns and operates a unique Autonomous Underwater Vehicle (AUV) and one of Europe's most extensive marine instrument parks including gliders, remotely operated vehicles, deep-sea moorings, coring equipment, nets, specialized laboratories, chambers and sensors. The marine infrastructure is an important part of the university's internationalization through visiting scientists and used in research projects of the highest quality. The marine infrastructure is also the national hub of the EMBRC, which coordinates high-level marine research infrastructure access throughout the EU. The Kristineberg Center hosts excellent facilities for controlled experimental work on marine organisms and materials, simulating *in situ* conditions, and access to the unique Gullmar Fjord. Tjärnö is providing infrastructure for world-class level research and education in the nearby Kosterhavet National Park, and has also been supporting many high impact laboratory studies and projects on chemical signals in the ocean, novel forms of aquaculture and species development and evolution, for example by hosting the Linnaeus Centre of excellence named "Centre for Marine Evolutionary Biology" during 2008-2018. R/V Skagerak is an ocean-going 49 m vessel (commissioned 2021) and equipped for multidisciplinary oceanographic research, handling large

underwater vehicles, advanced acoustic surveys, underway and profiling multiparameter sensing and sampling, or water, sediment, and atmosphere. The AUV is primarily used in polar seas and deep oceans, and performs long excursions into hitherto unreachable areas, such as below the Antarctic ice sheet. All units are openly available to national and international researchers, used for education, and have been developed through long-term investments that have been part of the strategy of the university since the 1960s with the initial construction of the Tjärnö Marine Laboratory, and more recently with the purchase of Kristineberg from the Royal Academy of Sciences in 2008, and the commissioning of R/V Skagerak in 2021. A Swedish RV coordination proposal to VR was furthermore ranked highest in the VR infra inventory process 2022.

UGOT Ocean's strategies for collaboration with the surrounding society

Collaborative, solution-oriented and transdisciplinary research is increasingly recognized as crucial for ensuring that global environmental challenges are addressed in an effective, relevant and legitimate way (35). Ocean-related research across the different faculties at GU is increasingly designed as joint knowledge production processes and platforms. The profile area can show both an extensive experience from contributing to societal relevance and legitimacy of UGOT research through collaboration with the surrounding society, science-based policy advice, as well as a high potential for future, innovative collaborative approaches and themes.

Strategy for maintaining quality in collaboration

A strategic decision by the Vice-Chancellor to create the collaborative Centre for Sea and Society was taken in 2015 to make marine research at UGOT more internally and externally visible and to promote cross-faculty research interactions. The centre also facilitates structured partnerships between university and non-university actors and stakeholders and will form an integrated part of UGOT OCEAN, providing a university-wide extensification and intensification of ocean-related collaboration with the surrounding society, increase the UGOT capacity to compete for strategic research programs, and support transdisciplinary ocean research at faculties and departments that aspire to strengthen their ocean profile.

Ongoing and planned collaboration activities

UGOT is the host of the Swedish Institute for the Marine Environment (SIME), a collaboration between five Swedish universities, assigned by the government (recently renewed for a period of 10 years) to provide relevant authorities with scientific support. UGOT is furthermore a leading partner in the Maritime Cluster of West Sweden and the Kristineberg Center for Marine Innovation and Research (the recently entered infrastructure agreement to create a multi-stakeholder innovation center involving UGOT, CHALMERS, KTH, IVL and RISE), Lighthouse (a leading maritime sector R&D Triple- Helix collaboration between industry, academia and institutes), and the Centre for future seafood - Blue food. Furthermore, UGOT has several strong research centers within or closely related to the proposed profile area, which all have close collaboration with societal actors (e.g. CeCAR, SWEMARC, GGBC, CARe, FRAM, CCHS).

The importance of collaboration for the scientific quality and relevance of research within UGOT Ocean

UGOT Ocean intends to address the challenge of increasing the quality, relevance, as well as the legitimacy of ocean-related research by systematically promoting problem- and solution oriented research. This approach encompasses collaboration within and across scientific disciplines and faculties, but also with societal actors (public and private) across different ocean-related sectors and civil society, on different levels (international, national, regional and local). This is a continuous and joint learning process through co-design, co-production, and dissemination of knowledge (36). As an example, the success of UGOT ocean scholars in attracting FORMAS grants that require societally relevant excellent research could be explained by a close transdisciplinary stakeholder involvement (Box1).

The importance of collaboration for joint knowledge production and use of UGOT Ocean research in the surrounding society

The existing and emerging collaborative platforms and organizations accounted for above provide a great potential for involving a relevant and diverse group of actors. Through SIME, close collaboration with government agencies, especially SwAM, in order to increase the use and applicability of UGOT Ocean research is already established. A key focal point for joint knowledge production with national and international government agencies is the ongoing implementation of Ecosystem Based Management (EBM) across the world. Through easier access to relevant and excellent research, the development of EBM can substantially contribute to a sustainable blue economy as set out in key international policy initiatives such as the Common Fisheries Policy (CFP), Marine Strategy Framework Directive (MSFD), Marine Spatial Planning Directive (MSPD), and the UN Sustainable Development Goals (SDGs). A prerequisite for effective ecosystem-based management with stakeholder engagement, is a raised ocean awareness among key actors as well as the general public, and the concept of ocean literacy is gaining momentum within the UN Ocean decade. SIME is assigned by SwAM to be the node for the Swedish work on Ocean Literacy. This work is synergistically complemented by UGOT scholarly expertise that explores novel ways of public learning about the ocean as well as initiatives that promote increased public knowledge about the sea (37). In addition, to meet the need for new partnerships between science and the private sector, Kristineberg Center for Marine Innovation and Research, is emerging as important arenas for joint, transdisciplinary knowledge production. Also, the newly launched web portal gu.se/ocean is a unique cross-faculty project at the UGOT web, producing easily accessible information and news that showcases UGOT ocean-related research, education and activities. The portal is edited and managed by an established cross-faculty network of communication officers.

University education is an important arena for dissemination of research and training next generation of ocean professionals, where UGOT Ocean host several master programs that builds on recent ocean-related research across different faculties at UGOT. Three prominent examples can be found in the master program in marine sciences, in sea and society, and the Nordic master in sustainable production and utilization of marine bioresources. Furthermore, there is a unique experience within UGOT Ocean from advancing PhD-education through cross-faculty, multi-disciplinary graduate schools

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34. Jagers SC, Harring N, Löfgren Å, Sjöstedt M, Alpizar F, Brülde B, et al. On the preconditions for large-scale collective action. Ambio. 2020;49(7):1282-96.
35. Wardani J, Bos JJ, Ramirez-Lovering D, Capon AG. Enabling transdisciplinary research collaboration for planetary health: insights from pracice at environment-health-development nexus. Sustainable Development. 2022;30(2):375 – 92.
36. Mauser W, Klepper G, Rice M, Schmalzbauer BS, Hackmann H, Leemans R, et al. Transdisciplinary global change research: the co-creation of knowledge for sustainability. Current opinion in environmental sustainability. 2013;5(3-4):420-31.
37. Fauville G, Strang C, Cannady MA, Chen Y-F. Development of the International Ocean Literacy Survey: measuring knowledge across the world. Environmental Education Research. 2019;25(2):238-63.

UGOT OCEAN

Excellent multidisciplinary research and transformative societal collaboration for ocean sustainability

UGOT Ocean profile area - selected high impact publications

Ten publications with motivation (underline UGOT affiliations), IF impact factor, citations

Vargas, C. A., Cuevas, L. A., Broitman, B. R., San Martin, V. A., Lagos, N. A., Gaitán-Espitia, J. D., & Dupont, S. (2022). Upper environmental pCO2 drives sensitivity to ocean acidification in marine invertebrates. Nature Climate Change, 12(2), 200-207. IF: 25.17, 11 citations

Motivation: This meta-analysis synthesizing experimental studies examining the effects of pCO_2 on biological traits in marine invertebrates, in the high-impact journal Nature Climate Change, is following a line of previous field shaping papers from this author team. By analyzing both biological responses and natural variability of pCO_2 in global coastal systems they highlight the importance of understanding local adaptations in interpreting experimental results.

Persson, L., Carney Almroth, B. M., Collins, C. D., Cornell, S., de Wit, C. A., Diamond, M. L., Hassellöv, M.. . . Ryberg, M. W. (2022). Outside the safe operating space of the planetary boundary for novel entities. Environmental science & technology, 56(3), 1510-1521. IF: 11.36, 75 citations

Motivation: A meta analysis assessment to quantify the planetary boundary of chemicals and plastics pollution, by a weight of evidence approach along the impact pathway of the life cycle of chemicals. Huge media visibility, >100.000 views, 75 citations (Scopus), and referenced in 3 policy documents, in <8 months. One of the highest Altmetric output (2080 score) from ES&T ever (7th place), which is outstanding considering the short time since publication. Sea and Society and FRAM UGOT Challenge co-organized a webinar about the paper, and a side event at the UN Oceans conference in Lisbon 2022

Sandblom, E., Clark, T. D., Gräns, A., Ekström, A., Brijs, J., Sundström, L. F., . . . Jutfelt, F. (2016). Physiological constraints to climate warming in fish follow principles of plastic floors and concrete ceilings. Nature communications, 7(1), 1-8. IF: 17.69, 144 citations

Motivation: This paper uses an innovative approach to investigate the tolerance and resilience of teleost fish to climate change. The paper successfully challenges the two previous main hypothesis of how fitness and performance traits (for example, growth, reproduction, aerobic swimming capacity) is affected by long term and acute increases in temperature.

Santos, I. R., Chen, X., Lecher, A. L., Sawyer, A. H., Moosdorf, N., Rodellas, V., Stefano, B., …Sugimoto, R. (2021). Submarine groundwater discharge impacts on coastal nutrient biogeochemistry. Nature Reviews Earth & Environment, 2(5), 307-323. IF 37.2, 62 citations

Motivation: This recent meta-analysis of the role of submarine groundwate discharge of nutrients to coastal waters, which is an often overlooked pathway, showed that in 60% of the 200 study sites SGD exceeded riverine nutirent fluxes. This research group have published several more high impact publications, e.g. in the nature family, about SGD and coastal blue carbon.

Abrahamsson, K., Granfors, A., Ahnoff, M., Cuevas, C. A., & Saiz-Lopez, A. (2018). Organic bromine compounds produced in sea ice in Antarctic winter. Nature communications, 9(1), 1-8. IF: 17.69, 19 citations

Motivation: This study changed the current view, that bromine was the most important ozon layer reacting compound and that it require sunlight; instead it revealed that organic bromine compounds formed by Antarctic winter ice during southern spring was ten times higher flux than from Antarctic seawater and substantially more than summer ice, and further that emitted bromocarbons will disperse through the in the southern hemisphere troposphere and through photochemical degradation to bromine atoms, and contribute ~ 10% to the tropospheric ozon reactive bromine budget.

Wåhlin, A. K., Steiger, N., Darelius, E., Assmann, K. M., Glessmer, M. S., Ha, H. K., Heuzé, C., Mazur, A. K., . . Kim, T.-W. (2020). Ice front blocking of ocean heat transport to an Antarctic ice shelf. Nature, 578(7796), 568-571. IF 49.96, 19 citations

Motivation: The rate of melting and heat transport from Antarctic glaciers and ice shelves, are critical for modeling future sea level rise. The mechanisms for warm salty ocean currents to pass in under the ice front and contribute to this heat transport and melting at the base of the glacier was the aim of this study, where moorings were deployed in close vicinity of the ice edge, and complemented by laboratory simulations of currents under a ice edge.

Johannesson, K., Le Moan, A., Perini, S., & André, C. (2020). A Darwinian laboratory of multiple contact zones. Trends in Ecology & Evolution, 35(11), 1021-1036. IF: 14.76, 41 citations

Motivation: This study, utilizing the formation of the strong salinity gradients of the Baltic-North sea ~8000 years ago, to study the gen flow in 23 marine species from variaety of taxa. The highlights showed steep genetic clines supported by divergent selection and/or temporal or spatial segregation. Contacts were primary or secondary and shaped by ancestral variation sometimes involving inversions. Studies of multispecies contact zones will increase our understanding of speciation. The exciting findings among the 23 studied species, despite widely different biology and traits, almost all shows genetic clines at the entrance to the Baltic. Since 2020 several similar papers have followed similar studies.

Jagers, S. C., Harring, N., Löfgren, Å., Sjöstedt, M., Alpizar, F., Brülde, B., Langlet, D., Nilsson, A.,. . . Dupont, S. (2020). On the preconditions for large-scale collective action. Ambio, 49(7), 1282-1296. IF 6.94, 82 citations

Motivation: This is a theoretically original and well-cited paper on a topic that is central to ocean governance: large-scale collective action. It furthermore points at the potential for high quality multidisciplinary research at UGOT as it involves sholars from 4 different faculties.

Asche, F., Eggert, H., Oglend, A., Roheim, C. A., & Smith, M. D. (2022). Aquaculture: Externalities and Policy Options. Review of environmental economics and policy, 16(2), 282-305. IF: 6.05, 4 citations

Motivation: This is a paper that illustrates the urgent need for high quality ocean governance research in relation to globally expanding uses of the ocean that provokes novel governance challenges.

Bengtsson-Palme, J., Kristiansson, E., & Larsson, D. J. (2018). Environmental factors influencing the development and spread of antibiotic resistance. FEMS microbiology reviews, 42(1). IF: 16.41, 672 citations

Motivation: This high impact review studies the role of gene environmental transfer of antibiotic resistence genes, critical for clinical dimension of antibiotics in health care. The environmental factors controlling specifically antibiotic resistance genes is poorly understood, and here was reviewed how resistance genes evolve, are mobilized, transferred and disseminated in the environment, and the ecological and evolutionary environmental factors that contribute to resistance development and transmission.

Other 20 selected publications (underline shows UGOT affiliation)

Atwood, T. B., Connolly, R. M., Almahasheer, H., Carnell, P. E., Duarte, C. M., Ewers Lewis, C. J., Santos, I,. . . Macreadie, P. I. (2017). Global patterns in mangrove soil carbon stocks and losses. Nature Climate Change, 7(7), 523-528. IF: 21.7, 294 citations

Boyd, P. W., Collins, S., Dupont, S., Fabricius, K., Gattuso, J. P., Havenhand, J., . . . Vichi, M. (2018). Experimental strategies to assess the biological ramifications of multiple drivers of global ocean change—a review. Global change biology, 24(6), 2239-2261. IF: 13.11, 240 citations

Callier, M. D., Byron, C. J., Bengtson, D. A., Cranford, P. J., Cross, S. F., Focken, U., Sundell, K., . . . McKindsey, C. W. (2018). Attraction and repulsion of mobile wild organisms to finfish and shellfish aquaculture: a review. Reviews in Aquaculture, 10(4), 924-949. IF: 10.62, 89 citations

Cooley, S., Schoeman, D., Bopp, L., Boyd, P., Donner, S., Ito, S.-i., Dupont, S,. . . . Racault, M.-F. (2022). Oceans and Coastal Ecosystems and their Services. In IPCC AR6 WGII: Cambridge University Press.

Duffy, J. E., Stachowicz, J. J., Reynolds, P. L., Hovel, K. A., Jahnke, M., Sotka, E. E., Moksnes, P. O, . . . Eklöf, J. (2022). A Pleistocene legacy structures variation in modern seagrass ecosystems. Proceedings of the National Academy of Sciences, 119(32), e2121425119. IF: 12.78, 1 citation

Fang, M., Li, X., Chen, H. W., & Chen, D. (2022). Arctic amplification modulated by Atlantic Multidecadal Oscillation and greenhouse forcing on multidecadal to century scales. Nature communications, 13(1), 1-8. IF: 17.69, 4 citations

Fauville, G., Dupont, S., von Thun, S., & Lundin, J. (2015). Can Facebook be used to increase scientific literacy? A case study of the Monterey Bay Aquarium Research Institute Facebook page and ocean literacy. Computers & Education, 82, 60-73. IF 11.18, 67 citations

Fritz, S., See, L., Carlson, T., Haklay, M. M., Oliver, J. L., Fraisl, D., When, U., . . . Schade, S. (2019). Citizen science and the United Nations sustainable development goals. Nature Sustainability, 2(10), 922-930. IF: 28.22, 289 citations

Gomez-Gener, L., Rocher-Ros, G., Battin, T., Cohen, M. J., Dalmagro, H. J., Dinsmore, K. J., Santos, I., . . . Horgby, Å. (2021). Global carbon dioxide efflux from rivers enhanced by high nocturnal emissions. Nature Geoscience, 14(5), 289-294. IF: 16.91, 23 citations

Goolaup, S., Solér, C., & Nunkoo, R. (2018). Developing a Theory of Surprise from Travelers' Extraordinary Food Experiences. Journal of Travel Research, 57(2), 218-231. IF: 10.98, 60 citations

Graham, A. G., Wåhlin, A., Hogan, K. A., Nitsche, F. O., Heywood, K. J., Totten, R. L., . . . Anderson, J. B. (2022). Rapid retreat of Thwaites Glacier in the pre-satellite era. Nature Geoscience, 1-8. IF: 16.91

Hartmann, N. B., Huffer, T., Thompson, R. C., Hassellöv, M., Verschoor, A., Daugaard, A. E., Karlsson, T., . . . Cole, M. (2019). Are we speaking the same language? Recommendations for a definition and categorization framework for plastic debris. *Environ. Sci. Technol.* 2019, 53, 3, 1039–1047. IF: 11.36, 692 citations

Hendriksen, R. S., Munk, P., Njage, P., Van Bunnik, B., McNally, L., Lukjancenko, O., Larsson, J,. . . Kjeldgaard, J. (2019). Global monitoring of antimicrobial resistance based on metagenomics analyses of urban sewage. Nature communications, 10(1), 1-12. IF: 17.69, 450 citations

Kissling, W. D., Ahumada, J. A., Bowser, A., Fernandez, M., Fernández, N., García, E. A., Obst, M,. . . . Los, W. (2018). Building essential biodiversity variables (EBV s) of species distribution and abundance at a global scale. Biological reviews, 93(1), 600-625. IF: 14.35, 142 citations

Kotta, J., Futter, M., Kaasik, A., Liversage, K., Rätsep, M., Barboza, F. R., Bergström, P,. Jonsson, R. P,. Lindegarth, M., . . . Díaz, E. (2020). Cleaning up seas using blue growth initiatives: Mussel farming for eutrophication control in the Baltic Sea. Science of the total environment, 709, 136144. IF: 10.75, 45 citations

Nicholson, S.-A., Whitt, D. B., Fer, I., du Plessis, M. D., Lebéhot, A. D., Swart, S., . . . Monteiro, P. (2022). Storms drive outgassing of CO2 in the subpolar Southern Ocean. Nature communications, 13(1), 1-12. IF: 17.69 7 citations

Thompson, L. R., Sanders, J. G., McDonald, D., Amir, A., Ladau, J., Locey, K. J., …,Hult, S,. . . . Ackermann, G. (2017). A communal catalogue reveals Earth's multiscale microbial diversity. Nature, 551(7681), 457-463. IF: 49.96, 1051 citations

Thor, P., & Dupont, S. (2015). Transgenerational effects alleviate severe fecundity loss during ocean acidification in a ubiquitous planktonic copepod. Global change biology, 21(6), 2261-2271. IF: 13.11, 210 citations

Vargas, C. A., Lagos, N. A., Lardies, M. A., Duarte, C., Manríquez, P. H., Aguilera, V. M., . . . Dupont, S. (2017). Species-specific responses to ocean acidification should account for local adaptation and adaptive plasticity. Nature Ecology & Evolution, 1(4), 1-7. IF: 18.62, 245 citations

You, Q., Cai, Z., Pepin, N., Chen, D., Ahrens, B., Jiang, Z., . . . Wu, T. (2021). Warming amplification over the Arctic Pole and Third Pole: Trends, mechanisms and consequences. Earth-Science Reviews, 217, 103625. IF: 12.41, 34 citations