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[17] SDG17: Partnerships for the Goals

[17.3] Publication of SDG reports

[17.3.14] Publication of SDG reports - per SDG 14 : 32 Publication

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List Publication of SDG 14 Reports :

Title	An updated checklist of blenniiform fishes (Teleostei: Blenniiformes) in the North-Western Indian Ocean
SDG	**SDG 14 - Life Below Water**
Authors.	Al Jufaili, Saud
Links/ DOI	https://doi.org/
Abstract	The current checklist presents species diversity of the order Blenniiformes in most parts of the Northwest Indian Ocean (NIO) and encompassing the marine waters of the Persian Gulf, Sea of Oman/Oman Sea, Arabian Sea, Red Sea and the Gulf of Aden. This updated checklist enumerates 81 species, representing 28 genera and two families. The family Blenniidae/ combtooth blennies present 25 genera and 64 species. Within this family, the genera Ecsenius and Istiblennius, each with seven species (8.64%), and the genus Antennablennius with six species (7.40%), comprise ranks first and second in terms of species diversity. The other 11 genera comprise one species each (1.24%). In the family Tripterygiidae/ triplefin blennies, the genus Enneapterygius presents 11 species (13.58%), Helcogramma 5 species (6.17%) and Norfolkia one species 1.24%. During the last 12 years, only three new species Adelotremus leptus, Enneapterygius qirmiz and Entomacrodus solus have been described from the region. Species diversity of both families in the Persian Gulf is lower than in the Oman, Arabian and Red Seas due to substantial variations in the environmental features and oceanographic characteristics of the Persian Gulf (e.g., sea surface temperature ranges (12-36°C), high salinity (>45), low depth (90-100 m), closed geographic position and its geological history during the glaciation in Pleistocene. Based on the IUCN red list, most of the reported species (75 species, 92.6%) have been rated as least concern (LC), two species (Oman ypsibn and Omobranchas mekranensis) are listed in the vulnerable (VU), and Entomacrodus solus is considered as endangered (EN). Ongoing research and intensive collections will likely reveal additional species in the northwest Indian Ocean.

Title	Application of gradient boosting regression model for the evaluation of feature selection techniques in improving reservoir characterisation predictions
SDG	**SDG 14 - Life Below Water**
Authors.	Arbi Omar Ganat, Tarek
Links/ DOI	https://doi.org/10.1016/j.petrol.2021.109244
Abstract	Feature Selection, a critical data preprocessing step in machine learning, is an effective way in removing irrelevant variables, thus reducing the dimensionality of input features. Removing uninformative or, even worse, misinformative input columns helps train a machine learning model on a more generalised data with better performances on new and unseen data. In this paper, eight feature selection techniques paired with the gradient boosting regressor model were evaluated based on the statistical comparison of their prediction errors and computational efficiency in characterising a shallow marine reservoir. Analysis of the results shows that the best technique in selecting relevant logs for permeability, porosity and water saturation prediction was the Random Forest, SelectKBest and Lasso regularisation methods, respectively. These techniques did not only reduce the features of the high dimensional dataset but also achieved low prediction errors based on MAE and RMSE and improved computational efficiency. This indicates that the Random Forest, SelectKBest, and Lasso regularisation can identify the best input features for permeability, porosity and water saturation predictions, respectively.

Title	Behavior of effluents discharged into shallow coastal waters under the influence of spring-neap tidal currents
SDG	**SDG 14 - Life Below Water**
Authors.	Purnama, Anton
Links/ DOI	https://doi.org/10.1007/s10652-021-09826-1
Abstract	The oscillatory nature of the coastal longshore currents is one of the major factors that play a significant role in the spreading of discharged effluents in marine environments. Most previous investigations of the dispersion of discharged effluents through an outfall into the sea have been based on a simple sinusoidal tidal. In reality, tidal currents are more complicated and often contain oscillations of two different frequencies. An analytical solution of a two-dimensional advection-diffusion equation containing a developed spring-neap tidal current has been applied in the present paper. A parametric examination has been performed to study the effects of the spring-neap tidal currents on the concentration at the shoreline and along the centerline of discharge effluent plume from a single outfall. A comparison study of a constant discharge and a time-varying discharge strategy which depends on the spring-neap tidal current is also conducted. Finally, the interaction and merging of effluent discharge plumes from a system of two outfalls, including a single outfall installed with two-port diffuser, are investigated.

Title	Environmental DNA reveals a multi-taxa biogeographic break across the Arabian Sea and Sea of Oman
SDG	**SDG 14 - Life Below Water**
Authors.	Bruss, Gerd // Mansour, Shawky // Marshell, Alyssa
Links/ DOI	https://doi.org/10.1002/edn3.252
Abstract	Environmental DNA (eDNA) is increasingly being used to assess community composition in marine ecosystems. Applying eDNA approaches across broad spatial scales now provide the potential to inform biogeographic analyses. However, to date, few studies have employed this technique to assess broad biogeographic patterns across multiple taxonomic groups. Here, we compare eDNA-derived communities of bony fishes and invertebrates, including corals and sponges, from 15 locations spanning the entire length of the Omani coast. This survey includes a variety of habitats, including coral and rocky reefs, and covers three distinct marine ecoregions. Our data support a known biogeographic break in fish communities between the north and the south of Oman; however, the eDNA data highlight that this faunal break is mostly reflected in schooling baitfish species (e.g., sardines and anchovies), whereas reef-associated fish communities appear more homogeneous along this coastline. Furthermore, our data provide indications that these biogeographic breaks also affect invertebrate communities, which includes corals, sponges, and broader eukaryotic groups. The observed community shifts were correlated with local environmental and anthropogenic differences characteristic of this coastline, particularly for the eDNA-derived bony fish communities. Overall, this study provides compelling support that eDNA sequencing and associated analyses may serve as powerful tools to detect community differences across biogeographic breaks and ecoregions, particularly in places where there is significant variation in oceanographic conditions or anthropogenic impacts.

Title	Evaluation of algal active compounds as potent antibiofilm agent
SDG	**SDG 14 - Life Below Water**
Authors.	Joshi, Sanket
Links/ DOI	https://doi.org/10.1002/jobm.202100470
Abstract	Biofilm is the syntrophic association of microbial colonies that remain adhered to the biotic and abiotic surfaces with the help of self-secreted polymeric substances also termed extracellular polymeric substances. Chronic pathogenicity caused by biofilm-associated pathogenic microorganisms becomes a significant threat in biomedical research. An extensive search is being made for the antibiofilm agents made from natural sources or their biogenic derivatives due to their effectivity and nontoxicity. Algae being the producer of various biogenic substances are found capable of disintegrating biofilm matrix and eradication of biofilm without exerting any deterrent effect on other biotas in the ecosystem. The current trend in phycological studies includes the exploration of antifouling efficacy among various algal groups. The extracts prepared from about 225 microalgae and cyanobacteria species are found to have antibiofilm activity. Polyunsaturated fatty acids are the most important component in the algal extract with antibacterial and antibiofilm properties. The antibiofilm activity of the sulfated polysaccharides extracted from a marine alga could be effectively used to remove dental biofilm. Algal extracts are also being used for the preparation of different biogenically synthesized nanoparticles, which are being used as potent antibiofilm agents. Genome editing of algal species by CRISPR/Cas9 may make precise modifications in the algal DNA for improving the algal strains and production of a more effective antibiofouling agent.

Title	Facies analysis and distribution of Late Palaeogene deep-water massive sandstones in submarine-fan lobes, NW Borneo
SDG	**SDG 14 - Life Below Water**
Authors.	El-Ghali, Mohamed
Links/ DOI	https://doi.org/10.1002/gj.4553
Abstract	Deep-water massive sandstones (DWMS) are characterized by large volumes of sand accumulations which are considered as potential reservoir intervals in deep-marine environments. Lithological variations and bed thickness statistics are used to interpret the distribution of massive sandstones in a deep-marine fan-lobe system. These massive sandstones are interpreted based on lithological heterogeneities and detailed facies analysis in seventeen exposed sections of the Late Palaeogene deposits in Sabah, NW Borneo. Sedimentary logs containing details of lithology textures and structures were used to recognize nine sedimentary facies of DWMS. These lithofacies were then grouped into three sedimentary facies associations: (1) massive facies association with basal part of turbiditic Bouma sequence, (2) massive facies association having soft-sediment deformation structures, and (3) massive facies association with erosional features. The facies analysis portrays inner to middle submarine fan deposition and was later applied to reconstruct the distribution of a channel-lobe complex. Individual sandstone bed thicknesses vary from 1 m to more than 8 m and the number of massive sandstones in submarine lobes range from less than 10% to more than 50%. The thicknesses of massive sandstones in channels are more than 8 m, whereas distal lobes have thicknesses from 1–2 m only. These sandstones are concentrated in channels, proximal and medial lobe settings that can also be verified from calculating the average of all maximum thickness of massive sand intervals that is, 8.91 m. The lithological heterogeneities and the processes associated with the deposition of these massive sandstones are vital for potential hydrocarbon reservoirs in the deep-marine environments around the globe.

Title	Facile fabrication of flower-like γ-Fe$_2$O$_3$ @PPy from iron rust for high-performing asymmetric supercapacitors
SDG	**SDG 14 - Life Below Water**
Authors.	Pillai, Sumesh Sofin R G
Links/ DOI	https://doi.org/10.1016/j.jallcom.2022.166055
Abstract	Flower-like rust with porous structure can be obtained on the Fe plate by accelerated corrosion in the marine atmosphere. A core-shell structure of γ-Fe$_2$O$_3$ @PPy was developed through annealing and in situ chemical polymerization of pyrrole. The dehydroxylation after annealing enriches the inherent pore structure of rust. The conductive PPy layer with the capacitive properties were found to improve the stability of iron-based anodes while enhancing the charge storage performance. The rust-based composite exhibited superior capacitance performance over the original rust. By matching with a cathode from nickel-cobalt layered double hydroxide (NiCoLDH) based porous Ni network, the asymmetric device delivered a high volumetric energy density of 7.9 mWh cm^{-3} at a power density of 14.99 mW cm^{-3}, and favorable cycle stability (capacitance retention of 90.1% after 8000 cycles). Most importantly, the energy storage mechanism of rust-based electrodes with flower-like structures was discussed in detail. The recycling and reuse of rust resources were successfully realized by the direct utilization of rusted steel as anode materials for supercapacitor applications.

Title	Field attributes and organic geochemical analysis of shales from early to middle Permian Dohol Formation, Peninsular Malaysia
SDG	**SDG 14 - Life Below Water**
Authors.	El-Ghali, Mohamed
Links/ DOI	https://doi.org/10.1016/j.jksus.2022.102287
Abstract	The early to middle Permian Dohol Formation falls under the Eastern Belt of Peninsular Malaysia. This formation is part of the Palaeozoic rock sequence in East Johor, composed of several metasedimentary, metamorphic, volcanic, and siliciclastic rocks. The Dohol Formation is said to have abundant black shales; however, the previous studies done in the area does not focus on the field attributes and the ability of the shales to generate hydrocarbons. Detailed traditional fieldwork was conducted in East Johor to characterize the shale facies of the formation. Different types of shale facies have been identified and interpreted in this study: (i) dark grey shale facies, (ii) light grey shale facies, (iii) red shale facies, and (iv) dark brown shale facies. XRD analysis was used to evaluate the mineralogy of the rock samples; the results show that the shales are primarily composed of kaolinite, illite, and quartz. The organic geochemical analysis also revealed that the samples collected had low TOC content, with an average TOC value of 0.40 wt%, with type II and type III kerogen predominating. The R_o and Tmax values and plots indicated that the samples are mature, with most already generating oil. The findings of this study suggest that the Dohol Formation has a low potential for generating hydrocarbons in commercial quantities, and also, the rocks are from a deep marine depositional setting.

Title	First feed matters
SDG	**SDG 14 - Life Below Water**
Authors.	Malzahn, Arne
Links/ DOI	https://doi.org/10.1016/j.aquaculture.2022.738586

Abstract	The use of cleaner fish, such as the ballan wrasse (Labrus bergylta), is important for combatting the sea lice problem in salmonid cage farming. Ballan wrasse is the only wrasse species that is cultivated, though only about 50% of the approx. 3 million ballan wrasse used in 2020 was produced by aquaculture. The major obstacle for large scale cultivation of ballan wrasse is the difficult first feeding phase and a lack of functional feeding protocols. Like most pelagic marine fish larvae, ballan wrasse do not accept inert diets as first feed, and feeding regimes based on rotifers and Artemia (brine shrimps) usually lead to mixed results and are far from being optimal nutrition for the larvae. In a 48-day start feeding experiment, we studied the feasibility of replacing rotifers by an Experimental cirriped diet or copepod nauplii (Acartia tonsa) and replacing Artemia by nauplii of the cirriped Semibalanus balanoides. Later, all treatments received the same formulated diets. We sampled larvae at each feed transition to analyze different response variables such as growth, morphometry, gene expression, lipidomics, histology, and microbiology. We found significant differences in survival rates and growth. Larvae fed copepods as the first diet had significantly higher survival rates than larvae start-fed on either rotifers or small experimental cirripeds, and this pattern was also reflected in early growth and bone development. Gut histology at the end of the experiment (48 days after hatching) showed a more developed intestinal tissue in the larval group fed copepods first and cirripeds as the second diet compared to the other larval groups. Gene expression at day 48 post hatch still revealed pronounced differences between the larval group first fed on rotifers and larvae from the other three feeding regimes which received natural, unenriched diets. Even weeks after receiving the same formulated diets, lipidomics analyses revealed that several lipid species correlated either negatively or positively with larval growth rates or mortality. Our results are a clear indication for nutritional programming, pointing towards the importance the first diet has for the further life of a fish.

Title	Goatfishes of the world
SDG	**SDG 14 - Life Below Water**
Authors.	Al Jufaili, Saud
Links/ DOI	https://doi.org/

Abstract	Members of the Mullidae family are characterized by body elongate and almost compressed, head and body completely scaled (except the periorbital region of some Upeneus), with 27 to 39 vertical scale rows from the upper end of gill opening to the base of caudal fin; chin with 2 long hyoid barbels; opercle usually with a small flat spine; two well-separated dorsal fin and 24 vertebrae. They inhabit brackish and marine waters above sandy to muddy bottoms as well as coral reefs. Mullids are distributed worldwide in tropical, subtropical, and temperate habitats of the Mediterranean and the Black Sea, Pacific and the Atlantic Ocean, southern and eastern Australia, and New Zealand between the upper littoral and the upper slope. This checklist aims to list all the valid Mullidae fishes of the world. It lists 101 species in 6 genera. The most diverse genus is Upeneus (48 species, 47%), followed by Parupeneus (35 species, 35%), Mulloidichthys (7 species, 7%); Mullus (6 species 6%); Pseudupeneus (3 species, 3%), and Upeneichthys (2 species, 2%). For this genus, several taxonomic species groups, including moluccensis, margarethae, stenopsis, japonicus, suahelicus, and tragula have been proposed. Some of the species are still ungrouped. The high inter-and intraspecific phenotypic diversity among the genus Upeneus requires a careful taxonomic approach regarding both species diagnoses and descriptions, re-descriptions, resurrections, or synonomizations. Among 101 listed species, 54 (55%) species are Least Concern (LC), 36 (36%) species are Not Evaluated (NE), 6 (6%) species are Data Deficient (DD), 1 (1%) species are Vulnerable (VU), 1 (1%) species are Near Threatened (NT) and 1 (1%) species are Endangered (EN) of the Red List of IUCN. Some of the less-known species, or species from less explored areas, merit more attention and approval of a similar fine-resolution taxonomy approach, ideally accompanied by comprehensive integrative molecular studies, to more completely understand the overall diversity, the speciation events, and the evolutionary pathways involved in mullids.

Title	Harmful algal blooms associated marine bacteria: Composition and potential
SDG	**SDG 14 - Life Below Water**
Authors.	Al-Bulushi, Ismail
Links/ DOI	https://doi.org/
Abstract	

Title	History of a disaster
SDG	**SDG 14 - Life Below Water**
Authors.	Rajendran, Sankaran
Links/ DOI	https://doi.org/10.1016/j.marpolbul.2022.113330
Abstract	Oil spills from tanker ships provide adverse and irreversible impacts of a pollutant over coastal and marine environments. Using Sentinel-1 and 2 satellite images, this baseline paper presents the detection, assessment, and monitoring of the aground and further oil spill from the Wakashio ship of August 06, 2020, on the Mauritius coast. The oil spill started on August 06, after cracks developed on the hull, and continued until the total breakup of the ship on August 15, 2020. Data shows displacements in ship position of about 100 m, and a maximum change of 80° in orientation (from NS to NE). The remote sensing results were validated using met-ocean observations and reanalysis, which showed winds, waves, and tides of high magnitude at the accident site during the incident period. Analysis of the results of this event using REAS and CMEMS data indicate their usefulness to study similar future oil spills events.

Title	Microfacies and composition of ferruginous beds at the platform-foreland basin transition (Late Albian to Turonian Natih Formation, Oman Mountains)
SDG	**SDG 14 - Life Below Water**
Authors.	Mattern, Frank // Pracejus, Bernhard // Scharf, Andreas
Links/ DOI	https://doi.org/10.1016/j.sedgeo.2021.106074
Abstract	Two forebulge successions exist in the Oman Mountains at the platform-foreland basin transition between the Late Albian to Turonian Natih Formation and the foreland basin shales of the Late Cretaceous Muti Formation. Forebulge creation is suggested by limestone microfacies analyses and analyses of ferruginous crusts and oolites, showing rapid changes in bathymetry and relative sedimentation rate. Each succession displays basal shallow subtidal limestone, passing upward directly to ferruginous crusts and then to Fe-rich oolites deposited in shallower and agitated water. Each succession is topped by clayey layers. Microfacies and lithological evolution of the two successions are alike, suggesting repetitively similar depositional and tectonic conditions. As both sequences occur at the same site, lateral forebulge migration possibly did not occur, suggesting an overall stationary vertical and stepwise forebulge development. The compositional evolution of the ferruginous crusts was complex and includes postdepositional diagenetic effects of the rocks. Both ferruginous crusts once consisted of iron sulfides, implying at least slightly reducing conditions during their formation, associated with water-deepening events. Both oolite levels contain chlorite, hematite, quartz, calcite and apatite. They also contain fragments of chlorite and hematite as nuclei, suggesting that these fragments derived from preexisting ferruginous crusts. Iron oxyhydroxides and clinochlore within the oolites reflects bathymetric changes to more oxidizing aqueous conditions, associated with water-shallowing events. Fe-rich anoxic to sub-oxic sea water of the marine foreland basin was the source for the crusts and oolites which coincided with a high rate of global Cretaceous ocean crust production and related hydrothermalism as well as the regional proximity of an active spreading axis. Fe was probably stabilized in ocean water as organic Fe complexes and Fe colloids.

Title	Mixed deltaic and carbonate deposition in a tectonically restricted basin
SDG	**SDG 14 - Life Below Water**
Authors.	Ahmed Abbasi, Iftikhar // El-Ghali, Mohamed
Links/ DOI	https://doi.org/10.1002/gj.4542

Abstract	Mixed siliciclastic and carbonate sediments of the Eocene Musawa Formation were deposited in the Abat Basin in the south-eastern part of the Oman Mountains when the rest of the Arabian Plate was experiencing extensive carbonate sedimentation. The Musawa Formation was deposited as mixed siliciclastic and carbonate sediments in the Abat Basin bounded by the Ja'alan and Qalhat strike-slip faults. Movements along these bounding faults and extensive deformation in the source area provided an enormous amount of clastic sediments in a laterally restricted basin undergoing strong tectonic-related subsidence and was fed by basin axis parallel drainage system. The lithofacies assemblage represents fluvial and wave-dominated deltaic sediments that accumulated as a local siliciclastic feature in a carbonate-dominated subtropical environment. The Musawa Formation is divided into three members, the lower, middle, and upper, based on lithological characteristics; however, this study focuses on the lower and middle members of the formation. The lower Musawa member is about 350 m thick, comprising laterally confined conglomerate (lithofacies GL) beds interbedded with Alveolina-bearing sandstone in the lowermost part of the formation. These beds were deposited as fan-delta on top of the underlying Ypresian limestone of the Abat Formation. The conglomerate beds grade up-section into over 170 m thick medium- to thick-bedded channelized sandstone lithofacies (lithofacies CSL), occasionally interbedded with mudstone and peat streaks. The sandstone sequence northwards of the study area passes into fine-grain lithofacies of siltstone and mudstone (lithofacies ML). The sandstone (CSL) was deposited in a delta-plain setting with coastline shifting northwards. The enormous thickness of the sandstone sequence is due to the location of the depocenter around Wadi Musawa area, from where the streams entered the basin and deposited their sediment load. The upper part of the lower Musawa member comprises interbedded clay, siltstone, and thin-bedded fine-grain sandstone (lithofacies association LFA3) deposited as mud-flat accumulations. The middle Musawa member is about 650 m thick, comprising both carbonate (LFA4) and siliciclastic (LFA2 and LFA3) lithofacies associations. The carbonate lithofacies association (LFA4) was deposited during flooding events. The marl lithofacies (CM) comprising branching corals,

gastropods, and oysters was deposited in a lagoonal setting, whereas thick-bedded limestone lithofacies (CL) comprising Nummulites was deposited in open-marine conditions. Occasional coarse siliciclastic influx resulted in the deposition of mouth bar and shoreface lithofacies association (LFA2), especially in the upper part of the middle Musawa member. The mouth bar and shoreface sandstone interbedded with occasional chert-bearing conglomerate are laterally persistent across the Abat Basin outcrops. The uppermost part of the middle Musawa member is defined by ridge-forming, thick-bedded open-marine limestone (CL) extending across the Abat Basin. The upper boundary of this limestone facies (i.e., CL) marks the boundary between the middle and upper members of the Musawa Formation. This study helped in understanding the mechanism of mixed siliciclastic–carbonate deposition in the Abat Basin.

Title	Mixed deltaic and carbonate deposition in a tectonically restricted basin: An example from the lower and middle members of the Eocene Musawa Formation, Abat Basin, south-eastern Oman Mountains
SDG	**SDG 14 - Life Below Water**
Authors.	Ahmed Abbasi, Iftikhar // Ali, Arshad // El-Ghali, Mohamed
Links/ DOI	https://doi.org/

Abstract | Mixed siliciclastic and carbonate sediments of the Eocene Musawa Formation were deposited in the Abat Basin in the south-eastern part of the Oman Mountains when the rest of the Arabian Plate was experiencing extensive carbonate sedimentation. The Musawa Formation was deposited as mixed siliciclastic and carbonate sediments in the Abat Basin bounded by the Ja'alan and Qalhat strike-slip faults. Movements along these bounding faults and extensive deformation in the source area provided an enormous amount of clastic sediments in a laterally restricted basin undergoing strong tectonic-related subsidence and was fed by basin axis parallel drainage system. The lithofacies assemblage represents fluvial and wave-dominated deltaic sediments that accumulated as a local siliciclastic feature in a carbonate-dominated subtropical environment. The Musawa Formation is divided into three members, the lower, middle, and upper, based on lithological characteristics; however, this study focuses on the lower and middle members of the formation. The lower Musawa member is about 350 m thick, comprising laterally confined conglomerate (lithofacies GL) beds interbedded with Alveolina-bearing sandstone in the lowermost part of the formation. These beds were deposited as fan-delta on top of the underlying Ypresian limestone of the Abat Formation. The conglomerate beds grade up-section into over 170 m thick medium- to thick-bedded channelized sandstone lithofacies (lithofacies CSL), occasionally interbedded with mudstone and peat streaks. The sandstone sequence northwards of the study area passes into fine-grain lithofacies of siltstone and mudstone (lithofacies ML). The sandstone (CSL) was deposited in a delta-plain setting with coastline shifting northwards. The enormous thickness of the sandstone sequence is due to the location of the depocenter around Wadi Musawa area, from where the streams entered the basin and deposited their sediment load. The upper part of the lower Musawa member comprises interbedded clay, siltstone, and thin-bedded fine-grain sandstone (lithofacies association LFA3) deposited as mud-flat accumulations. The middle Musawa member is about 650 m thick, comprising both carbonate (LFA4) and siliciclastic (LFA2 and LFA3) lithofacies associations. The carbonate lithofacies association (LFA4) was deposited during flooding events. The marl lithofacies (CM) comprising branching corals,

| | gastropods, and oysters was deposited in a lagoonal setting, whereas thick-bedded limestone lithofacies (CL) comprising Nummulites was deposited in open-marine conditions. Occasional coarse siliciclastic influx resulted in the deposition of mouth bar and shoreface lithofacies association (LFA2), especially in the upper part of the middle Musawa member. The mouth bar and shoreface sandstone interbedded with occasional chert-bearing conglomerate are laterally persistent across the Abat Basin outcrops. The uppermost part of the middle Musawa member is defined by ridge-forming, thick-bedded open-marine limestone (CL) extending across the Abat Basin. The upper boundary of this limestone facies (i.e., CL) marks the boundary between the middle and upper members of the Musawa Formation. This study helped in understanding the mechanism of mixed siliciclastic–carbonate deposition in the Abat Basin. |

Title	Monthly Succession of Biofouling Communities and Corresponding Inter-Taxa Associations in the North- and South-West of the Arabian Gulf
SDG	**SDG 14 - Life Below Water**
Authors.	Abed, Raeid
Links/ DOI	https://doi.org/10.3389/fmars.2021.787879
Abstract	Marine biofouling is a complicated process involving changes within micro- and macro-fouling community, species co-occurrence, and inter-taxa association patterns. An investigation of all above-mentioned aspects has rarely been conducted so far. Our study aimed to compare the monthly succession of the biofouling community developed at two locations each in the north- (Kuwait) and south-west (Oman) of the Arabian Gulf (AG) over 6 months, and to explore the association patterns within microfouling and between micro- and macro-fouling communities on a temporal and spatial scale. Spatio-temporal effects on the abundance and composition of micro- and macro-fouling communities were detected based on total biomass, bacterial and phototroph abundances, macrofouling coverage and 16S rRNA gene sequencing. We documented the development of distinct ecological niches within the fouling community resulting in fundamentally different succession patterns depending on location. Network analysis revealed nine clusters of highly interconnected co-occurring fouling bacterial taxa (M1-M9), with strong association (both positive and negative) to microalgae and macrofoulers in both Kuwait and Oman. Early stages of Kuwait biofilm showed M7 (cyanobacterial OTUs) positively and negatively associated with the majority of diatoms and macroalgae (Cladophoraceae), respectively, unlike the later stages where M5 (composed of Vibrio spp.) was positively associated with polychaetes (Hydroides elegans). While the causal relationships behind the observed inter-taxa associations remain unknown, our study provided insights into the underlying dynamics of biofouling processes encountered in the north- and south-west of the AG. Comprehensive future investigations encompassing transcriptomic or metabolomic tools may be required to address the challenge of interpreting such complicated dynamics over time and space in a continuously changing environment.

Title	Optimization of double-layer perforated breakwater based on risk assessment of uncertainties
SDG	**SDG 14 - Life Below Water**
Authors.	Etri, Talal // Nikoo, Mohammad Reza
Links/ DOI	https://doi.org/10.1016/j.oceaneng.2022.112612
Abstract	In this work, the optimal dimensions of a double-layer perforated breakwater were determined by considering the risk of uncertainties in marine conditions, including wave height and wavelength. To do so, the CVaR-NINP technique combines Conditional Value-at-Risk (CVaR) and Nonlinear Interval Number Programming (NINP), which are useful in dealing with discrete interval uncertainties and probabilistic. Based on experimental data, two Extreme Learning Machine (ELM) models were developed to simulate the hydraulic behavior of the breakwater. To increase accuracy and performance, the parameters of these two models were optimized using single and multi-objective optimization algorithms. The obtained results indicate that the non-dominated sorting genetic algorithm (NSGA-II) exhibited better performance in optimizing ELM. Subsequently, optimized ELM, which better modeled the hydraulic performance of perforated breakwater, was selected to link to the NSGA-III algorithm to determine the trade-off between the defined objective functions based on the CVaR-NINP technique, namely, minimize CVaR of (C_t), minimize the radius of the interval number of (C_t), minimize CVaR of (C_r), minimize the radius of the interval number of (C_r). Pareto optimal solutions, obtained from NSGA-III, using the multi-attribute decision-making (MADM) method, also called the R-method, were ranked and applied to select the best solutions.

Title	Potential control of invasive species of orange cup coral Tubastrea coccinea Lesson, 1829 using a synthetic natural compound
SDG	**SDG 14 - Life Below Water**
Authors.	Dobretsov, Sergey
Links/ DOI	https://doi.org/10.1590/2675-2824070.21069RDSC
Abstract	Non-toxic defence against marine biofouling species including invasive species is urgently required. The effect of a synthetic natural compound "1-hydroxy-2-O-acyl-sn-glycero-3-phosphocholine" was tested against larvae of the invasive orange cup coral T. coccinea Lesson, 1829. The larvae were placed in 24-well microtiter plates immediately after their release and subjected to the compound at concentrations of 0.5, 5, 10, 50, and 100 µg mL-1 and three treatments (copper sulfate, solvents, and seawater). Larval mortality ranged from 35% (100 µg mL^{-1}) to 3% (5 µg mL^{-1}), and their average of lethal concentration (LC50) was 142.2 µg mL^{-1}. The results of this study show that compound is a potential option to be applied in the management and control of T. coccinea on artificial structures.

Title	Process optimization and modeling of Cd^{2+} biosorption onto the free and immobilized Turbinaria ornata using Box–Behnken experimental design
SDG	**SDG 14 - Life Below Water**
Authors.	Hassan, Sedky
Links/ DOI	https://doi.org/10.1038/s41598-022-07288-z

Abstract	The release of effluents containing cadmium ions into aquatic ecosystems is hazardous to humans and marine organisms. In the current investigation, biosorption of Cd^{2+} ions from aqueous solutions by freely suspended and immobilized Turbinaria ornata biomasses was studied. Compared to free cells (94.34%), the maximum Cd^{2+} removal efficiency reached 98.65% for immobilized cells obtained via Box–Behnken design under optimized conditions comprising algal doses of 5.04 g L^{-1} and 4.96 g L^{-1}, pH values of 5.06 and 6.84, and initial cadmium concentrations of 25.2 mg L^{-1} and 26.19 mg L^{-1}, respectively. Langmuir, Freundlich, and Temkin isotherm models were suitably applied, providing the best suit of data for free and immobilized cells, but the Dubinin–Radushkevich model only matched the immobilized algal biomass. The maximum biosorption capacity of Cd^{2+} ions increased with the immobilized cells (29.6 mg g^{-1}) compared to free cells (23.9 mg g^{-1}). The Cd^{2+} biosorption data obtained for both biomasses followed pseudo-second-order and Elovich kinetic models. In addition, the biosorption process is controlled by film diffusion followed by intra-particle diffusion. Cd^{2+} biosorption onto the free and immobilized biomasses was spontaneous, feasible, and endothermic in nature, according to the determined thermodynamic parameters. The algal biomass was further examined via SEM/EDX and FTIR before and after Cd^{2+} biosorption. SEM/EDX analysis revealed Cd^{2+} ion binding onto the algal surface. Additionally, FTIR analysis confirmed the presence of numerous functional groups (hydroxyl, carboxyl, amine, phosphate, etc.) participating in Cd^{2+} biosorption. This study verified that immobilized algal biomasses constitute a cost-effective and favorable biosorbent material for heavy metal removal from ecosystems.

Title	Remote sensing and deep learning techniques for impact assessment of Shaheen cyclone at Al Batinah governorate of Oman
SDG	**SDG 14 - Life Below Water**
Authors.	Al-Mulla, Yaseen // M. Bait-Suwailam, Mohammed
Links/ DOI	https://doi.org/10.1117/12.2638466
Abstract	The Shaheen cyclone triggered coastal areas of Al-Batinah Governorate of the Sultanate of Oman and caused devastating impacts on vegetation areas, infrastructure and properties that resulted in severe damages and human casualties. A comprehensive evaluation of the cyclone is essential to identify the most impacted areas in the Governorate especially in its four regions Al-Musanaah, Al-Suwaiq, Al-Khaboura and Saham. An advanced techniques and very high resolution datasets have been used to study, analyze and mapping the effects caused by the shaheen Cyclone. The systematic approach included investigating changes before and after the cyclone of various parameters such as vegetation coverage, detection of buildup damages in agriculture lands, detailed study on coastline changes and inundations in agriculture areas & urban community. Both pre-classification and post classification change detection techniques were used to assess the impact of the cyclone. Using very high resolution datasets and application of latest techniques of Geographical information system and remote sensing like vegetation indices, deep learning models, spatial analysis and advanced object based detection methods were used to analyze the damages caused by the cyclone. Agricultural land change detection and its coverage calculation was studied and mapped. All individual vegetation parcels within the study area were analyzed and delineated. Date palm trees classification and counting was conducted and mapped. Inundations in agriculture lands and urban buildings in the agriculture areas were identified and mapped. The changes in the coastline and marine features were studied and mapped using latest object based classification. The outcome of this study was helpful in identifying the most affected areas and providing tempo-geospatially damage assessment that assist the humanitarian aid as well as paving the road for future hazard mitigation and new protection strategies.

Title	Replacement of Vegetable Protein Sources with Marine By-Product on Nutrient Utilization, Protein Digestibility, Meat Quality and Economics in Ross-308 Broilers
SDG	**SDG 14 - Life Below Water**
Authors.	Farooq, Muhammad
Links/ DOI	https://doi.org/10.17957/IJAB/15.1956
Abstract	The objective of this experiment to study the effect of replacement of vegetable protein with marine by-product (fish meal) sources on nutrient utilization and economics in broilers fed on low protein diet. Five diets (CP 18%; ME 2950 kcal/kg); (R1) control: vegetable protein ingredients whereas in R2, R3, R4 and R5, 25, 50, 75 and 100% of total dietary protein was replaced with a Hi-Pro fish meal on a protein-equivalent basis. Four hundred and twenty-five (n=425) day-old Ross-308 broiler chicks were divided into 5 treatments having 5 replicates (17 birds in each). Feed intake, weight gain, FCR and dressing percentage were improved (P < 0.05) in birds fed diet R3 in which fish meal contributed 50% of the dietary protein compared to those on all-vegetable protein (Control-diet R1) and those in which 25% (diet R2), 75% (diet R4) or 100% (diet R5) of the dietary protein was replaced with fish meal till day 21. Digestibility of CP was the highest (P < 0.05) in birds fed diet R3 in which fish meal replaced 50% of the dietary protein. Production cost/kg live weight was lesser in birds fed diet containing 25 and 50% replacement of fish meal with vegetable protein sources.

Title	Review of fisheries and management of sea cucumbers in the Indian Ocean
SDG	**SDG 14 - Life Below Water**
Authors.	Claereboudt, Michel
Links/ DOI	https://doi.org/10.4314/wiojms.v21i1.10
Abstract	Several sea cucumber species (Echinodermata: Holothuroidea) are fished, mostly for export of the dried product for Oriental consumers. Previous studies had analysed the historical trends at the world-scale until 2014. In the Western Indian Ocean (WIO) holothurian fisheries have a long history and several programmes have tried to ameliorate their management. Information has been recently gathered through a questionnaire and access to the most recent, yet unpublished available data (2015 to 2021) from different countries, through the evaluation of catches and/or processed product, present management systems, the imports of beche de mer and other products from Indian Ocean (IO) countries into the major market hub of Hong Kong SAR, and the Food and Agricuture Organisation (FAO) yearly statistics. The results are first presented for WIO countries, highlighting recent improvements in man-agement. Imports from 16 WIO countries into the Hong Kong market (2017-2020 data) indicate the importance of the hub. The FAO world statistics are used to present the changes for the last few years, concentrating on the WIO countries. The recent trends show that demand for holothurians is still very high. Inconsistencies in the unit used in the reported statistics (fresh or dry weight) exist, and this needs to be addressed. The national data should be collected at the species level, to be able to follow the changes and the stock status. A regional approach is needed to encourage use of comparable management tools and follow future trends.

Title	Sea turtle hatchlings can distinguish between coastal and oceanic seawaters
SDG	**SDG 14 - Life Below Water**
Authors.	Leduc, Antoine
Links/ DOI	https://doi.org/10.1242/jeb.244702
Abstract	Following their emergence on land, sea turtle hatchlings need to travel through the open ocean. Whether hatchlings can detect ecologically and functionally relevant chemical cues released in the marine habitat is unknown.We collected seawater at 6 and 27 km off the Brazilian coast, i.e. within and beyond the continental shelf. In a two-choice flume, we exposed post-emergent (<24 h old) loggerhead (Caretta caretta) turtles to these seawaters. Based on their life history, we posited that if hatchlings could distinguish between the seawater from these regions, they should prefer the oceanic seawater and/or avoid the coastal seawater. Hatchlings were tested singly and could access any parts of the flume. We recorded the seawater plume first visited and the time spent in each plume. Of all the first choices and time spent in a plume, nearly 70% involved the oceanic seawater. The ability of hatchlings to distinguish between seawaters could provide goal-recognition information.

Title	Short-Lived Aggregations of Filograna/Salmacina Tube Worms in the Gulf of Oman
SDG	**SDG 14 - Life Below Water**
Authors.	Claereboudt, Michel
Links/ DOI	https://doi.org/10.3390/d14110902
Abstract	Dense aggregations of serpulid worms were encountered in the Daymaniyat Islands (Gulf of Oman) from 10 to 20 m depth, over the period January–March, 2021. The species responsible for these aggregations belongs to the Filograna/Salmacina-complex (Annelida: Serpulidae). This species has been present in the area and observed along the Oman coastline, but high-density aggregates like this have not been reported before. The most probable cause of the aggregations, supported by field observations and Aqua-MODIS satellite data, was natural eutrophication with a subsequent algal bloom linked to the local winter monsoon. This observation emphasises the importance of documenting biodiversity and dynamics of reef communities along the Oman coastline.

Title	The Significance of PCR Primer Design in Genetic Diversity Studies
SDG	**SDG 14 - Life Below Water**
Authors.	Delghandi, Madjid
Links/ DOI	https://doi.org/10.1007/978-1-0716-1799-1_1
Abstract	Genetic markers are widely applied in the study of genetic diversity for many species. The approach incorporates a Polymerase Chain Reaction (PCR) amplification of targeted sequences in the genome. Crucial for the overall success of a PCR experiment is the careful design of synthetic oligonucleotide primers. Ideally designed primer pairs will ensure the efficiency and specificity of the amplification reaction, resulting in a high yield of the desired amplicon. Important criteria such as primer-sequence, −length, and -melting temperature (T_m) are fundamental for the selection of primers and amplification of targeted nucleotide sequences from a DNA template. There are many computational tools available to assist with critical bioinformatics issues related to primer design. These resources allow the user to define parameters and criteria that need to be taken into account when designing primers. Following the initial in silico selection, a primer pair should be further tested in vivo for their amplification efficiency and robustness. Using examples taken from genetic diversity studies in a marine crustacean, this chapter provides outlines for the application of PCR technology and discusses details for the design of primers for the development and characterization of microsatellite and SNP-markers.

Title	Ichthyodiversity in southeastern Arabian Peninsula
SDG	**SDG 14 - Life Below Water // SDG 15 - Life on Land**
Authors.	Al Jufaili, Saud
Links/ DOI	https://doi.org/10.11646/zootaxa.5134.4.1

Abstract	Oman, a country in Southwest Asia, situated on the southeastern quarter of the Arabian Peninsula presents a high level of biological diversity especially marine elements. Although arid habitats cover most parts of Oman (82%), the region has several freshwater systems that are vital for the survival of people as well as for different groups of animals and plants. Research works on Oman biodiversity including terrestrial and marine, have been steadily increasing over the last few decades, but freshwater ecosystems have not been well investigated. Oman comprises parts of three freshwater ecoregions including the Oman Mountains, Southwestern Arabian Coast, and Arabian Interior having xeric freshwaters and endorheic (closed) basins which support a variety of inland fishes. The current checklist provides for each species of inland waters of Oman all recognized and named taxa, documenting recent changes and controversies in nomenclature, its records, taxonomic status, synonyms, etymology, common English name, short description, range expansion, and detailed distribution map based on several field surveys throughout the country. We also provide native, endemic, and introduced species. The diversity of inland fishes of Oman included in this annotated checklist consists of 23 recognized species in 15 genera, 10 families, seven orders, and a class. Also, for the first time, we report and confirm the presence of four species in the inland waters of Oman. The most diverse order is Cypriniformes (nine species, 39.13%), followed by Gobiiformes (six species, 26.09%), Cyprinodontiformes (three species, 13.04%), Cichliformes (two species, 8.69%), and Centrarchiformes, Gonorynchiformes and Mugiliformes (one species, 4.35% each). 21 native species (91.3%) in nine families and two exotic species (8.7%) in two families are listed here. Out of 21 native species, eight species (16.8%) in two families are endemic elements that are restricted to the Oman territory only. Identification of all recognized species was confirmed by DNA barcoding (mitochondrial COI). Oman Mountains Ecoregion (OME), Southwestern Arabian Coast Ecoregion (SACE), and Arabian Interior Ecoregion (AIE) harbor 15, 12, and one species, respectively. The provided data will be necessary for increasing the fish knowledge, the development of competent and pragmatic management plans and effective conservation policies.

Title	Intracellular nitrate storage by diatoms can be an important nitrogen pool in freshwater and marine ecosystems
SDG	**SDG 14 - Life Below Water // SDG 15 - Life on Land**
Authors.	Abed, Raeid
Links/ DOI	https://doi.org/10.1038/s43247-022-00485-8
Abstract	Identifying and quantifying nitrogen pools is essential for understanding the nitrogen cycle in aquatic ecosystems. The ubiquitous diatoms represent an overlooked nitrate pool as they can accumulate nitrate intracellularly and utilize it for nitrogen assimilation, dissipation of excess photosynthetic energy, and Dissimilatory Nitrate Reduction to Ammonium (DNRA). Here, we document the global co-occurrence of diatoms and intracellular nitrate in phototrophic microbial communities in freshwater (n = 69), coastal (n = 44), and open marine (n = 4) habitats. Diatom abundance and total intracellular nitrate contents in water columns, sediments, microbial mats, and epilithic biofilms were highly significantly correlated. In contrast, diatom community composition had only a marginal influence on total intracellular nitrate contents. Nitrate concentrations inside diatom cells exceeded ambient nitrate concentrations ~100–4000-fold. The collective intracellular nitrate pool of the diatom community accounted for <1% of total nitrate in pelagic habitats and 65–95% in benthic habitats. Accordingly, nitrate-storing diatoms are emerging as significant contributors to benthic nitrogen cycling, in particular through Dissimilatory Nitrate Reduction to Ammonium activity under anoxic conditions.