DOSI

DEEP-OCEAN STEWARDSHIP INITIATIVE

DEPICTING THE DEEP: THE ART OF ILLUSTRATING SCIENCE

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THE ARTIST AT WORK

I'm pictured here in my studio at Scripps Institution of Oceanography where FIVE VULNERABLE DEEP-OCEAN ECOSYSTEMS was created. It was my task to picture these deep-sea worlds in their pristine beauty and ecological balance, and then to "see" what industrialisation would bring to the picture. This investigation made me into an activist-through-art on behalf of our planet's ocean. My hope is that it may impress upon all who see it the need to protect our fragile and singular blue and green planet - vast but not inexhaustible.

In order to paint anything well I must understand it, so the first step in my process is research. Once I've chosen the species to represent, I begin to design the composition. Line and colour are used to move a viewer's eye around the page, and the scene goes off the page in all directions to avoid being static. I paint a watercolour sketch (used in the top-half background of this poster) to lay out the colours. Once I'm satisfied with the composition, I transfer the sketch onto canvas, which I have already painted in oils with the pre-planned colours of the background (used in the bottom-half background of the poster). Finally, I paint in the detail in oils, where the magic happens. I'm always thinking about colour, because that's where the painting reaches people's hearts.

Soon after its inception in 2013, the Deep-Ocean Stewardship Initiative (DOSI) commissioned a bespoke artwork to illustrate its subject and scope. The resulting image (above) by artist Tanya Young has become DOSI's calling card, used in all DOSI's digital outlets, presentations, promotional materials and event backdrops. Its power to entice is not only in its intricate and wholesome beauty, but also in its detail and scientific accuracy of the fauna, activities and impacts it depicts. This poster explores the origin story of the artwork, the inspiration, techniques and processes that led the artist to its creation, as well as Tanya's own story of her interest in the deep ocean as a subject matter for her art. DOSI has certainly benefited from the attention the artwork attracts, opening DOSI's work on the provision of science-based knowledge to a wider audience of scientists and artists alike, and showing how the art-science collaboration is a potent tool to create understanding.

MANGANESE NODULE FIELDS

For the MANGANESE NODULE FIELDS ecosystem, I depicted a flat abyssal plain with exaggerated perspective to show how vast the nodule fields are at the bottom of the ocean. The Clarion-Clipperton Zone in the northern Pacific Ocean east of Hawaii may be the first area of deep seafloor where these metal-rich nodules are mined commercially, principally for rare metals needed for the "green energy transition": electric car batteries, smartphones, solar panels and wind turbines.

Manganese nodules come in various shapes and sizes, usually resembling potatoes. They form extremely slowly - their thickness increasing by just a millimetre every million years. As a result, manganese nodules can only form where environmental conditions remain constant over such long periods of time.

My representation depicts a manganese nodule collector, a yellow sea cucumber; the jellyfish *Voragonema pedunculata*, deep-sea anglerfish *Melanocetus johnsoni*, and a tripod fish *Bathypterois grallator*. The perception that deep-sea plains are uniformly flat and sparsely populated still persists, yet we now know the biological diversity there is vast, especially where manganese nodules cover the seabed. Most of the lifeforms there have yet to be discovered.

CONTINENTAL SHELF MARGIN/ PHOSPHATE MINING

I was interested to show the balance and interdependence of species; one of my criteria in choosing which species to show among the many possible for each ecosystem. An example of this interdependence is the three species shown in CONTINENTAL SHELF MARGINS/PHOSPHATE MINING: hake (*Merluccius merluccius*, a member of the cod family), bearded goby (*Sufflogobius bibarbatus*) and African jellyfish (*Chrysaora africana*). If the goby is killed by the vacuum, the hake population is reduced because of the loss of its food source. The jellyfish then proliferates, destabilising the natural balance of the ecosystem. It also causes the loss of a food source for humans.

I wanted to show those species which would be harmed by human activities. Other species I chose based on emotional impact, such as the angler fish (scary teeth) or the blob fish (funny face!). I try to include a face in my paintings, if possible, as the viewer's eye will always go first and with personal interest to a face. So, it is important that the face be very well painted!

Plans now exist for mining deep marine phosphates, which are to be used as fertiliser in industrial agriculture in several places worldwide: Namibia, Papua New Guinea, Baja California Sur, and New Zealand - using a device such as the Subsea Slurry Lift Pump, the vacuum pictured in my painting.

METHANE SEEPS

Dead and long-buried organisms at the bottom of the ocean slowly decompose, producing methane in the process. As pressure builds, the gas finds its way out of the sediment through fissures, emerging as bubbles into the water above - these are METHANE SEEPS. These streams of dancing bubbles rarely reach the ocean surface, as they dissolve into the water on their ascent.

Far from the sunlit shallows, seeps in the deep ocean encourage the proliferation of microbes that use the chemical energy in methane - instead of sunlight - to grow. These in turn are food for other organisms uniquely adapted to their environment, they include the tube worm *Lamellibrachia luymesi*, which can live more than 250 years, the mussel *Bathymodiolus childressi*, the yeti crab *Kiwa puravida*, and the deep-sea crab *Chaceon quinquedens*.

Also called "cold seeps", they are found along continental margins and are associated with mineral deposits, carbonate rock formations and oil deposits. Because of these rich natural deposits, they can be targeted for sub-sea oil drilling. The Subsea Spar Well platform pictured here containing risers for drilling and water injection can be deployed in the ocean up to 3,000 meters deep.

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HYDROTHERMAL VENTS

Black smoker HYDROTHERMAL VENTS are a dramatic and unearthly backdrop for fish and other organisms living at these submarine hot springs where life on Earth may have originated. Here, over millions of years, an ecosystem has developed that is perfectly adapted to conditions that are usually hostile to life. In an environment of absolute darkness, extreme pressure, dissolved toxic compounds and temperatures greater than 350 degrees Celsius, there is a unique community of species.

In the dark, white bacteria *Beggiatoa alba* obtain their energy not from sunshine through photosynthesis, but from chemicals dissolved in the geysers of scalding water. These bacteria are food for other organisms such as the galatheid crab *Shinkaia crosnieri* and hydrothermal vent mussels *Bathymodiolus thermophilus*. Giant tube worms *Riftia pachyptila* host in their bodies their own chemosynthetic bacteria from which they get their nourishment. These deep-ocean habitats contain a "living library" of genetic resources with unimaginable potential.

Vent chimneys form as the scalding water cools on contact with the frigid deep ocean and dissolved metals come out of solution. They contain gold, copper and zinc, which are of commercial interest to miners and their host nations. The giant robot Seafloor Production Tool is almost eight meters high and may mine vents for copper in the near future.

In 2021 I was invited as Artist-at-Sea aboard the *RV Falkor* operated by Schmidt Ocean Institute, to visit the San Juan Seamount on the continental shelf off the coast of Southern California. It was simply gorgeous! Watching by video in real time as the remotely operated vehicle (ROV) descended through the water was thrilling.

In the water column I saw transparent ctenophores, giant siphonophores, a vast group of lavender pyrosomes, the striking red jellyfish *Poralia rufescens*, and marine "snow" - detritus drifting down from the world above. Upon reaching the seamount, I saw exquisitely coloured corals and sponges, and a variety of fantastical creatures living upon them - a beacon of biodiversity in a seemingly empty ocean. Such beauty is best described by art, not words!

For the SEAMOUNT FISHING ecosystem (as for all five ecosystems depicted), I researched the species and the technologies used to exploit them. I relied on live feeds of undersea exploration, as well as websites of companies developing deep-sea mining and fishing equipment. In this section I illustrated a bottom trawl net, as well as the blackbelly rosefish *Helicolenus dactylopterus*, an orange roughy *Hoplostethus atlanticus*, which can live up to 149 years, the adorable blobfish *Psychrolutes marcidus*, a squat lobster *Munida quadrispina*, cold-water coral *Desmophyllum pertusum*, bubblegum corals *Paragorgia arborea*, and the feather star *Florometra serratissima*.

SEAMOUNT FISHING

ABOUT THE ARTIST

I trained at the Art Institute of Chicago and at the University of Michigan School of Art. I received the Postgraduate Certificate in Science Illustration from California State University at Monterey Bay and completed an internship at the Scripps Institution of Oceanography in La Jolla, CA, where I launched my career painting ocean subjects.

My grateful appreciation goes to Dr Lisa Levin who commissioned this painting for DOSI. From Lisa I learned about human activities taking place in the deep ocean "virtually out of sight and often beyond national jurisdiction and control". I am so honoured that my painting has become the "calling card" of DOSI, and thrilled to know that it has been seen so many times at international scientific conferences and forums, at PhD defences and online.

To find out more about my work, visit my website by scanning the QR code above.