Poseidon Marine Science News

ANTIFOULING R&D

POSEIDON OCEAN SCIENCES (NY, USA)
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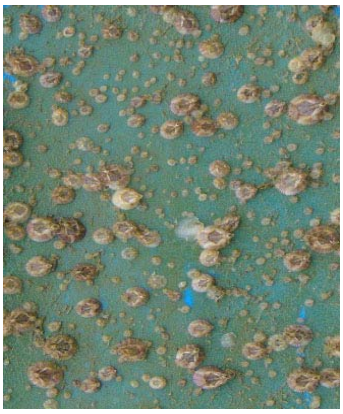
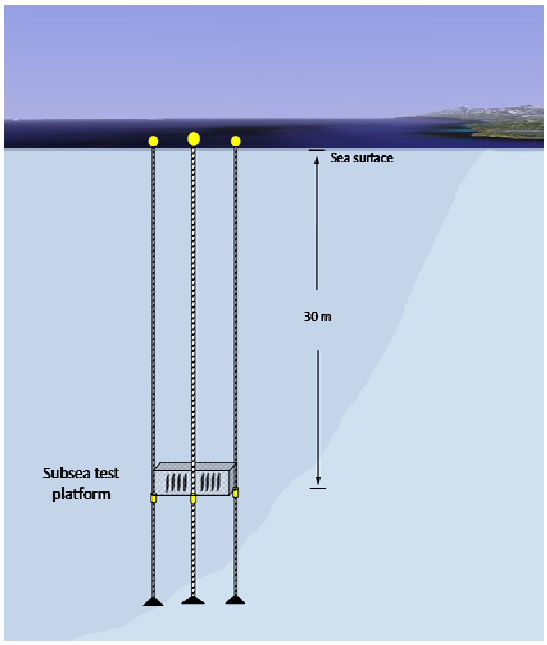
Poseidon Sciences launches subsea antifouling test platform at 30 meter depth to evaluate deepwater fouling

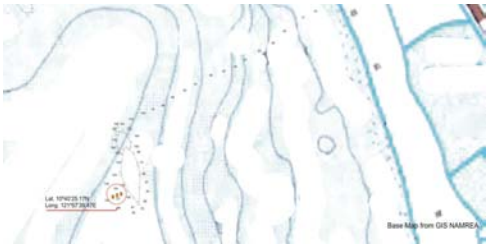
The evaluation of marine biofouling is typically conducted in shallow depths, usually 2 to 4 feet from the surface. This test is sufficient to determine the performance of antifouling coatings for applications in small boats and ships. Poseidon's marine antifouling research center in Tuticorin, India provides R&D services to support this industry. However, there are many applications where coatings are used in much deeper waters, particularly for those to coat pipelines and oil rigs, where the fouling communities, environmental conditions and pressures are markedly different.

In December, 2008, Poseidon Sciences launched a new test facility at its Athena Biosystems Station in the island of Panay (Philippines) . This new Athena Subsea Test facility comprises an underwater platform extending from the surface to 45 m depth. The structure, anchored at the sea bottom, allows for installation of test panels in static immersion at various depths, depending on project sponsor specifications.

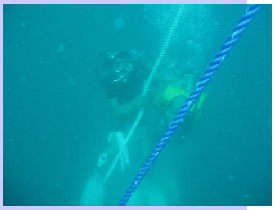
Because it is located in a tropical environment, fouling attachment is rapid, with settlement of goose barnacles as the primary hard fouling species. The figures on the right are examples of the typical fouling found on an unprotected PVC panel in static immersion for only 1 month. Algal soft fouling are also common.







Schematic representation of the subsea platform and sonar map of the test site.



SUBSEA antifouling research

Understanding the interactions between fouling communities and surfaces is a complex issue. And, coatings system that work well against fouling at the submerged bottom of the ship's hull does not necessarily perform well against surfaces in deeper submergence. Building a subsea test facility offers the opportunity to begin validating the performance of coatings against such an environment. *Why build the site in Philippine waters?* There are many reasons. First, Athena Biosystems Philippines, a division of Poseidon Sciences, already has an operating subsea facility that samples pelagic fishes from depths down to 50 meters. Second, we have marine biologists, botanists and divers maintaining the subsea test site. Adding another component to the current operation minimizes the capital cost of developing the program. Third, the marine tropical location is ideal for testing because of existing aggressive year-round subsea fouling environment enabling faster evaluation of subsea coatings. This facility shall enable coatings chemists to fine tune their formulation. Test results are supplied electronically after the inspection period, along with, barnacle counts and other relevant biological and structural information.

Athena Biosystems staff at subsea site

Araceli Lorella, science officer and director of operations of Athena

The subsea fouling environment is a challenging one for marine paint chemists. Poseidon's R&D team is here to make biofouling R&D a little easier and a lot faster

Darwin's sketches of barnacles

Charles Darwin's passion for barnacles: rediscovering the origins of barnacle research

Having been in fish biology in my earlier years and a biomedical scientist in my middle ones, my own passion for barnacle research did not come until later after meeting Prof. Dan Rittschoff at Duke University and Sister Avelin Mary at SHMRC in the early 1990's. Barnacles are not exactly the cute furry creatures one can get passionate about, so I have to admit that the interest was partially clouded by my capitalistic pursuits. Like many of us in this business, we write about the barnacle, *Balanus amphitrite amphitrite Darwin*, and yet did not spare any second thoughts about why Darwin's name came to be part of it. So, let me tell you why.

The Charles Darwin we are all familiar with is the English naturalist who wrote *The Origins of Species and Natural Selection,* which has since become the foundation for our understanding of evolution and the unifying explanation for the diversity of life on earth. He wrote about his theory in 1844, then quickly shelved it inside his desk drawer, specifically instructing his wife to release it for publication only if he died unexpectedly. Darwin was a modest man who shied away from controversies and he knew his theory will be so controversial, and even remains to be so on this 150th anniversary of writing the *Origins*. For 20 years, the paper remained hidden until he received a letter from a young English naturalist, Alfred Russell Wallace, then living in an island of what is now Indonesia. In a malarial fit, Wallace remembered reading Thomas Malthus' 1798 *Essay on the Principle of Population* (which coincidentally also inspired Darwin) and reached his own *Eureka* moment totally independently. He quickly dispatched a letter to Darwin describing an almost identical theory of evolution. In the typical Darwin sense of fair play, he presented Wallace's ideas and his own at the same time during the meeting of the prestigious Linnean Society, giving equal credit to the ideas of Wallace and the share of the controversy as well. Yet, Darwin is credited with the theory of natural selection because his ideas were written while Wallace was yet in his teens, over 20 years before.

Young Charles Darwin

HMS Beagle

Then, you may ask, what did he do for 20 years? Besides dealing with his failing health and the tragedies in his life, he was consumed by the passion of cataloguing barnacles. His interest in these tiny, ugly creatures began during his famous round the world voyage in HMS Beagle. Then, at the age of 26, young Darwin was exploring the Chilean coastline looking for biological specimens when he came

upon a conch shell riddled with tiny boreholes despite its thick shell. Inside the hole was a microscopic creature, attached by its head to the shell and waving six tiny legs. Darwin was fascinated, knowing that it is a barnacle, but without a shell. It was never been described by any naturalist before. He was a disciplined taxonomist and organized the chaotic nomenclature of this organism, numbering over 1000 species, which were often misnamed during his time. Upon his return to England and immediately after writing his ideas on natural selection, at great expense to his health, he began his day and night obsession with barnacles that lasted for 8 years (1846-1854) cataloguing the collection from his voyage and from the hundreds more sent to him by mail from around the world .

What drove this passion about such a mundane organism? Perhaps a clue comes from his earlier publication of a controversial, incendiary, speculative book, *Vestiges of the Natural History of Creation*. Widely panned even by his friends, the failure of the book was a great disappointment. Even his best friend, the noted botanist Joseph Hooker wrote "no one has the right to examine the origin of species who has not minutely described many." Perhaps, one reason for this obsession was indeed to minutely observe a distinct part of the natural world and in so doing earn his right to question their origins.

Whatever the reason might be, Darwin started us all on a path of research towards understanding barnacle biology and the commercial opportunities that follow in its wake. As for me, at least I have someone else to blame now for my current obsession with barnacles — Charles Robert Darwin.

Sister Avelin and Dan Rittschof, 1988

Jonathan R. Matias, *Executive Director*
Poseidon Sciences Group

In Celebration of the 150th Anniversary of Charles Darwin, Poseidon Science Foundation will award the Darwin Society Prize for best series of scientific papers of the last five years that sheds more light on the physiology and behavior of barnacles. Winner to be announced at this year's Darwin Society Symposium to be held at Poseidon-SHMRC Station in Tuticorin, India.

The Poseidon Science Foundation (PSF) is the non-profit science and technology organization of the Poseidon Science Group. Its mandate is to pursue development programs that promote safer utilization and protection of the world's water resources, conservation of endangered species and development of livelihood technologies for the coastal communities around the world. In collaboration with SHMRC (India), PSF has established Darwin Society, which focuses on the biology of barnacles and promotion of environmentally safer technologies to prevent unwanted biofouling on submerged surfaces. A Workshop is being planned as the first of many symposia on this subject. For more information about forthcoming meetings and the Darwin Society Prize, please send email to *foundation@poseidonsciences.com*. Please use subject heading as Darwin Society programs.

Announcing a new society, *The Darwin Society*, dedicated to barnacle biology.

Join us.

Become an active member.

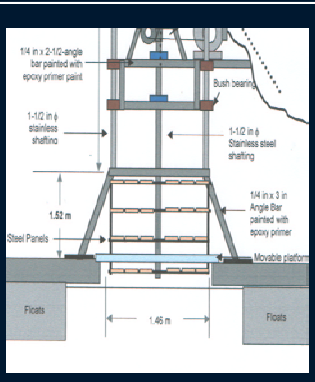
Testing marine antifouling paints in small fishing boats in India

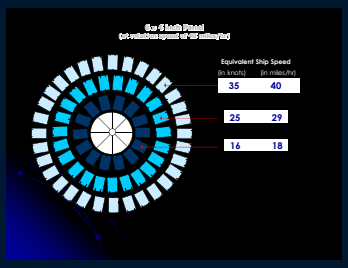
Coastal fishing villages throughout India rely heavily on small fishing boats for their livelihood. Barnacle fouling is a major problem in local fishing boats, along with the concern on cost of marine paints. More effective, yet affordable paint systems especially tailored to local fishing boats will help in reducing chemical pollution of the coastal water and reduce cost to local fishermen. As part of SHMRC-Poseidon program, field testing

of coatings on fishing boats is now made possible through the collaboration with fishing communities along the coast around the port city of Tuticorin. Over 50 fishing boats have been entered into the program that permits regular inspections of boats coated with experimental paints. Companies interested in participating in this testing program, please contact our NY headquarters by sending email to : info@poseidonsciences.com.

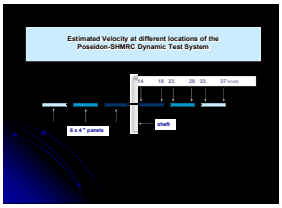
Fishing boats in Tamil Nadu

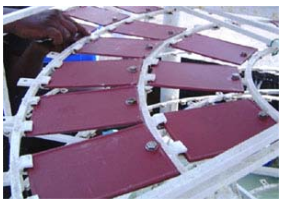
SHMRC - Poseidon's Dynamic Test Platform in its 6th year of operation !





The concept began during a discussion between Sister Avelin, Juergen Rabenhorst and Jonathan Matias in May 2002. Athena Biosystems (Philippines) was assigned the task of developing the engineering design and construction of the prototype of the dynamic testing machine. After completion of its engineering tests, the prototype was shipped to Sacred Heart Marine Research Station (Tuticorin, India) where it was mounted on a floating platform and launched out to sea in the middle of Karrapad Cove in Tuticorin Bay in 2003. Since then, over 25 companies have used this new technique in the evaluation of marine coatings. This novel dynamic system, the only one of its kind in the world, makes it possible to simulate performance of coatings at multiple speeds simultaneously in an actual open ocean environment.

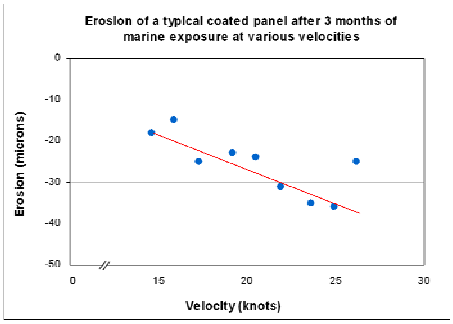




The Poseidon Dynamic Test System (PDTS) is a versatile platform that allows exposure of flat panels on a rotating frame in the middle of the sea. Supplied with electric power through an underwater cable from the shore laboratory (photo on right), the motors rotate the panels horizontally at various speeds ranging from 15 to 25 knots. The erosion rate as a result of the fluid shear forces can be determined at each specific speed. The figure on the right shows the erosion of a self-polishing copolymer coating at different speeds.

Although static immersion test is sufficient to measure the antifouling characteristics of a particular coating, it is not as reliable in determining the performance of the entire coating system. In many cases, panels that do well under static, fail when exposed to shear stress in the PDTS machine. Testing in advance enables reformulation or redesign of the top coat, primer and application procedures to meet customer expectations. On the right is a comparison of same coating exposed for 2 months in both immersion tests. The difference in the results was compelling.

Static immersion

Dynamic immersion

The shore laboratory of SHMRC especially dedicated to marine antifouling testing.