

Pollution

Editorial

The marine habitats and organisms we are studying are under siege due to human activities, and pollution remains one of the most insidious and long-lasting anthropogenic destructors. The oil spill in the Gulf of Mexico in 2010 reminded us of the extensive harm caused by this type of pollution and fortunately, stimulated additional research to gauge the impacts of the spill on Gulf wildlife. Gulf species such as the Bluefin Tuna and the critically endangered Kemp's Ridley sea turtle have unique and important breeding and nesting sites located in the Gulf. With all the interest in the oil spill, we seemed to forget about the consistent appearance of dead zones in the Gulf believed to be caused by agricultural run-off from the heartlands of America. Agricultural runoff and human sewage are believed to be largely responsible for the 80% decline in Caribbean coral species in the past two decades. In Florida, 60 to 70% of green sea turtles in intra-coastal waterways polluted by agricultural runoff have a disease known as fibropapillomatosis, versus 4% of green turtles with the disease in the ocean. This indicates a potential causal relationship of agricultural runoff to this debilitating disease. For a depressing visual of the state of our coastal waters, fire up your Google Earth and click "dead zones" under the "Ocean" layer.

Before the oil spill, interest was centered on the Pacific Garbage Patch which is comprised of discarded, floating plastics undergoing photo-degradation into smaller and smaller pieces. The area covered by this patch, north of the Hawaiian Islands, is estimated to be equivalent to the State of Texas and is doubling in size every ten years. Some estimates state that the amount of plastics in the Pacific exceeds the amount of plankton, weight for weight, by upwards of 6-fold. Given that much of this plastic has photo-degraded to the size of average planktons, causes one to wonder what is happening to the diets of planktivores feeding in that area. Larger bits of colorful plastics are collected by foraging albatrosses which are then fed to their chicks, resulting in a 50% mortality rate on the Midway Island nesting population chicks. In the Atlantic, things are not much better. Studies on post-hatchling sea turtles have demonstrated that upwards of 80% of the less than one-year-old hatchlings already have plastics and tar in their stomachs. It is clearly important to analyze the impact of this plastic ingestion on the mortality of these vulnerable animals. When the estrogen-mimicking properties of some of the plasticizers used in these plastics are considered, there is the potential for a whole lot of trouble coming our way! In a similar vein, we still dump untreated or partially treated sewage into our oceans at such a rate that medications, such as birth control pills and anti-depressants, have been shown (in fresh water studies) to alter the behavior or gender of fish in the vicinity of the outflows. We have the technology to correct these problems; we are just unwilling to pay the additional costs.

One final type of pollution that has largely gone unnoticed is light pollution. Recognition of the negative impacts of light on nesting sea turtles and their hatchlings led to the adoption of beach front lighting ordinances starting in the mid-1980s. Around the same time, reports emerged on the negative impacts of light at night to marine birds. Many species were found to circle point sources of light until they fell into the ocean from exhaustion. Lights are used to attract fish and squid, and many studies have reported altered behavior, changes in

reproductive behavior, and heightened vulnerability to predation in fish exposed to light at night. Recent studies on humans show that light at night suppresses melatonin production which alters the normal circadian rhythm. Little is known about the effect of light at night on the circadian rhythms of fish, birds, corals, and algae. Recent work by me and others has shown that point sources of lighting alone are not the only problem with light at night. The cumulative glow of city lights at night (sky-glow) are now negatively impacting nesting sea turtles and their hatchlings in areas that have no beachfront lighting. Sky-glow generally doubles in intensity every ten years and in the past three years has begun to be lethal to sea turtle hatchlings on otherwise dark beaches. Satellite images of the earth at night show that sky-glow apparently affects waters kilometers offshore. One can only guess at what damage is being done to the inhabitants of near-shore reefs, including the corals. The one good thing about light pollution is that it can be corrected by the flip of a switch and there is no remaining toxic residue as seen in oil spills and agricultural runoff.

In 2006, Stephen Meyer wrote a short book called "The End of the Wild" in which he stated, "...the race to save the composition, structure, and organization of biodiversity as it exists today- is over, and we have lost." Sadly, our ability to study pristine eco-systems, even in the oceans, is being compromised by our continued belief that we can dilute our waste in the vastness of the oceans. My purpose in this editorial is to ask marine scientists, whether they work in the field or in a laboratory, to continue to study the negative impacts of human activities, and more importantly, educate students and members of the public that this needless loss of our "wild" areas need not happen. And let's not forget, we still have climate change, sea level rise, and ocean acidification to deal with.

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