Growing populations and tightening water supplies have spurred people in many places--including the Middle East, Australia, California and China--to look to the oceans and other salty waters as a source of new drinking water.Discharge from plants using thermal technologies can be much hotter than the ocean; this can be "fatal for marine life and can cause a lasting change in species composition and abundance," according to a 2012 paper focused on the Arabian (aka Persian) Gulf, the epicenter of desalination. Reverse osmosis plants, on the other hand, do not have much of a heat impact. Chemicals--especially chlorines, which are lethal to many organisms--are generally neutralized prior to discharge. But brine waste may contain residues of cleaning chemicals, reaction by-products and heavy metals from equipment corrosion. Miki Tramer, vice president of sales and marketing at Israel-based IDE Technologies (a major manufacturer of desalination technology), says the chemicals--at least from the company's own plants--have a negligible influence. The chemicals are treated and the water diluted before discharge, he says, so the amounts are very small. Different desalination technologies, however, produce varied levels of chemical pollution in their brine. And even the desalination industry agrees concentrated salt is a problem. Because it is heavier than seawater, the brine tends to settle toward the bottom of the coastal areas where it is released--unless it is diluted. The excess salt decreases dissolved oxygen in the water, suffocating animals on the seafloor. Technologies exist to reduce brine waste prior to disposal or to mine pollutants out of the waste for commercial use--but this is generally cost-prohibitive. Instead, plants use other strategies to minimize damage. One such alternative involves situating plants in areas where strong currents help disperse the brine. But this is not always possible. For example, the Arabian Gulf is shallow, lacks strong currents and has seen incoming freshwater slow to a trickle due to upstream dams and to people in the region diverting water for drinking and irrigation. The Gulf is also a receptacle for salty "produced water" from the oil and gas industry.Despite the ecological threats, "there was no comprehensive assessment about brine--how much we produce," says Manzoor Qadir, assistant director of the United Nations University Institute on Water, Environment and Health. So he and his colleagues calculated that figure and found it is 50 percent greater than the desalination industry's previous rough estimate. In fact, it is enough to cover Florida with 30 centimeters of brine every year. How much brine a desalination plant produces depends on its water source--such as seawater or brackish (semisalty) water--and on the type of technology it employs, Qadir says. Reverse osmosis, which pushes water through a membrane to strain out the salt, is the most widely used technology today and produces 69 percent of the world's desalinated water. When used on seawater it creates an average of 42 percent water and 58 percent brine, for a "recovery ratio" of 0.42.Credit: Carla Gottgens Getty Images Because brine discharge had not been reported comprehensively, Qadir and his colleagues looked at the recovery ratios for various combinations of water types and desalination technologies in the scientific literature.Two other methods, called "thermal" technologies, work by heating water to steam in order to separate the salt and produce about 25 percent of global desalinated water--and much more brine waste. One such process, called "multistage flash distillation" has a recovery ratio of just 0.22.But the abnormally fast flow prevented species with slow-swimming larvae--such as tube worms, lace corals and sponges--from colonizing the impact zone.At the same time, species that thrive in high-flow conditions--such as barnacles and bivalves--increased

in number, says study lead author Graeme Clark, a senior research associate at the University of New South Wales's School of Biological, Earth and Environmental Sciences.But desalination plants are energy intensive and create a potentially environment-harming waste called brine (made up of concentrated salt and chemical residues), which is dumped into the ocean, injected underground or spread on land.Some plants make efforts to better mix the brine into the ocean when discharged, either by using multiple waste outlets that spread it over a larger area or by pressurizing the waste flow to disperse it by force.A recent six-year study at the Sydney Desalination Plant in Australia found its pressure diffuser reduced excess salinity in coastal areas where waste brine was released.They found that instead of creating one liter of brine for every liter of freshwater produced, as had generally been assumed, desalination on average has a ratio closer to 1.5 to 1.As a result of these factors, the Gulf is now about 25 percent saltier than typical seawater, with hotspots double or triple its regular salinity.Solids are separated from seawater as it undergoes treatment at a desalination Plant in Wonthaggi, Australia.From these data points they were able to calculate the average recovery ratios for more than 80 percent of the desalinated water produced worldwide.The study showed an attempt to reduce the harm of extreme salinity can change the composition of species living in the outfall area.says Heather Cooley, research director for the Pacific Institute, an independent water research organization based in California.That attitude could be why there have been few studies of brine discharge effects in specific locations.The researchers' U.N.-backed study was published in December in Science of the Total Environment."This is not dumping buckets of chemicals into the water," he notes.In addition to harming sea life, extreme salinity also makes desalinating the water more difficult and expensive.The Red and the Mediterranean seas are also growing more saline.Returning salt to the ocean might not seem like an environmental concern.People tend to think, "It's seawater. It came from there. Who cares?"