



WILDLIFE AND OFFSHORE DRILLING

The 2010 Gulf of Mexico Disaster: *Sargassum*

SEA TURTLES IN SARGASSUM © MASA USHIOKA/SEAPICS.COM; OIL RIG © U.S. COAST GUARD

A common brown seaweed found in dense concentrations in the Gulf of Mexico is getting a lot of attention from scientists assessing the harm caused by the BP Deepwater Horizon oil spill. *Sargassum*, better known regionally as gulfweed or sea holly, floats in large mats or aggregations that function as biological oases in the nutrient-poor surface waters of the deep Gulf and play a significant role in providing food and shelter for a wide variety of marine life.

FLOATING HABITAT

Sargassum is a widespread genus of seaweed that takes its name from the Portuguese word for little grapes, *sargaço*, which the tiny, air-filled bladders that sprout from its branches and keep it afloat resemble. The genus includes about 150 species found in the shallow waters and coral reefs of the world's temperate and tropical oceans, but is best known for its two completely free-floating species, *S. fluitans* and *S. natans*. These species live their entire life cycle in the surface waters of the open ocean, forming impressively large floating mats made up of individual plants.

Buoyed by its "little grapes," *Sargassum* stays at the surface, which is necessary for photosynthesis, the process it uses to

make food with energy from the sun. In fact, *Sargassum* is specially adapted for photosynthesizing at the air-sea interface, where solar radiation is so intense. It can make cellular adjustments to decrease functional light absorption during the sunniest days and increase light absorption on overcast days. *Sargassum* even has a natural sunscreen to protect it from UV rays.

If ocean currents are favorable, *Sargassum* can form patches that at their very densest reach up to a few acres and are three to five feet deep. These "islands" of *Sargassum* in the middle of the ocean provide crucial habitat for a wide variety of marine animals, including sea turtles, marine



Seahorses blend right in and find food, shelter—and a free ride—in the dense, floating mats of *Sargassum* that blanket the surface of the deep waters of the Gulf of Mexico.

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before ending up northeast of the Bahamas in February of the following year.

The Gulf produces so much *Sargassum*, incredibly dense swaths of it—some miles-long—are easily detected from space. In satellite images, *Sargassum* aggregates appear as light yellowish or greenish strands dispersed throughout the entire Gulf of Mexico off Louisiana and Texas.

Teeming with life

A diversity of marine life thrives in these dynamic, floating oases. Many hide deep in the *Sargassum* aggregate, some perfectly camouflaged by their color and shape. Seahorses and slender pipefish, for example, are practically indistinguishable from *Sargassum*'s branches. And the *Sargassum* crab and *Sargassum* fish mimic the colors and patterns of the seaweed so well they are practically invisible to all but the most discerning eye.

The larger animals found in floating mats of *Sargassum* consume crabs, shrimp and tiny fish and attract even larger marine predators. One way to visualize this *Sargassum* food web is to imagine an upside-down, floating coral reef. Instead of the base of this reef being on the sea floor, however, it drifts along at the sea surface. Just as on a coral reef, the smaller fish and marine life hide close to the foundation, with the progressively larger predatory fish stacking up at ever greater distances below.

Fish and squid are far more abundant in and around *Sargassum* than they are in the Gulf's open waters. At least 80 species of fish alone have been recorded in *Sargassum*. Filefish, jacks, blue runners, Atlantic flyingfish and triggerfish are among the most common species. Seahorses, which have low mobility and small home ranges, travel by holding fast to floating *Sargassum*. *Sargassum* habitat also seems to provide an overall ecological advantage: Fish associated with the mats are comparatively larger than those found in open-water habitat.

Sargassum is also a vital nursery for newly fledged sea turtles that are especially vulnerable to ocean-going predators. Hatchling loggerhead, green, Kemp's ridley and hawksbill sea turtles have all been recorded in *Sargassum*. Several seabirds forage in and around *Sargassum*, and some species frequently roost in or on the thickest mats. Audubon's shearwater, masked booby, red-necked phalarope and several species of terns are specialists at targeting the mats for bouts of feeding. The tropical-dwelling bridled tern is the most closely tied to this habitat, rarely straying far from the large clumps of *Sargassum* on which it feeds, perches and rests in open water.

birds and economically important species such as tuna, dolphin-fish, wahoo and billfish. *Sargassum* offers food and shelter for these animals, which in turn provide the seaweed with nutrients it needs, like nitrogen and phosphorus, via their waste products. As an integral part of such a mutually dependent and delicately balanced community, *Sargassum* is highly vulnerable to oil exposure.

SARGASSUM IN THE GULF OF MEXICO

The Gulf of Mexico serves as the Atlantic's *Sargassum* nursery. *Sargassum* is "born," i.e., splits into fragments that generate new growth, mostly in the northwest Gulf during the spring months. From there, currents transport it through the Straits of Florida and out into the open Atlantic Ocean by about July. It then appears off Cape Hatteras, North Carolina,

IMPACTS OF OIL

Petroleum hydrocarbon residues are often found in trace amounts in *Sargassum* and its larger associated fauna. Because oil and *Sargassum* both float, they tend to eventually aggregate in greater concentrations together, even if initially

separated by vast distances, especially if ocean winds are not too strong. In addition to the liquid components of crude oil that pose risk, the more weathered tar balls are also known to stick to *Sargassum*.

Ocean currents concentrate oil at and near *Sargassum* mats, but the oil does not magnify in concentration from one trophic level to the next in the food web. Nevertheless, the contamination seen so far in the BP Deepwater Horizon spill goes far beyond the background levels of light contamination previously reported. Without a clean, functioning base for this food web, not just the smaller immediate inhabitants of *Sargassum*, but also the top predators, the large fish, the sea turtles, the marine birds, all are at risk. Lifeless, oil-soaked clumps of *Sargassum* were found just a few weeks into the spill. There is little precedent for understanding what will happen to the *Sargassum* community after months of continued exposure to such contamination.

Other threats

A survey of pelagic *Sargassum* in the North Atlantic Ocean, Caribbean Sea and the Gulf of Mexico between 1977 and 1981 showed that the biomass of the plants in the Sargasso Sea was less than 6 percent of what it was from 1933 to 1935. There were also major decreases in the Gulf of Mexico, the waters of the North American continental slope and near the

Bahamas. These drastic reductions over the past half century may be related to an increase in human-introduced pollutants in the ocean.

Prior to 2004 when it was effectively banned inside U.S. territorial waters, commercial harvest of pelagic *Sargassum* removed as much as 180 tons per year. A single firm processed the raw algae into a variety of agricultural fertilizers and dietary supplements used in the swine and poultry industries. Potential effects of commercial use as well as any impacts from climate change on *Sargassum* are unknown.

WHAT CITIZENS CAN DO

- Advocate careful training and oversight for all Gulf oil clean-up operations to prevent inadvertent harm to sea turtles and other marine life that can remain hidden in the contaminated *Sargassum*.
- Work to assure oil spill clean up protocols prohibit the burning of *Sargassum* and the myriad marine species that rely on this productive marine habitat.
- Urge elected officials to pass comprehensive climate change legislation that addresses the impacts of global warming on marine ecosystems and our other natural resources.

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A well-camouflaged swimming crab is barely distinguishable amid *Sargassum*.



A mat of *Sargassum* floats in the open ocean, where it supports a teeming community of marine life—from invertebrates and sea turtles to sea birds and economically important fish like tuna, dolphin-fish, wahoo and billfish.

WHAT POLICY MAKERS CAN DO

- Ensure that BP funds the long-term research necessary for documenting impacts to all of the Gulf ecosystems in harm's way from the spill and provides mitigation for any long-term physiological damage from exposure to dispersants.
- Support requirements for discharge practices that reduce if not eliminate the risk of hydrocarbon pollution of ocean surface waters within U.S. jurisdiction.
- Impose greater safety and environmental standards and develop comprehensive spill response plans for offshore drilling operations.
- Prevent expanded drilling operations off the coast to limit future spill risks.
- Enact comprehensive energy and climate change policies to transition away from harmful oil and fossil fuels.

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