

Topical Review

Longline Fishing (How What You Don't Know Can Hurt You)

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Longline fishing utilizes monofilament lines that can be as much as 62 miles long. The line itself is buoyed by Styrofoam or plastic floats. Usually, at about every 100 ft, a secondary line is attached and hangs down from the mainline. The lines are baited with mackerel, squid, or shark meat and have as many as 10,000 hooks. Every 12–24 hours, the line is hauled in, mechanically rebaited, and set back into the water behind the vessel. The baited hooks can be seen by albatross and other seabirds as they are placed in the water or being hauled out. When the birds dive for the bait, they are hooked, dragged behind the fishing boat, and drown. Spectacularly nonselective, longline fishing techniques also hook many other forms of marine life—“bycatch” (sea turtles, seals, dolphins, penguins, sharks, and many other nontarget finfish). It is estimated that 300,000 seabirds (including 100,000 albatross) die on longlines each year. Albatross are among the longest-lived birds. They can live up to 60 years and some species do not start breeding until they are 10 years old. They have a low reproductive rate and many species only breed every other year. In addition, a species like the Wandering Albatross (*Diomedea exulans*) rears its chicks for an average of more than 270 days. Albatross pair for life and may take years to find a new partner if their mate is killed. Owing to their incredibly low reproductive rate, albatross are particularly vulnerable to longline fishing. Currently, it is believed that 4 albatross drown per 100,000 hooks set. This is more than 400 birds a week. The current mortality rate for adult birds is not sustainable and for some species, the birds are dying faster than they can repopulate. Currently, 19 of the world's 22 albatross species are threatened with extinction. This year longline fishing ships will set 10 billion hooks worldwide. Various mitigation measures (bird-scaring lines, weighted, faster-sinking line, setting lines deeper out of the bird's sight, reduction in the amount of offal discarded from fishing boats, night fishing, and restriction of longline operations from areas where nesting and foraging birds are congregated during the breeding season, among others) have been proposed and attempted. There is no one panacea for the effects of longlining and mitigation efforts are most successful when used in combination. Some of these mitigation measures have shown very promising results. Some experts feel that government legislation, regulation, and enforcement in conjunction with incentives for the fishing industry to incorporate and implement mitigating techniques have the best chance in ameliorating the problem. The public is surprisingly unaware of this wanton and wasteful exploitation of the ocean's resources, and the worldwide demand for seafood continues to rise. Meanwhile, globally, fishermen voice the same complaints: fewer fish, smaller fish, shorter fishing seasons, bizarre developments in their seasonal appearance and dispersal, and fewer overall species seen. These are all the classic signs of overfishing. Each year it is estimated that some 90 million tons of wild fish are harvested from our planet's oceans. Nearly 30 million tons of this is discarded as the incidental bycatch of nontarget species. If international curbs are not placed upon wasteful fishing practices, we are doomed to learn a painful maxim. “The ocean is not infinite.” Veterinarians must become involved in worldwide conservation efforts, acting locally, while thinking globally.

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Introduction

What you don't know doesn't hurt you
 “Puddn'head Wilson”—Mark Twain

For many cultures and civilizations worldwide, fish have traditionally provided a steady supply of available protein. As the population of the Earth has exploded and many developed countries have identified fish as a healthier source of sustenance, international demand for fish has skyrocketed. Commercial fishing ventures in a multitude of countries deal in supply and demand. These commercial fishing enterprises are bound by 3 realities; the actual operational costs of fishing (in terms of equipment, manpower, licenses, processing, etc.), the supply of the target species, and the demand for and price of the target fish set by a world market.¹ Like any other business, commercial fisheries must attempt to maximize their profitability and productivity. As a result, modern commercial fishing techniques are a far cry from a worm on a hook at the local fishing hole. Centuries of stalking the

same species, studying their natural history and behavior, and modern sophisticated fish-finding equipment have taken most of the guesswork out of locating targeted species in their largest numbers.² Many modern fishing techniques are astonishingly nonselective in what is caught and are damaging to the environment at a variety of levels. Compliance by commercial fisheries with local, national, and international laws and agreements regarding quotas, fishing techniques, and illegal activity is difficult to monitor and adherence to these laws at sea is next to impossible to enforce.

The problem is demand for fish by virtually the entire global market. People are eating more fish. In the last 50 years, world per-person consumption of fish has gone from 20 lb/y (1960) to 36 lb (2005).¹ Even the way we look at fish is skewed. We call them “seafood.” What other species or group of animals has our ultimate goal in its name? The other problem is that of all the tens of thousands of species of fish in the oceans, world demand clamors for only 5 fish: cod, tuna, halibut, salmon, and sea bass (and before that the now somewhat protected swordfish). Industrial fishing

with its sophisticated factory ships is only too happy to oblige. As a result, worldwide fishermen voice the same complaints—fewer fish, smaller fish (“no more big ones”), shorter fishing seasons, bizarre developments in their seasonal appearance and dispersal, and fewer species seen. In 1900, the average Atlantic swordfish caught weighed more than 300 lb.¹ In 1963, the average swordfish landed was 266 lb and in 1996 the average swordfish weighed just 90 lb. That the size of the animals captured is shrinking and that almost all the fish caught are juveniles are classic signs of overfishing. Despite these observations, wild fish are still being caught in huge numbers. Wild fish harvested from the oceans is estimated to amount to some 90 million tons a year.¹ Although we are fast approaching a tipping point with regard to wild fish species, there is still time to do something. Fish do not need us to survive, they reproduce just fine on their own. We need them.

Recently, I returned from my third trip to Antarctica. While at sea, I had the opportunity to visit with seamen, researchers, scientists, and oceanographers. In our conversations, they all in different ways drummed home the same message. “*The ocean is not infinite.*” On my trips, I witnessed many worrisome things; pollution, contamination, retreating ice fields, resumption of Japanese whaling, and factory fishing, and I was discouraged. Nevertheless, we cannot allow ourselves to be pessimistic. There is much that we can do. In this discussion, we focus on one type of commercial fishing, investigate the damage it has caused, and explore what measures can be taken to alleviate its destructive effect. Veterinarians must become integral players in conservation efforts. We are duty bound to safeguard animal life on this planet and this does not stop at the doors of our hospitals. Veterinarians must become stewards and guardians of all life on Earth. We cannot afford to be like Pudd’nhead Wilson. What we do not know can hurt us more than we can imagine. We must learn to take stock of the world around us.

Longline Fishing

The herring are not in the tides as they were of old.
The Meditation of the Old Fisherman—W.B. Yeats

Aside from pollution and contamination with toxins, commercial fishing has the greatest effect upon marine ecosystems.³ It affects both the life cycle and the habitat of the target species. In the face of smaller catches, greater costs for fuel and operations, and decreasing revenues, the fishing industry has been forced to adopt evermore invasive techniques. With fishing methods falling under greater governmental and international agency scrutiny, techniques like gill netting falling into worldwide disfavor, and a United Nations (UN) ban on drift nets, longline fishing appeared by the early 1980s. By this method, vessels trail a monofilament fishing line, often more than 60 miles long. Every 100 ft or so, a secondary line (called a “gangion” or a “snood”) branches off carrying additional baited, barbed hooks as it dangles. These lines themselves can be up to 1200-ft long. Often, there are as many as 2000 of these secondary branches over the 60 miles that the line stretches. Hooks are typically baited with squid, mackerel, or sometimes shark and a single longline may carry up to 10,000 hooks. The longline is buoyed by Styrofoam or plastic floats. Most of the longline boats have freezer capacity, a small working crew, and can stay at sea for months covering vast ranges of ocean. They know the fish they seek and use sophisticated fish-finding equipment such as sonar and computer-guided imaging to find schools of fish. Every 16–24 hours, they haul in the lines they trail, retrieve their catch, mechanically rebait the hooks, and reset the lines. In 2006, it was estimated that 3 billion longline hooks were set worldwide and in 2012 the number of longline hooks set worldwide was 10 billion.^{4–6} More than 80 million tons of fish is caught each year through longline techniques.⁷

The nonselective nature of longline fishing is immediately apparent. This limited selectivity leads to “bycatch,” which is the incidental and unintentional capture of living nontarget species.^{3,8–10} Each year thousands of seabirds, marine mammals, sea turtles, sharks, and unwanted finfish are caught by longline techniques.^{3,6,11} Most of this bycatch is discarded with the majority of these unintentionally caught animals dying. Worldwide, a recent estimate of the total marine bycatch discarded was more than 30 million tons per year or about one-third of the yearly total catch.^{3,4,12} In one study, 149 other species of unwanted finfish were observed to be caught and discarded in 1 week aboard a fishing boat.³ The usual target of longline enterprises are large predatory fish such as tuna, swordfish, Chilean sea bass (Patagonian toothfish), and to a lesser extent halibut, cod, marlin, and snapper. Everything else is discarded as undesirable, usually for economic reasons.

Lost fishing gear threatens marine life. Lines can break away and this lost gear continues to function (“ghost fishing”), catching target, nontarget, and protected species alike.^{3,13–15} Comprehensive data on the effect of ghost fishing is not available but ingestion of and entanglement in discarded human fishing gear has been documented in more than 250 marine species.^{3,14}

It is easy to blame the commercial fishing industry, easy to look for the “smoking gun.” Nevertheless, the blame lies in multiple places. Lack of cooperation among the countries with regard to conservation of ocean resources, lack of incentives of the fishing industry to follow government mandates, lack of a coherent and visionary “ocean policy” by our own government and leaders, ignorance on the part of the public about the dire straits facing both the fishing industry and many species of fish, and the ever-increasing demand by the consumer for seafood, all drive and sustain the incredible waste and exploitation being witnessed. The fishing industry is in trouble. As early as 1989, a study by the UN Food and Agricultural Organization estimated that it cost about \$92 billion annually to maintain and operate the world’s fishing fleets. That year revenue was only \$70 billion. The difference was made up mainly through subsidies from governments to commercial concerns.^{1,16} According to the UN, in the 1990s, the 12-country European Union was spending more than \$580 million annually in subsidies to fishing companies.¹⁶ Norway alone pays \$150 million a year to its fishermen. Japan has been estimated to be extending nearly \$20 billion in credit to its troubled fleets. Why do countries continue to subsidize such a failing proposition? It is because they know it is better to subsidize a faltering industry as in the new world economy there are no jobs for thousands of out-of-work fishermen and boat builders. In addition, the UN further estimates that the world fishing fleet currently is twice as large as what wild ocean stock can support.¹ Nations must cease to subsidize such large-scale waste and senseless exploitation.

Finally, fishing can have unintended effects on the populations of target species and upon the ecosystems they inhabit. The fishing industry’s continual removal of larger, older, and more fertile individuals from the population deplete the best reproducers and reduce a species ability to replenish itself. Not only does it affect the target species but also the food chain which the target is a part of. Depleting a dominant predator species such as swordfish or tuna can cause both competitors and prey species to increase whereas animals that prey upon the swordfish and tuna may decrease precipitously. These increases and decreases in other species can have unexpected effects. Increased discarding of unwanted dead bycatch increases the amount of food for opportunistic scavengers such as crabs, other invertebrates, nontarget fish species, and seabirds.

Commercial fishing provides numerous benefits to the nations of the world; food, employment, business opportunities, and nonedible products used in a variety of endeavors, fish meal

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