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Feature

Thinking Like an Ocean

ECOLOGICAL LESSONS from Marine Bycatch.

By Scott Norris with Martin Hall
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I've just finished another two-hour conversation with a man who considers it necessary that Pacific tuna fishers be allowed to set nets on dolphins. His outspoken and influential views have been controversial among some environmentalists. Yet there is some irony here. The man who has been bending my ear about fisheries bycatch has been a tireless advocate of industry reform and has overseen a program that has reduced dolphin mortality in tuna nets by nearly 99 percent.

His point now is that the ecological price of this "success story" has been too high. And it will climb higher still if the fishing techniques that sometimes result in dead dolphins are banned entirely.

He's right; I'm convinced of that. I believe Martín Hall, head of the Inter-American Tropical Tuna Commission's (IATTC) tuna-dolphin program, is a conservationist in the tradition of Aldo Leopold, for his interests—both philosophical and practical—are centered on spreading awareness of what is ecologically right, both among resource users and environmental activists. But solutions of the sort Hall has to offer are not always welcome, for they require both sides to stop and reexamine what exactly it is they are fighting for.

Bycatch is the word for all the nontarget organisms hauled from the ocean and discarded dead in fishery operations. The well publicized case of dolphins caught in tuna nets is one example. There are many others, including seabirds and sea turtles. Depending on the fishery, bycatch ranges from a minuscule percentage to a majority of the catch. Although fishery statistics provide no firm numbers, on a global scale even conservative estimates of bycatch are appalling. Every year, tens of millions of tons of dead marine organisms,

representing perhaps 25 percent of the world's fishery catch, are dumped into the ocean.

Martin Hall may know as much about this as anyone. One of his jobs is to study the data accumulated by on-board observers of the tuna fleet over the past two decades, and one of the things these numbers tell us is that bycatch in the Eastern Pacific has risen by an order of magnitude since the "dolphin-safe tuna" protections became law in 1990. Bycatch of undersize, nonusable tuna has risen 10-100 times by weight. Mortality of sea turtles, sharks, and many other fish species has risen significantly as a consequence of new procedures adopted to achieve dolphin-safe certification. Only dolphin bycatch has decreased.

These facts, Hall believes, tell us something important about how we define and pursue our conservation objectives. They also illustrate what can go wrong when emotionally appealing solutions substitute for ecological understanding. Animal rights is one thing; conservation is quite another. Martín Hall asks: how many billfish, how many sea turtles, how many sharks is one dolphin worth?

Bycatch can be managed, reduced, sometimes nearly eliminated. It depends on the fishery, the gear and methods used, and the species targeted for harvest and for protection. It also depends on what we're willing to accept as a solution, and in this regard the tuna-dolphin controversy is one that stops us dead in our tracks. We can't proceed without defining some beliefs about the nature of the problem, the kinds of solutions we're willing to work toward, and the principles upon which we base our stance.

Three Stories in One

Sorting through the complexities of the dolphin-tuna issue, I have come to realize that there is not just one story to be told. There are three. The one most people know something about is the lengthy battle between environmental groups and fishers over the deliberate netting of dolphins as a method of fishing for tuna. Effective publicity of the issue led to widespread public anger at the number of dolphins being killed, and a push for regulation. A series of political skirmishes ensued, and alternative means of capturing tuna were developed to comply with amended U.S. regulations on marine mammal protection. Dolphin-safe labeling was introduced in 1990 as a certification that Eastern Pacific tuna sold in the U.S. were not captured using the "dolphin set" technique. Battles have continued over exactly how dolphin-safe should be defined and how and when tuna embargoes should be imposed on other nations that don't adhere to U.S. standards. But the story is basically one of triumph over an international extractive industry. Score one for the environmentalists.

The second story, less widely known, describes the real work that was undertaken by the fishery managers, scientists, and industry leaders to reduce dolphin mortality. This story centers on a series of technical innovations and operational modifications originated by the fishers themselves. It also features a highly effective campaign of bycatch monitoring and crew training overseen by the IATTC, and most recently, an incentive-based program for implementing the new gear and procedures. In sum: with little public notice and through a process operating alongside the more visible and emotionally charged debate over whether fishers should be allowed to set nets on dolphins, methods were devised and adopted that reduced dolphin mortality in such sets by almost 99 percent from 1986 to 2000.

Finally, there is the story of unintended ecological consequences. The continuing push for zero dolphin mortality and outlawing of dolphin sets altogether has led a growing portion of the international fleet to switch to alternative ways of fishing for tuna in order to sell to U.S. and other dolphin-safe markets. The most popular of these is the setting of nets around floating objects in the water, where skipjack tuna (*Katsuwonus pelamis*) and other species often tend to aggregate. Indeed, this is a very productive way of catching skipjack. At issue, however, are the yellowfin (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*) associated with these objects that tend to be younger and smaller than either bigeye caught in longlines or the fully mature yellowfin capable of keeping up with fast-moving dolphin herds. The increase in "floating object sets" in the 1990s brought about an enormous increase in bycatch of these nonusable juvenile tuna—as well as sharks, billfish, mahi-mahi (*Coryphaena hippurus*), sea turtles, and others.

The real lessons of the dolphin-tuna experience emerge only when all three stories are told. Have dolphins benefited from the campaign waged on their behalf? Undoubtedly. Is the marine ecosystem better off as a result? Probably not. The kind of bycatch tradeoffs that

emerged in the tuna fishery are, Hall believes, the typical results of emotionally-driven, single-species approaches to defining and solving environmental problems. In this case, the problem of unwanted catch was never really solved; it was simply displaced, away from highly charismatic dolphins to other, less visible components of the marine ecosystem. Consumers, anxious to do the right thing but unaware of the tradeoffs involved, were led to believe in a questionable conservation victory.

How can scientists, environmentalists, managers, and industry leaders work toward resolution—rather than displacement—of bycatch impacts? Part of the answer lies in story number two and the work Hall and others have done with Pacific tuna fishers. Other answers can be found in the work of Ed Melvin and Julia Parrish, biologists at the University of Washington who have worked with Puget Sound gillnetters and North Pacific longliners to invent, test, and implement solutions to seabird bycatch problems. The key, all of these scientists argue, is to move beyond moral outrage and top-down regulation to cooperative engagement and problem solving.

Two Levers

Hall referred me to one of the many papers in which he has grappled with the phenomenon of fisheries bycatch, and a sentence jumps out at me, eye-opening in its neutrality: "Bycatch...is simply the result of deficiencies in our ability to select what we harvest from the ocean." Such language invites consideration of bycatch not as a morally objectionable practice requiring prohibition but rather as a technical problem amenable to solution. It also points to the fact that bycatch benefits no one. Nobody would be happier to see the "deficiencies" eliminated than the fishers themselves, whose time and energy are spent in dealing with them.

Essentially, Hall argues, there are two "levers" that can be moved to reduce bycatch in a given system: either reducing fishing effort itself or reducing the amount of incidental catch per unit of effort. The first type of solution, which typically involves regulatory bans or limits, has been the favored method of both managers and environmental groups. This approach is perhaps best represented by the United Nations ban on high seas driftnets, which effectively reduced a particular form of bycatch to zero by eliminating an entire fishery. However, such approaches may also be costly—and hence heavily resisted by the fishing industry—and often result in displacement rather than resolution of the problem. The driftnet ban, for example, resulted in both the loss of more than 15,000 jobs and the rapid expansion of a longline fishery with bycatch problems of its own.

Regulation of fishing effort is often the fastest and best solution for protecting endangered species. But single-species protections may simply postpone crises or lead to new ones. More promising in the long run may be solutions that reduce the amount of bycatch taken during ongoing fishery operations. The addition of "turtle excluder devices" to shrimp trawls, for example, has reduced sea turtle mortality dramatically. The search for these kinds of solutions, Hall says, requires a different kind of mindset than that which academics and environmentalists have typically brought to the problem. It requires imagination and engagement in trying to find workable solutions, and it requires technical expertise found only within the fishing industry itself.

Innovation and Testing

"Do you know who invented the backdown procedure?" I confess my ignorance and in so doing confirm Martin Hall's rhetorical point. Widespread adoption of the "backdown" technique for retrieving the purse seine has saved thousands of dolphin lives. After a group is encircled, the vessel moves in reverse along a curved path, causing the top portion of the net to sink and allowing dolphins to swim free. The technique's originator is not, however, known as an environmental hero; he is a tuna boat captain. Innovations such as the backdown or the Medina panel—a section of smaller size mesh in the area of the net where dolphins most often became entangled—typically originate within the fishing industry. "Fishers can often come up with better, more effective solutions than academics, agency personnel, or environmentalists," Parrish says. "They know the system better than anyone else."

Melvin and Parish have developed that simple observation into a model for cooperative problem solving in seabird and other types of bycatch reduction. Their approach incorporates both fishers' knowledge and rigorous scientific testing and is based on an expanded view of

what a true bycatch solution should entail. According to their criteria, bycatch must be reduced without simply shifting the weight of impacts to other species and without reduction in the catch of the target species. The solution must appear practical and achievable to fishers. And it must be scientifically defensible to managers, conservation groups, and the general public.

Seabird bycatch is a global conservation issue, with tens of thousands of murres, auklets, albatross, and other species taken annually in gillnet and longline operations. In Washington State, observer reports from the drift-gillnet fishery for sockeye salmon (Oncorhynchus nerka) showed that thousands of seabirds were being killed, possibly including the endangered marbled murrelet (*Brachyramphus marmoratus*). As pressure mounted from environmentalists, resource managers threatened fishery closures if fishers did not develop and test gear and practices that would reduce their catch of seabirds. Melvin met with fishers of the Puget Sound Gillnetters Association to identify possible solutions and to hash out a plan that evolved into a 3-year effort

The fishers proposed a change in the time of day when nets would be deployed (most of the seabirds seemed to be caught during the changing light conditions of early morning) and the addition of a highly visible mesh panel in the upper portion of the net. The scientific team brought another idea to the table: acoustic alarms.

In the meantime, pressure continued to build for an immediate solution. An anti-gillnetting initiative appeared on the state ballot, and environmentalists filed a lawsuit against the state over seabird bycatch. To resolve differences, Melvin and Parrish participated in a series of meetings with the Puget Sound Gillnetters Association, sport fishers, environmentalists, and resource managers. Two important points emerged from the early meetings. Gillnetters were dismayed at the speed at which the crisis had emerged—from their perspective, the numbers of seabirds killed had always seemed minuscule compared to the vast numbers of birds that often surrounded their vessels. Parrish in turn provided reasons why this seemingly rare bycatch represented a legitimate conservation concern.

As fishers reached some acceptance of the problem, their commitment to finding solutions grew. “When they offered ideas, we agreed to test them,” Melvin says. This was powerful in terms of developing trust and motivation. As the research expanded, volunteers were sought among the gillnetters to participate in a test fishery established by agreement with the management agency. Participants were rewarded by being allowed to fish outside the strict system of weekly openings and closures that regulated the commercial salmon fishery.

The test program followed strict scientific protocol but also allowed fishers to suggest additional refinements based on their experience working with the different methods being tested. The solution that finally emerged—mesh panels of a particular depth in the net, daylight fishing, and improved timing of fishery openings—reduced seabird bycatch up to 75 percent without loss of the target catch. Test fishers shared their experience using the modified gear with the rest of the fleet, supportive articles appeared in trade publications describing visible panels as a “win-win” solution, and eventually the fleet adopted the recommendations issued by Melvin’s group. He and Parrish went on to successfully duplicate their Puget Sound experience in a different kind of fishery, working with longliners harvesting sablefish (Anoplopoma fimbria), halibut, and cod in the North Pacific and the Bering Sea. Again, multiple solutions were tested, and one—flying streamers to frighten away birds while the hooked line is deployed—was adopted by the fleet.

The two scientists describe theirs as a common-sense approach: involve all parties, apply scientific rigor within the active fishery, keep solutions simple, and don’t expect miracles. Not all bycatch problems are as amenable to technical solutions, but Hall believes that in many fisheries there is great room for progress. For example, new acoustic and software technology is under development that would help tuna fishers identify species, possibly reducing bycatch in floating object sets. “Fisheries are a dynamic process,” he says. “We’re not doing a good job of bringing a lot of imagination to the technical development side. We keep making everything bigger, but we need a similar push in technology to fish better in terms of reducing ecological costs.”

Incentive-Based Management

Technical innovation doesn’t automatically lead to change. But the availability of new

technologies and procedures can open the door to new kinds of management strategies. The focus, Hall says, can shift toward rewarding effective application of new tools for bycatch reduction. In the Eastern Pacific tuna fishery, such a program has resulted in process he calls a “Darwinian selection of fishers,” in which only those skilled in avoiding dolphin mortality survive.

Implementation of this system came about only after gradual improvements in gear and methods, after observer coverage, and after formal training by the IATTC’s tuna-dolphin program produced new and achievable standards for the international tuna fleet. Seeking to create a strong incentive for fishing “clean,” most members of the IATTC, together with other countries from the Eastern Pacific, signed an Agreement for the International Dolphin Conservation Program (AIDCP) that established the current regime. Now, a total dolphin mortality limit is divided by the number of boats in the fishery, resulting in a limit for individual vessels. Well equipped boats with motivated, well trained crews are able to stay below the individual limit and keep fishing. Vessels exceeding the limit must stop setting nets on dolphins, limiting their harvest. As a result, boat owners weed out bad operators and seek captains highly skilled in dolphin avoidance and rescue techniques.

The system is powerful because it places responsibility at the level of the individual while creating a direct positive linkage between bycatch reduction and financial reward. Most years, individual vessel limits drop as more vessels join the fishery; this in turn forces fishers to continually improve. Despite the pressure this places on individual operators, the system is widely perceived as fair. Infractions are reviewed by an independent panel including members of both the fishing industry and environmental groups, with the identity and national flag of the offending vessel kept secret.

Not all fisheries have the kind of institutional framework that makes the AIDCP system possible. But in fisheries where there is a strong trade association or other unifying body, Melvin says, some kind of incentive-based management or self-policing can work. In the North Pacific longline fishery, he and Parrish have encouraged an industry reporting system with information on the bycatch totals for each boat available to all participants. The result is strong negative peer pressure against operators who, by contributing a disproportionate share of bycatch, may bring about a loss of fishing opportunity for the entire fleet. Such a system strongly promotes acceptance of new operating protocols and encourages the transfer of skills and knowledge from superior to less experienced fishers.

Thinking Like an Ocean

As a thought experiment, Hall suggests imagining a fishery in which all bycatch is eliminated. Would the marine ecosystem be better off?

Complete “victory” in bycatch reduction equals complete selectivity in fishery harvest. Such selectivity is, however, itself an ecologically strange and undoubtedly consequential phenomenon. What are the effects of a massive, precisely focused effort to harvest only one specific element of the food web? Or of a series of such efforts? The answer, in the case of tuna or virtually anything else, is that we simply have no idea. But basic ecology teaches us that substantial impacts may occur and reverberate up and down the trophic chain. Indeed, ecological common sense suggests that if the same effort were spent harvesting organisms in a diversified manner, spreading the impact vertically and horizontally across the food web rather than concentrating on a single target, impacts on community structure and function might be considerably less.

But from an ecosystem perspective, wouldn’t such a diversified harvest amount to something similar to our present system, in which one species is targeted but multiple species are taken as bycatch? No, Hall says. For one thing, under an ecological approach, the sheer waste of the current system, objectionable on both moral and ecological grounds, would be eliminated. Rather, we would learn to harvest and use other species, thereby reducing the pressures currently mounting on targeted species high in the food web.

It is of course unlikely in the extreme that the technology, infrastructure, and economy of the world’s fisheries will be redesigned to follow an ecological prescription anytime soon. Hall’s thought experiment is offered simply as a reminder that the ecological ramifications of selective fishing and of bycatch may go beyond—or be different from—what we think we already know. Thinking ecologically about these problems can be difficult both for fishers and

for conservationists, Hall says, precisely because we are so used to letting economic considerations determine policy. “We seem to have a tremendous respect for the economy, and for economic laws that can’t be broken,” he says. “We don’t seem to be very aware that we’re breaking the ecological laws.”

Parrish agrees that a new kind of thinking is needed. “We need solutions that address the larger ecosystem, working for a range of species and not just the conservation concern of the moment,” she says. Gear modifications that reduce habitat destruction by shrimp trawls, selectively releasing fish of all species below a certain size, or protecting multiple species of seabirds are at least a start in that direction.

Perhaps even more importantly, these solutions show that ecological thinking and cooperative problem solving can go hand in hand. Fishers and environmentalists may never adopt the same set of values. But concepts such as sustainability and ecosystem health form the basis for dialog and provide the potential for an agreed-upon reasonableness of policy objectives to which all parties can contribute. “An intelligent fisherman and an intelligent environmentalist will agree,” Hall says. “If you destroy the ecosystem where you are making a living, you destroy your source of income.”

To go further will require, more than anything, better information. Ecosystem-level effects of both unintentional harvest and discarded biomass are largely unknown, as are specific impacts on most bycatch species. Even knowing what the bycatch is, for most fisheries, is difficult. Observer programs remain rare throughout the world, and as a result, problems are often not identified until a crisis point has been reached. Trying to teach fishers not to fear observer programs is one of Hall’s current, self-adopted challenges. Observers can and must do more than report numbers of dead individuals of the focal species. Well trained observers, capable of identifying multiple species in the bycatch and documenting the factors that contribute to unwanted mortality, can play a key role in identifying problems and contributing to solutions before a crisis point is reached.

Clearly, Hall emphasizes, crises of species endangerment such as those faced by the vaquita (*Phocoena sinus*) and the Pacific leatherback turtle (*Dermochelys coriacea*) do require a strong and immediate response. What is equally clear is that we can’t continue to solve endangered species problems one by one. Ultimately, we need to acknowledge ecological reality, both in how we try to reduce bycatch and, in a larger sense, in how we harvest the ocean.

Conservationists cannot simply regulate fishermen out of existence nor put a ban on six billion people’s hunger for protein. Fishermen cannot ignore the concerns of many sectors of society nor expect that the resilience of ecosystems will be enough to buffer change. That’s the message Hall delivers in his talks to representatives from different fisheries wishing to learn from the dolphin-tuna experience. “It’s helpful to them just to hear that there is a solution possible,” Hall says. “We tell them they can find a solution only when they stop denying there’s a problem and stop shifting the blame to others. Then they need data. A program for testing possible solutions. And training for the fleet.”

Suggested Readings

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Inter-American Tropical Tuna Commission (IATTC): www.iattc.org

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