Excellence *ja*, elitism *non*

France and Germany are pursuing parallel initiatives to bolster their best universities. Do they go too far or not far enough?

"We're developing an institution with all of the characteristics of a research university."

—MONIQUE CANTO-SPERBER, PARIS SCIENCES ET LETTRES

"Everyone says that a large university is hard to turn round, like a supertanker," proclaims Axel Freimuth, rector of the University of Cologne in Germany. "But that's simply wrong. We have 40 new appointments every year. Our size gives us the potential to act dynamically."

A solid-state physicist, Freimuth personifies what a German university leader needs to be: three-parts persuader and one-part autocrat. That combination has worked well for Freimuth, a bear of a man who became rector at Cologne in 2005. In June, his 40,000-student university competed successfully for a €50 million, 5-year "future concepts" grant, one of 11 winners in a federally funded "Excellence Initiative" designed to build stronger German research universities.

The grant supports a strategic plan to develop the entire university. It built on earlier support for a research "cluster" in Cellular Stress Responses in Ageing-Associated Disease. The cluster grant alone, Freimuth says, has helped attract €300 million of investment—including brand-new Max Planck and Helmholtz centers—at the university. "Cologne is now *the* focus of aging research in Germany," Freimuth says.

Yet Freimuth acknowledges that some of his colleagues at Cologne are skeptical that the initiative will be able to turn a handful of German universities into global powerhouses. In addition, some faculty members outside the sciences still question whether they should be judged on their ability to obtain competitive funding.

The Excellence Initiative, launched in 2005 by then-Chancellor Gerhard Schröder, was born of politicians' and scientists' fears that Germany's research universities were falling behind in the global race to attract the best faculty members and students. Two years later, French President Nicolas Sarkozy began pushing through a set of measures with the same goal. After passing laws that gave university presidents more autonomy and greater control over their institutions, France established a program to select and support eight major research universities, eventually granting them public funds as the basis for building private endowments.

Both initiatives assume that world-class research universities are essential drivers of economic growth. And the initiatives follow the same game plan: Inject money into a small number of leading universities and allow newly empowered administrators to spend them on developing the institutions' strengths.

But this drive runs counter to egalitarian traditions in both countries. Although the quality of universities in each country differs, the gap isn't as large as, say, between Harvard University and some U.S. state universities. Many European scientists are queasy at what they see as attempts to mimic the U.S. system.

There are also institutional roadblocks to rewarding excellence. In Germany, the drive for reform comes primarily from the federal government, but control of higher education rests with the states, or Länder. In France, students and nonacademic staff have a strong say in university governance. That democratic tradition runs counter to the notion of strong, strategic leadership.

Germany's universities have long featured a weak, ponderous central administration, combined with near-total autonomy for professors. That autonomy has led to much inbreeding, with faculty members giving junior staff positions to their own best students rather than outsiders, never mind foreigners. Much of the best German research is undertaken in adjacent but separately managed Max Planck institutes and Helmholtz centers.

France's university system is centrally funded from Paris. But the country's best students customarily attend selective, research-free *grandes écoles* and bypass university altogether.

The value of international rankings in assessing a nation's scientific prowess is debatable. But there's no denying their influence. This year, France had only three institutions in one such yardstick, known as the Shanghai Top 100, and Germany's total was only one greater (see chart).

Superficial as this metric may be, it has led to much public soul-searching. "You can say what you like about the rankings," muses Louis Vogel, head of the Paris-based Conference of University Presidents. "But there's no question that a high ranking attracts people to a university."

Online

sciencemag.org

Podcast interview with author Colin Macilwain (http://scim.ag/pod_6107).

CREDITS: LEFT TO RIGHT): ROI BOSHI/WIKIMEDIA COMMONS;

"Our size gives us the potential to act dynamically."

—AXEL FREIMUTH, UNIVERSITY OF COLOGNE

Despite their differences, the same questions are being asked of both efforts: Were they fair? Do they go far enough? Will they strengthen the university system as a whole? And, above all, will they endure?

The German initiative is set to expire in 2017. But the current German government, led by Angela Merkel, remains firmly behind it until then. In France, the new Socialist government of François Hollande is reviewing the entire program. And although the general thrust of the reforms seems safe, the government is under considerable pressure to modify them.

German teamwork

Graduate education in Germany is well-respected around the world. But its traditional structure, based on a tight one-to-one relationship between the student and a professor, excludes the taught components and multiple academic inputs now commonplace internationally.

In designing the Excellence Initiative, German officials were struck by the autonomy enjoyed by U.S. researchers once they won their own grants, recalls Reinhard Grunwald, then–secretary-general of the DFG, Germany's main research agency. "We paid special attention to American universities, because many of our scientists spent their formative years there," he says.

However, the aim of the initiative was not to "get even" with other countries in the rankings, Grunwald recalls. Rather, it was intended to help universities foster greater innovation in Germany and across Europe. Reaching that goal required the intervention of the federal government, Grunwald adds. "We knew the universities were having a hard time because the Länder couldn't come up with enough of a financial contribution," he says.

The Excellence Initiative comprises three components: graduate schools, clusters of excellence, and future concepts. The first two were continuations of older DFG programs. The funding has been implemented in two rounds: The first injected €1.9 billion into the universities between 2006 and 2012, and an additional €2.7 billion will be spent between 2012 and 2017.

The graduate school component of the Excellence Initiative has given grants of about €1 million a year to dozens of departments. Germany has about 100 Ph.D.-granting universities that this funding has been spread across (39 in the first round and 45 in the second) to support programs that will incorporate more teaching and have students mentored by several faculty members. The second component of the initiative awarded about €6.5 million annually to 80 "clusters" of research excellence—37 in the first round, 43 in the second.

The most radical element of the Excellence Initiative, however, is the third component, called future concepts. The scramble for this money sparked an unprecedented rush among senior faculty members, university rectors, consultants, and outside organizations to develop strategic plans that would bolster their research strengths. Some plans identified particular disciplines for investment and development; Cologne's, unusually, pledged to build a broad base of excellence across all fields of research.

"People started to talk with one another across faculty," says Stefan Hornbostel, director of the Institute for Research Infor-

GLOBAL RESEARCH UNIVERSITIES
WWW.SCIENCEMAG.ORG/EXTRA/GLOBAL

This is the third in a series of articles on global research universities. The first article (7 September, p. 1162) examined the importance of mobility by exploring the reasons for the increased flow of talent to Hong Kong and Singapore. The second article (28 September, p. 1600) looked at cross-national collaborations created through satellite laboratories, a relatively new phenomenon. This article focuses on Europe, where two of the continent's scientific powerhouses have launched separate initiatives with the same goal: to strengthen research at a handful of elite universities without eroding the quality of the country's other academic institutions.

CREDITS (TOP TO BOTTOM): ALEKSANDER PERCOVIC (2); ISTOCKPHOTO

mation and Quality Assurance in Berlin. "Even those universities who weren't successful had a 'plan B' of how to act without government money."

Particular emphasis was placed on forging stronger links with industry and with the Max Planck institutes and Helmholtz centers. "We wanted the universities to be more alert to their roles, not just in research and teaching, but as agenda-setters for innovation," Grunwald says.

The process of selecting universities for future concepts funding was bound to be contentious, and the final approach struck a less elitist tone than did the original version. Nine institutions were funded in the first round, as opposed to the three initially suggested by the Schröder administration. In addition, after international peer review narrowed the field, the winners were selected not by the DFG but by Germany's science council, the Wissenschaftsrat, whose membership includes representatives of the federal government and the Länder, as well as leading scientists.

Christiane Gaehtgens, a former secretary-general of the German Rectors' Conference, believes that the process has greatly strengthened university leadership. But she worries about the middle-ranked institutions that failed to win awards: "We're seeing stratification. We're losing out in the middle, which is where many of our strengths used to lie."

Others think the reforms don't go far enough, either in concentrating resources or in updating the patchwork of governance laws decreed by the Länder. "The Excellence Initiative did put money into the system—but it didn't achieve true excellence," says Ernst Winnacker, who stepped down as president of the DFG in 2006 and now runs the Human Frontier Science Program in Strasbourg, France. "The extra money really did a lot of good, but a world-class standard has not been reached."

Winnacker had pushed for the government to select a single national winner in the future concepts competition. He would now like the Max Planck institutes to create a single, distributed graduate university. Such an institution, he says, would "illustrate the high quality of the German research system."

Tim Stuchtey, an economist and director of the Brandenburg Institute for Society and Security in Potsdam, Germany, thinks that permanent change would require governance reform. North Rhine-Westphalia, of which Cologne is part, introduced reforms including greater autonomy and performance-related pay, but other Länder have not followed suit.

When the initiative draws to a close in 2017, universities can expect no extra help from the Länder, which will shortly face severe new borrowing limits. But many predict that a constitutional amendment will pass after next year's elections, allowing the federal government to continue some form of block-grant support for the elite.

Paris match

The obstacles facing French university leaders are yet more daunting. After the governance laws were passed, Sarkozy introduced a set of measures as part of an economic stimulus package known as the Big Loan. A program called LABEX supports centers of excellence in specific disciplines, while a second piece, EQUIPEX, pays for equipment.

The largest component, Initiatives d'Excellence (IDEX), aims to build an elite club of research universities. So far, eight groups of institutions have won IDEX awards. Most of the winners plan to merge fully, but others will form confederations and seek to be classed as single entities in the institutional rankings.

Financing is generous but not guaranteed: Selected proposals have been initially funded for 4 years, to the tune of about €30 million each annually. Projects deemed successful could then receive permanent endowments of about €1 billion from the government.

The headquarters of Paris Sciences et Lettres (PSL)—one of the first three IDEX projects selected in July 2011—are inauspiciously located in a side street in the Latin Quarter. But its leader, Monique Canto-Sperber, compensates for her modest, half-complete surroundings with a steely determination to build something new and distinctive.

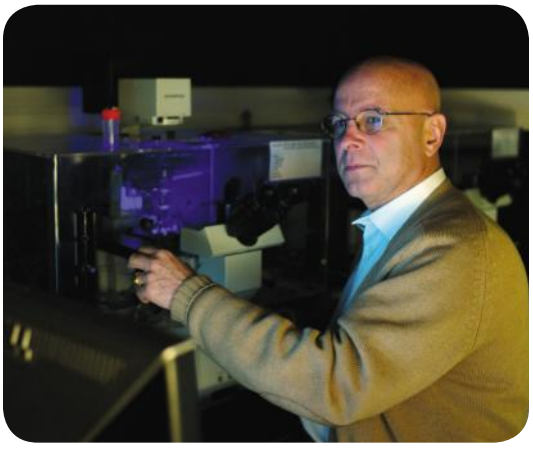
"We're developing an institution with all of the characteristics of a research university," Canto-Sperber says. The 16 institutions participating in PSL will not be merged, but they plan to submit a single set of data to the rankings systems. "We believe in the benefits of having scientific inputs from autonomous components," she says.

The PSL project isn't the first attempt to build stronger ties among several outstanding academic institutions in the Latin Quarter. But it is, by far, the most comprehensive effort. The goal is a confederacy of 2500 researchers, with a private endowment worth €1.24 billion.

Antoine Triller, the director of the prestigious biology institute at École Normale Supérieure (ENS) in Paris, says he's long immunized himself against the frustrations of working inside a system in which researchers from agencies such as CNRS and INSERM operate cheek-by-jowl with colleagues at universities and other institutes. "It's not so easy, but we get used to it," he says. "It's like if you speak Chinese, you don't go on complaining about how hard it is to speak Chinese."

As dean of research at PSL, Triller is hoping to streamline the existing potpourri of institutes. "We all have our own histories," Triller wryly observes. "The idea is to respect each other and develop a community. I am Dean of Research here. I didn't want to be 'research director'—I'm not going to direct anybody!"

Scientists acknowledge that it will be a major feat to get 16 institutions, many of them with their own illustrious histories, to sing



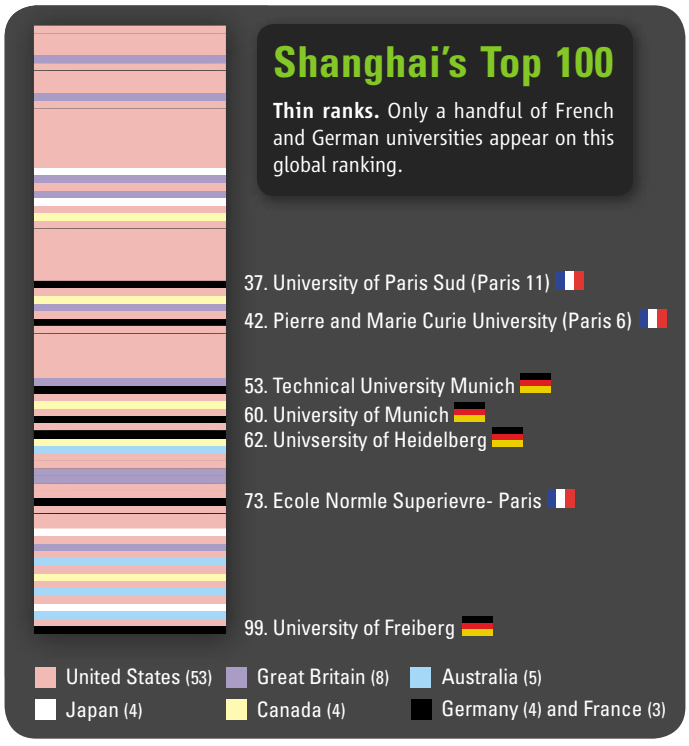
Common purpose. Biologist Antoine Triller (*left*) is trying to "develop a community" of scientists in Paris; Ernst Winnacker (*right*) cautions that "a world-class standard" is yet to be attained at German universities.

CREDITS (LEFT TO RIGHT): INSTITUT DE BIOLOGIE DE L'ENS; ADRIEN COQUARD

from the same song sheet. "It will take time for us to think of ourselves as part of PSL," says Patrick Tabeling, a prominent physicist at the École Supérieure de Physique et de Chimie Industrielles (ESPCI). He notes that ESPCI has a long history and a superb recent record in establishing start-up companies: "We don't want to homogenize, that's for sure!"

The new institution may not even make the type of leap in the Shanghai ranking that many had hoped for. Some have calculated it would "only gain a few places" above the 73rd position now held by its highest-ranked component, ENS, Tabeling says: "That came as a surprise to me."

In its application last year, PSL said it "would appear within the first 20 academic institutions on a worldwide level." Canto-Sperber says that predicting PSL's place in the Shanghai ranking has proven harder than expected. While speaking with *Science*, Canto-Sperber heard that Serge Haroche, a physicist at ENS and the College de France—both part of PSL—had won this year's Nobel Prize in physics for his work in quantum mechanics. That honor will certainly help boost PSL's Shanghai ranking, which gives weight to recent Nobels.



Some full-blown mergers between established institutions with IDEX awards have already run into trouble. The Toulouse IDEX, for example, was approved in May. But it stalled after one of its partners, Université Paul Sabatier, elected as president mathematician Bertrand Monthubert. As former leader of the grassroots researchers' group Sauvons La Recherche, he was an outspoken critic of the reforms.

In common with most critics, Monthubert professes full support for IDEX's goals but disputes its means. He takes issue, for example, with the enhanced powers for university presidents, narrower franchises for their election (which removes the influence of students and junior staff members), and the focus on a small number of winning institutions. Monthubert also opposes the idea of the state transferring an endowment to the IDEX institutions: "Public universities should be funded by the state," he says.

Even researchers who are generally sympathetic to Hollande fear what now lies ahead. "I'm not optimistic," says Philippe Froguel, a geneticist at Imperial College London and the Pasteur Institute in Lille. "At least with Sarkozy, he tried to do something." Froguel gives Sarkozy credit for promoting the idea "that universities should lead the system and that it should be based on excellence. That was something people like me can endorse. Nothing has been achieved yet—but if the effort gets further support, it can still be a big success."

But some now fear that whatever gains have been made could be reversed. Jacques Crémer is research director of the Toulouse School of Economics (TSE), a cluster affiliated with the University of Toulouse, which obtained its first backing under RTRA, a research network program launched under Sarkozy's predecessor, Jacques Chirac. The money was used to start a private, €30 million endowment to help support a growing, international school of 160 researchers and 100 graduate students.

"I think it would be a pity if the Toulouse IDEX didn't go through—although more for the university than for TSE," he says. "And, speaking personally, I think it would be catastrophic if we went backwards, in terms of autonomy for the universities. There are some elements in the French university system who would like to take us back to the 1950s. I think that's the wrong road to follow."

Along with the rest of Sarkozy's reforms, however, IDEX is now being subjected to a consultation exercise led by France's new Socialist research minister, Geneviève Fioraso. The ministry declined to comment for this article pending the outcome of the consultation, but interviews with a dozen senior university officials and observers suggest that the government is likely to retain some of the autonomy measures granted in the 2007 law and honor its short-term financial commitments to the universities. However, it's anyone's guess what will happen to the transfer of substantial endowments to the universities, a central tenet of IDEX.

"We are proceeding exactly as we had planned," Canto-Sperber says emphatically. "There's been no signal at all that we should change track." Within weeks, PSL will issue its first call for internal research projects to be supported from IDEX funds. Canto-Sperber says PSL will also be holding discussions with rankings organizations on a joint entry next year for the combined institution.

Making it work

As the former convener of the policy working group at the League of European Research Universities, which represents 21 elite institutions, Geoffrey Boulton is quite familiar with the German reform effort. And he's impressed with its impact thus far.

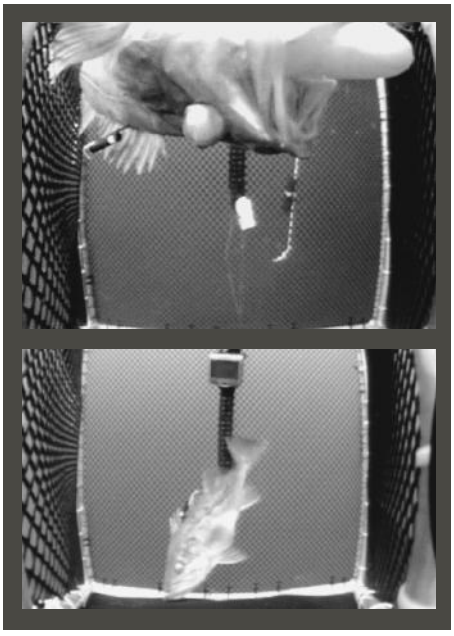
"The Excellence Initiative has made German universities think more deeply about their strategic futures, and that's a good thing," says Boulton, a geologist at the University of Edinburgh in the United Kingdom who now heads the Science Policy Advisory Group at the Royal Society of London. Boulton also chairs the Academic Advisory Council at Heidelberg University, which won backing under all three components of the initiative. The selection process administered a "salutary shock" to prestigious German universities that lost out early on, he notes.

The French initiative is more problematic, Boulton says: "For the last 10 or 15 years, French governments have been thrashing around, looking for the 'magic bullet' that will bring their universities up to what they regard as international standards."

He's especially concerned about the sustainability of the new federations backed by IDEX. "They look good on paper," he says. "But the operational challenges of making them work will be really severe."

–COLIN MACILWAIN

Colin Macilwain is a writer in Edinburgh, U.K.



OVERLINE

Putting Rockfish Back Where They Belong

New gadgets for releasing by-catch of critically overfished rockfish could help ease a regulatory bottleneck on the West Coast recreational groundfish fishery

On an overcast September day, fishing in a small boat off the coast of San Diego, California, marine biologist John Hyde has just reeled in a 10-inch, bright-orange starry rockfish that looks like a creature in a horror show: Its eyes are freakishly inflated, popping out of their sockets, and glazed milky white from tiny air bubbles inside. Its pale stomach sticks out of its mouth. The fish is stiff, "just like an inflated balloon," says Hyde, a program leader at the National Oceanic and Atmospheric Administration's (NOAA's) Southwest Fisheries Science Center in San Diego. Hyde and Nicholas Wegner, a NOAA biologist and postdoc, have been studying a new technique that hook-and-line fishers can use to resuscitate unwanted by-catch of severely overfished rockfish stocks.

Hyde's fish is suffering from barotrauma. When rockfish (*Sebastes*) are hauled up from deep waters, the gas in their swim bladder swells with the pressure change, often triggering the dramatic symptoms and leaving the fish too buoyant to swim back down, explains Hyde, a lifelong angler. Fishers and biologists traditionally thought that these "floaters" were goners; they either succumbed or got picked off by seagulls. But Wegner grabs a small, black, cylindrical gadget with articulated, noninvasive jaws and locks them onto the rockfish's lower lip. The device, called a SeaQualizer, is hooked onto a PVC pipe that the researchers lower into the water with a rope. The pressure-sensitive device is preset to pop open at about 45 meters down, releasing the fish. It's like giving a rockfish an ambulance ride home after an angler catches it.

Over the last decade, a growing body of studies and dramatic underwater research videos [link to video] has shown that barotrauma can largely be reversed. Bulging eyes and stomachs go back into place, and many rockfish can swim away and survive, at least short term, if they are released back down to depth with so-called descender or recompression devices. On the boat, Wegner and Hyde demonstrate several gadgets, from the $55 SeaQualizer to an inexpensive weighted, inverted barbless hook—and even an upside-down milk crate on a rope. As with CPR in people, timing is critical. "If you don't get 'em down quickly, they'll die," Hyde says.

View video of fish with barotrauma.
www.scim.ag/xxxx_xxx

Although the science on recompression is in many ways still preliminary, interest in the work has reached the point where, at a 5 November meeting, the federal Pacific Fishery Management Council (PFMC) will begin considering proposals to give recreational anglers regulatory "credit" for releasing depleted rockfish species with descender devices. If such a move were eventually approved, the premise is that anglers not only would get to spend more time angling, but their voluntary use of recompression tackle could also potentially help restore some depleted fish stocks over time.

Off the West Coast, seven species of rockfish, including cowcod, yelloweye, canary, and bocaccio, were federally listed as overfished about 10 years ago. These fish are long-lived and slow to reproduce (yelloweye, for example, can live up to 120 years), and some of the species will likely take decades to recover under rebuilding plans managed by PFMC. To protect these and other groundfish stocks off the coasts of California, Oregon, and Washington, in the early 2000s the federal council and state agencies closed large ocean areas to bottom-fishing, restricted fishing depths, and reduced daily catch limits for anglers. New rules also mandated that if hook-and-line fishers caught certain depleted species, they had to throw them back. Upset about the floaters going to waste, some anglers began experimenting with resubmerging them.

So did biologists, who started studying the issue. Barotrauma is caused by "gas breaking out of the swim bladder and going wherever it's going to go" as tissues fail, says marine biologist Robert Hannah of the Oregon Department of Fish and Wildlife (ODFW) in Newport. The expanding gas can force air bubbles beneath the corneas and may tear blood vessels, lacerate the liver and other organs, and leak out through the skin or from under the gill flap. The extent of

CREDITS: (LEFT) ALENA PRIBYL/NOAA; (RIGHT, TOP AND BOTTOM) NICHOLAS WEGNER AND JOHN HYDE/NOAA

Bloated from barotrauma. With its eyes bulging and stomach protruding from its mouth, this bocaccio rockfish shows injuries from barotrauma after being reeled in from 146-meter-deep waters. When NOAA researchers lowered the fish back to 42.5 m in a camera-equipped cage, the fish recovered enough to swim away when the cage door opened.

injuries is species-specific, but the deeper the capture depth, the worse the damage can be.

Studies have demonstrated that recompression can achieve high short-term survival in several types of rockfish when taken from depths of up to 65 m, says marine biologist Alena Pribyl, although how effectively the technique works in much deeper waters or in the long term is less certain. In a study published this spring in the *Journal of Fish Diseases*, Pribyl (then a Ph.D. student) and colleagues at Oregon State University, Corvallis, tracked 1-month survival in 30 black rockfish that underwent simulated catch-and-release in pressurized aquaria. "Most of them did just fine," she says, with tissue and blood samples and a gene expression analysis revealing a surprising capacity for physiological recovery. Some fish, however, had nonfatal swim bladder ruptures that hadn't healed after 30 days.

Although few rockfish recompression studies have been done in the field, the latest results include a recently published study by Hannah's team. After catching 287 rockfish from depths of up to 64 m and lowering them to the sea floor in modified plastic barrels, the biologists observed 2-day survival rates ranging from 100% in canary and yelloweye to 78% in blue rockfish. Hannah is now running a similar field trial at depths up to about 80 m and tracking 4-day survival.

Other deepwater data have come in from Wegner and Hyde. Working with Pribyl, they recently finished a 4-month acoustic tagging study of 50 rockfish (including cowcod and bocaccio) that they reeled in from 80 m to 180 m of depth off southern California and released with cages or SeaQualizers. Preliminary analysis of the tagging data indicates that about 93% of the animals survived after 2 days, and 77% after 10 days. However, those numbers are based only on "the fish we heard from," Wegner says. By day 10, 40% of the study subjects moved out of detection range; whether they swam off happily, died from barotrauma, or got eaten by a shark is unknown, which increases the uncertainty of the survival estimates, the scientists say.

But a number of tagged fish were still alive at 4 months. And the data the researchers did gather indicated no signs of barotrauma-related deaths occurring beyond 6 days, Wegner says. "What we have is a good sense that this technique works for a lot of the species that we care about," Hyde says, but much more research is needed to better characterize the survival rates for the different species and capture depths.

Among other unanswered questions, can rockfish recover from multiple captures, and would barotrauma injuries keep them from functioning or reproducing normally over a potentially long life span? "There's a lot of work left to do," says ODFW's Hannah, who adds that the actual benefits of recompression in helping to rebuild the overfished stocks are hard to predict.

Nonetheless, after learning that floaters may survive if released properly, recreational fishing groups such as the Sportfishing Association of California and the Oregon Coalition for Educating Anglers have distributed

thousands of descender devices. Avoiding depleted rockfish species is best whenever possible, but as a next-best practice, using recompression tackle "is the right thing to do," says Dan Wolford, the science director of the Coastside Fishing Club, which represents anglers in the San Francisco Bay Area. "We can make a difference saving one fish at a time." Wolford, a retired aerospace engineer, is also chair of PFMC.

In June, PFMC directed its scientific staff to develop possible methods for estimating and incorporating the reduced mortality of rockfish released with descender devices into its catch accounting models—starting with cowcod and yelloweye. For most rockfish species, current metrics count any fish caught from deeper than 55 m and released at the surface as dead, a 100% mortality rate. At the council's November meeting, its groundfish management team will propose different options for applying lower mortality rates when fish are recompressed, based on the existing research data; where data are insufficient, conservative buffers for uncertainty could be built into estimates. Although the committee wishes to encourage anglers' good stewardship in using recompression tackle, it also wants "to make sure we aren't jumping in too fast," says team member Lynn Mattes, a fisheries manager at ODFW. PFMC's scientific and statistical committee will give feedback on the proposals, and the council will decide next year whether or how to proceed with adopting survival-rate credits.

For anglers, Wolford says, such credits could mean having a longer fishing season targeting other, abundant groundfish species before getting shut down if they reach the federally allotted annual by-catch quotas on cowcod, yelloweye, canary, or other key depleted species. Down the road, he says, the use of descender devices could help in particular to rebuild yelloweye and canary—of which recreational fishers take a third or more of the overall catch allocations compared to commercial fishers—and might open the door for the council to consider reopening some areas now closed to fishing.

Recompressing rockfish. Anglers can clip a variety of descender devices to a fishing line to grip onto and release bloated rockfish by-catch underwater. Gadgets range from low-tech (*left*) to high-tech (the SeaQualizer, *right*).

It's unknown, however, exactly how many recreational fishers currently use descender devices—Oregon and California have begun collecting usage data—or how effectively. Some gadgets take practice to handle well, and each has pros and cons.

Still, even as they cite the need for further data, some scientists are cautiously supportive of bringing descender devices into rockfish management policy. As NOAA's Hyde says of the techniques for recompressing rockfish, "there's no question that it's better than letting them die."

–INGFEI CHEN

Ingfei Chen is a writer in Santa Cruz, California.

CREDITS: (RIGHT) DAN WOLFORD; (LEFT) MARK HUPP/ECOLEESER