California neurologist Fred Baughman Jr. blasted the use of Ritalin in congressional testimony on 29 September. Baughman called the ADHD diagnosis "a total fraud." Enrolling young children in a trial of MPH, he adds, is "outrageous" and "immoral." Robert Findling, a psychiatrist at Case Western Reserve University in Cleveland, Ohio, who conducts research in this field, dismisses such views as "nihilist" and says that they don't carry much weight among the experts.

Greenhill acknowledges that ADHD is "not a well-defined psychiatric disorder in this age group." Findling agrees but says that ambiguity should not be an excuse for inaction. "Just because we don't know what causes it doesn't mean it's not a problem," he argues. "This is not just benign fidgetiness. ... Parents will tell you how awful it is that these kids can't be taken out in public because they're so impaired. We know they suffer for years and years. "

Hyman agrees that researchers have not identified any distinguishing biological hallmarks of ADHD. But he says that the disorder is well defined in behavioral terms, that ADHD children who fail to receive treatment often suffer life-changing harm, that older ADHD kids appear to benefit from drug therapy, and that no "really gross side effects" have been documented. All this adds up to a strong argument for the trial, he believes. "Without good clinical data, every child who receives this medication represents an uncontrolled experiment," says Hyman. "That is entirely unacceptable."

Assessment of efficacy is another major issue. How will researchers know whether a 3-year-old is functioning "on-task" during therapy—one of the goals of giving MPH? Greenhill explains: "We're going to set up a laboratory classroom, and we'll observe common tasks done in nursery school," such as stacking blocks and stringing beads on a thread. Children will be asked to sit in a circle and take part in group events. The test will be whether the child is "compliant" and participates or "attends for a few seconds before drifting away and doing everything else in the room."

The PATS researchers have taken other steps to allay qualms about the effects of MPH therapy itself and the difficult issue of getting informed consent. Each family will begin the trial with a 10-session "training" period in which researchers will attempt to treat ADHD with nonchemical therapy. Only if this fails will a child be assigned randomly to drug therapy or a placebo group. To address concerns about the effect of MPH on young children, only very low doses of MPH will be used in the initial stage—so low that a planning memo calls the level "homeopathic."

In fact, Greenhill anticipates that this initial dose may have no effect. Once safety has been demonstrated, children will receive gradually higher doses until they reach a "best dose," which they will receive for 40 weeks. No child will be enrolled who lacks the language skills to "indicate that he or she is in distress," and parents will be given information and asked to give fresh consent on behalf of their child at each of the five stages of the trial.

After what Vitiello calls "zillions" of safety and ethics reviews and funding approval, the trial received a final green light from the data safety monitoring board. Greenhill says the clinics will begin recruiting the first subjects in a few weeks.

–ELIOT MARSHALL

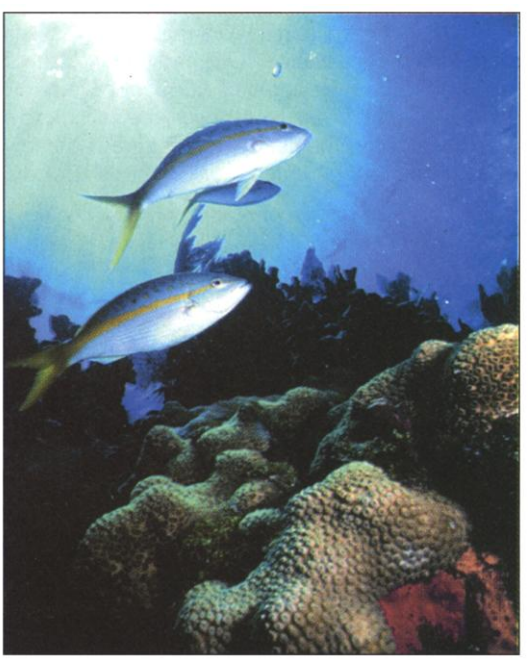
MEETING NINTH INTERNATIONAL CORAL REEF SYMPOSIUM

Reef Migrations, Bleaching Effects Stir the Air in Bali

NUSA DUA, INDONESIA—More than 1500 marine biologists, ecologists, conservationists, and community activists met at this Bali resort from 23 to 27 October for the Ninth International Coral Reef Symposium. Topics included the dynamics of reef fish communities and the lingering impacts of coral bleaching.

Staying Close to Home

Marine biologists have long known that adult fish that inhabit coral reefs don't stray far from home. But their larvae were presumed to be scattered by currents to distant shores, where they join existing communities, settle, and mate. This "open system" was thought to result in a thorough mixing of the gene pool, characterized by widespread homogenous populations. In the last few years, however, some scientists have begun to question that assumption. "The evidence is accumulating that reef fish communities are closed systems," in which the vast majority of larvae return to the reef where they were born, says Robert Warner, a marine biologist at the University of California, Santa Barbara (UCSB). If that new vision holds up to scrutiny—and there are skeptics—it would not only change ideas about fish population dynamics but would also have implications for protecting marine biodiversity and managing fisheries.



Community watch. The fondness of reef fish for their origins puts a premium on local preservation.

CREDIT: FLORIDA KEYS NATIONAL MARINE SANCTUARY/NOAA

Domingo Ochavillo and colleagues at the University of Southern California in Los Angeles have employed genetic tools to look at interbreeding among three different populations of the rabbitfish *Siganus fuscescens* that live within 350 kilometers of contiguous reefs along Luzon Island in the Philippines. When the researchers examined the mitochondrial DNA, says Ochavillo, they found that each population had a distinct pattern, suggesting little genetic mixing among them. The group also found that late-stage larvae settling on a particular patch of reef shared the same genetic pattern as the local adults. Ochavillo and his colleagues obtained further evidence after releasing 500 larvae at a point 2 kilometers from shore. "They started swimming toward where they had been born," says Ochavillo, leading him to conclude that "larval dispersal may not be as widespread as usually assumed."

Other studies support this so-called self-recruitment, in which larvae return to the community of their origins. Robert Cowen, a marine biologist at the University of Miami, fed data on actual Caribbean currents and information on survival

times for larvae at sea into an ocean circulation model. Although seasonal currents affect the outcome, currents typically don't bring larvae close to suitable habitats within their limited larval phases. "You end up with relatively few viable individuals to populate downstream locations," says Cowen.

On three different reefs surrounding St. Croix in the U.S. Virgin Islands, UCSB marine biologist Stephen Swearer has been studying bluehead wrasse, reef fish with distinctive vibrantly blue heads. To track their movements, Swearer examined larval otoliths, bony structures in the ear that grow over the course of a fish's life and incorporate trace elements from the water it inhabits. "They are like flight recorders, allowing you to determine where a fish has been," Swearer says. The results, he says, showed that the majority "had spent little time in pelagic waters" and never ventured far from the reef where they spawned.

Work by Paul Barber, a Harvard University postdoc, suggests that these self-recruitment patterns have lasted for millennia. Barber gathered numerous specimens of three species of mantis shrimp from throughout Indonesia's nearly 2 million square kilometers of territory. Barber found that for each species, individuals from a given region shared distinctive genetic markers not found in other regions. Even though the three species were analyzed separately, the regions defined by the genetic groups tended to be the same. And each of these regions could be associated with deep ocean basins that would have been separate bodies of water during the last ice age, when sea levels were lower. "Despite 10,000 to 15,000 years of modern oceanic conditions, time and water movements have not erased regional genetic differences," Barber concludes.

If reef fish indeed live in closed communities, different strategies may be needed to manage and protect them, says Stephen Palumbi, a molecular biologist at Harvard University. At present, protected areas allow fish to grow larger and produce more eggs. But if those larvae remain close to home, local communities have a compelling economic reason to host a protected area. "We can make the case that hosting a marine protected area will benefit local fisheries," Palumbi says. Limited larval movement also means that each region needs its own protected area to protect biodiversity.

Peter Sale, a marine ecologist at the University of Windsor, Canada, says that what is missing from the discussion is a clear definition of the scale at which fish populations are open or closed. He suggests that the scale might vary by reef conditions, water movement in particular locations, and fish species. Previous studies conducted on smaller scales of roughly 100 square meters with fish communities large enough to form reproductive units found open populations with all newly settling larvae coming from outside. Current studies, he says, are looking at groups of populations on much larger scales. The line that separates open and closed populations "is a very important question," he says, whose answer will affect where protected areas are located and how big they should be.

Bleaching Takes a Toll on Reproduction

When coral reefs regained their colors shortly after the massive bleaching triggered by the 1997–98 El Niño–La Niña event, reef scientists cheered. They hoped that the return of the characteristic brown, yellow, and rusty hues was a sign that the corals had recovered. But two new studies have reinforced previous suggestions that such recovery may be only skin deep. Bleaching, it seems, can damage the coral's reproductive capacity, meaning full recovery could take much longer than expected.

Hot sex. After bleaching as a result of warmer waters, reefs produce fewer eggs and have less reproductive success.

CREDIT: EMMA HICKERSON/NOAA

One line of evidence comes from Makoto Omori, a marine ecologist at Tokyo University of Fisheries. When hit with an environmental stress, such as the warm waters brought by El Niño, corals expel zooxanthellae. The departure of these symbiotic algae turns the coral white—thus the term bleaching. In an ongoing study of coral genetics, Omori had gathered samples of five coral species from reefs off Okinawa for several years before the punishing 1998 bleaching. In samples collected before the event, more than 90% of the coral's spawned eggs were successfully fertilized in a lab experiment. But that rate dropped to 42% for samples gathered from the reefs in June 1999, a year after widespread bleaching. The same year, Omori and his colleagues also found that concentrations of sperm in reef seawater declined more quickly than usual after spawning.

Omori believes that the coral are producing fewer and less fit sperm, which perish before finding an egg. The data "match field observations of dramatically reduced production of new coral polyps in Okinawa in 1999," he says. At least one species also had a reduced fertilization rate in summer 2000, he notes.

Areas within Australia's Great Barrier Reef took a similar reproductive hit, reported Selina Ward, a marine biologist at the University of Queensland in Brisbane. In March 1998, a month after the bleaching, Ward and colleagues began periodic sampling of 200 colonies around Heron Island Reef. Roughly half of these had bleached. By July, 23% of the bleached colonies had died and the rest had regained color, suggesting recovery. But in November, just before spawning season, Ward found that the colonies that had regained color produced half as many eggs and testes as colonies that had not bleached. "A lot of the corals [that had been bleached] had no eggs at all, and some had no testes," she says. This low egg production continued the next year for large areas of the coral.

Earlier research suggests that bleaching hurts coral reproduction in two ways, says Ward. Rising water temperatures alone appear to damage reproductive organs, whether or not the corals bleach. And when temperatures rise enough to trigger bleaching, the corals are effectively starving themselves, because they rely on zooxanthellae to supply their energy. "We know that in most organisms the first thing cut [under starvation conditions] is reproduction," she says.

These new findings have reminded the community of work done following a 1987 bleaching event in the Caribbean, says Mark Warner, a marine biologist at the University of Georgia, Athens. "These papers solidify the evidence," he says, "and they're important because they came from two different geographical locations and involve different species." Warner adds that the new evidence "makes the severity of the 1998 bleaching event more alarming. If the corals that are still alive can't reproduce over the next year or two, it raises questions about the chances of reseeding the population."

–DENNIS NORMILE