Our Nasty Impingement

Unknown to nearly everyone, billions of our favorite fish are getting impinged.

Billions more are entrained.

No fish hooks or nets involved.

Impingement and entrainment.

These are the twin killers in a silent scandal we explore this month in a conservation feature that should trigger corrective actions.

Some insiders tell us that the impingement/entrainment slaughter is the power industry's dirty big secret, a stupendous overkill that is glossed over with slick public relations, "good neighbor" campaigns and sheer complexity.

In essence, the 27 "once-through" cooling systems in Florida suck in billions after billions of gallons of life-rich coastal water, use it to cool down boiler water and then expel it back into nature, warm and sans life.

One source estimates that the power-company killing of potential animals rivals the entire quantity of sealife taken for food and sport by all citizens.

"Well, so what?" may be a typical reaction. "We all have to have power, don't we?"

It is that essential nature of power that tends to shield the industry from close inspection. We just gotta have electricity, no matter.

That pervading defensive posture is a dang shame, especially for those who love marine life, because there are important steps that could stop the overkill, as you'll note in the investigative article by Editor Jeff Weakley.

Of course, it should also be acknowledged that power companies and their regulators have addressed the impingement/entrainment problem to some extent, however late and limited.

Also this month, Editor Weakley leads us along an intriguing path of content over our 35 years. It's a hopscotch trek through the annals of *Florida Sportsman* that's likely to bring back your own memories of happenings on the outdoors scene.

So much has changed, so much is the same.

Our years of acceptance and growth have been possible only because of a dedicated and talented staff that now is as strong as ever. To them, past and present, I tender my warmest thanks and commendations.

The same thoughts extend to our loyal and responsive readers.

They are in the end the foundation for it all.

Karl Wickstrom

Shocking News for Marine Life

An inside look at how new power plant regulations could save billions of fish.

What could air conditioning possibly have to do with black drum? The two subjects may seem as unrelated as hurricanes and butterfly sneezes, but in Florida's web of action and environmental reaction, there's a connection all right.

Most of the electricity that runs your grumpy old AC comes from a steam-powered generator. The heart of the system is a heat source, either a fossil fuel-burning furnace or nuclear reactor. Here, water in a hundred-plus-mile network of tubing (or boiler) is cooked at 2,000-plus Fahrenheit, producing steam. Pressurized as it travels through more tubes, the steam ultimately rushes across the fan-like blades of a turbine, which propels an electromagnetic generator. Watts are delivered to your neighborhood—lots and lots of watts come summer.

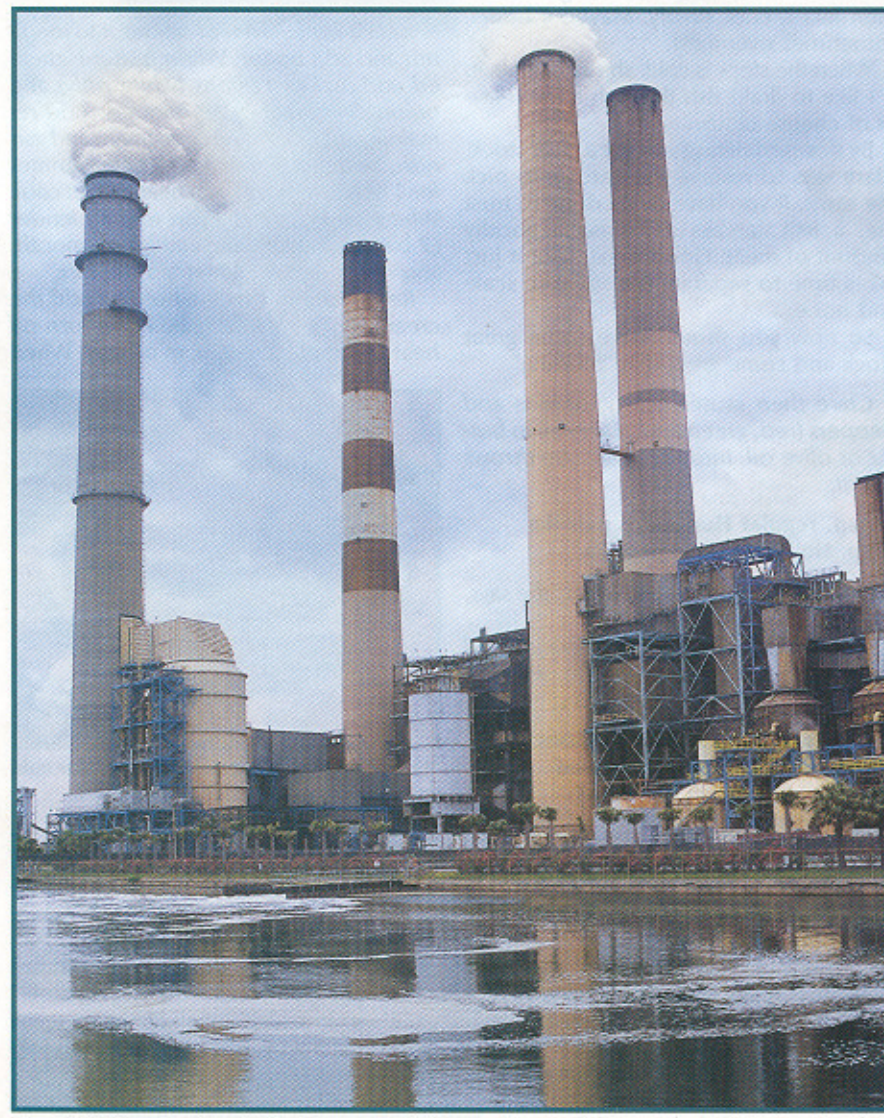
So where's the fish figure into all this?

To keep the generators spinning at max efficiency, steam passes through the turbine, then it's exposed to a cooling source, or condenser, and recirculated. The condenser, another network of pipes, uses its own supply of water—a steady flow, often in the hundreds of millions of gallons per day. That's known as once-through cooling.

If the condenser drinks from a biologically rich source, like an estuarine bay, whatever's living in the water has to contend with the possibility of getting sucked into the system. Large fish, turtles and marine mammals can usually swim away from the tractor-beam intake structure, but smaller, slower-swimming critters might get pinned against a debris screen, and drown. That's termed impingement.

Very small organisms—microscopic plankton, gamefish eggs and larvae—are frequently pulled right on through the system. Their vast numbers are sloshed around, chlorinated, superheated and discharged in an endless broth of dead organic matter. That's entrainment.

In the late 1970s and early '80s, the federal Environmental Protection Agency (EPA) required many power plants to document the organisms impacted by once-through cooling. In 1972, Congressional amendments to the Clean Water Act, section 316(b), directed the EPA to regulate cooling water intake structures to "minimize adverse environmental impacts." Data collecting went on for years, but only in the last couple years—after prodding by environmentalists—has EPA done much regulating.



The TECO Apollo Beach Plant is one of five on Tampa Bay—and one of 27 in Florida—using a once-through cooling system. Organisms caught up in the intakes are killed by the billions each year. Shown here is the heated outfall water from the cooling system.

One of Florida's largest generating plants is the Tampa Electric Company (TECO) Big Bend station, situated on Tampa Bay, at Apollo Beach. Big Bend provides a telling case study in impingement and entrainment, or I&E. Consultants found that annually, impingement resulted in the loss of 419,286 "age 1" equivalent fish, and 11,113 pounds of fishery yield (age 1 equivalent is a statistical way of

converting loss of fish eggs and larvae into numbers of year-old individual fish. Fishery yield loss means pounds of fish that won't be landed due to I&E losses).

Entrainment was far more lethal: 7.71 billion—Billion!—age 1 equivalent fish were being decimated; 22.8 million pounds of lost fishery yield. Most heavily hit were bay anchovies, but the list included other valuable organisms like stone crabs, pink shrimp, seatrout, herring...and black drum.

I wondered about those drum. The Big Bend plant, with all four generators humming, can supply enough electricity to power about 170,000 households. Entrainment data showed Tampa Bay could be short 5.2 million black drum each year. I did a little math, and the figure that emerged was pretty scary:

In theory, the electrical demands of a single household could wipe out 30 black drum in a year.

Dial down your AC in August, catch fewer drum next March.

It doesn't have to be that way—and in fairness to the TECO people, the two newer (post 1975) generators at the Big Bend plant have been equipped with fairly effective marine life barriers.

I visited the Big Bend plant as a guest of David Lukcic, Manager of Land and Water Programs, Environmental Health and Safety. Wearing hard hat and protective goggles, I got a look at what happens to critters vacuumed into the cooling water intakes at Apollo Beach. It was more or less an industrialized water park for plankton.

Rectangles of .5 mm mesh, arranged five-across in a long conveyor, circulate through the incoming water stream. A trough at the bottom of each rectangle catches organisms that fall off; what sticks to the mesh is blown into the trough by pressurized water, near the top of the conveyor. The troughs dump into a waterslide, for lack of a better term, which winds down to a sump, and ultimately flows to the plant's warmwater outfall canal.

The EPA notes that these "fine-mesh traveling screens" at Big Bend have achieved an 86 to 95 percent reduction in entrainment (a certain percentage of creatures don't survive the waterslide, so it's more accurate to say 66 to 93 percent survival).

Why haven't these devices been installed on the other two intakes at Big Bend?

Lukcic was candid in his answer: "We were not required to. Those intake structures were permitted in the 1970s."

Retrofitting the older intakes would be costly, Lukcic explained, but that's just what TECO may have to do when its 5-year National Pollution Discharge Elimination System (NPDES) permit comes up for renewal in 2006.

In February 2004, EPA published final regulations for Phase II rule-making under 316(b). The regulations will require large existing power plants using once-through cooling systems to reduce impingement by 80 to 95 percent from uncontrolled levels, and entrainment by 60 to 90 percent.

"We're currently studying our options," said Lukcic.

There are 27 plants in Florida affected by the 316(b) regulations, according to Allen Hubbard, Supervisor for Power Plant NPDES Permitting with the Florida Department of Environmental Protection (DEP). In 1995, EPA granted NPDES permitting authority to the Florida DEP. Hubbard and his staff review permit applications, deciding whether they'll meet EPA standards.

One Florida facility currently up for permit renewal is the Florida Power and Light Cape Canaveral Plant. It's a mid-sized, oil- and natural gas-burning facility on the Indian River near Titusville. On average, its condenser system siphons some 664 million gallons of Indian River water per day, or the equivalent of more than 664 Olympic-size swimming pools. (TECO Big Bend draws twice that). That's every day.

In Florida, a power plant must give public notice when a draft NPDES permit has been issued; DEP then coordinates a local public information session, and invites public comment. Related government agencies such as the Fish and Wildlife Conservation Commission and U.S. Fish and Wildlife Service, are also contacted.

On a rainy August afternoon, I joined a handful of concerned citizens at the Titusville Library, to learn what we could about the Canaveral plant. Turns out not much, other than fuzzy details about the permitting process, and techy stuff about plant operations. There weren't any particulars about ecological impacts on the Indian River, though DEP staff offered to mail me a fact sheet.

"It's clear that once-through cooling water intakes represent an insidious threat to fish populations..."

Guides Rodney Smith and Tom Van Horn voiced serious concerns about how hot discharge water from the Canaveral plant—up to 124 degrees Fahrenheit, at the tail end of the once-through system—has wiped out turtlegrass, manatee grass and an associated estuarine ecosystem. "I'd say thousands of acres," said Smith, who's been observing the area for 20 years.

Thermal pollution is a separate but related issue, addressed under section 316(a) of Clean Water—and subject to evaluation for NPDES permitting.

As to the churning of planktonic marine life in the cooling structures, Smith, Van Horn and I left wondering about larval redfish, seatrout and the other fish we enjoy catching.

At the meeting I asked about the fine-mesh traveling screens I'd seen at TECO Big Bend. Does the Canaveral plant have anything like this? Plant Manager Lowell Trotter said the plant did not, but he seemed curious about them.

"What's that about fish barriers?" he asked.

Allen Hubbard, also at the meeting, said that plants are pretty much on their own when selecting I&E reduction technology.

"Folks in the regulated community will have to figure out what they need to do for compliance, and we'll review it," explained Hubbard.

By now it's guaranteed that most power plants in Florida have heard from the sales people at Gunderboom. Sensing a devel-

Fine-mesh screens circulated through the incoming cooling water can help exclude fish eggs and other tiny life forms, but so far have been installed on very few plants.

oping market, the multi-million-dollar company recently opened a sales, operations and manufacturing office in Sanford, Florida. Through the mid 1990s, Gunderboom tested a Marine Life Exclusion System (MLES) on the intake structures of Lovett Generating Station, on the Hudson River in New York. The Gunderboom MLES is a top-to-bottom, water-permeable barrier that's anchored some distance out from a cooling water intake. It effectively slows the "approach velocity" of water moving toward the intakes, allowing more organisms to swim away. Stuff that can't fight the flow is trapped by the fabric barrier, a micro-perforated material that reminds me of the headliner of my old Jeep Cherokee, then blown free by bursts of air. How well does it work? At Lovett, EPA notes a 99 percent reduction in impingement, and 82 percent reduction in entrainment.

The Hudson has many allies these days. Perhaps chief among them is Riverkeeper, a leader in the alliance of environmental groups that spurred EPA action on 316(b). A Riverkeeper fact sheet notes that Lovett and four other generating stations on the Hudson had been wiping out more than 40 percent of juvenile striped bass in the area. That's the same kind of impact that shrimp trawl bycatch has inflicted on red snapper populations in the Gulf of Mexico.

A Gunderboom Marine Life Exclusion System anchored outside the Lovett Generating Station, on the Hudson River in New York, brought about a 99 percent reduction in impingement and 82 percent reduction in entrainment. Due to new federal standards, you may begin seeing devices like this at power plants which are unable to convert to closed cooling systems.

Riverkeeper hasn't been satisfied with the Gunderboom MLES, citing a 2001 study that identified a number of performance problems—such as the colonization of algae, mussels, tube worms and other organisms that might cling to the MLES fabric and hinder water flow to the intakes or damage organisms which drift into the fabric. Gunderboom Chief Operating Officer Bob Dove contends that the test cited by Riverkeeper was performed in a lab environment—and that real-time performance, amid tides and current, demonstrates the system's effectiveness.

One logistical downside to the Gunderboom MLES is that it seems to require a lot of space; in some parts of Florida, anglers

would no doubt bristle at being shut out of fishing waters by a huge black curtain.

Short of installing some kind of barrier, there are process alternatives to once-through cooling. A recent federal court ruling, in fact, obligates new power plants to use what's known as closed-cycle cooling, kind of like the radiator on my Jeep (though hopefully more reliable).

Cooling towers are one example of closed-cycle cooling. These are tall concrete structures, hundreds of feet high, in which water droplets cascade from top to bottom, cooling as they fall. One industry source I spoke with said there are inefficiencies inherent in towers—a certain amount of water is lost through evaporation, and the energy used to run pumps and fans in the tower can siphon off up to 5 to 15 percent of the plant's power generation.

Closed reservoirs, where cooling water recirculates, are attractive in some cases. The FPL Martin Plant in Indiantown sits on a 6,800-acre freshwater pond, owned and managed by FPL for the sole purpose of cooling the five generating units, said media relations spokesperson Kathy Scott. Over a billion gallons of water per day cycle through the cooling structures here—but the flow doesn't include the foundations of public fishery stocks.

Seems like a no-brainer to require coastal plants to convert to a system like this, but there are ecological tradeoffs.

In the early 1970s, a network of self-contained cooling water canals was constructed at the FPL Turkey Point nuclear plant, in Dade County. Nuclear plants require a tremendous amount of cooling water—almost four times the amount of fossil fuel plants, according to a United States Geological Survey (USGS) Web site. Before the canals were built, hot water releases from the plant had been killing hundreds of acres of seagrass in South Biscayne Bay. The canals ended the thermal pollution, but at a price: Over 6,000 acres of salt marsh and mangroves had to be destroyed to make way for the new system. (In recent years the cooling canals have been spotlighted as American crocodile habitat; FPL has also aided in the restoration of 13,500 acres of wetlands).

Some plants may be required to mitigate for damage to fish stocks—perhaps raising and stocking affected species, for instance.

The Crystal River Mariculture facility, at the Progress Energy Crystal River power generating site, has been growing and stocking fish since 1991. It's a modest project. Full-time staff: one, Eric Latimer, who coordinates with part-time and contract labor, as well as local students.

"Our best year for seatrout was 300,000; best year for redfish about the same," said Latimer. "Most all the fish are stocked here in Citrus County."

A certain portion of fish cultivated at Crystal River are marked with belly or dorsal tags. In one batch of 350 reds Latimer released, he got back 49 tags. "That's pretty good," he said.

Progress Energy had been required to implement the mariculture program to offset the environmental impacts of cooling water withdrawals. At full capacity, the one nuclear and four coal-fired generators use a staggering 1 million gallons of cooling water per minute: 1,440 Olympic pools per day.

I asked Eric if the plant would be making more changes in light of the new EPA regulations.

"We'd like to stay with the stock enhancement option, at least for part of it…I don't want to see it go away, but that's for courts and the state to decide."

It's clear that once-through cooling water intakes represent an insidious threat to fish populations—insidious because the worst of the damage is not visible. You can look at a picture of shrimp trawl bycatch and immediately sense the wrongness of it. Likewise for sea turtles in a gill net, or a fish kill in a river polluted by runoff from the phosphate industry.

Florida can get along fine without gill nets and wild-caught shrimp, but we can't live without electricity. There is a system in place to ensure that power companies manage their activities in a responsible manner, but it's critical that we keep the process from falling into a dark hole of bureaucracy.

Attend public hearings, ask questions, consider what's happening in your local waters…turn up your AC and turn on the political spotlight.

—Jeff Weakley

The Losses Are Staggering

- 274 billion fish eggs and 83 billion fish larvae entrained annually by five plants on Tampa Bay (from EPA data).
- Power plants in the North Sea wipe out herring and sole in numbers equal to about half the British commercial landings for the region (Pisces Conservation Ltd.).
- More than 40 percent of young striped bass on Hudson River entrained by local power plants (Riverkeeper).