



**NOAA
FISHERIES**

Artificial Reefs: the good, bad, and ugly

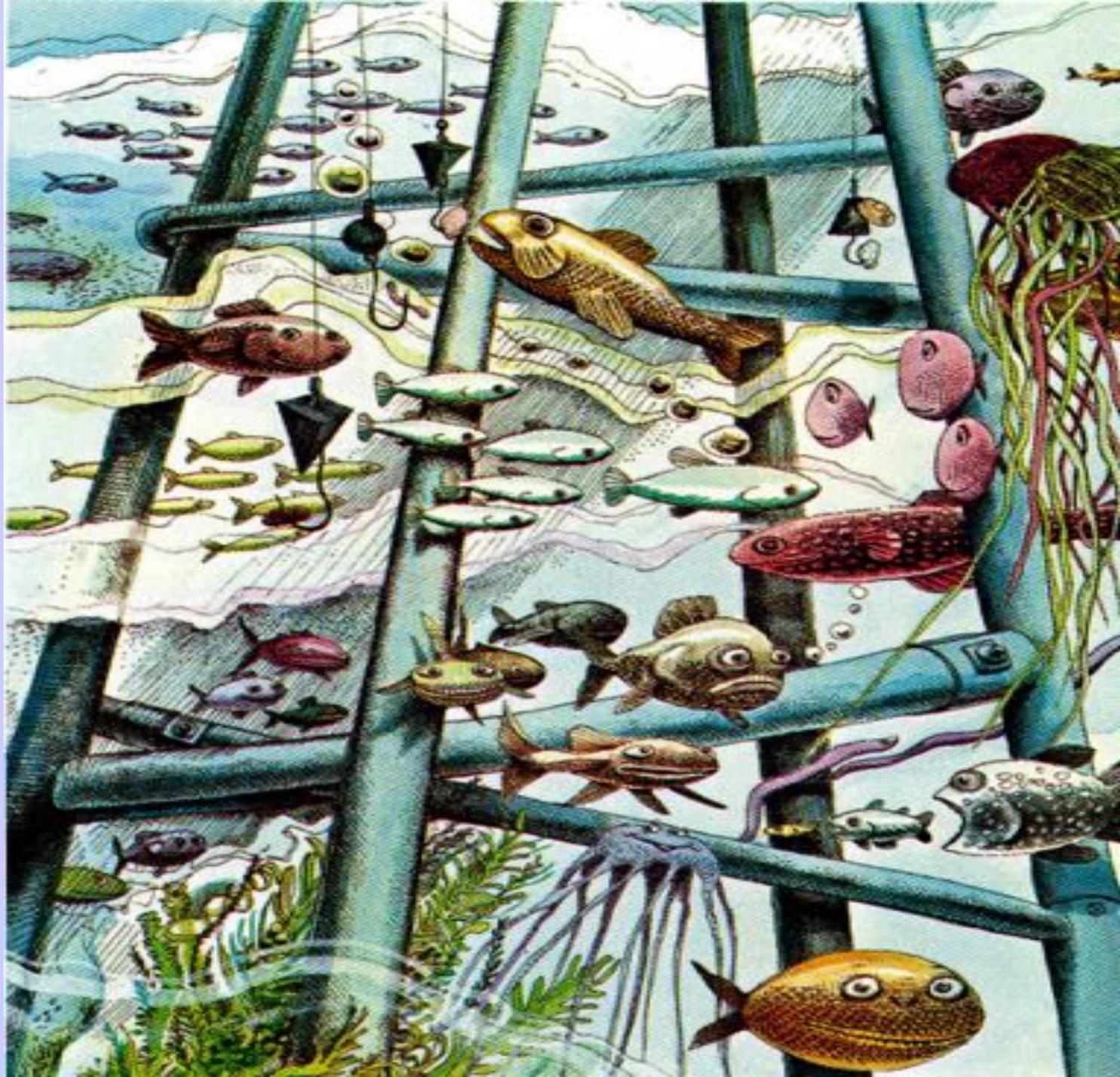
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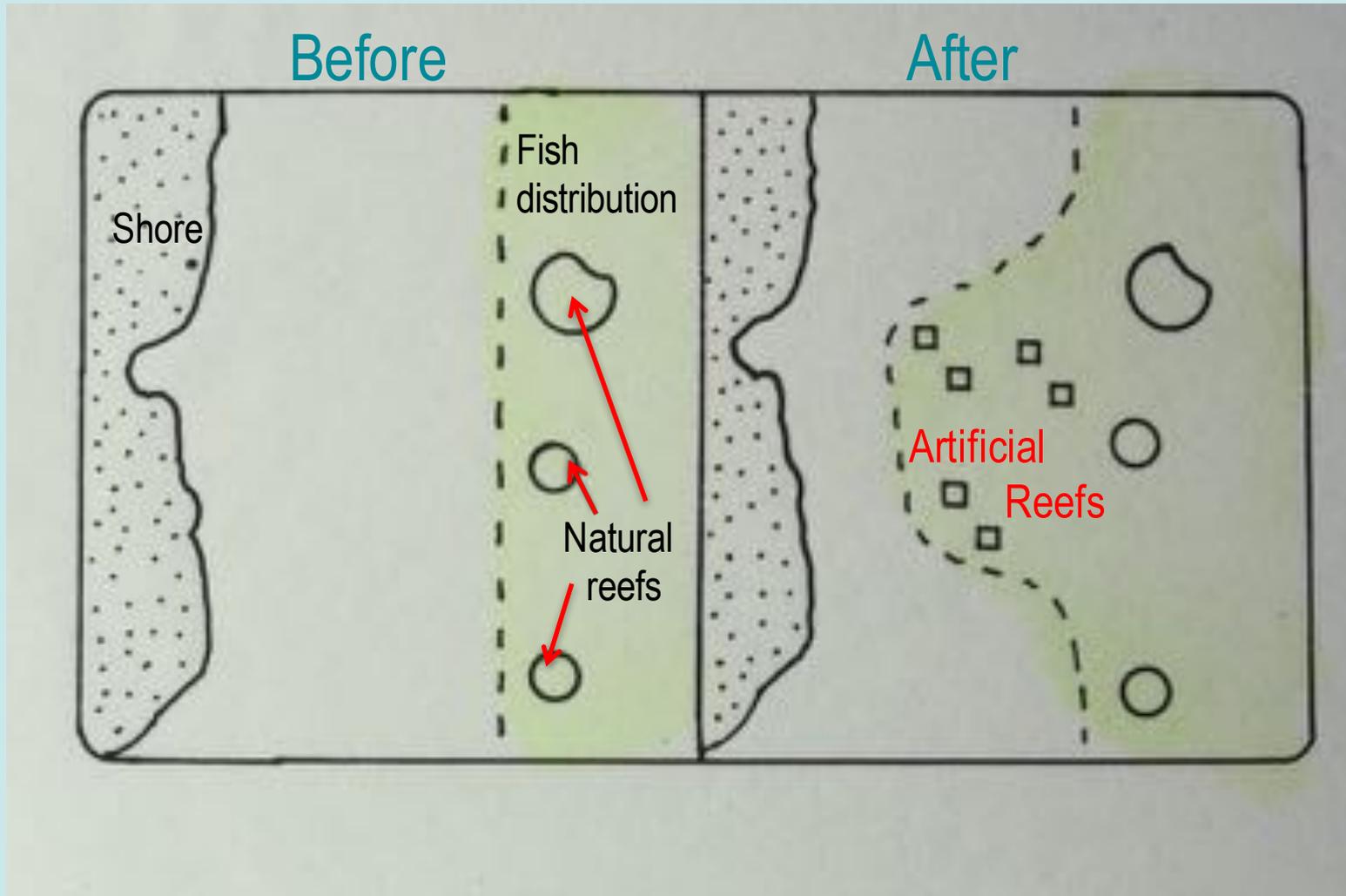
National Artificial Reef Workshop
Alexandria, Virginia, 8-9 June 2016





The Good

Create fishing opportunities near ports.



Ecosystem Services:

Aesthetics

Fishing & Diving

Fishing tackle & bait

Charter fees, vessels

Licenses

Hotel/housing

Fuel/gas/oil

Rental Cars

Restaurants, Supermarkets

Tourism & Real Estate

Waterfront properties

Tourism Industry

Ramps & docks

Resident recreation

Non-residents

Supporting Marine Industries

Transportation

Boating

Electronics

Communications

Fishing Tackle

Newspaper, Magazine & TV Media

Dockage, storage



South Florida Reef Economics 2001

28,300,000
person-days spent on reefs

\$ 4,395,000,000
Sales

\$ 2,047,000,000
Income

71,300 **jobs**

Johns et al. 2001



Fishing and Diving (snorkel & SCUBA) contribute about equally to reef use in SE Fla

Recreational person-days (millions) spent using reefs in southeast Florida (residents and visitors)					
	Palm Beach	Broward	Miami-Dade	TOTAL	%
Diving (Snorkel and SCUBA)	2.5	4.9	3.3	10.7	47%
Fishing	1.8	4.5	5.9	12.1	53%
TOTAL	4.2	9.4	9.2	22.8	
\$ Value (millions) residents and visitors					
					%
Diving (Snorkel and SCUBA)	\$27	\$68	\$16	\$112	53%
Fishing	\$9	\$57	\$30	\$97	47%
TOTAL	\$36	\$126	\$47	\$209	

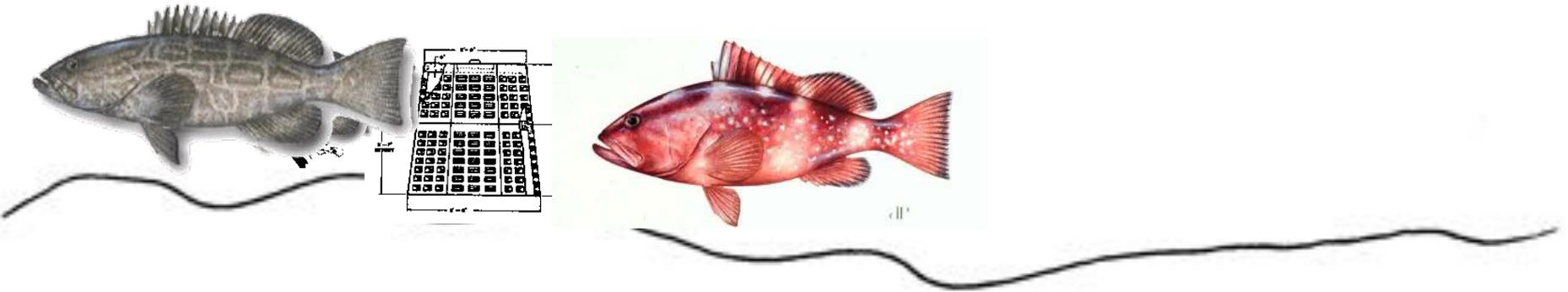


8 hours after sinking
by a hurricane



One month later

Assumption: Habitat Limitation - Adding more habitat increases the supply of fish.



Artificial reef performance depends on reef **structure** (size, materials, and composition), **location**, and the **life history** of targeted species



Fig. 11.3 Problems with artificial reefs that primarily attract fishes. Before (top) and after (bottom).

Fishing for species attracted to artificial reefs is not a problem from a fishery perspective, unless the population is overfished.

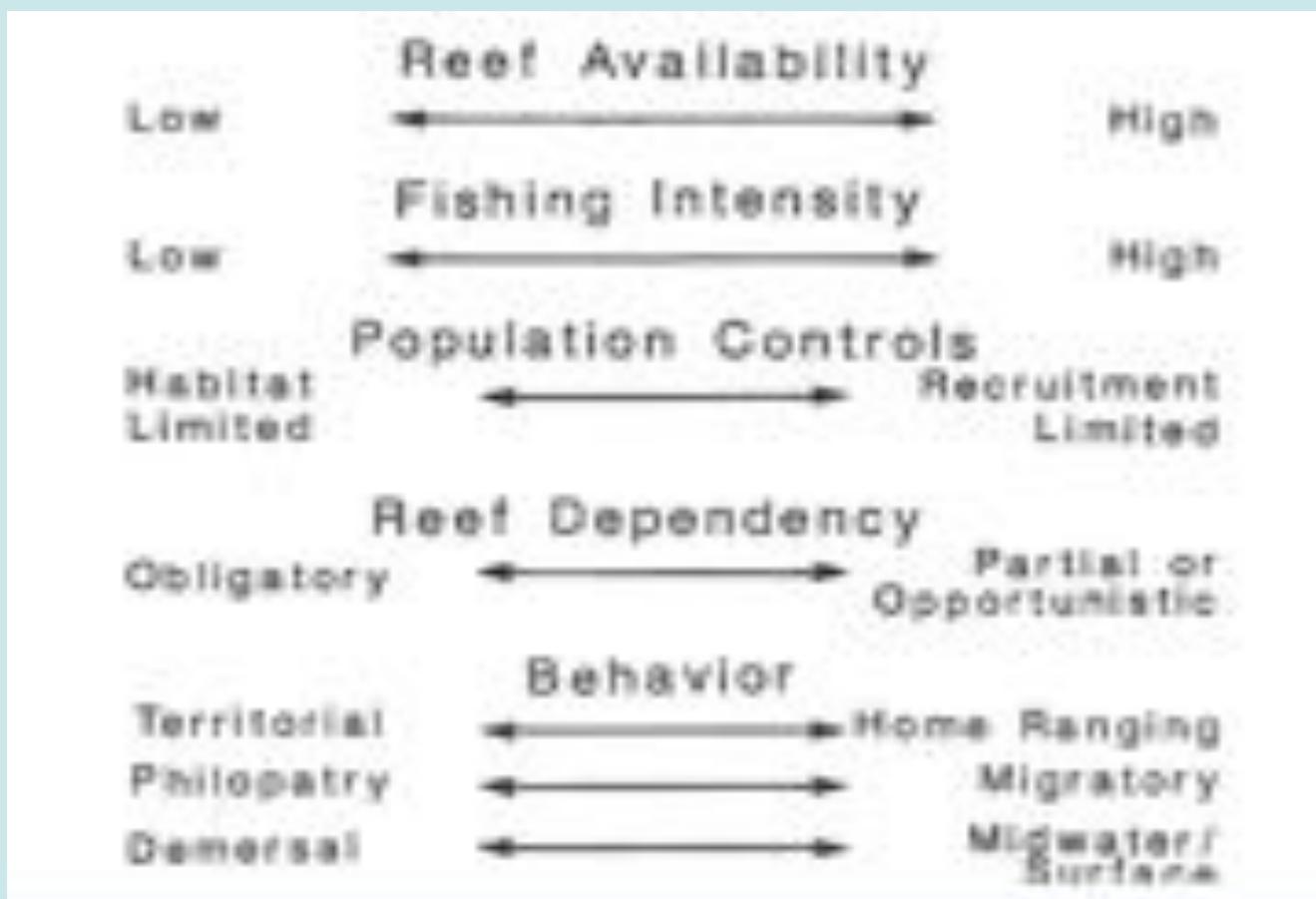
Artificial reefs can accelerate overfishing by concentrating remaining adults and making them easier to locate and more vulnerable to fishing.

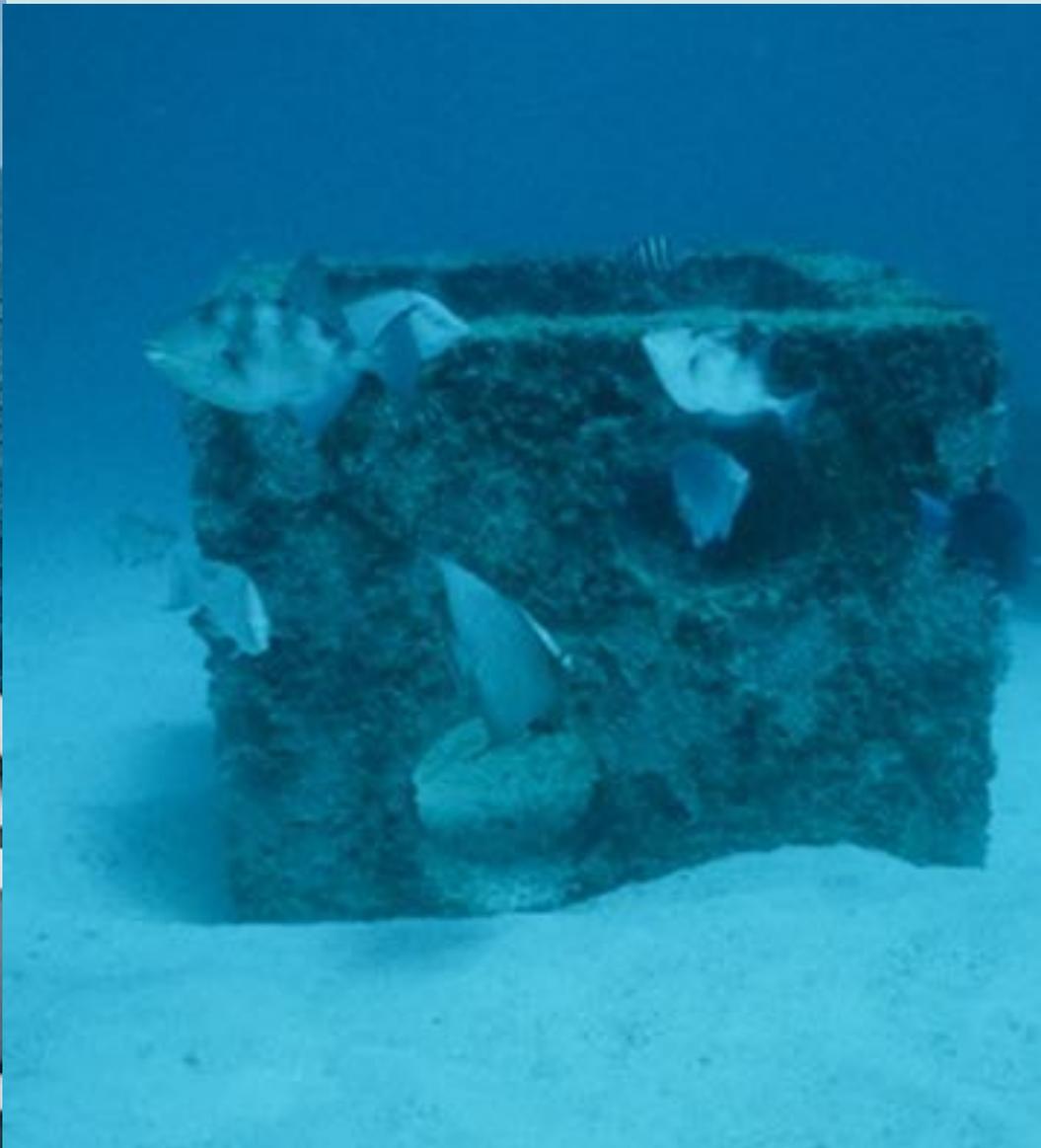
Under overfishing, habitat is not limiting. The limiting factor is total reproduction based the abundance & size of reproductive females.

Predicted species characteristics that influence population responses to artificial reefs

More Production

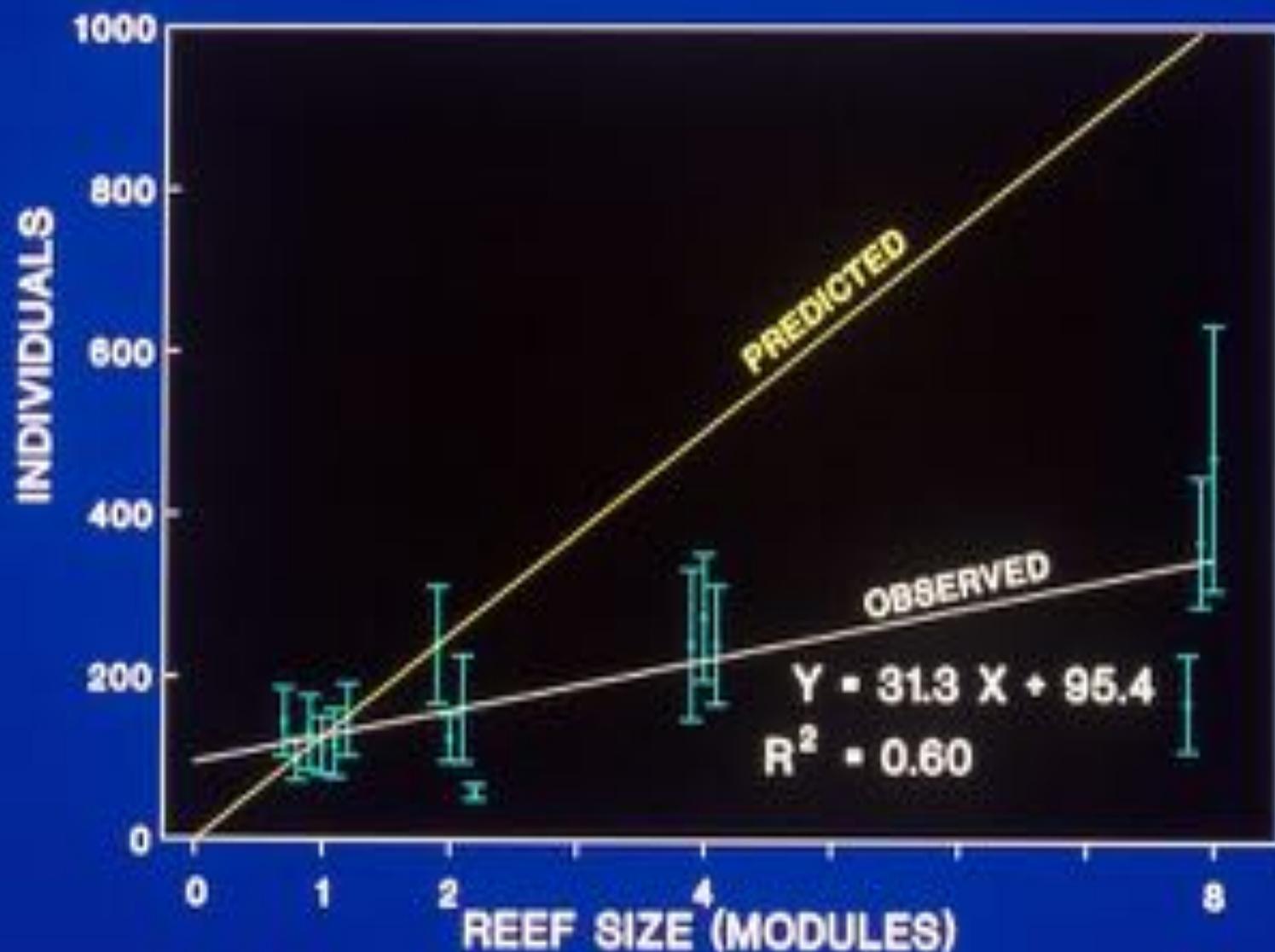
More Attraction

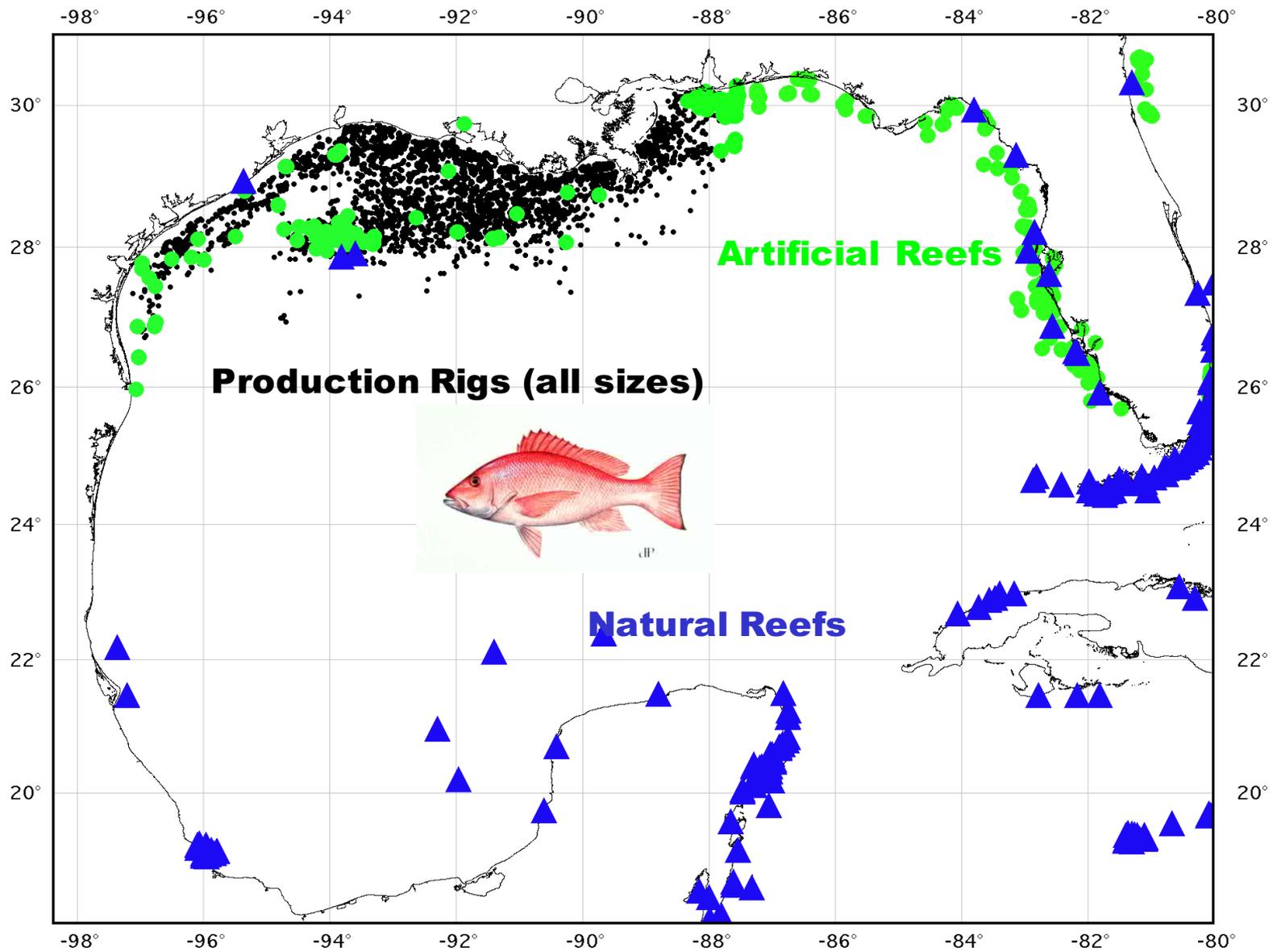




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MEAN ABUNDANCE-REEF SIZE REGRESSION RESIDENT SPECIES





Courtesy of Tracy Villareal, U. Texas at Austin

A satellite image of the Gulf of Mexico showing a dense network of sediment trails. The trails are light-colored lines crisscrossing the darker ocean surface. Small, bright white spots are visible at the ends of many of these trails, representing individual vessels. The image is a detail from a Landsat satellite image.

Detail from Landsat satellite image,
Gulf of Mexico. Individual vessels are
bright spots at end of sediment trails.

6.2 mi

10 Km

GoMex - Area 1 - 10/24/99



The Bad



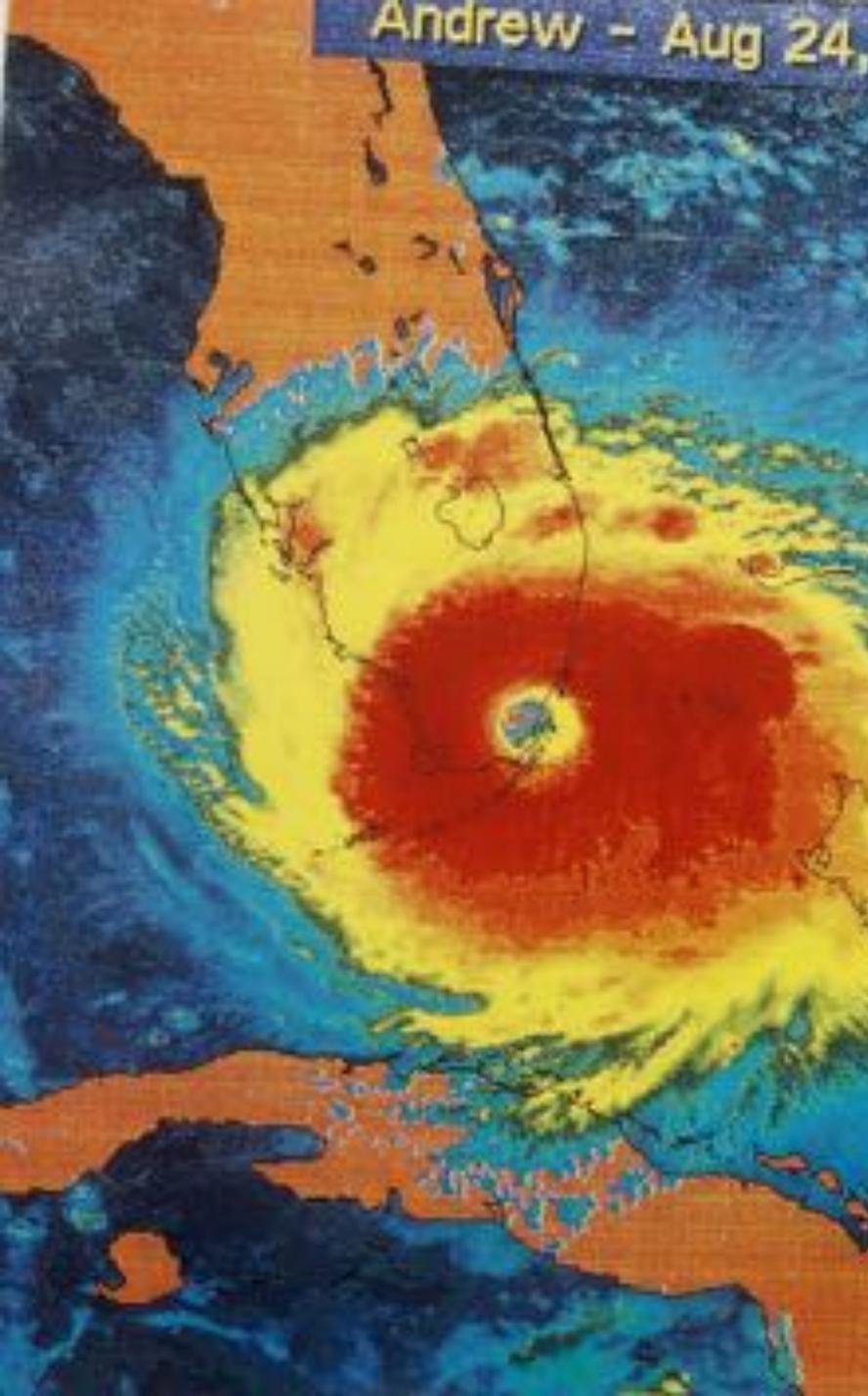


BARBARA MYTHER / ASSOCIATED PRESS

Adrian Harrold of Rocky Mount, N.C., reads on Pine Knoll Shores, N.C., Friday, among tires washed on the beach from an artificial reef which was damaged by Hurricane Bonnie.



Andrew - Aug 24,



Do No Harm



ARTIFICIAL REEF DAMAGE

The principal parts of Dade's artificial reef program, with wreck, location and status.

- **Almirante**, South Dade: turned upside down
- **Andro**, Haulover: deck twisted
- **Arida**, Key Biscayne: flattened and crushed
- **Belcher Barge**, Key Biscayne: no damage
- **Belzona Barge**, Key Biscayne: missing
- **Belzona Two**, Key Biscayne: was moved,

lost roof.

- **Biscayne**, Key Biscayne: extensive damage

- **Blue Fire**, North Dade: lost bottom, hull collapsed.

- **C-One**, Sunny Isles: no damage.

■ **Concepcion**, Sunny Isles: broken into three pieces, middle collapsed.

- **Doc DeMilly**, South Dade: no damage.

- **Lakeland**, Key Biscayne: collapsed.

■ **Miracles Express**, Key Biscayne: reduced to rubble.

- **Miss Karlina**, Miami Beach: broken.

- **Narwal**, Haulover: extensive damage.

- **Orlon**, Key Biscayne: lost pilot house.

- **Patricia**, Miami Beach: broken.

- **Proteus**, Key Biscayne: broken and moved.

- **Radio antenna**, Miami Beach: no damage.

- **Rio Miami**, Key Biscayne: no damage.

- **Shamrock**, Miami Beach: lost pilot house

- **Sheri-Lyn**, Key Biscayne: broken in half.

- **South Seas**, Key Biscayne: stern broken off

- **St. Anne**, SE of Key Biscayne: no damage

- **Tarpoon**, SE of Key Biscayne: devastated

■ **Tenneco Oil platform**, Dade-Broward line
lost legs, leaning



Conflicts between artificial reefs and endangered sea turtles

Entanglement and entrapment of sea turtles on artificial reef structures

- Growing number of reports of sea turtle mortality on artificial reef structures.
- Most mortality is never witnessed or reported.
- **Entanglement** occurs in lost gear (anchor line, fishing line)
- **Entrapment** occurs in structural elements.
- Design considerations should include potential for sea turtle entrapment.



Entrapment occurs in structural elements.
Artificial reef modules with closed tops
may increase entrapment risk



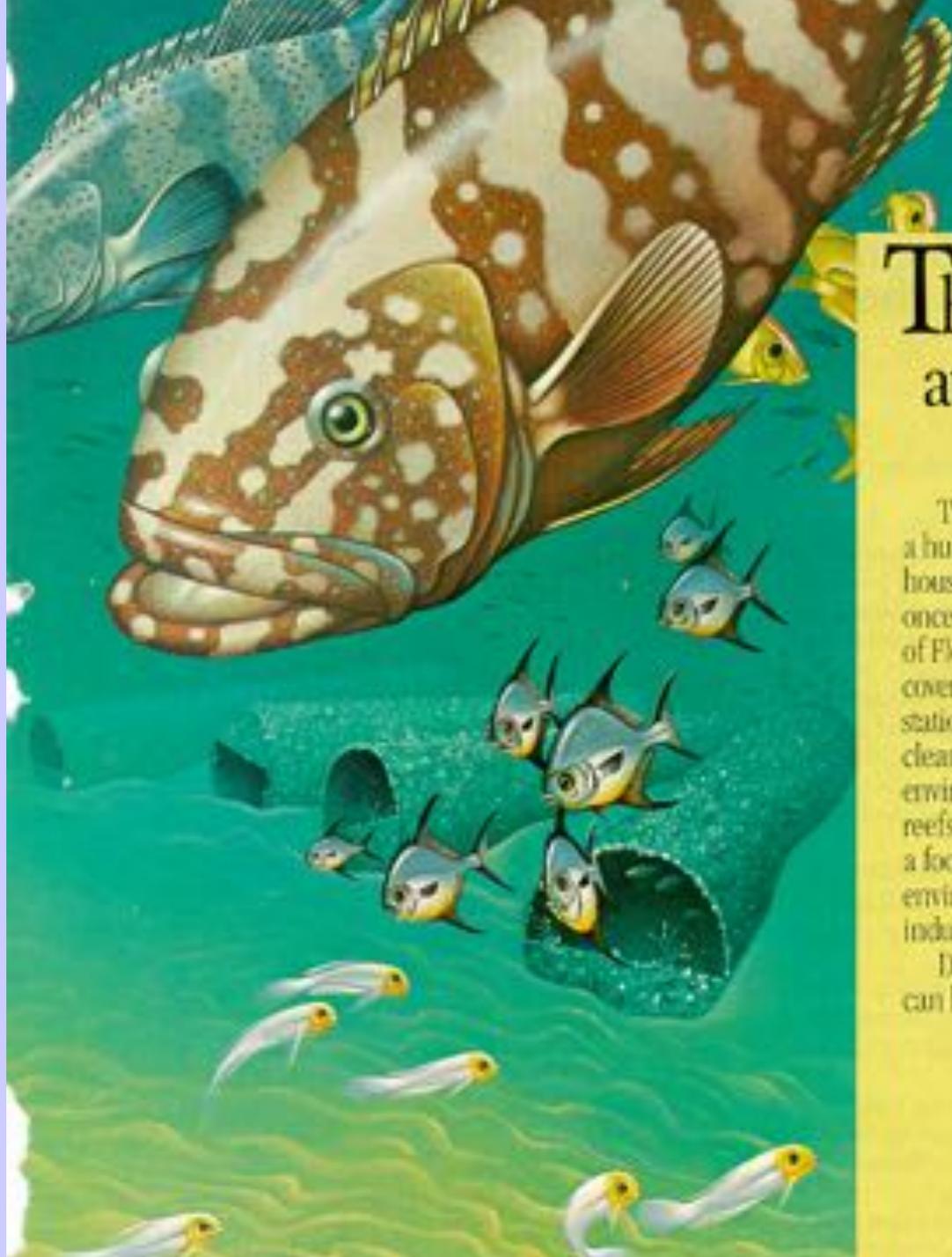
Turtle Entrapment Documentation
Okaloosa County, Florida
Friday, June 3, 2016

Conflicts between artificial reefs and sea turtles

Sea turtle hatchling predation over artificial reefs adjacent to nesting beaches

- Artificial reefs deployed on sand close to shore in shallow water off sea turtle nesting beaches may increase the predation risk to hatchling sea turtles.
- Several studies have shown higher predation of hatchling turtles traversing areas of with bottom structure, such as saballerid reefs and patch reefs.





The little house at the bottom of the sea.

Two-and-a-half miles offshore, a hundred feet down, is an unusual housing development. In an area once virtually empty of life, families of Florida fish now live in coral-covered cylinders that were once gas station storage tanks — sandblasted clean and lowered into the sea as environmentally approved artificial reefs. Algae form, fish gather and a food chain begins — good for the environment and the local fishing industry.

Do people really do all that so fish can have a population explosion?

People Do.



For more information visit: [People Do.](#)



Anchors away

Vandals destroying system that steadies sunken jetliner

By JIM HARDIE
Special to The Herald

Crime has hit new depths in Dade County — 68 feet below the Atlantic Ocean surface.

Dade County authorities say vandalism to the newest and most popular artificial reef is not only illegal but potentially dangerous.

Last Sept. 8, the shell of an old Boeing 727-100 jetliner was sunk in 68 feet of water off Key Biscayne. It became an instant hit with scuba divers and is developing into

plane. If currents or shifting sands cause the plane to move slightly, it can be tightened by twisting the turn-buckles.

Some divers have been taking advantage of the system and removing the turn-buckles. So far they have disabled three of the 10 anchors.

"The plane is county property, it belongs to all of the citizens. It is on ocean bottom owned by the State of Florida," Mostkoff said. "Vandals are committing a crime: Damage to county property."

Spirit of Miami, Boeing 727, deployed 1993

Spirit of Miami “found” in 2010, 17 years later





DS DAILY SABAH 
@DailySabah

 Follow

Turkey's biggest reef, an Airbus A300, sunk off coast of Kuşadası to boost diving tourism [sabahdaily/fcqTRq](https://www.dailynews.com.tr/q)

6:20 PM - 4 Jun 2016



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“Ships used as artificial reefs must be deployed at least a quarter of a mile away from natural reefs.”

“Mercedes”

Broward County (Fla)
Artificial Reef Program
Promotional Brochure



The Ugly

2002 Sinking of Spiegel Grove – Key Largo



Miami Herald

Capsizing barge with Rapa Nui Reef modules
7 June 2015 – Deerfield Beach, FL



www.nydailynews.com



Luxury limo: In 1990, this Rolls-Royce was pushed off Palm Beach as an artificial reef. While regulators no longer allow cars to be used, hundreds of cars and school buses have been sunk in state waters.



Water wings: Rigged apart by a freighter's anchor, this DC-4 served as a reef off Fort Lauderdale beach. World War II planes covered in the South Pacific led to modern-day artificial reef programs.





PHOTOS BY CHUCK FADLEY/HERALD STAFF

ALMOST UNSINKABLE: The Brandywine, one of three drug boats that were sunk Friday to form an artificial reef, proved tough to send down. Water cannons were employed to fill the hull enough to sink it in about 140 feet of water.

New course is charted for seized drug vessels

**Ships are sunk
for artificial reef**

to the Miami River, didn't go to its watery grave easily on Friday, despite fiery explosions that drew cheers from boatloads of spectators.

boats went down in minutes.

"This event completes the circle of our campaign against drugs," said Gov. Jeb Bush, who was joined by several community leaders and about two dozen



Jeff "Skj" Guzowski captures the freighter "Polociana" going out in "a blaze of glory" off Broward County recently.

Explosives damage structural integrity and create diving hazards

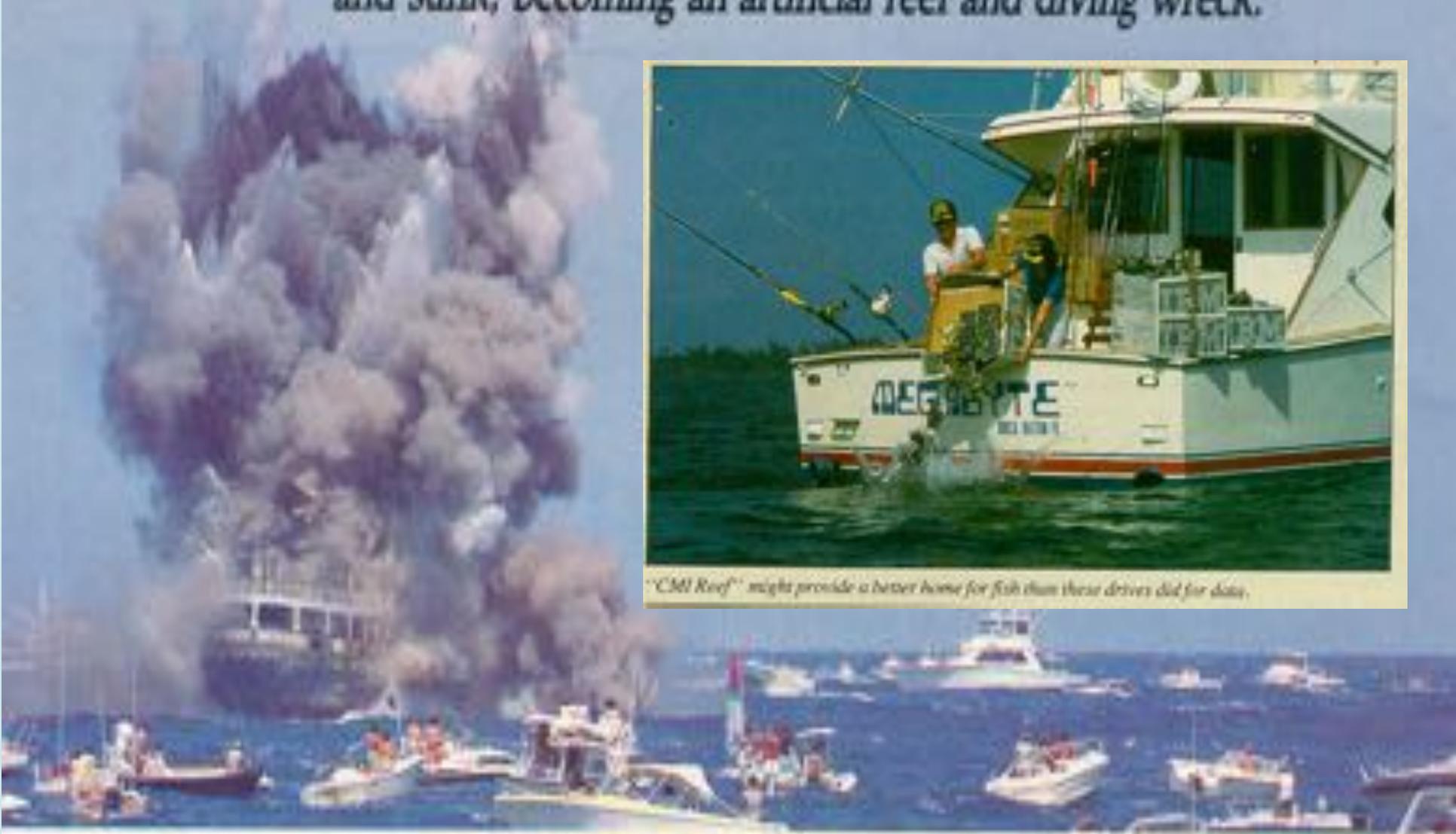


Explosives are unnecessary for ship deployment. The concussion kills fish underneath and nearby.

On March 30, 1985, the freighter MERCEDES was deliberately dynamited and sunk, becoming an artificial reef and diving wreck.



"CMI Reef" might provide a better home for fish than these drives did for data.



BUY A DRIVE. GET A REEF.

We'll allow you a \$1,000 rebate on

like bumping, dropping and steering the drives while the company was

the story. Mr. Dickinson concludes that "There have been plenty of 'aestheticians'

firmness and reliability. Even novices should be able to install the kit, and

CONCLUSIONS

- Do No Harm.
- Have clear, realistic goals and expectations.
- Beware of other agendas (public relations, media, waste disposal).
- Understand the biology, ecology and population limitations of target species.
- Remember that artificial reefs are one tool best used as part of an comprehensive, integrated, holistic ecosystem-based approach to conservation and management.
- Artificial reefs are not a panacea – alone they will not solve overfishing.
- Other measures may be more appropriate and effective for conservation and restoration (protecting nursery habitat, marine reserves).
- Ecosystem capacity to support recreational angling is finite.



Photo credit: Don DeMaria

