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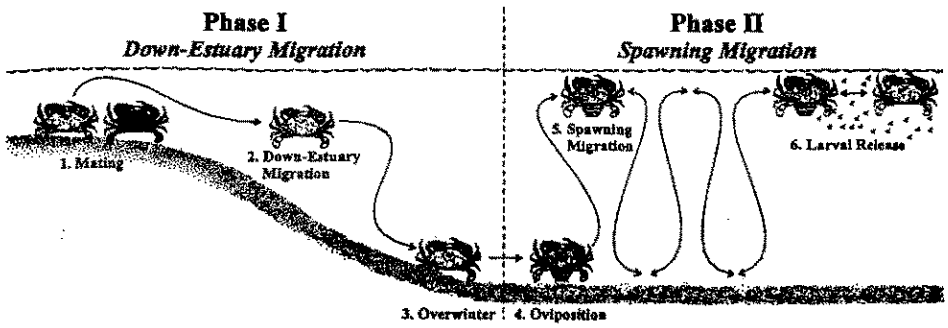
BLUE CRABS RIDE THE TIDE

All crab fishermen are aware that male blue crabs are most common in low-salinity or even fresh waters, and that females reach their largest numbers in high-salinity waters near the coast, where they spawn. It is known that females mate with males in the low-salinity areas and then migrate toward the coast rather than vice versa.

Until recently, few of the details of this movement and of the migration of the young crabs back into the estuary have been studied. Biologists in North Carolina have found that, in spite of being excellent swimmers, blue crabs on the move tend to hitch a ride on the tide, rather than swim.



Movement of adult females takes place in two phases. After mating, the females, over a period of weeks or months, move down the estuary towards higher salinities (Phase I). This movement may involve swimming, walking or passively riding on tidal currents, but certainly does not occur all at one time. Females that mate in late spring may reach the lower bays in time to spawn that year. Crabs that reach the lower estuary in the fall will overwinter near the mouth of the estuary and spawn the following spring. Males usually remain in the low-salinity areas in the upper estuary.

Phase II migration occurs in females in the lower estuary that have deposited their fertilized eggs in sponge-like masses on their belly aprons. These females actively ride the tides, with all movement taking place at night. The females do not swim, but rather use their back leg paddles to tread water and keep them near the surface.

On falling (ebb) tides, females with dark brown or black sponges are carried by the tides to coastal or estuary mouth waters were they release their larvae. Brown or black sponges contain late-stage eggs within 2-3 days of hatching. Most females with early-stage yellow-orange sponges do not make this movement. The biologists found that 80% of the crabs carried near the surface on falling night-time tides are late-stage females.

An individual female's eggs will all hatch within minutes of each other and the sponge will almost disappear. Such females will then swim up to near the surface at night and ride incoming (flood tides) back into the estuary. The biologists found that 98% of the crabs traveling in flood tides were females without sponges. A female will repeat this Phase II migration several times in a season as she produces one brood after another.

Crab megalopae larvae also selectively ride the tides to move up into the estuary. At night, on incoming flood tides, they rise up into the water, letting tidal currents carry them in. As soon as daylight approaches they drop to the bottom and wait for another rising tide to ride at night. This occurs again and again until the larvae reach the areas that they will feed and grow in.

Source: *Selective Tidal-Stream Transport of the Blue Crab Callintectes sapidus: An Overview.* Richard B. Forward, Jr., Richard A. Tankersley and James M. Welsh. Proceedings of the Blue Crab Conference 2000. Bulletin of Marine Science, 72 (2): 347-365, 2003.

MARLIN MORTALITY—THE NUMBERS

White marlin are a prized saltwater big game fish. But they are in trouble. So much trouble that they have twice been considered for listing as an endangered species. The plight of this fish has caused a lot of finger-pointing.

Most of it occurs by recreational fishermen and is pointed at commercial longline fishermen who target tuna and swordfish. Often quoted is the fact that recreational fishermen release 99% of their catch and that U.S. longliners catch almost 160 thousand pounds of white marlin each year as bycatch, of which 49% are estimated to die.

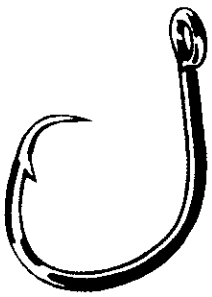
A recent scientific paper printed in the *Marine Fisheries Review* points out, however, that there is plenty of blame to share. The culprit is release mortality of recreationally-caught white marlin. Because of the large numbers of white marlin caught by recreational fishermen, the 35% release mortality figure results in an estimate of 170 thousand pounds of dead marlin, which is larger than the entire longline catch. An additional 9 thousand pounds of white marlin were also deliberately landed each year by recreational fishermen during the study period.

Much of the recreational mortality could be eliminated by fishermen switching from J-hooks to circle hooks. Unlike blue marlin which are usually caught on high-speed trolled lures, white marlin are more likely to be caught on natural baits, with longer drop-back durations. With the use of J-hooks, many fish are deep-hooked and later die.

Source: *Life After Catch and Release.* Jean Cramer. Marine Fisheries Review 66(1), 2004. U.S. Department of Commerce. National Marine Fisheries Service.

MORE ON CIRCLE HOOKS

The use of circle hooks can yield positive results in release survival in fisheries besides the white marlin fishery. Fisheries with stringent minimum (or maximum) size limits force fisherman to release many fish. High release mortality can defeat the intent of conservation regulations and result in even more stringent regulations.



Fishery researchers in North Carolina studied one such fishery, the grouper fishery. During 20 research trips between May and August 2003, four types of hooks were fished, 5/0, 7/0, and 9/0 offset J-hooks and 12/0 circle hooks. All four hook types were fished at the same time and were randomly assigned to four rods. A normal day of fishing was 8-10 hours and was done 20-60 miles offshore.

As fish were caught, the species of fish was recorded as were their length, hook type and size, position of the hook, bleeding, whether the stomachs were "blown", and water depth. A total of 1,249 fish were landed. The three most common species caught were red grouper, red porgy, and Atlantic sharpnose sharks. Groupers catches totaled 564 and were comprised of gag, red, scamp, red hind, rock hind, and coney groupers.

As expected, the number of gut-hooked groupers was much lower with circle hooks than with J-hooks. Only 1% of fish caught on circle hooks were gut-hooked compared to 15% for fish caught on J-hooks.

Overall grouper catch was about the same for all hook sizes and styles, although the catch rate for larger groupers was slightly higher for larger sizes of J-hooks. Bycatch rates become less as the size of the J-hooks used increased, and the least bycatch occurred with circle hooks.

Finally, also as expected, there was a definite relationship between depth of capture and the percentage of blown stomachs in grouper. No grouper had stomachs sticking out of the mouths if captured from less then 80 feet of water. For groupers

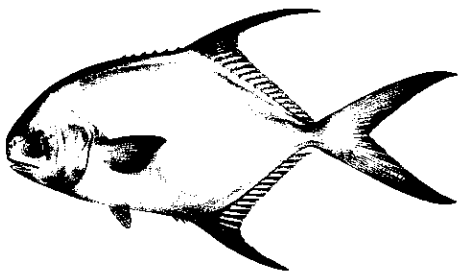
taken from 80-99 feet, 11% were blown, for 100-119 feet the percentage rose to 43% and for 120-139 feet, it was 63%.

Source: *Circle Hooks. A Way to Reduce Injury and Mortality in Grouper?* Jeffrey Buckel, Nathan Bacheler, Alex Ng, and Anthony Ng. Blueprints, UNC-SG-BP-2004-02, North Carolina Sea Grant Program. 2004.

SPAWNING AGGREGATIONS

Many species of reef fish are known to form "spawning aggregations". The term simply refers to a synchronized spawning event by a number of fish that are not normally schooling species. Most well-known are the spawning aggregations of Nassau grouper. This fish, which spends most of the year staking out a patch of reef as a solitary predator fish, will travel long distances to spawn as part of an aggregation of up to 100,000 fish.

Fish at spawning aggregations are concentrated in numbers and are not wary, making spawning aggregations very easy targets, perhaps too easy, for fishermen. A basic knowledge of a species' spawning behavior is important for its effective management. Biologists in Belize in 2000-2002, closely studied two spawning aggregations, predominately of permit, over reefs off of their coast.



Permit, *Trachinotus falcatus*, look like their close relative, the Florida pompano, but are much larger. They are valuable sport fish, especially in the southern Gulf of Mexico and the Caribbean. The two sites studied by divers were Turneffe Elbow and Gladden Spit. Both sites are reef peaks, with sloping shelves that drop off steeply at depths of 115-150 feet to depths of over 3,300 feet.

At Turneffe Elbow, the divers observed 250-500 permit near the top of the reef 7 days after the full moon in August. The group of fish streamed over the surface of the reef above the drop-off. At 41 minutes before sunset, the fish began to gather near the reef edge, and by 26 minutes before sunset the permit formed a dense school right at the edge of the drop-off.

Then a 40-inch fish left the dense school, trailed by 7 other fish, each from 22-30 inches long. The larger fish (assumed to be female) swam upwards, with the smaller fish, assumed to be males, following and bumping its vent with their snouts. At about 50 feet from the surface the lead permit stopped swimming, tilted its head down slightly, shuddered and released a puff of gametes (likely eggs). The other permit positioned their vents as close as possible to the vent of the larger fish and released their own gametes (likely sperm). This activity was repeated over and over again by small groups leaving the dense school until it became to dark to see.

Spawning activity was very similar for permit at Gladden Spit. There, a similar number of large permit, some over 48 inches long, formed a dense ball of fish at the edge of the reef drop-off in 130-160 feet of water. Subgroups of 5-9 fish, with the lead fish being the largest, rose on the edge of the school until they were over it, spawned and then dropped back into the school. Spawning took place 10 days after the full moon in April, and began at 66 minutes before sunset. At the same time, at this site, a school of yellow jacks spawned in identical fashion as the permit, only 50 yards from the permit spawning aggregation.

At both sites, the spawning permit developed a large dark-colored patch on each side, above and behind the pectoral (side) fins. The fish in spawning aggregations showed little fear of divers, a behavior common in fish that form aggregations to spawn.

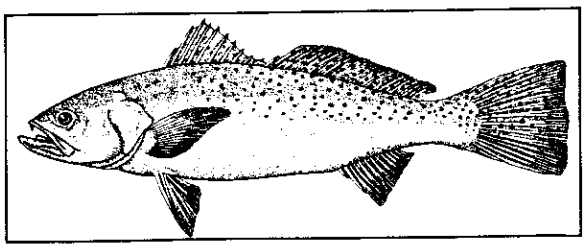
Not all jacks are group-spawners. The scientists on numerous occasions saw pair-spawning occurring in schools of crevalle jacks, horse-eye jacks, and bar jacks in schools of over 1,000 fish, in rainbow runners in schools of 300 fish, and occasionally greater amberjacks in schools of about 120 fish. These spawnings took place on full moons or after full moons between February and October.

In these five species, a male and a female fish would pair off from the group and swim near a reef edge, with the male closely following the female and nuzzling her vent until she discharged her eggs. In all species, spawning females' heads and upper bodies turned black. Male amberjack turned a vivid electric blue color with a scrawled pattern on their uppersides.

Source: *Courtship and Spawning Behaviors of Carangid Species in Belize.* Rachael T. Graham and Daniel W. Castellanus. U.S. Department of Commerce, Fishery Bulletin, Vol. 103: 426-432. 2005.

SPECKLED TROUT REPRODUCTIVE RESEARCH

The spotted seatrout, *Cynoscion nebulosus*, or as we usually call it, the speckled trout, is the most researched saltwater fish in the southeastern United States. The amount of research is appropriate because it is likely the most popular and the most closely managed fish in the region.



Biologists in South Carolina conducted research on speckled trout to get information on how often they spawn, how many eggs they lay per spawn, and what contribution to the total spawn each age-group of the fish makes. To collect the fish, the biologists made trammel net sets over a 3-year period in the Charleston Harbor,

South Carolina area. The biologists speculated that from mid to late-afternoon, females which would spawn that day move from along marsh edges toward groups of ready-to-spawn males in deeper water. The trammel nets were set in the afternoons, shortly before the fish began their spawning activity, which took place between 6 p.m. and 10 p.m. This produced ready-to-spawn females.

All specks caught were measured. Then 5-10 fish from each net set were iced and brought to the lab. They were measured again, weighed, the egg masses were weighed, a sample of the eggs was removed for study, and the otoliths (ear bones) of each fish were removed to use in aging the fish.

A total of 1038 speckled trout, ranging in age from 1 to 5, were collected in the study, 97% of which were ages 1-3. The smallest mature female was 9.8 inches long. By 10.6 inches, 50% of females were mature. At 11.9 inches, 100% of the females are mature in South Carolina (compared to 10.6 inches in Louisiana).

The researchers found that females became mature about one full year after their birth. While, not all age-1 females are mature on their birthday, they can be expected to become mature before the spawning season ended.

The spawning season in the Charleston Harbor area was found to begin in late April and extend through early September. The lowest temperature at which spawning was found was 68°F. Seventy-five percent of spawning took place in water temperatures of 77°F or above, although spawning stopped at temperatures higher than 82°F.

In answer to their first question — how often do speckled trout spawn, the answer was age-1 fish spawn once every 4.7 days, age-2 fish every 4.2 days and age-3 fish every 4.0 days. This is quite close to what has been found for Gulf states trout.

As to how many eggs were laid per spawn, the estimates were 145,452 eggs for age-1 fish, 291,123 for age-2 fish, and 529,976 for age-3 fish. This is higher than the latest research indicates for Louisiana specks.

Interestingly, as the spawning season progressed, the size of the eggs laid by each female grew steadily smaller. This had been noted before by other scientists, and has produced quite a bit of speculation as to why it occurs. One researcher suggested that the eggs didn't need to be as large nearer the end of the spawning season as near the beginning because more food was available in the water later for the newly hatched larval fish.

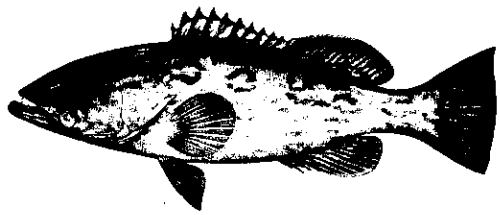
Others said that some sort of relationship based on water temperature existed, with the higher the water temperatures being, the smaller the egg produced by the female. Another suggestion was that as the spawning season wore on, females become leaner and less plump, therefore producing smaller eggs. Indeed, in this study the females did become less plump later and later in the season.

When egg production per fish was worked out on an annual basis, the estimates were that age-1 fish produced 3.2 million eggs per year, age-2 fish 9.5 million eggs per year, age-3 fish 17.6 million, age-4 fish 24.4 million, and age 5 fish 31.6 million.

From these figures, it would seem almost a sure thing that the oldest fish produce a much higher percentage of the total annual spawn than the younger fish. However, in this study, over half the fish were 1-year olds. There were twice as many 1-year old fish as 2-year fish and 7 times more than 3 year olds. As a result, age-1 fish produced 29% of the total spawned eggs for the year, age-2 fish produced 39%, age-3 contributed 21%, with age-4 producing only 7%, and age-5 only 4% of the total annual spawn.

Source: *Reproduction Dynamics of Female Spotted Seatrout (Cynoscion nebulosus) in South Carolina.* William A. Roumillat and Myra C. Brouwer. Fishery Bulletin. Volume 102, Number 3. July 2004.

GADABOUT GAG



The gag grouper, *Mycteroperca microlepis,* may be the most important grouper species in the Southeastern United States. Both commercial and recreational fishermen heavily pursue the fish. So much so, that in the last 6–8 years, scientists have become concerned.

The reason for their concern is the rapid decline in the percentage of male gag in the population. While the decline in males has also occurred in the Gulf of Mexico, it is even more evident in the South Atlantic, where males have gone from 33.3% of the population in 1976 to 3.7% in 1996.

Gag are protogynous hermaphrodites, which simply means that they are all hatched as females and mature as females (at 29 inches average). At 5 years old and 32 inches they are all still females, but after that some begin changing their sex to males. By 11 years old and 42 inches in length, about half have changed sex to males. As can be imagined, few live that long, and if they do, the larger males tend to be more aggressive than the smaller females and the first to grab a baited hook.

Additionally, gags are known to form spawning aggregations, where hundreds of fish from many miles around will congregate in one small spot for spawning. Reef fish that are in spawning aggregations have been found to be especially easy to catch.

Because of this pattern of movement to spawning aggregations, biologists on the south Atlantic coast set about trying to document gag movement patterns, and what effect these movements have on populations. To do the study, commercial fishermen from North Carolina to Key West, Florida were paid to tag gag (and other fish that were

caught on the trips) and release them. Before the fish were released, their swim bladders were deflated with a 16-gauge hypodermic needle by piercing the side of each fish about an inch behind its pectoral (side) fin. Fishermen who caught and reported tagged fish received cash awards and prizes.

During the 1995–1999 study, 3,876 gag were tagged, and 436 (11.2%) were recaptured. The longest distance moved by a gag was 1,060 miles from South Carolina into the Gulf of Mexico. On average, fish were free for 366 days after tagging and they had moved an average distance of 90 miles.

Interestingly, gags tagged at some depths showed far longer movement than did gags tagged at other depths. Gags from 61–90 feet of water moved an average of 125 miles and gags from 91–120 feet moved 131 miles. Yet gags from 31 – 60 feet moved only 26 miles and those from 121 – 150 moved 23 miles. For waters of 151 – 180 feet and 181 – 210 feet movement was a little more, but still only 55 and 51 miles. Overall, with no consideration for depth, 36% of the gag moved more than 22 miles, and another 36% moved 1.2 miles or less.

The decompression damage done to gag brought up from deep waters was clear from the recapture data. As the depth of the first capture (tagging depth) increased, the percentage of fish recaptured after release steadily decreased. Obviously, the deeper-caught fish didn't survive to be recaptured. The researchers believed that survival would have been even lower if they had not deflated the air bladders before release.

Tagging Depth, feet	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300
Recaptures	19%	15%	12%	9%	6%	5%	3%	0	0

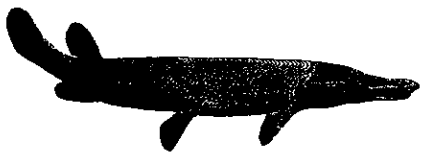
It should be noted that decompression damage is very specific to the species of fish. Over 2,200 greater amberjack were tagged in this same study. For this species, tag returns for fish from 271–300 feet of water were higher than for any other depths except for 31– 60 feet and 151–180 feet. Obviously, decompression has less of an effect on this species, which normally ranges from the top to the bottom of the water column.

The biologists were not able to identify any specific activity in gag that would indicate movements to spawning aggregations in this study. They did conclude that gag are very vulnerable to overfishing and that at the depths at which gag form spawning aggregations, 150 to 270 feet, a high percentage of released fish would die. Their final conclusion was that in these deepwater habitats, marine reserves (marine protected areas) may be an appropriate management tool along with other management measures to protect the gag resource.

Source: A *Tag and Recapture Study of Gag, Mycteroperca microlepis off the Southeastern U.S.* John C. McGovern, George R. Sedberry, H. Scott Meister, T. Mark Westendorff, David M. Wuyanski, and Patrick J. Harris. 2005. Bulletin of Marine Science, 76(1):47 – 59.

ALLIGATOR GAR STUDY

The alligator gar, *Astractosteus spatula*, is quite common in Louisiana's coastal rivers, bayous, bays, and lakes, and is found scattered everywhere else in the state. On the national picture, however, alligator gar are considered much less common than they once were. Historically, they were found as far north as the Missouri and Ohio Rivers. Now, they are listed as endangered in Kentucky and threatened in Tennessee and Illinois. Reasons given for the species' decline are the usual — fishing pressure and habitat loss and degradation.



Little research has been conducted on any species of gar. For alligator gar, most of the research has been on their food habits, because of concerns about their impact on other fish. No research has been conducted on their movements. In fact, the only research done on movement of any gar species was done on spotted gar in the Atchafalaya Basin in 1999.

To fill that information gap, biologists in Alabama conducted a study in the lower Mobile and Tensas Rivers, near where they enter Mobile Bay. In Alabama, alligator gar are managed as gamefish, with a limit of two per day.

The biologists used gill nets, run hourly, to catch 15 alligator gar for tagging. The first five fish (46 – 72 inches long) were radio-tagged, however it was quickly learned that saltwater interfered with the radio signals. The next 10 fish were fitted with ultrasonic transmitters. These fish were 38 – 76 inches long. An electric drill was used to drill through the heavy scales of the gar and the transmitters were attached with stainless steel wires and crimps.

The biologists attempted to track the fish 1 – 3 times monthly over a 23-month period. Twelve of the 15 alligator gar were relocated at least once after tagging, with the highest number of relocations for an individual fish being 19.

The home ranges of individual fish ranged in size from 1.7 to 7.6 miles across, although one fish was seen to make total movements of 14.4 miles during the study. The larger the size of the individual fish was on average, the bigger than home range was and the further they moved. The largest gar in the study was seen to move 1.3 miles in 1 hour and 15 minutes.

Alligator gar reach maturity at 39 to 55 inches, with males maturing at a smaller size than females. While spawning areas could not be determined from the study, the study data showed the smaller tagged fish using a small area in one creek as a nursery area. The biologists noted that the long range movement of larger alligator gar means that they are likely to easily move into and out of areas protected from fishing.

Source: *Movements and Home Ranges of Alligator Gar in the Mobile-Tensaw Delta, Alabama.* Peter C. Sakaris, Allyse M. Ferrara, Kevin J. Kleiner and Elisa R. Irwin. Proceedings of the Fifty-Seventh Annual Conference. Southeastern Association of Fish and Wildlife Agencies. October 2003.

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THE GUMBO POT

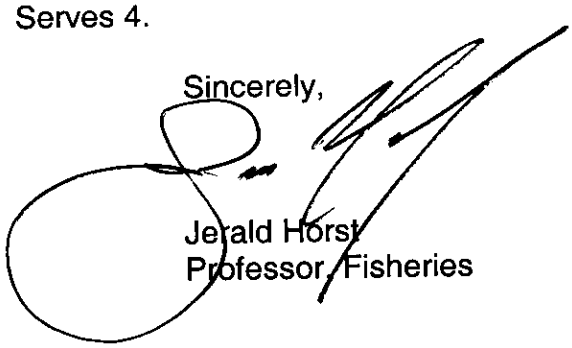
Shrimp Vanney

When I tasted this dish, it brought back a flood of memories from when I moved to New Orleans nearly 40 years ago. Italian bread crumbs, laced with garlic, tied together New Orleans dishes ranging from stuffed artichokes to merliton and seafood casseroles. If you love old timey New Orleans cooking, you will love this one. I found this recipe in "*An Island" Between the Chef & Rigolets,* an accounting of life in the Lake Catherine area in the 1900s by Arriollia "Bonnie" Vanney. I did make one significant change in her recipe. The original called for 4 tablespoons of minced garlic instead of the 2 that I used.

1	lb 16-20 or larger peeled shrimp
1	1 lb regular sliced bacon
1	medium onion, minced
6	green onions, minced
2	tbsp garlic, minced
3	tbsp parsley, chopped
½	cup Romano cheese
1	tbsp salt
1	tbsp pepper
1½	cups Italian seasoned bread crumbs
7	tbsp olive oil
¼	lb butter
¾	cup lemon juice

Butterfly each peeled shrimp deeply. Fold each shrimp over your finger and wrap with a half of strip of bacon. Secure with a toothpick. Place each wrapped shrimp end up in a baking dish. In a small bowl combine onions, garlic, parsley, salt, pepper, cheese, bread crumbs, and olive oil. Mix until the stuffing clings together. Place a teaspoonful of stuffing on each shrimp. In a small pan, melt the butter. Add the lemon juice to the melted butter and spoon over the top of the shrimp. Bake the shrimp uncovered in a 350°F oven until done, about 15 minutes. Serves 4.

Sincerely,



Jerald Horst
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