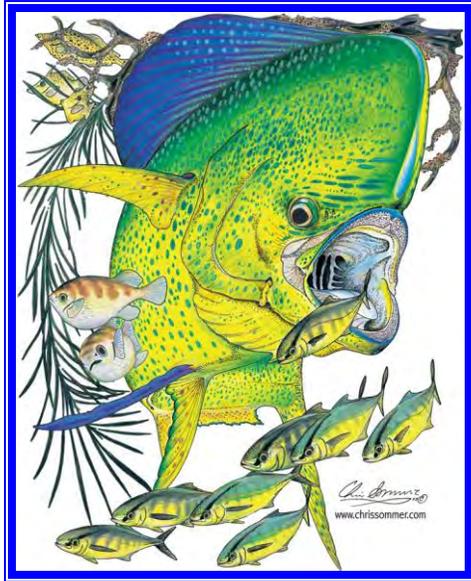


Cooperative Science Services, LLC

Dolphinfish Research Program

July 2015



Toxicity of Crude Oil

We hear each month in the news about reports of new oil spills or the damage past spills have caused to marine life. Just recently a report came out in which science showed that an additional 46 mammal dolphins died as a result of the Deepwater Horizon oil spill that occurred in 2010. This is in addition to the more than 1,000 reported by the Associated Press as being killed in the years immediately following the spill. Now there has been another major oil spill in the ocean off Santa Barbara, California, forming slicks over nine miles of ocean. We get graphic images of the dead and dying animals that are immediately affected by the spill, but scientists know there will be long-term effects as well on the spawning success of fish in the area for years to come.

Scientists with the Ecotoxicology Program at NOAA's Northwest Fisheries Science Center in Seattle, Washington, have been working to understand the toxicity of oil. Even before the Deepwater Horizon disaster, research demonstrated that relatively low concentrations of oil could cause developmental abnormalities in fish. But in the five years since, scientists have shown that oil damages the still-forming hearts of fish embryos and larvae, and they have discovered the causes for that injury at a molecular level.

Researchers at NOAA's Alaska Laboratory showed that larval fish exposed to oil as embryos suffer a broad range of developmental deformities in the heart, jaw, eye, and other areas. They were able to show that larval fish exposed to trace concentrations of oil develop into fish that look normal but are less likely to survive when released into the ocean.

In the years between the Exxon Valdez and the Deepwater Horizon spills, NOAA scientists discovered

that compounds found in oil called polycyclic aromatic hydrocarbons (PAHs) target the developing hearts of fish embryos and larvae. Most of the other abnormalities, which together have become called crude oil toxicity syndrome, were shown to be a consequence of a misshapen heart that functions poorly.

A study led by University of Miami Rosenstiel School of Marine and Atmospheric Science scientists showed that even a relatively brief, low-level exposure to oil decreases the overall swimming performance of juvenile dolphinfish up to 37 percent. The study shows that toxic effects of oil harm the swimming capabilities of dolphinfish, and likely other large pelagic fish, during the early life stages. Altering the swimming capabilities of the larval fish affects their ability to capture food and avoid predators.

An oil leak in the Gulf of Mexico has gone largely unnoticed for more than a decade, according to the Associated Press, even though it is responsible for miles-long slicks. Taylor Energy, the company tasked with fighting the oil leak, and the government agencies overseeing it have both downplayed the spill saying it was nothing more than a minor spill, such as those that happen dozens of times and which the Gulf absorbs.

Findings from the AP investigations indicate that this spill is 20 times larger than the most recent estimate by the company. Experts say it could be one of the largest ever in the Gulf of Mexico. This leak was caused by hurricane Ivan when it destroyed the Taylor platform. The president of Skytruth, an environmental watchdog group, estimates that between 300,000 and 1.4 million gallons of crude oil have leaked into the waters of the Gulf since 2004, and leakage continues today.

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NOAA researchers are working to determine at what level does PAH begin to affect larval fish. This information will not cure or prevent future damage. At best, it will only allow a better prediction of the damage. No one knows how long these contaminants will continue to kill larval fish and whether lethal levels of these toxins will be spread to other areas by the ocean's currents. Such toxins in our oceans are silent, invisible killers that will continue to have a deadly effect on larval fish for years to come. We could be left to wonder what happened to the dolphin and never know what caused their decline.



Larval and early juvenile dolphin have been shown to be highly susceptible to the toxins present in crude oil, suggesting that all dolphin young spawned in an affected area could be killed.

What Will 2015 Bring in Dolphin Fishing?

At the start of each fishing season, fishermen are always wondering what kind of fishing the year will bring. As I delve deeper into the life history of dolphin, I am learning about more and more factors that influence dolphin abundance in any given area; sea surface temperatures, ocean current flow patterns, upwelling patterns, prevailing winds, quantity of Sargassum present, baitfish abundance, etc. Then on top of these factors the weather conditions will dictate whether boats can get offshore to fish. With so many variables at play, I have learned that is currently impractical to attempt to predict dolphin's future abundance in any area.

What we can do is to look at the hard data that have been collected at the same location and under similar methodology for multiple years. The survey that the DRP has carried out starting with the 2013 season at the Ripley Light Marina basin in Charleston, South Carolina, offers that opportunity. This is one time where there is no substitute for a long-term study.



A survey of the dolphin harvested by the boats operating out of this marina can offer insight to the day-to-day fluctuations in the number of dolphin harvested daily by boats fishing off South Carolina. Unfortunately, records of the number of fish harvested by individual boat-trips were not kept in 2013, allowing only for a comparison of the harvest rates for the month of May in 2014 and 2015.

Sampling between the two years was very close with 16 days sampled in 2014 and 18 days in 2015. There were 10 percent more trips surveyed in 2015 than 2014 and a 16 percent rise in the total number of dolphin harvested in 2015 from 2014. Looking at the overall trip average in May for the two years, we see just a small, 5.8 percent, increase in the number of fish harvested per trip in 2015 over the previous year. (See following table.) However, this table does not address the variability in the harvest for each year.

Overall results from vessels surveyed in May.

Year	Number Trips	Number Dolphin	Overall Ave.
2014	79	667	8.44
2015	87	777	8.93

The overall average number of fish harvested per boat trip does give a good overview for comparing the two years but it does not show the daily variations in the harvest. The following figure plots out the average number of dolphin caught each day of May for the two years. The most prominent difference between the daily harvest rates was that the largest catches occurred in the last half of the month in 2014 and the first half to middle in 2015.

Just looking at the ragged lines that represent each year's daily harvest rate, it is hard to see any developing trend. By adding a polynomial trend line, we can get a sense of how the harvest changed during the month. The 2014 trend line (red) indicated the harvest gradually improved as the days passed. In 2015 the trend line

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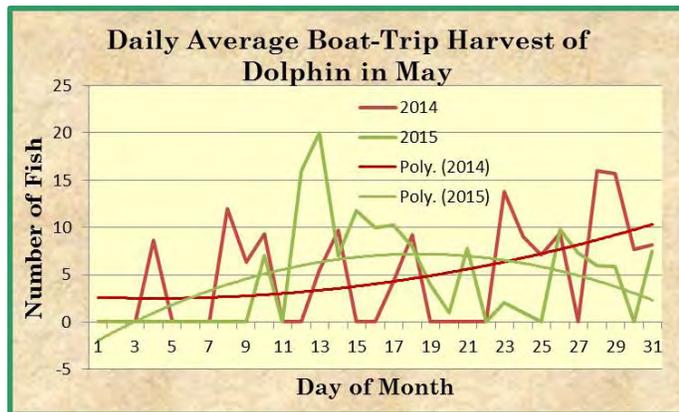
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shows the harvest improving from the first of the month to mid-month where it peaked. After mid-May the harvest rate began to decline.



So just what does this mean? In 2014 the average harvest for the first two weeks of June was 8.58 fish per boat trip, a slight rise above the overall harvest average for May, but the last half of June saw the bottom fall out of the harvest dropping to an average of 3.53 fish per boat trip. With the trend line indicating an earlier start to the decline in catches for 2015, one has to wonder if it means an early end to our primary dolphin season? As I said at the beginning of this article, I don't know. But I will be monitoring the catch.

This article was written at the first of June 2015, so by the time you read this, I should be close to an answer as to how the dolphin fishery fared in June. Stay tuned to get the results.

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