# CONSUMER GROUP

ALABAMA CENTER FOR ECOLOGICAL RESILIENCE

## SUBGROUP SPOTLIGHT

Consumer group PI's Dr. Valentine (right) and Dr. Martin (left). (*Photo/ACER*)

The Consumer group, one of ACER's seven research groups, is examining the impacts of the Deepwater Horizon (DwH) oil spill on ***consumer*** resiliency by investigating food web function and the ***taxonomic*** and ***functional biodiversity*** of consumers. Consumers are heterotrophs, or organisms that eat other organisms for food. Previous DwH oil spill research has suggested that the oil had little to no effect (or even a positive effect) on consumer populations. One possible explanation is that ***mid-level*** and ***higher-order consumers*** emigrated out of the oiled areas: non-oiled areas showed increased abundance. This mass migration of predators may in turn have led to an increase in feeding pressure (***top down control***) on juvenile fishes and crustaceans in non-oiled areas resulting in their reduced abundance. Alternatively, the reduced abundance may have been due to prey species that were unable to avoid oiled areas and died as a result of the toxic effects of the oil. Regardless of the reason, changes in consumer abundance resulted in changes in the coastal food web. Additional field collections and laboratory manipulations are being conducted by ACER scientists to investigate the extent of these food web changes.

*Field Investigations:* Two types of field collections are being conducted, bottom trawls and bottom longline. Importantly, the specific trawling methods are identical to that used by National Marine Fisheries Service (NMFS) methods so that these data can be compared with historical datasets. Bottom trawls are being conducted seasonally at 20 stations in inshore and offshore waters throughout the nGoM to determine if the taxonomic diversity of mid-level consumer species has changed from pre- and earlier post-spill data. Longlining typically collects larger and higher-order consumers. Bottom longline surveys are being conducted at 20 inshore and offshore locations to determine the taxonomic diversity of higher-order consumers. Methods used will also mirror those used by NMFS and consequently allow pre- and post-spill comparisons.

*Laboratory manipulations*: Scientists will also be conducting manipulative experiments in the Sea Lab's mesocosm facility. Predator-prey interactions will be investigated for four coastal habitats, oyster reef, salt marsh, seagrass and bare sand under oiled and non-oiled conditions. A variety of predator and prey species will be used. Results will show how changes in predator and habitat diversity affect trophic exchange, allowing additional insight into potential food web changes.


Consumer group PI Dr. Drymon. (*Photo/David Hay Jones*)

*Behavioral experiments:* There is some question as to whether fish species actively avoid water containing oil and yet this possible avoidance plays an important role in explaining observed patterns. ACER scientists will explore some of this behavior by conducting a series of habitat choice experiments using common coastal fish species.

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### KEY WORDS

***apex predator*** - a predator residing at the top of the food web with no predators

***catch per unit effort (CPUE)*** - a relative measure of the abundance of a target species

***consumer*** - an organism that eats (i.e. consumes) other organisms for energy. A *mid-level* consumer eats lower-level or primary consumers, but is also prey to *higher-order* consumers

***functional diversity*** - the variety of ways that organisms make their living in their environment

***resilience*** - the ability to resist, recover or bounce back from a disturbance

***taxonomic diversity*** - the number of species in a community

***top down control***- pressure from the highest trophic level species on the next lower trophic level species (their prey)

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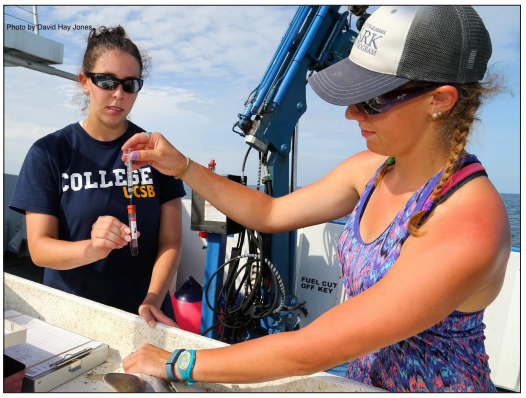
*Stable Isotope Analysis:* Stable isotopes of carbon (C) and nitrogen (N) are now commonly used as a tool to gain insight into food web relationships without the need to conduct predator-prey experiments or analyze gut contents. Scientists look at the relative proportions of different (non-radioactive) isotopes of C ($^{13}C$:$^{12}C$) or N ($^{15}N$:$^{14}N$) knowing that each trophic interaction affects isotopes of the element differently. By measuring the relative proportion of these stable isotopes, one can infer the source of primary production and relative position within the food web. ACER scientists are taking blood and muscle tissues for stable isotope analysis from some of the consumers they collect in order to reconstruct the food webs in oiled and non-oiled areas.



Consumer group graduate student Emily Seubert (right) and intern Jaylyn Babitch (*Photo/David Hay Jones*)

## Results to date

The Consumer group has currently completed its first year of trawl surveys and bottom longline surveys. In 2015 trawling occurred at seven offshore locations that experienced heavy oiling from the DwH oil spill and four inshore locations that had lighter amounts of oiling. Figure 1 shows the locations of the trawls along with the locations of historical datasets (SEAMAP: National Marine Fisheries Southeast Area Monitoring and Assessment Program and FAMP: State of Alabama Fisheries Assessment and Monitoring Program).

To date, ACER longlining data have shown differences between inshore and offshore locations as well as geographic differences. Preliminary data from the 2015 trawl collections and historical data dating back to 1999 from SEAMAP and FAMP is presented in Figure 2 as ***catch per unit effort*** (CPUE) over time. Figure 2 shows six graphs that show CPUE as it varies with season as well as a number of data aggregations, total CPUE, fish CPUE or invertebrate CPUE. Peaks in CPUE, which are labeled on the graphs, are evident in 2010 and 2011 for inshore and offshore locations. These peaks indicate high abundances of fish, predominantly groundfish or invertebrates, predominantly shrimp and blue crabs. However, the 2015 data show CPUE at pre DwH oil spill levels.

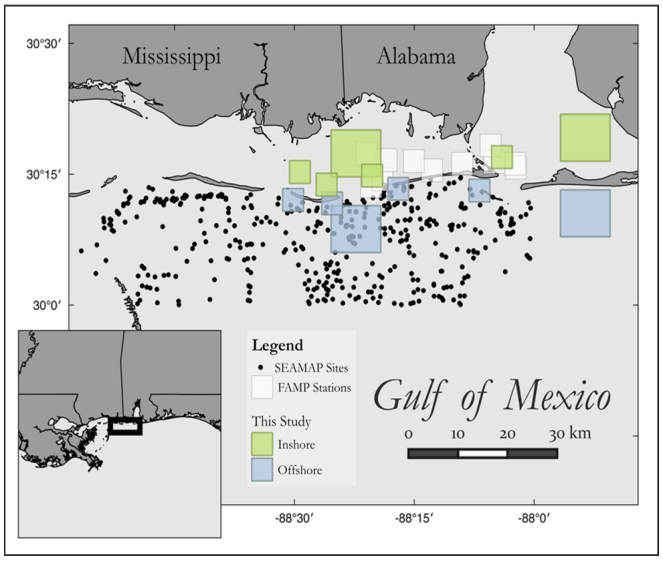


Figure 1. Trawl areas in inshore and offshore locations of coastal Alabama and Mississippi

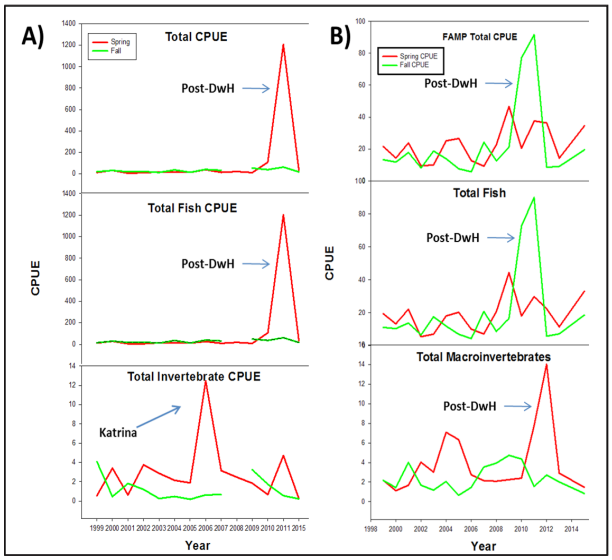


Figure 2. Catch per unit effort (CPUE) over time for A) offshore and B) inshore areas

## ABOUT US

The Alabama Center for Ecological Resilience (ACER) Consortium investigates how biodiversity influences an ecosystem's ability to resist and recover from disturbance, focusing on impacts of the 2010 Deepwater Horizon oil spill on coastal ecosystems in the northern Gulf of Mexico.

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