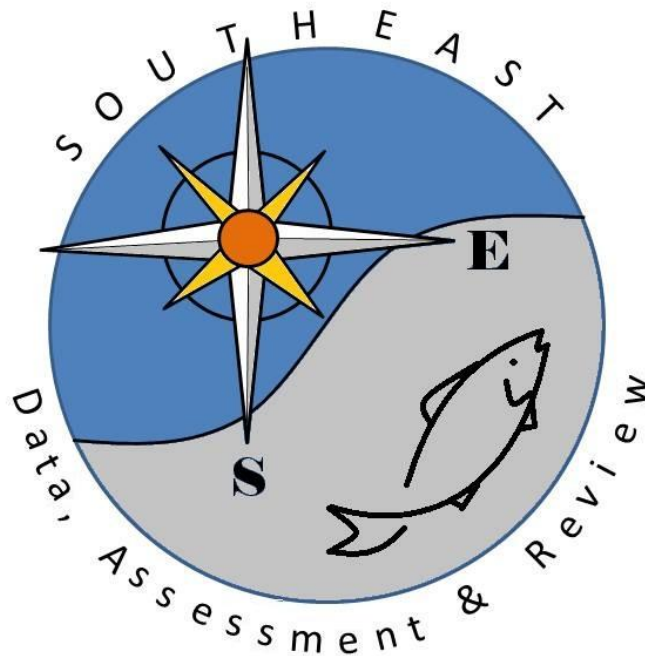# Examining delayed mortality in barotrauma afflicted red snapper using acoustic telemetry and hyperbaric experimentation

Gregory W. Stunz, Ph.D. Judd Curtis

SEDAR31-DW21

10 August 2012

Examining delayed mortality in barotrauma afflicted red snapper using acoustic telemetry and hyperbaric experimentation

Gregory W. Stunz, Ph.D.
Judd Curtis

Contact: Texas A&M University-Corpus Christi, Harte Research Institute for Gulf of Mexico Studies, 6300 Ocean Drive, Corpus Christi, TX 78412, 361-825-3254; greg.stunz@tamucc.edu

The fate of regulatory discarded red snapper remains highly ambiguous for recreationally caught-and-released fish. Fish released at the surface that at first appear healthy and capable of swimming back to depth may in fact experience delayed mortality 2-3 days post catch-and-release. There has also been much controversy surrounding which release strategy (i.e. venting, non-venting, rapid recompression) proves most effective in maximizing survival of discarded snapper. The purpose of this study was to compare the survival rates of red snapper released using each of these treatments, quantify the amount of delayed mortality that may be occurring post catch-and-release, and determine the effects of depth on the extent of barotrauma and delayed mortality. A combination of field trials using acoustic telemetry and lab trials using hyperbaric pressure chambers was used to investigate these questions.

Field trials

Acoustic transmitters (VEMCO© V9AP accelerometer) outfitted with an acceleration sensor and a depth sensor were externally attached to red snapper and released using one of four release methods: Surface non-vented, Surface vented, Bottom release using a weighted descender hook, and Control group (i.e. no barotrauma). Detections were recorded using stationary hydrophone receivers attached to the legs of oil/gas platforms and collected data for approximately 45 days (the estimated battery life of the tags). From the sensor collected data, acceleration and depth profiles of individual fish were generated that allowed us to classify the fate of caught-and-released fish into three categories: survivor, mortality, or unknown. Survivor fish showed high levels of activity in their acceleration profiles and vertical movement in the water column. Mortality fish were classified as fish that "flat-lined" or reached a zero acceleration value and resided at the depth of the seafloor before 2 days had elapsed. Fish that did not fall into either category were classified as unknowns. Unknown fish typically had too few detections to confidently classify as mortality or survivor and were omitted from analysis. Based on the acceleration/depth profiles generated, we observed a substantial amount of delayed mortality occurring. Because of a large number of unknowns, sample sizes were too small to analyze statistically. However, there appear to be seasonal, release treatment, and depth effects that influence delayed mortality. For the Summer trial, we observed 0% survival in non-vented, surface released fish, while vented fish showed 67% survival. Descended fish appeared to perform even better at 80% survival. Differences in survival among release treatments were much less pronounced in the winter and spring seasons. Over all experimental treatment groups, we observed 59% survival, meaning that up to 41% of fish released may be experiencing delayed mortality. Fish exhibited greater survival in all release treatment groups at 30 m depth compared to 50 m depth.

Lab trials

In laboratory experiments using hyperbaric chambers, we assessed barotrauma sublethal effects and survival rates of red snapper after single and multiple simulated capture events from pressures corresponding to 30 and 60 m. We evaluated the use of rapid recompression and venting to decrease release mortality and improve recovery indices. A condition index of impairment, the barotrauma reflex (BtR) score, was used to evaluate sublethal effects. Fish were examined for eleven different barotrauma injuries and reflex responses. The sum of the total number of unimpaired indices was divided by the total possible, and then subtracted from one, to get a numerical score for each fish. Non-vented fish had higher BtR scores (more impairment) than vented fish after both single and multiple decompression events. Non-vented fish showed greater difficulty achieving an upright orientation upon release and less ability to evade a simulated predator, yielding higher scores. Greater capture depths also resulted in higher BtR scores. All fish in vented treatments had 100% survival after a single capture event, while non-vented fish demonstrated much lower survival; 67% from 30 m and 17% from 60 m. Rapid recompression was a significant predictor of survival ($p < 0.05$) compared to release at surface (ambient) pressure, and 96% of all rapidly recompressed fish survived one decompression event. Survival decreased with multiple barotrauma events in all treatment except controls. These results illustrate the importance of using venting or rapid recompression to alleviate barotrauma symptoms, improve ability to evade a predator, and increase survival.
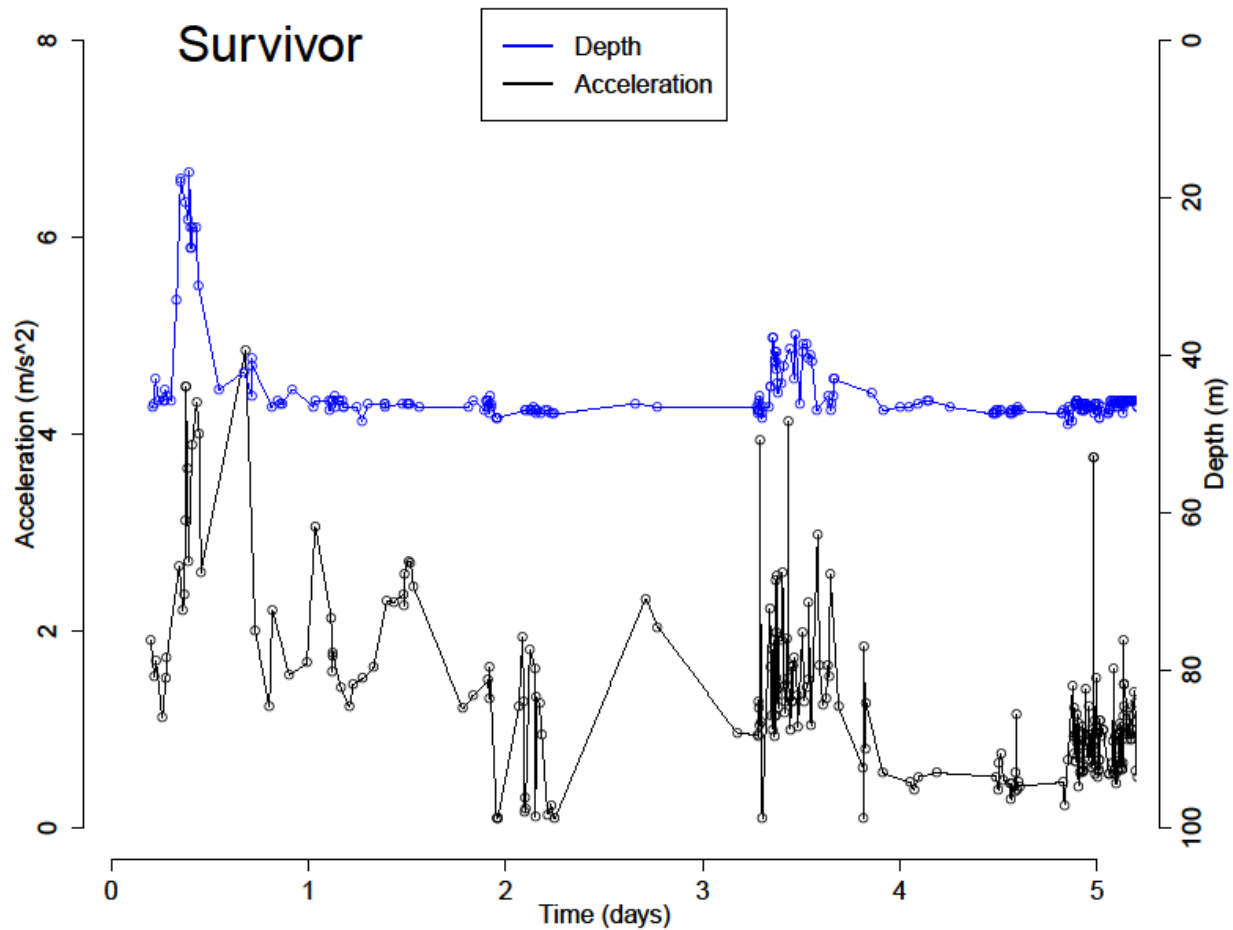
Fig 1. Acoustic telemetry acceleration (m/s^2) and depth (m) profiles of one acoustically tagged red snapper determined to have **survived** catch-and-release for > 5 days. Points represent individual acoustic detections and are connected by lines for easier visualization. Black points/lines represent acceleration and reveal a healthy and active acceleration profile for this fish. Blue points/lines represent the depth profile for this fish. Site depth was ~50 m.
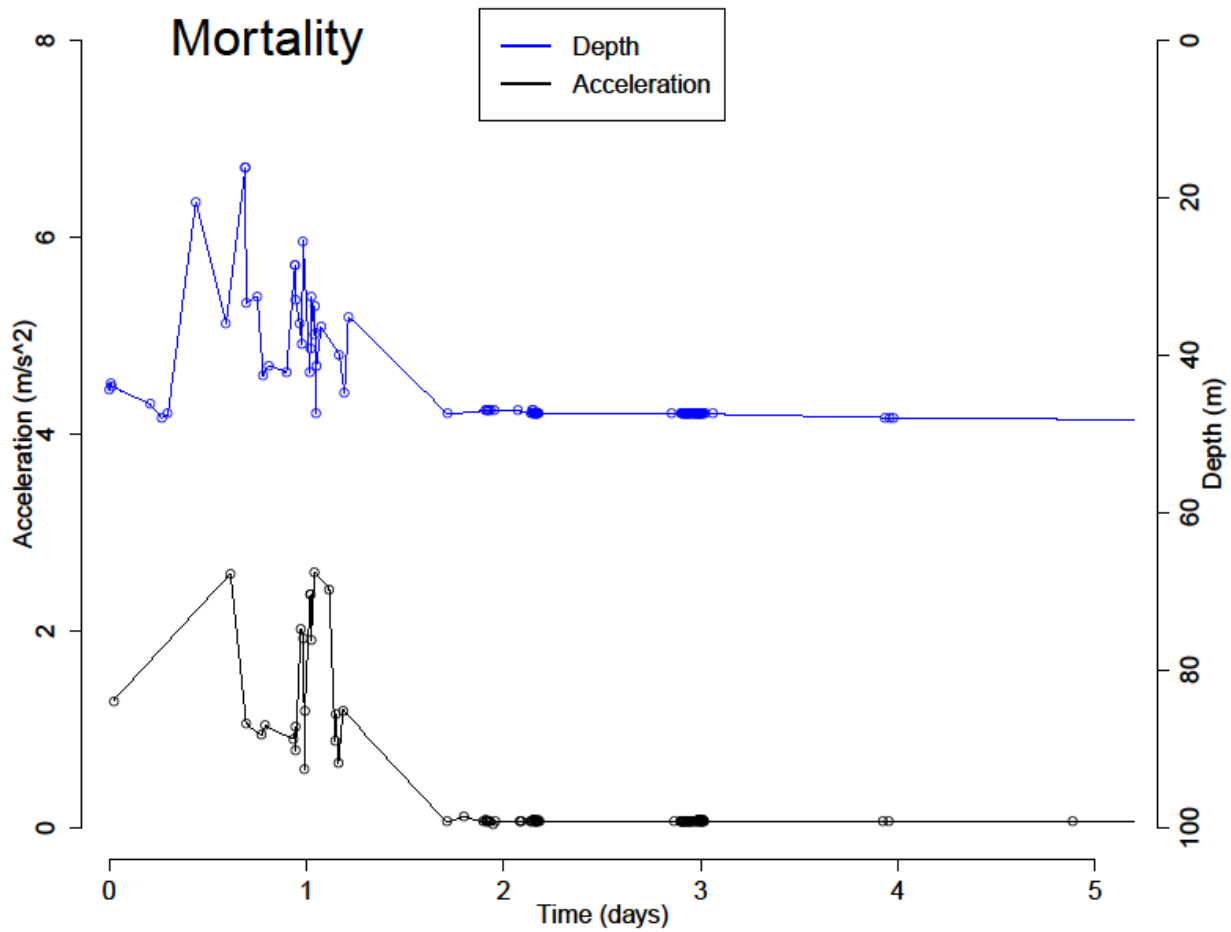
Fig 2. Acoustic telemetry acceleration (m/s^2) and depth (m) profiles of one acoustically tagged red snapper determined to have suffered **delayed mortality** post catch-and-release. Points represent individual acoustic detections and are connected by lines for easier visualization. Black points/lines represent acceleration and show that after < 2 days the fish has perished, no longer exhibiting any acceleration or movement. Blue points/lines represent the depth profile for this fish and show that after < 2 days the fish has fallen to the seafloor and perished, showing no further vertical movement. Site depth was ~50 m.
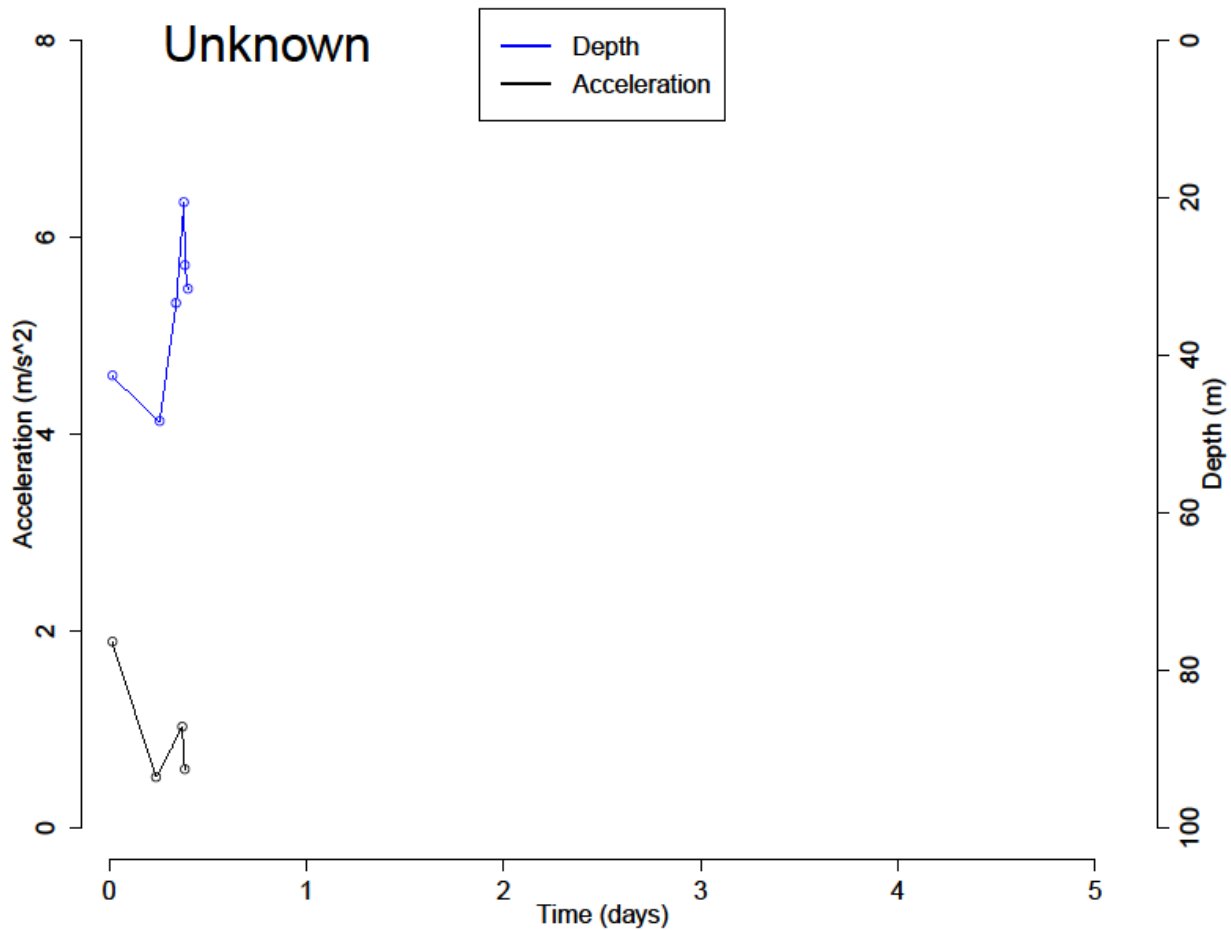
Fig 3. Acoustic telemetry acceleration (m/s^2) and depth (m) profiles of one acoustically tagged red snapper whose fate is **unknown** post catch-and-release. Points represent individual acoustic detections and are connected by lines for easier visualization. Black points/lines represent acceleration and show active detections for 0.5 days before disappearing. Blue points/lines represent the depth profile for this fish and show detections for 0.5 days before disappearing. These fish are classified as "unknown" because it is not possible to decipher whether the end of detections are due to fish emigration from the array (i.e. survival event), or predation (i.e. mortality event). Site depth was ~50 m.
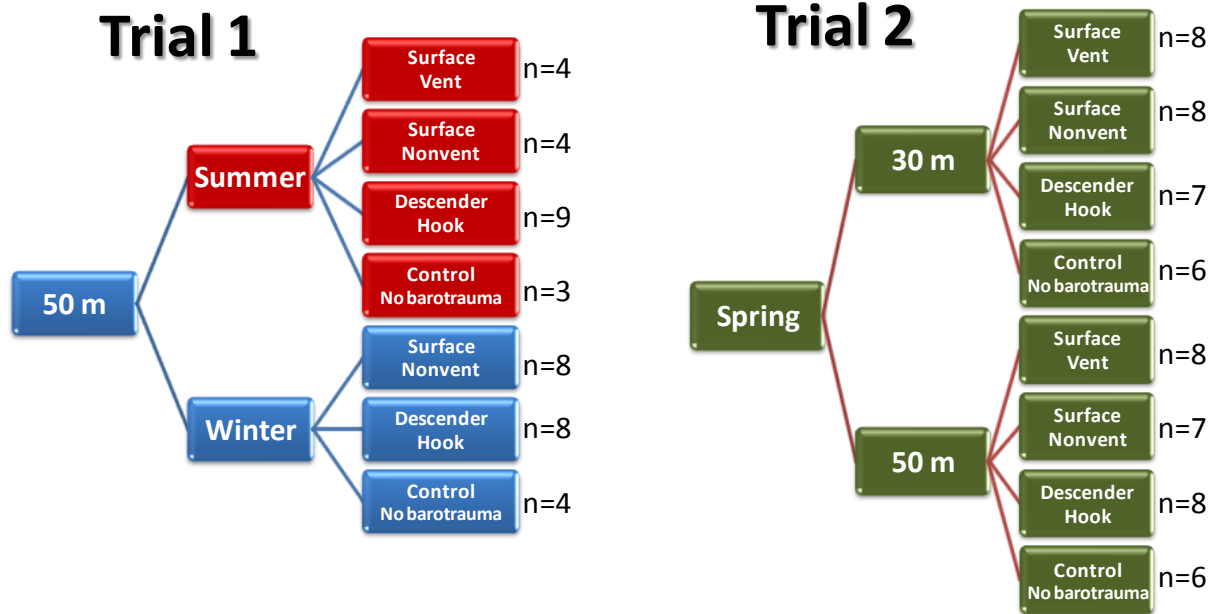
Fig 4. Experimental design for all acoustic telemetry field trials. The first trial consisted of 20 fish tagged in the Winter season with three release treatments: Surface non-vent, Bottom release using a weighted descender hook, and Control group (i.e. no barotrauma); and 20 fish tagged in the Summer season with an additional surface vented release in addition to the previous three release treatments. All trial 1 fish were caught at 50 m. The second trial performed in the Spring consisted of 29 fish caught at 50 m depth and 29 fish caught at 30 m depth. Four release treatments were performed at each of these depths: Surface non-vent, Surface vented, Bottom release using a weighted descender hook, and Control group (i.e. no barotrauma).
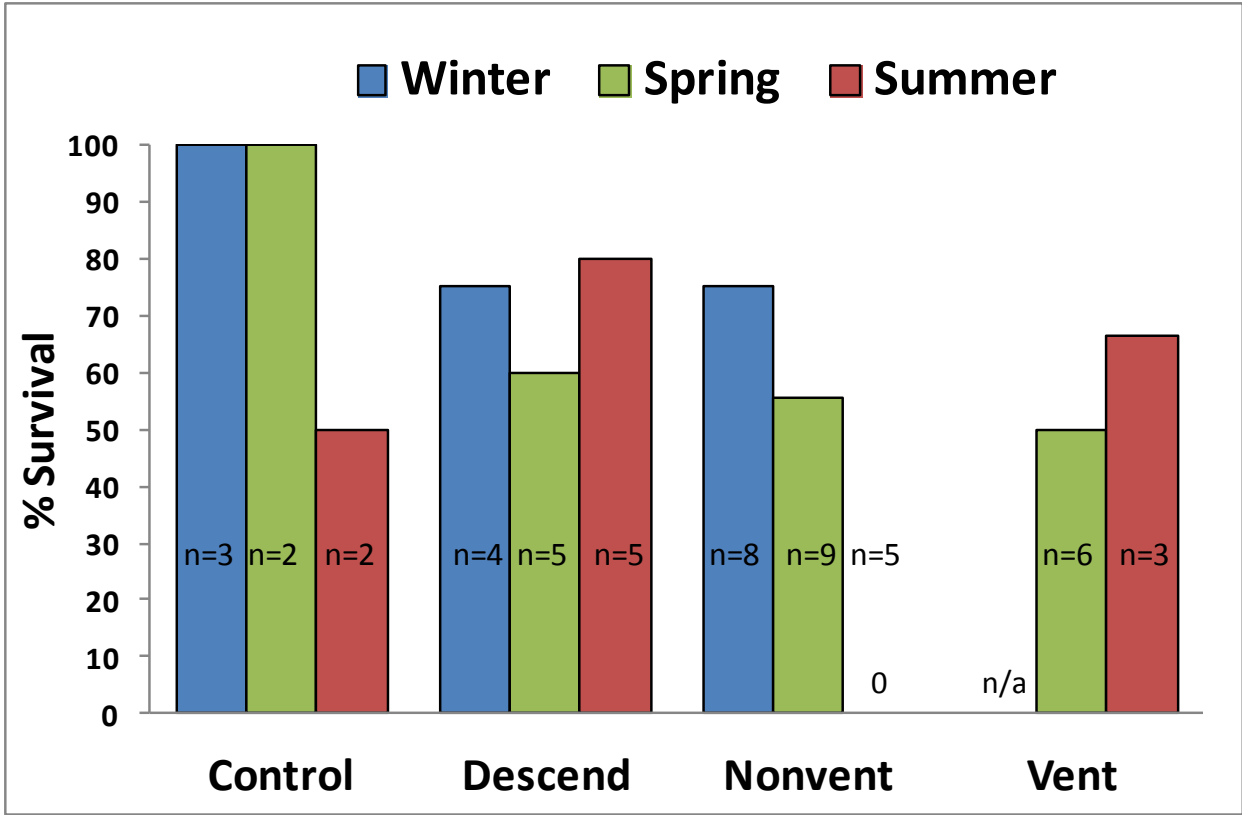
Fig 5. Percent (%) survival of red snapper during field trials for three seasons: Winter, Spring (50m depth only), and Summer. Fish classified as fate "unknown" from acceleration and depth profiles are omitted in analysis, therefore sample size for each group (n) is equal to the number of fish tagged minus the unknowns. Four release treatments: control fish (i.e. no barotrauma), descend (weighted descender hook), nonvent surface release, and vented surface release. Summer nonvented fish exhibited 0% survival. Winter vented fish show an "n/a" as this treatment group was not examined for this season only.
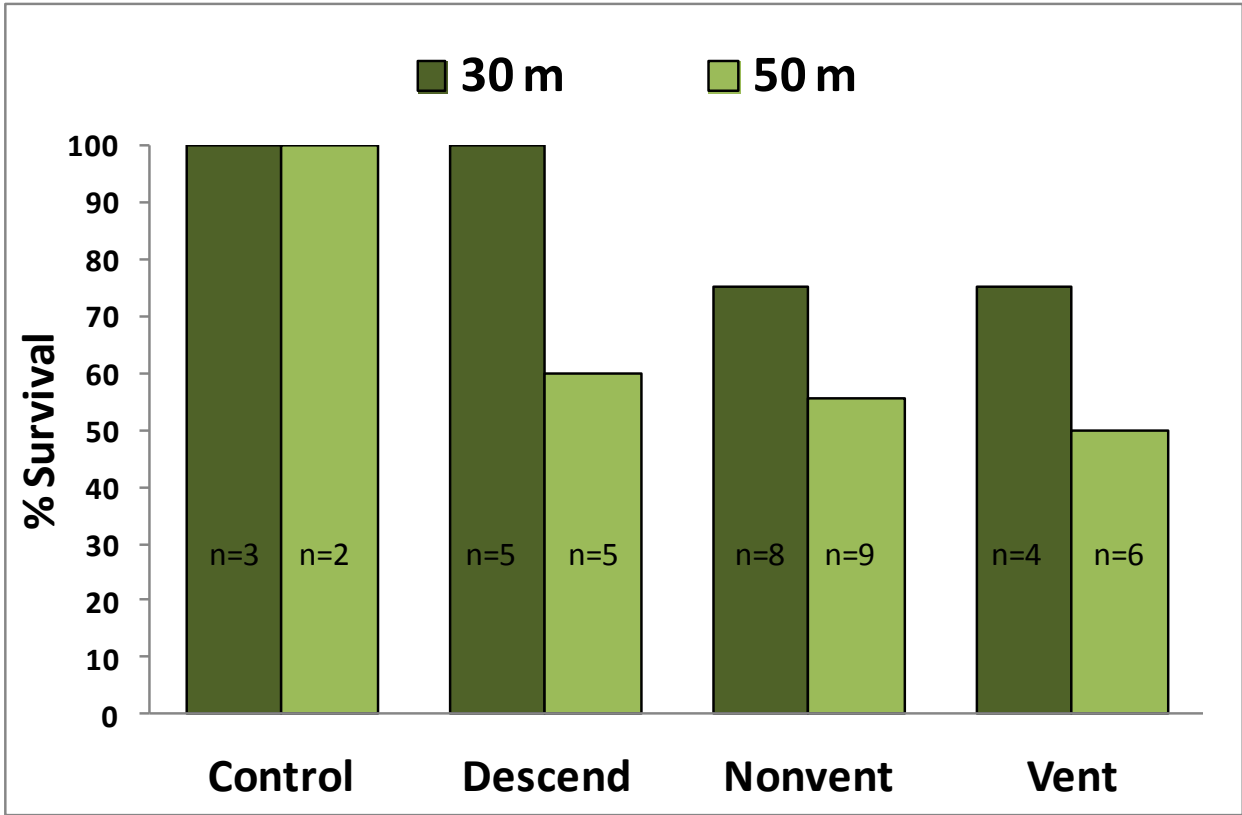
Fig 6. Percent (%) survival of red snapper during field trials for 50 m and 30 m depths during the spring season trial. Fish classified as fate "unknown" from acceleration and depth profiles are omitted in analysis, therefore sample size for each group (n) is equal to the number of fish tagged minus the unknowns. Four release treatments: control fish (i.e. no barotrauma), descend (weighted descender hook), nonvent surface release, and vented surface release. Percent survival in 30 m depth was greater than 50 m depth for each experimental group.
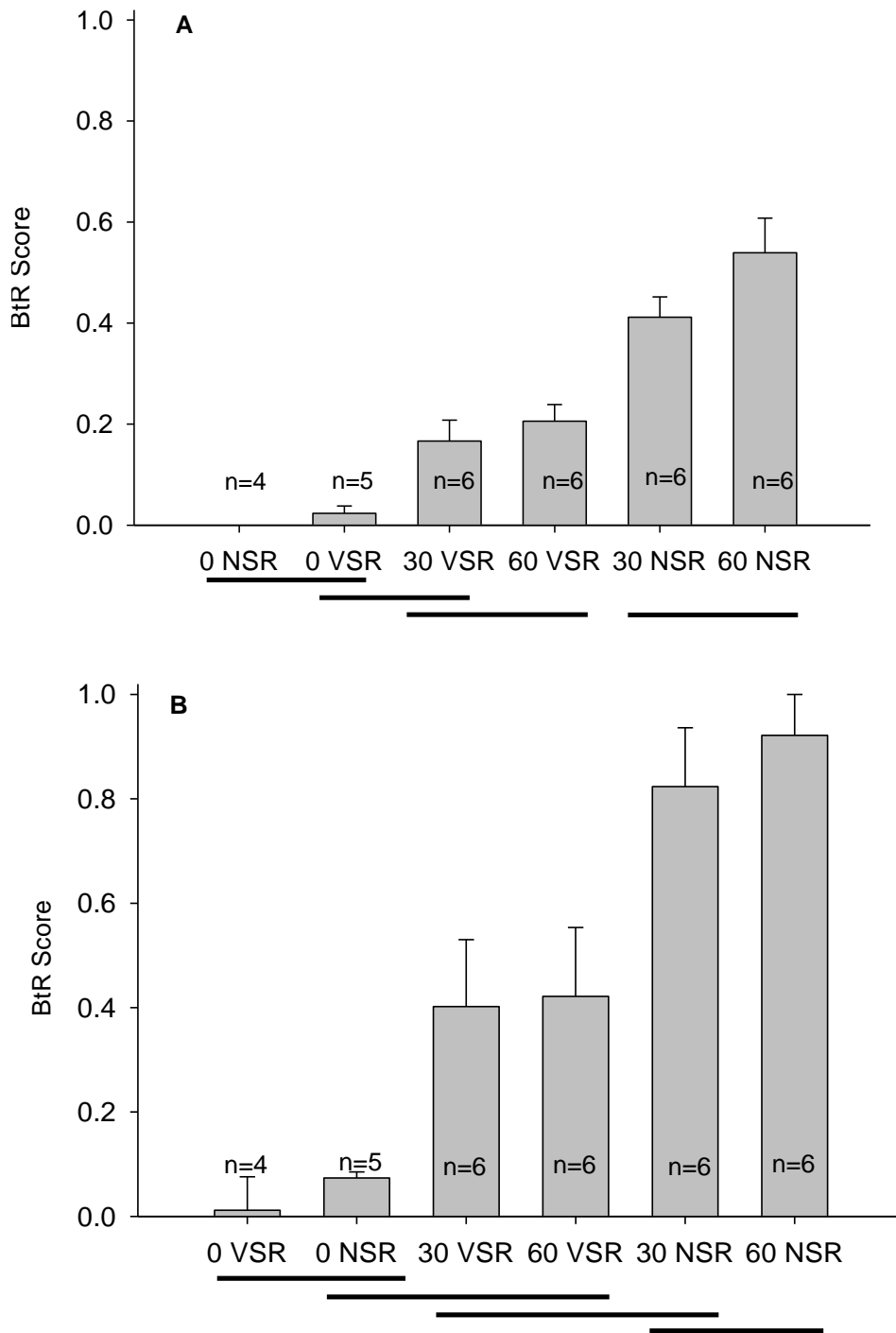
Fig 7. Relative impairment of red snapper in hyperbaric lab trials, as shown by mean barotrauma reflex (BtR) scores (± SE), among treatments of red snapper that have been decompressed from 0, 30 or 60 m depths (A) one time or (B) three times and then vented and surface released (VSR) into an open holding tank or non-vented and surface released (NSR). A higher score indicates greater impairment from barotrauma. Horizontal lines represent results from Tukey's *post-hoc* tests. Columns that do not share a horizontal line are significantly different (α = 0.05).
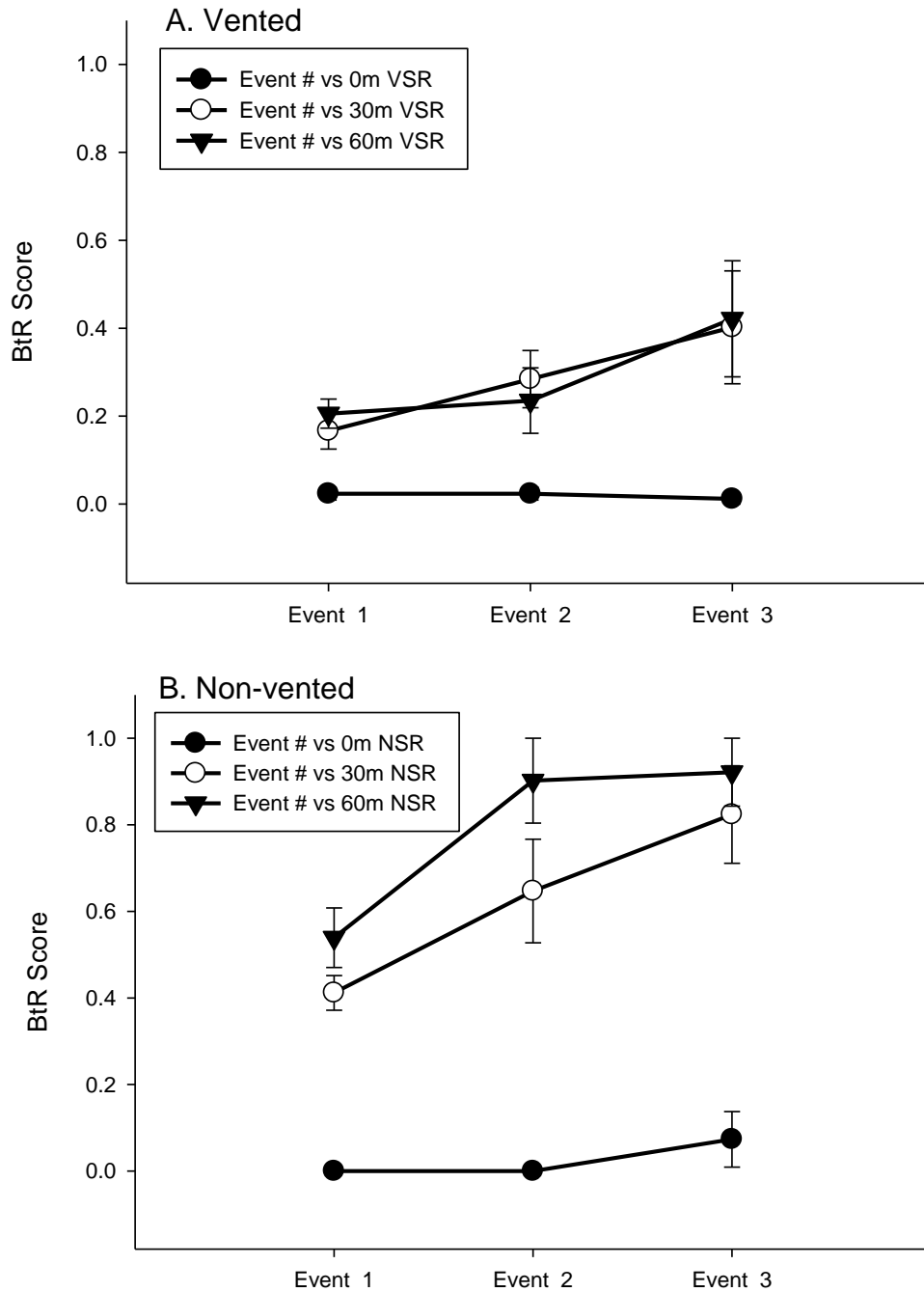
Fig 8. Relative impairment of red snapper in hyperbaric lab trials, as shown by mean barotrauma reflex (BtR) scores (± SE), of red snapper that have undergone three decompression events from 0, 30 or 60 m depths and then were (A) vented and surface released (VSR) into a holding tank or (B) non-vented and surface released (NSR). Fish was subject to the same depth and venting group for each event. A higher score indicates greater impairment from barotrauma. Tukey's *post-hoc* tests showed significant differences in non-vented and vented treatments for all decompression events, and showed that while 30 and 60 m depths were not different from each another, they were both significantly higher than controls for all events.
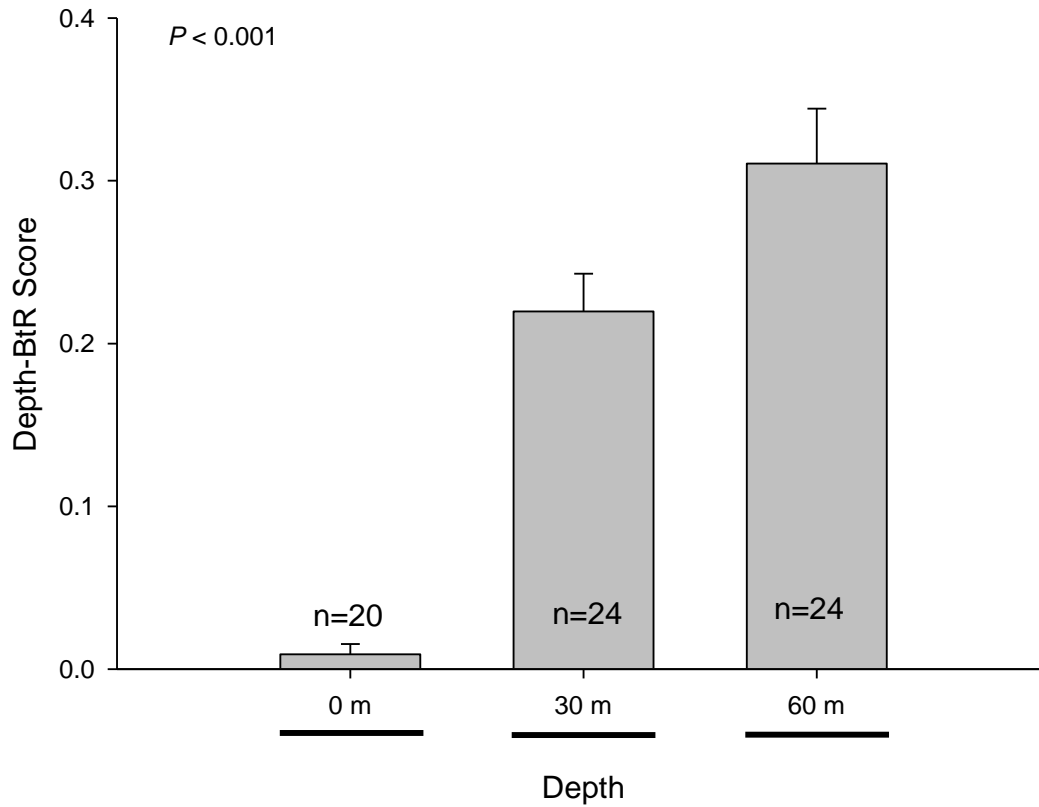
Fig 9. Relative impairment of red snapper in hyperbaric lab trials, as shown by depth-barotrauma reflex (depth-BtR) scores (± SE), of red snapper that have been decompressed from 0, 30 or 60 m depths. The depth-BtR score was calculated from 11 barotrauma symptoms and reflex tests that were recorded before the fish was vented. Horizontal lines represent results from Tukey's *post-hoc* tests. Columns that do not share a horizontal line are significantly different (α = 0.05).
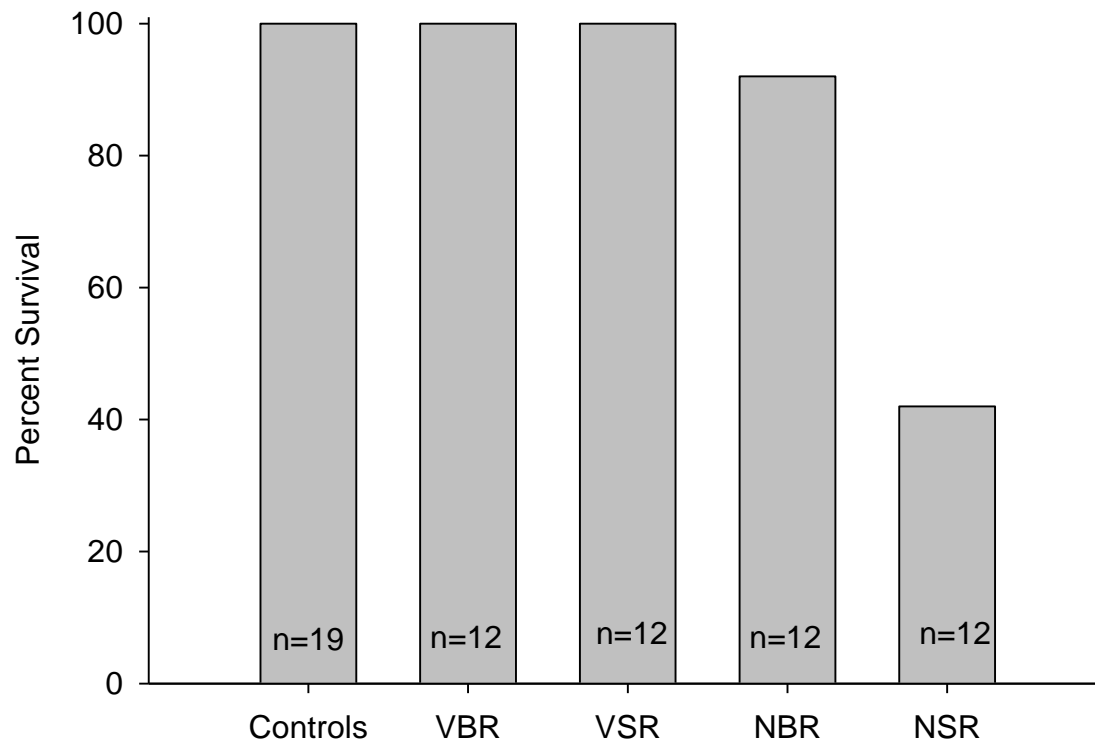
Fig 10. Percent survival of red snapper in hyperbaric lab trials decompressed from depth and then "released" by simulating vented and bottom released (VBR) by being rapidly recompressed, vented and surface released (VSR) into an open holding tank, non-vented and bottom released (NBR) or non-vented and surface released (NSR). Control fish were not subject to pressure changes but otherwise experienced identical treatment. The other four treatments shown include combined scores from 30 and 60 m depth treatments.
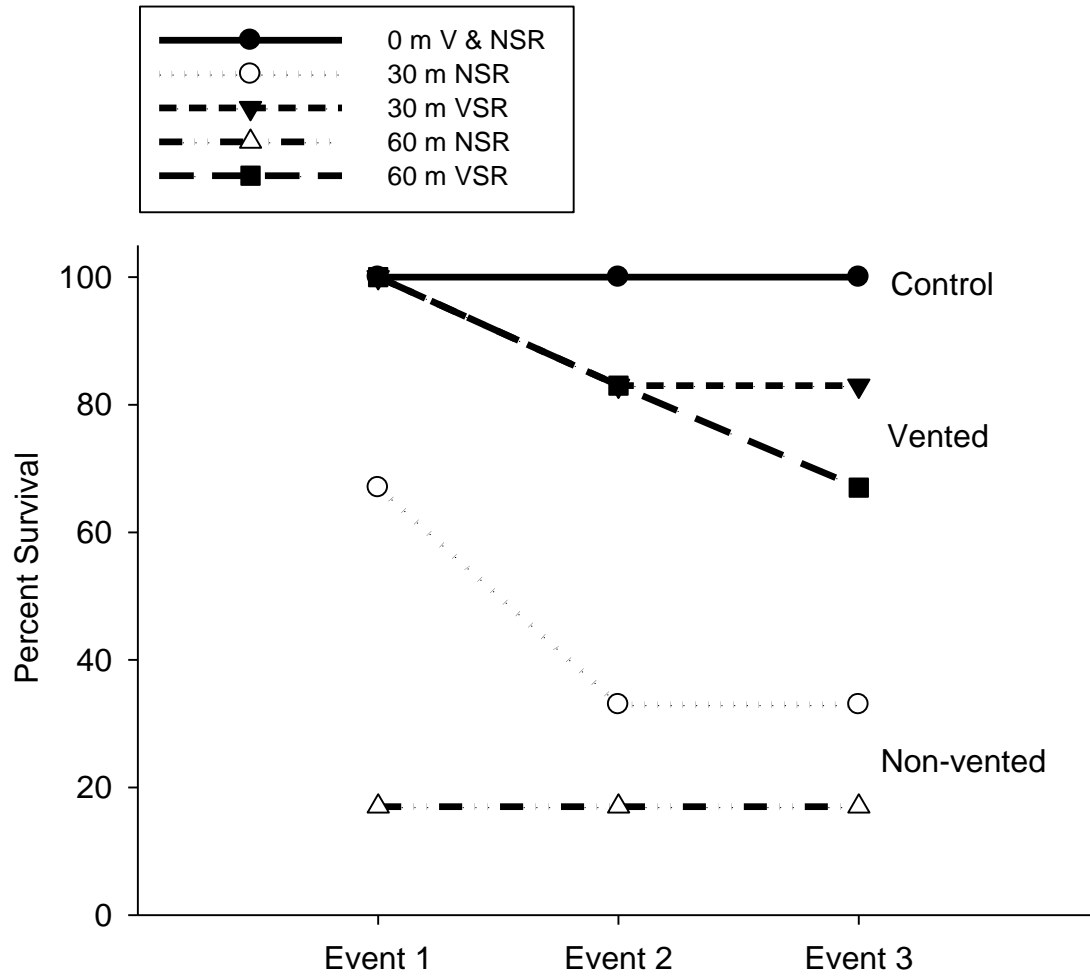
Fig 11. Percent survival of red snapper in hyperbaric lab trials by treatment group after each of three decompression events. Fish were decompressed from depths of 0, 30 or 60 m and vented and surface released (VSR) into an open holding tank or non-vented and surface released (NSR).