Bahamas Season Fishing Forecast for 2020:
GOOD FISHING ACTION THIS SEASON IN BAHAMAS

By Daniel C. Westhaver

Introduction:

Although we are all having challenges due to Coronavirus (COVID-19) and related restrictions, ROFFS™ will continue to remain open and continue to provide the same quality service and products throughout this year including our valued customer support. Remember, one of the safest places to be is offshore on the water, as the ocean remains open as well.

Since 2003, ROFFS™ has been developing objective methods for forecasting the overall fishing conditions during the spring Bahamas tournaments from April through early June. The hypothesis for forecasting the seasonal marlin fishing action stems from the location of the blue and often warmer water that occurs from the Cat Island – San Salvador Island area and south to southeast of these islands where it is presumed that the marlin concentrate before, during, and after spawning. We have been calling this water " blue marlin water" in our analyses. From satellite data, we can identify this water based on its optical signature and surface water temperature characteristics. Our working hypothesis and experience have shown that the marlin and other species are associated with this water and the more "blue marlin water" that exists in the Abaco Islands and Eleuthera Island areas in early season, the greater the relative abundance of marlin in these areas.

In recent years we have also observed an association between the "blue marlin water" and the yellowfin tuna action in the Bahamas, northward along the western side of the Gulf Stream between Jacksonville, Florida and towards Cape Hatteras, North Carolina. We do observe evidence that when more "blue marlin water" passes northwest of Abaco to the eastern side of the Gulf Stream that a certain unknown proportion of the migratory fish move to the western side of the Gulf Stream. This brings more fish to the coastal fisheries at the edges of the Gulf Stream water throughout the spring to early summer season.

Based on our observations in the Bahamas from Eleuthera to the Abacos over the last 25+ years, it appears that excellent fishing action occurs within the Bahamas areas when there is a substantial volume of the "blue marlin water" pushing over the 100-500 fathom (600-3000 feet) and shallower ledges along the eastern side of Eleuthera and the Abacos. Relatively favorable fishing seasons occur when this water only occurs over the 500-1000 fathom depths, but does not reach the 100-500 fathom or shallower depths of both areas. Mediocre years occur when there is a lack of this water over these areas. However, short pulses of this water bring fish into these areas. Unless there is a sustainable flow of the water into these regions, the catch rates remain below average to average through the season. It is also important to understand that good fishing action on a daily basis is linked to the water mass boundaries created by these currents, and where they are stable for consecutive days over good bottom structure and ledges. These features, that have remained favorable for multiple days, concentrate the baitfish and draw bigger fish into these areas.

The hypothesis is also based on our experience using the hourly satellite observations of the ocean conditions derived by ROFFS™ (www.roffs.com), catch reports provided by a variety of sources for the past 30 years, and information derived from other sources of oceanographic data. The infrared (IR) satellite data are used to observe the sea surface temperature (SST) and the ocean color data are used for indices of phytoplankton (chlorophyll), water clarity, and colorized dissolved organic material (CDOM) are received from a variety of data sources including NASA, NOAA, Suomi National Polar-orbiting Partnership (SNPP or JPSS), and the European Space Agency (ESA) satellites.

During the last few years, especially this past year, we had observed that the conditions over the Bahamas tournament areas were favorable in February and March in terms of the presence of “blue marlin water” off Abaco and Eleuthera (Figures 1 & 2). It remains to be seen, as in 2015-2016, if the “blue marlin water” will start to get pulled away late into the season (May, June, and July), causing a decline in late season action, or if the “blue marlin water” will push over the ledges during the early summer months providing a continuation of good preseason fishing action.

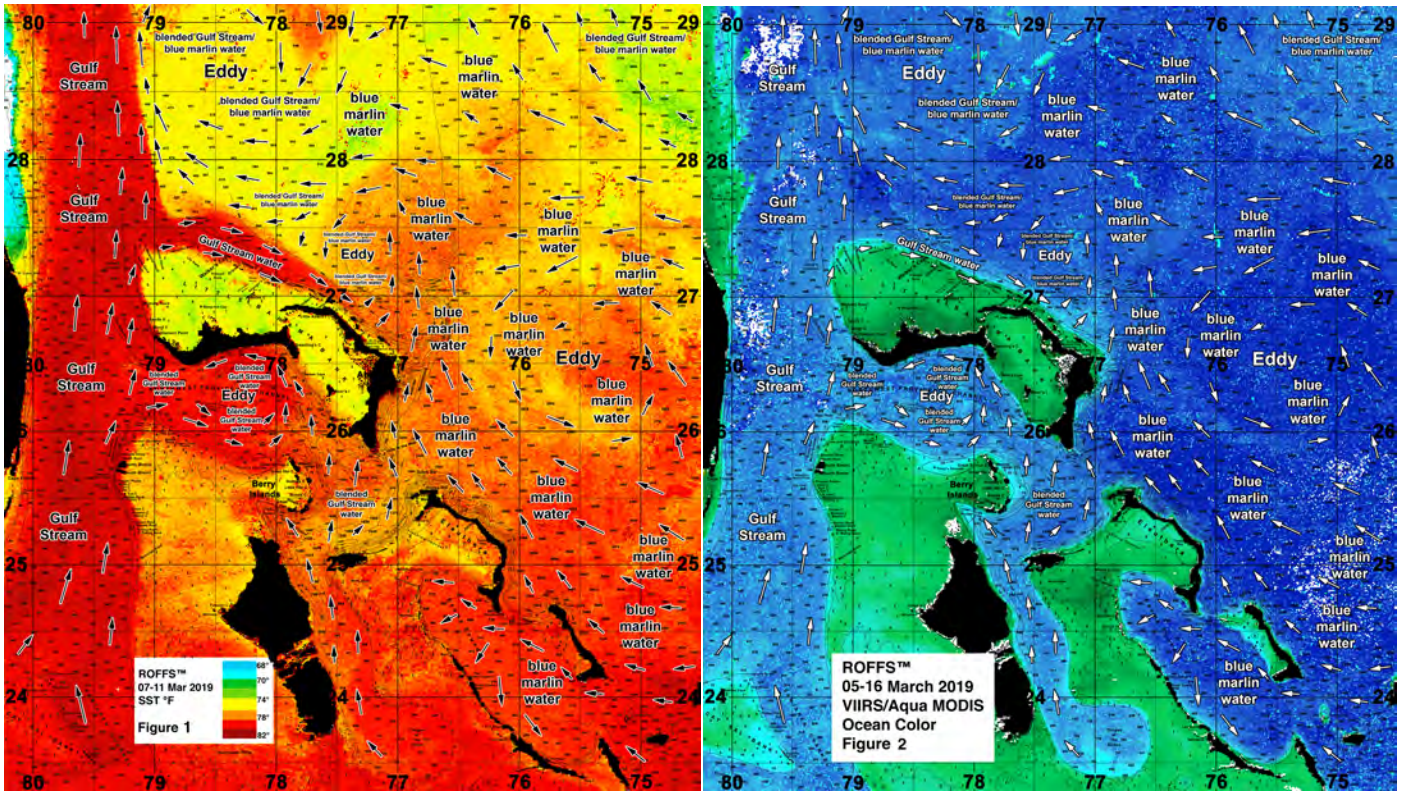

***Figure 1**: Last years conditions were derived from a variety of infrared sensors to get SST from NASA, NOAA, and ESA’s Sentinel satellites during March 07-11, 2019 and **Figure 2**: was derived from the ocean color/chlorophyll imagery during March 05-16, 2019 from the VIIRS sensors on SNPP satellite in combination with the Aqua and Terra sensor on the MODIS satellites supplied by the University of Delaware. We consider this an image pair.*

Background and Some Data for 2020

Although we have learned that the favorable oceanographic conditions develop from the presence or absence of the “blue marlin water” during the main tournament season, we continue to prepare the annual forecast from data around early-to-mid March. These allow us insight into the conditions prior

to the tournament season, and understand the ongoing fishing success starting in March through June. One challenge of producing such an early forecast is that conditions are likely to change significantly from one fishing event to the next without any proven and field-tested methods to predict the changes over the period from March through June. Despite what you may have been told through non-scientific means, there still are no reliable numerical oceanographic models that make accurate and reliable high resolution localized oceanographic forecasts for short-term or long-term fish finding applications. ROFFS™ continues to work with other oceanographers to improve, test and validate ocean and climate models, but as of now, they continue to be less accurate in daily oceanographic features than you would believe for fishing success.

For forecasting short-term oceanographic conditions related to finding fish, ROFFS™ believes that the conditions observed on any given day are the ones likely to continue into the short-term future (24 hours). While getting larger scale low-resolution interpretations of conditions using altimeter or models, we prefer to use real-time observations and have learned that evaluating the preseason conditions annually provides insight into future seasonal trends. For the spring Bahamas fishing season we derive our first indications of the ocean conditions during the first two weeks in March. We evaluate whether or not we are observing "normal" (climatologically mean conditions) or anomalies. We rely on real time satellite data but use climate models from some of the world experts in the field. One indication is sea surface temperature (SST) in the core of the Gulf Stream off Miami and the SST of the Bahamas "blue marlin water" east of Cat Island to east of Long Island. Because we started our forecasting studies during the first week or two of March in 2003 we have continued our time series using that same time period to directly compare each year.

The ROFFS™ 18 year (2003-2020) mean SST for the core of the Gulf Stream off Miami is 78.6°F during our standard early to mid-March measurement period. The SST has been as low as 74.8°F (2009) to a high of 80.5°F (2007) and we still have not observed any overall trends. This year the SST was 79.4°F in the core of the Gulf Stream off of Miami on March 10-13 (2020), which is about a degree cooler than during the same period as the previous year (2019) but similar to the same period as in 2018 and continues to remain slightly warmer than the 18-year mean. While we have not been recording the SST of the Bahamas "blue marlin" water offshore of Cat Island to Long Island as long, the 13 year mean (2008 – 2020) SST for the warmer water east of Cat Island area is 77.0°F. This year the SST of the "blue marlin water" east of Cat Island/Long Island was 77.2°F during the standard early to mid-March time period. The water both off Cat Island and within the Gulf Stream east of Miami both **decreased** over a degree from last year. Although we continue to observe this variability and no real consistent trend, the presence of the cooler "blue marlin water" off Cat Island could indicate a **later** arrival of an abundance of marlin and various tuna species into the Bahamas region and farther north compared to last year. However, overall it indicates a normal or average year in terms of SST as this water is remaining near the 13-year mean.

The global, hemispheric and especially the regional climate models provide guidance into the present and future conditions. We usually use the oceanographic models, climate data, analyses, and forecasts provided by NOAA's Climate Prediction website (http://www.cpc.ncep.noaa.gov), the National Center for Atmospheric Research (NCAR https://climatedataguide.ucar.edu/about), as well as advice from our colleagues at NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML http://www.aoml.noaa.gov/), and North Carolina State University (http://omgsrv1.meas.ncsu.edu:8080/CNAPS/atm.jsp). We also use catch data from a variety of

public and private sources. Based on the 2020 NOAA's Climate Prediction Center, the precipitation is expected to remain at the climatological mean or "neutral" conditions over the April-May-June period. The atmospheric temperature is likely to remain neutral (or consistent with the mean) or slightly above the mean from April through June and SST is also forecasted to be at the mean in the Bahamas Islands Area. This suggests that the "blue marlin water" is producing marginal blue marlin and yellowfin tuna catches over the Bahamas areas at this time, and the main population of marlin are likely to arrive later or at the average time due to the cooler water temperatures compared to the same time last year. Similarly, the arrival of the main marlin population to the northern Bahamas area will occur at slightly later or at average seasonal times when the "blue marlin water" has the time to get warmer than current conditions.

Furthermore, we continue to monitor and learn more about climate variability and ocean-wide circulation and consider other indices such as the North Atlantic Oscillation (NAO) and the Atlantic Multidecadal Oscillation (AMO). The NAO is the dominant mode of winter climate variability in the North Atlantic region ranging from central North America to Europe and much into Northern Asia. The NAO is a large-scale variation in atmospheric mass between the subtropical high and the polar low. The corresponding index varies from year to year, but also exhibits a tendency to remain in one phase for intervals lasting several years. The NAO is a climatic phenomenon in the North Atlantic Ocean defined as the difference of atmospheric pressure at sea level between the Icelandic low and the Azores high. Through east-west oscillation motions of the Icelandic low and the Azores high, it controls the strength and direction of westerly winds, currents, and storm tracks across the North Atlantic Ocean. It appears to be one of the most important manifestations of climate fluctuations in the North Atlantic and surrounding humid climates (https://www.ncdc.noaa.gov/teleconnections/nao/). This year (2020) the NAO index for January and February is higher (around 1.34) than last year and close to 2018 values and considered normal to above normal. Typically the NAO is more important for driving the west to east winds (westerly's) north of 30°N latitude (mostly 45°-65°N). Higher NAO index values means that the Icelandic low gets lower and the Azores high gets higher creating a stronger atmospheric gradient between the two which results in stronger winds from the west that essentially acts to cool the North Atlantic Ocean overall as is the case this year so far. A decrease in NAO index suggests less wind and more warming.

The Atlantic Multi-decadal Oscillation (AMO) has been identified by some as a coherent mode of natural variability occurring in the North Atlantic Ocean with an estimated period of 60-80 years. It is based upon the average anomalies of sea surface temperatures (SST) in the North Atlantic basin, typically over 0°- 80°N latitude. (https://climatedataguide.ucar.edu/climate-data/atlantic-multi-decadal-oscillation-amo). The unsmoothed AMO Index for January and February 2020 is approximately 0.35-0.91 which is higher than the last two years suggesting increased SST anomalies. We have learned that the current positive trend in these indices suggest a decrease in speeds of the North Atlantic Ocean Circulation is occurring. This includes a decrease in current speeds of the Gulf Stream system. The exact rate of decreased speeds is unknown and the impact on Gulf Stream intrusion into the Gulf of Mexico (Loop Current), as well as, the resulting meanders and eddy formation is yet to be shown, although we have already observed some changes. Also, a positive AMO is usually associated with an increase in the number of tropical storms that mature into hurricanes because the overall North Atlantic Ocean SST is higher (i.e., higher anomalies). This does not take into account the wind shear variability and other aspects of tropical storm genesis. For easy to understand

answers to frequently asked questions about the AMO see http://www.aoml.noaa.gov/phod/amo_faq.php#faq_2.

Regarding El Niño we have yet to see or read about any direct relationship between El Niño – La Niña and the Southern Oscillation (ENSO) and the oceanographic conditions in the Bahamas area. Currently we are in an ENSO-neutral phase that will likely continue through summer of 2020 (https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf). We will continue to investigate the relationship between the North Atlantic Ocean climate and the oceanographic conditions in the Bahamas in the future.

Nowcast Analysis

In this section we want to discuss and show you the current oceanographic conditions (Figure 3 and Figure 4) and compare it briefly to last years conditions (Figure 1 and 2). For clarification purposes Figures 1 and 3 were derived from a variety of U.S. (NASA, NOAA, Sentinel, JPSS) satellites during the early to mid-March (March 10-13) period and Figures 2 and 4 were derived from the U.S. SNPP VIIRS and NASA MODIS Aqua and Terra ocean color/chlorophyll imagery during relatively same early to mid-March time period (March 09-13). The exact values of the original data from different satellite sensors are not the same but we cross-calibrated the imagery so that the signature and values of the "blue marlin water" is consistent over the histories of the satellites.

In both instances, we could not use single and same day imagery for the SST and ocean color data due to cloud cover interference, so we used a combination of imagery and the ROFFS™ cloud reduction techniques to produce these relatively cloud-free images. However, for comparison purposes we consider these images as an equal image pair for the purposes of this discussion. While these provide a visualization of the pre-season March conditions, they also provide examples of how the eddy features, or lack of eddy features, and the water circulation are pulling the "blue marlin water" through the Bahamas. This is important for understanding the dynamics of the region. Both images for each year have the same arrows, eddy and "blue marlin water" labeling. The flow of the water was derived from our ROFFS™ sequential image analysis of Lagrangian coherent features where we study several days of satellite imagery to follow the signature water masses and their motion. An example of this years SST satellite infrared imagery can be found on the ROFFS™ website at (https://www.youtube.com/watch?v=Eb4ec0Kv9Vo) showing the flow of the water around the Bahamas region during the last two months, where the darker grey water represents the warmer water.

This year's indicator conditions are shown in Figure 3 and 4. Currently, there is only one counter clockwise eddy feature, centered east of Eleuthera Island in 3000-3500 fathoms, that is keeping the warmer "blue marlin water" offshore of the Bahamas Island chain. Although the warmer, and likely more favorable, "blue marlin water" remains offshore of the islands early this season, we do observe considerable amounts of "blue marlin water" (Figure 4) pushing inshore over the 100-1000 fathom ledges of Eleuthera and lower Abaco Island. While the "blue marlin water" is cooler than the past two years, suggesting slower early season action than in 2018-2019, there has been reports of early season yellowfin tuna, sailfish and blue marlin action associated with this water.

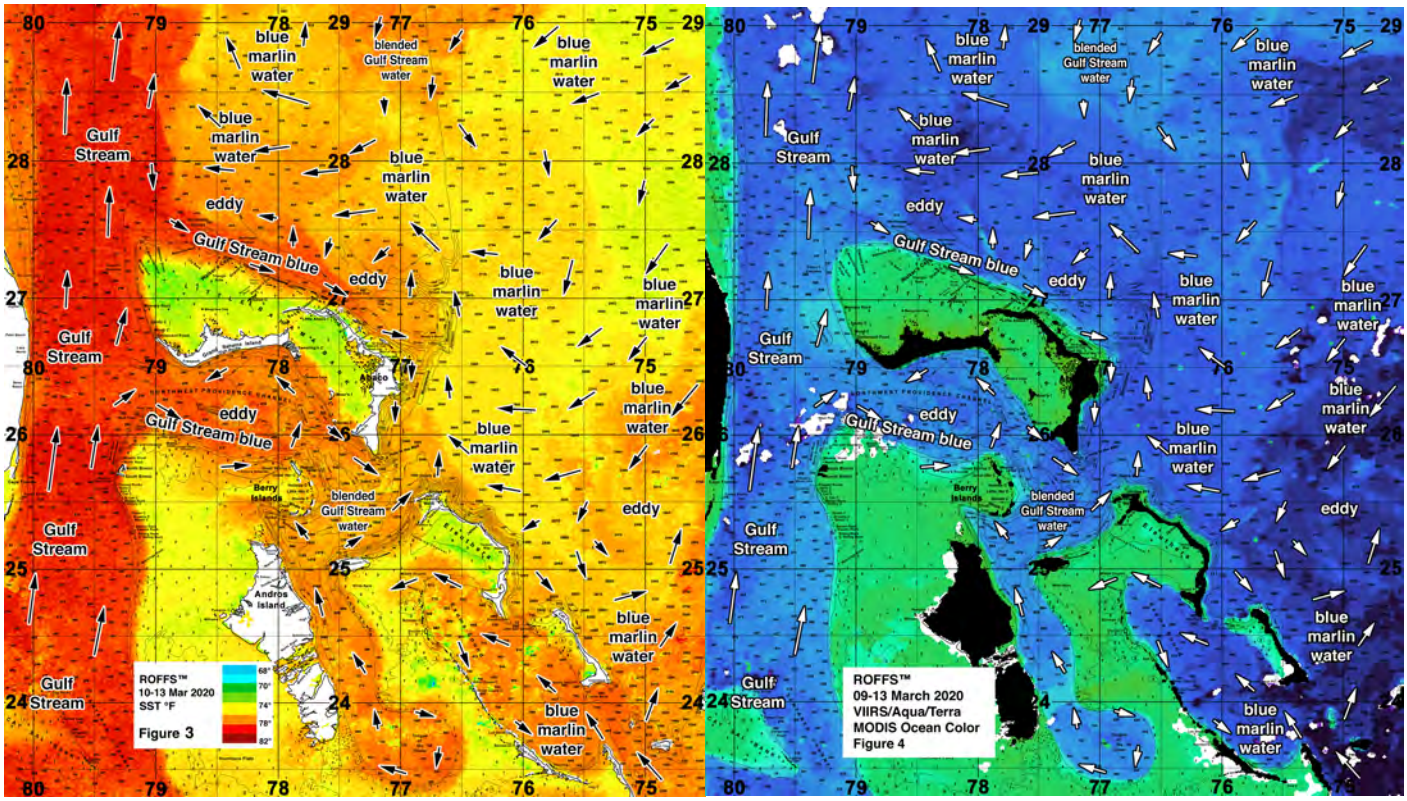

***Figure 3**: This years conditions were derived from a variety of infrared sensors to get SST from NASA, NOAA, and ESA's Sentinel satellites during March 10-13, 2020 and **Figure 4**: Derived from the ocean color/chlorophyll imagery during March 09-13, 2020 from the VIIRS sensors on SNPP satellite in combination with the Aqua and Terra sensor on the MODIS satellites provided by the University of Delaware. We consider this an image pair.*

Furthermore, two smaller counter clockwise rotating eddy features along the 500 fathoms ledge north of Walker's Cay are pulling the cooler "blue marlin water" northwest of Abaco Island and Walker's Cay towards the eastern side of the Gulf Stream, and inshore towards Walker's Cay. Although this water is cooler than the previous two years, catches of blue marlin and yellowfin tuna have been reported over the past few weeks and some good blue marlin action northeast of Matanilla Shoals recently. However, we believe the arrival of the main population of blue marlin is likely to occur when the "blue marlin water" warms up later in the season, or if there is a pulse of the warmer blue water pulled off the eddy east of Eleuthera and is carried northwest towards Abaco and north of Walker's Cay. This also means later arrivals of yellowfin tuna and blue marlin action within the Gulf Stream and along the coast from Cape Canaveral to off Cape Hatteras compared to last year.

The main eddy feature we need to continue to monitor occurs east of Eleuthera Island centered near 75°00'W & 25°30'N. Currently, the eddy is pulling the warmer "blue marlin water" off southern Cat Island and San Salvador northward, where it remains east of 75°30'W, except for a finger of warmer "blue marlin water" being pulled counter clockwise around the eddy and back towards Eleuthera Island. This eddy feature will determine how the majority of the warmer "blue marlin water" will feed northward into the Bahamas and over the ledges of Eleuthera Island and Abaco Island over the next month. If the eddy continues to pull the warmer "blue marlin water" westward towards southern Abaco Island and northward, there may be an influx of blue marlin in early April and into May providing good chances for action during these months. Looking at the imagery in late March, it does appear this is

happening, and the warmer water is starting to push in over the Wonderland region suggesting improving action in a few weeks. Unfortunately, the later arrival of this warmer “blue marlin water” suggest good fishing action in northern Bahamas may be delayed until mid-to-late April, and up the coast towards Cape Hatteras may be slightly later than normal.

The ocean color image shows darker blue water compared with the Gulf Stream water. The darkest blue water in Figure 4, east of Eleuthera, shows the water that likely has the greater abundance of the marlin and is a darker blue than the Gulf Stream water along the Florida east coast and water south of Grand Bahama Island. The “blue marlin water” is cooler overall than last year, but there has been mahi, yellowfin tuna, sailfish and blue marlin caught in northern Eleuthera, off Abaco, the Berry Islands, south off Chub Cay, and some good action happening off Walker’s Cay and north and northeast of Matanilla Shoals.

As the water warms in the coming weeks and the eddy east of Eleuthera Island hopefully directs the warmer “blue marlin water” towards the islands, we anticipate that a substantial amount of marlin, tuna and other species will continue to be moved closer to the Bahamas. These present conditions are considered moderate to good pre-season conditions, which is promising. Our hope for the Bahamas marlin fishing action is that the temperatures increase, are near or warmer than the mean, and that these fish and the conditions will improve quickly by mid-to-late April. However, there is also a possibility that due to the cooler water, by late May and June, the majority of these fish will be migrating farther northward if their habitat remains unfavorably cooler around the Bahamas region or the “blue marlin water” from the eddy remains further offshore of the ledges. ROFFS™ will be monitoring these and other conditions that develop over the next several weeks and months as we do in other areas.

Seasonal Concluding Thoughts…

Based on what we have been observing in March, the present ocean conditions for marlin, yellowfin and blackfin tuna, wahoo and dolphin action in the Bahamas region, particularly in the eastern and northern Bahamas, looks good to average. Compared to last year, the conditions this March appear slightly less favorable for early fishing action, but have the potential to be better for mid-spring to late spring fishing action. The current ocean conditions in the Bahamas suggest that the larger influx of blue marlin, yellowfin tuna and other pelagics may be later this year compared to last year. Due to the late introduction of warmer “blue marlin water” into the region, the fishing action this year has the potential to be better than last year during the months of May, June, and continue with good fishing conditions into early July. Although the recent health pandemic has prevented many from venturing offshore and getting into Bahamas ports, we have received a few positive reports of marlin, tuna, and mahi being caught in the Bahamas and off southeast Florida, and favorable wahoo and sailfish action as far north as Georgetown, SC. This suggests the cooler “blue marlin water” has reached the Gulf Stream and is holding fish. We will continue monitoring these developments as the season progresses and please contact ROFFS™ for more details.

In conclusion, it is very important to note that good fishing action on a daily basis is strongly linked to local, short-term (24-48 hours) current conditions that concentrate the fish once the preferred habitat of the fish are in a particular region. When the water mass boundaries of these currents are geographically stable and favorable, i.e., continuously pushing over good bottom topography such as

the Northeast Humps, Pocket, Hole in the Wall, or Little Abaco Canyon, then they concentrate the baitfish and larger fish can be found foraging. This means that the fishing action on any given day is controlled by hourly to daily and relatively small-scale (1-10 mile) movements of the currents and their water mass boundaries. Our experience indicates that to reliably forecast specific concentrations of fish on a daily basis, one must evaluate the ocean conditions on these scales. Relatively small subtle changes in the currents and their boundaries often have dramatic effects on the distribution and concentration of fish. Contact ROFFS™ for these daily detailed fishing forecasting analyses and get the inside track to where the better conditions are tomorrow. If you are able, prepare now for the spring Bahamas fishing season and other fun fishing action as the good fishing conditions in the Bahamas region may have already started. We hope that by May that the COVID-19 cases stabilize and start declining, and restrictions on travel and marinas into the Bahamas will lift. However, we also understand that the safety and health of the Bahamas visitors and citizens come first.

Stay safe and tuned in to ROFFS™ (www.roffs.com) for the next few weeks for additional discussion related to marlin, yellowfin tuna, mahi, wahoo, sailfish and bigeye tuna and oceanographic conditions and seasonal fishing forecasting off the United States east coast and in the Gulf of Mexico area.

Safe and Successful Fishing from ROFFS™