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EVALUATION OF THE
MIGRATORY BIRD HABITAT INITIATIVE
REPORT OF FINDINGS



Forest and Wildlife Research Center
Mississippi State University
Research Bulletin

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FOREST AND WILDLIFE RESEARCH CENTER

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Oil slick from Deepwater Horizon in the Gulf of Mexico on May 24, 2010 (photo by NASA/GSFC, MODIS Rapid Response).

INTRODUCTION

In the wake of the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) swiftly established and funded the Migratory Bird Habitat Initiative (MBHI). Under Farm Bill conservation program authority, MBHI provided \$40 million in cost-share assistance to private landowners in eight states to manage habitats through 1- to 3-year contracts (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Missouri, and Texas). Over 470,000 acres were enrolled through MBHI within a few short months following the oil spill to provide habitats for wetland-dependent migratory and resident birds inland of and away from oil-spill impacted areas along the Gulf Coast.


Through a Cooperative Ecosystem Studies Unit agreement, NRCS commissioned Mississippi State University (MSU) to lead a 3-year evaluation (2010-2013) of waterbird use and food abundance in MBHI-enrolled rice fields, idled catfish production ponds in Mississippi, and natural wetlands. MSU also engaged and subcontracted with researchers at Arkansas Tech University and the University of Missouri to lead the MBHI evaluation in Arkansas and Missouri. The evaluation focused on the regions where most MBHI enrollments occurred—the Mississippi Alluvial Valley (MAV) and the Gulf Coastal Plain of Louisiana and Texas. While aspects of the evaluation and analyses continue, results from the 3-year assessment indicated MBHI has provided significant habitat benefits to waterbirds in these regions. This report summarizes selected findings from the assessment.



Over 470,000 acres were enrolled through the Migratory Bird Habitat Initiative following the oil spill to provide habitats for wetland-dependent migratory and resident birds.

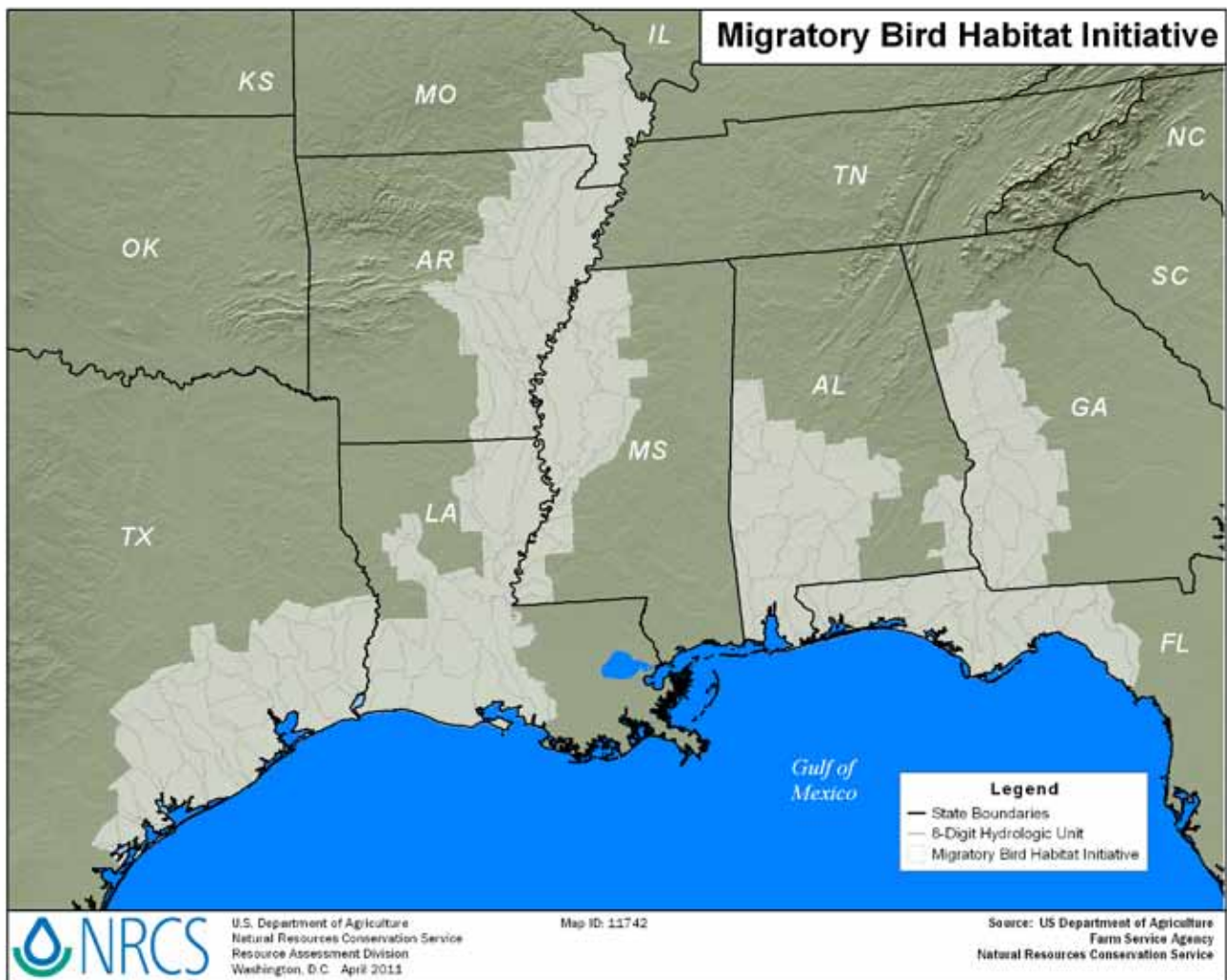
ACTIVE MANAGEMENT

MBHI evaluation results were consistent with earlier NRCS-supported studies in the MAV and elsewhere that actively managed Wetlands Reserve Program (WRP) sites generally received greater seasonal use by waterbirds than passively or non-managed WRP easements (Kaminski et al. 2006, Fleming 2010, Tapp 2013, Weegman 2013). Management of MBHI wetlands include approved NRCS practices such as mowing or disking natural vegetation, herbicide treatment of noxious vegetation, and artificial or natural flooding (Nelms 2007, Hagy and Kaminski 2012, Schummer et al. 2012). The MBHI wetland habitats were especially important soon after the oil spill during summer-autumn 2010, when widespread drought occurred across the MAV and Louisiana-Texas coastal prairies. In the MAV of Louisiana and Mississippi during winters 2011-2012, nearly three times more dabbling ducks and all species of ducks combined were observed on MBHI sites compared to non-managed wetlands (Weegman 2013). Waterbirds other than waterfowl also were nearly twice as abundant on MBHI than non-managed wetlands (Weegman 2013). Similarly in Arkansas and Missouri during the same time period, MBHI wetlands attracted over two times more dabbling ducks than non-managed private wetlands (Tapp 2013).



Mississippi and Louisiana: Three times more dabbling ducks on MBHI sites than non-managed wetlands.

Arkansas and Missouri: Two times more dabbling ducks in MBHI wetlands compared to non-managed private wetlands.



The NRCS Migratory Bird Habitat Initiative included portions of eight states (image produced by Natural Resources Conservation Service).

ACTIVE MANAGEMENT



(photo by Joe Marty)

Flooded rice lands supported 15 birds per acre versus 2 birds per acre in non-flooded rice fields.

Waterbirds in Flooded Rice Fields—

MBHI technical and financial assistance provided to rice producers in Louisiana and Texas enabled them to flood fields after harvest of grain crops. Flooded rice lands supported high densities of migrating and wintering waterbirds during fall 2010–spring 2011, averaging 15 birds/acre versus 2 birds/acre on non-flooded rice fields (Marty 2013). Additionally, different bird communities existed in rice production and idled rice fields. To conserve soil nutrients and moisture, producers in Louisiana and Texas do not plant rice in all fields annually, unlike in the MAV where rice and soybean crops generally are rotated among years. When production and idled fields both were flooded, ducks and geese dominated use of rice fields, while idled fields were used by a diversity of waterfowl, shorebirds, waders, and other waterbirds amid colonized natural vegetation. Thus, landscape complexes of aquatic working lands, such as flooded rice and idled rice fields, interspersed with natural wetlands, can help support diverse communities of wetland-dependent birds (e.g., Huner et al. 2002, Pearse et al. 2012).

MBHI and Mallard Winter Survival—

The MBHI assessment team documented winter use by radio-marked female mallards of Farm Bill conservation lands in the Mississippi MAV (Lancaster 2013). This research continues through 2015, but preliminary data from winters 2010-2012 revealed that female mallards exhibited greatest survival rates when their home ranges included habitat complexes of forested and scrub-shrub wetlands (54%), moist-soil wetlands (32%), flooded rice and other croplands (12%), and permanent water bodies (2%). The Mississippi MAV landscape is dominated by agricultural land, but these results imply the importance of conserving natural wetlands on working agricultural landscapes to provide suitable habitat complexes that promote survival of mallards and perhaps other waterfowl. Other data from the mallard study indicated that 13% of 110 radio-marked females spent 76 days on MBHI-enrolled private lands during winters 2010-2012. Seventy-eight (71%) females spent 851 (18%) days on MBHI and Wetland Reserve Program (WRP) sites during these winters. Daily survival of female mallards was 98-100% on MBHI and WRP sites during winters 2010-2012.



Joe Lancaster, MSU Ph.D. student

Daily survival of
female mallards was
98-100% on MBHI and
WRP sites.



ACTIVE MANAGEMENT



Justyn Foth, MSU Ph.D. student

Over seven times more shorebirds observed on shallowly flooded MBHI wetlands.

Shallow Water and Shorebirds—An important aspect of MBHI was to provide late summer and fall wetland habitat for migrating North American shorebirds. Surveys indicated that over seven times more shorebirds were observed on shallowly flooded MBHI wetlands (i.e., mudflat to 12 inches depth) created in idled catfish ponds in Mississippi from August through September than on production catfish ponds, state and federal conservation areas, and coastal wetlands. Additionally, during peak migration in fall 2013, MBHI sites also had over seven times more birds per acre than state or federal managed or conserved coastal wetlands in Alabama, Louisiana, and Mississippi combined. Thus, MBHI-managed former catfish production ponds provided important habitat for migrating shorebirds and other waterbirds during summer through fall, especially in drought years when other wetlands may have been limited. Finally, blood and other tissue samples have been collected from shorebirds captured along the Gulf Coast to determine if the birds contain any petroleum compounds. Results from this segment of the study will be available in 2015.

Active and Idled Catfish Ponds—

Autumn migrating and wintering waterfowl and other waterbirds (generally exclusive of shorebirds which are absent in mid-late fall-winter) occurred in densities on production aquaculture impoundments (~54 birds/acre) similar to idled aquaculture impoundments (~49 birds/acre), suggesting both provided important migration and overwintering habitat for waterbirds (Feaga 2014). However, different bird communities existed in production versus idled catfish ponds enrolled in MBHI. Diving and dabbling ducks and American coots were primary users of production aquaculture impoundments (Dubovsky and Kaminski 1987, 1992; Feaga 2014), whereas MBHI-enrolled idled impoundments were used by over 40 species of ducks, shorebirds, waders, and other waterbirds due to presence of mudflats and shallowly flooded (≤ 1 ft) areas and diverse vegetative structure (Feaga 2014).



Jim Feaga, MSU M.S. student

**MBHI-enrolled
idled catfish ponds
supported 40 species
of ducks, shorebirds,
waders, and other
waterbirds.**



WATERBIRD FOOD



Matt Weegman, MSU M.S. student

Invertebrate production at mowed wetlands was 4 times greater to non-mowed wetlands.

MBHI Increased Waterbird Foods— Wetlands enrolled in MBHI in Louisiana and Mississippi contained 1.3-1.5 times more biomass (dry weight) of seeds known to be consumed by waterfowl than non-managed wetlands (Weegman 2013). Additionally, in Arkansas and Missouri, natural seed abundance during winter was 21% greater on MBHI wetlands than non-managed wetlands (Tapp 2013). Although invertebrate biomass production did not differ between WRP and MBHI wetlands, secondary macroinvertebrate production during autumn was 200% greater on MBHI enrollments compared to WRP easements. During winter, invertebrate production was 40% greater on MBHI and WRP easements compared to public wetlands in Arkansas and Missouri (Tapp 2013). Additionally, invertebrate production at wetlands that had been mowed was approximately 4 times greater compared to wetlands that were not mowed. Mowing vegetation can increase amounts of submersed detritus in seasonal wetlands and may promote production and abundance of plant and animal foods for waterbirds (Kaminski and Prince 1981, Tapp 2013). Collectively, these results imply that management increased the potential

foraging carrying capacity of MBHI and WRP sites for migrating, wintering, and resident waterbirds.

Average biomass of seeds and tubers from managed WRP-managed wetlands and MBHI-managed catfish ponds in Mississippi was 234 lb/acre (Weegman 2013, Feaga 2014). In the Mississippi MAV, 28,046 acres were enrolled in MBHI. Estimated seed and tuber biomass in these wetlands potentially generated 20,286,559 duck-energy days (DEDs), calculated using the Lower Mississippi Valley Joint Venture's (LMVJV) North American Waterfowl Management Plan procedure for calculating DEDs. The 20+ million DEDs was about 28% of the LMVJV's objective for DEDs for the Mississippi MAV, despite the fact that MBHI-managed wetlands comprised less than 1% of the 4,942,890 acres of LMVJV area in Mississippi (Anne Mini, LMVJV Science Coordinator, personal communication). Moreover, the LMVJV estimated that 8,518,498 DEDs are generated annually on private wetlands within LMVJV programs in the Mississippi MAV. Thus, MBHI-managed private wetlands potentially contributed more than twice the LMVJV-estimated DEDs from within program private wetlands.

Catfish aquaculture is an important agribusiness in Mississippi. However, competition from foreign markets, increased production costs, and other factors have forced many producers in Mississippi to reduce acreage of catfish production ponds. In the Mississippi MAV, MBHI provided funding to catfish producers to flood and manage ponds not in production. A total of 4,903 acres of Mississippi catfish ponds were managed (e.g., flooding, disking, mowing vegetation) through MBHI to provide mudflats and shallow water for migrating shorebirds and other waterbirds. Elliott and McKnight (2000) reported for the U.S. Shorebird Conservation Plan that the current estimated fall population of 504,000 shorebirds migrating through the MAV and Western Gulf Coastal Plain would

**MBHI wetlands
provided 28% of
wintering duck energy
needs in the
Mississippi MAV.**



WATERBIRD FOOD



(photo by U.S. Fish and Wildlife Service)

MBHI-enrolled catfish ponds met nearly all the established shorebird migration habitat goal for the MAV.

require nearly 4,982 acres of wetland habitat. Thus, nearly all the estimated needed habitat for the shorebird population goal may have been provided by the 4,903 acres of MBHI-managed catfish ponds in Mississippi.

Soil cores were collected from the catfish ponds to estimate biomass of aquatic invertebrates as potential prey for shorebirds and other waterbirds. While analyses of core samples are underway, preliminary data from July-September 2011 indicated mean biomass of invertebrates from MBHI-managed catfish ponds was 0.263 lbs/acre. Estimates of true metabolizable energy (TME) derived by shorebirds from ingesting aquatic invertebrates have not been established. However, we do have TME data for seeds eaten by ducks and geese (Kaminski et al. 2003). We also acquired TME data from the literature on aquatic invertebrates ingested by dabbling ducks which imply mean TME of approximately 0.952 kcal/g of invertebrate biomass (H. Hagy, Illinois Natural History Survey, personal communication). If we assume shorebirds and ducks have similar physiological ability to metabolize and derive energy from soft-bodied invertebrates, we can use the above

mean TME value to calculate potential available energy from invertebrates in MBHI-managed catfish ponds in 2011. We estimated approximately 557,187 kcal from invertebrates may have been available for shorebirds and other waterbirds on the 4,902 acres of MBHI-managed catfish ponds (114 kcal/acre). However, we are not aware of daily existence energy values for shorebirds; therefore, we cannot estimate shorebird energy days (i.e., carrying capacity) potentially provided by MBHI habitats at this time. Future research should seek appropriate data to generate preliminary estimates of shorebird carrying capacity and compare estimates among sampled MBHI-managed catfish ponds, national wildlife refuges, and Gulf Coast wetlands.



Jessi Tapp, University of Missouri M.S. student

Estimated 557,187
kcal from invertebrates
on 4,902 acres of
MBHI-managed catfish
ponds.



WATERBIRD FOOD



Dowitchers and Wilson's phalaropes on Cameron Parish MBHI (photo by John Pitre, NRCS).

MBHI-managed ratoon rice fields in Louisiana contained the greatest density of waste rice for waterfowl.

Rice and Waterbird Foods—Rice lands in the MAV and Gulf Coast prairies provide important winter habitats for waterfowl (Stafford et al. 2006, Marty 2013). The MBHI-managed ratoon rice fields (i.e., fields producing two rice crops/year from single planting) in Louisiana contained the greatest density of waste rice (i.e., grain missed by combines) as potential foods for wintering waterfowl. Specifically, amount of waste rice in harvested ratoon rice fields in Louisiana was ~3 times greater than the amount of waste grain estimated available in MAV rice fields (Stafford et al. 2006). This finding underscores the importance of rice lands in the Gulf Coast Prairies for resident and migratory and wintering waterfowl and other waterbirds, assuming rice fields are flooded through MBHI or other management efforts to make these habitats accessible to waterbirds (Marty 2013). Greater abundance of rice in Louisiana and Texas rice fields is attributed to production of ratoon crops, which is less possible in the MAV due to its shorter growing season compared to Louisiana and Texas.

Rice production fields and fields taken out of production temporarily (i.e., idled

rice lands) contained abundant natural seed banks, which increase foraging carrying capacity and food diversity in these habitats for waterbirds (Marty 2013). Core samples and data from 2010 and 2011 have been analyzed. Moist-soil plant seed abundance in Gulf Coast idled rice fields increased during fall from 188 lb/acre in August to 506 lb/acre in October, but then declined to 251 lb/acre in November, likely due to decomposition, disking which may have displaced seeds beyond depth of core sampling, and seed consumption by birds and mammals (Stafford et al. 2006, Hagy and Kaminski 2012, Marty 2013). The autumn average of moist soil plant seeds (315 lb/acre) in production and idled Gulf Coast rice fields combined was 63% of the average seed mass found in actively managed moist-soil wetlands on public lands in the MAV (Kross et al. 2008). Although natural seed abundance was less in these rice fields, perhaps because natural seed recruitment into soils was reduced due to use of glyphosate-resistant rice varieties in production years, these natural seed banks increase the foraging capacity and nutrient diversity in rice fields for migrating and wintering waterfowl and other birds.



Mallards on Madison Parish WRP MBHI in January 2011 (photo by John Pitre).

WATERBIRD FOOD



Joe Marty, MSU Ph.D. student

Southwest Louisiana MBHI: Waterfowl “Ricebasket”—Based on soil-core data from 2010-2011, waterfowl carrying capacity provided by MBHI-flooded rice lands in southwest Louisiana revealed the importance of MBHI in potentially supporting wintering waterfowl and other waterbirds in that region away from potentially oil-impacted coastal wetlands. For example, the 177,000 acres of MBHI enrollments provided approximately 25% of the wintering waterfowl energy needs for the 9.3 million-acre south Louisiana portion of the Gulf Coast Joint Venture or GCJV (M. G. Brasher, personal communication). Thus, the 177,000 acres of MBHI land in southwest Louisiana provided one-fourth of the winter 2010 duck energy needs in the GCJV area on less than 2% of the land base.

177,000 acres of MBHI land in southwest Louisiana provided one-fourth of the region's duck energy needs.

COST EFFICIENCIES

In 2010, NRCS allocated \$5.3 million for MBHI management on the aforementioned 177,000 acres in southwest Louisiana, which equated to a cost of ~\$30/acre. However, considering duck foraging potential on these 177,000 MBHI acres, the estimated cost was less than 2 cents per DED, suggesting cost effectiveness of MBHI management in southwest Louisiana.

The 28,046 acres of MBHI enrollments in the Mississippi MAV were applied at a cost of \$5,158,215 allocated over three years beginning in September 2010. As reported above, this acreage contained seed and tuber biomass potentially generating 20,286,559 DEDs at a cost of 8 cents/DED, annualized over three programmatic years. This cost exceeded that for rice lands in southwest Louisiana; however, flooding was the only major management practice applied to Louisiana rice lands, whereas many Mississippi MBHI and WRP wetlands were restored during MBHI using a variety of practices including flooding, mowing, disking, and/or herbicide treatment.

These cost-benefit estimates are based on food energy potentially obtained by ducks by ingesting agricultural

and natural seeds and do not include energy that ducks and other waterbirds may obtain by foraging on aquatic invertebrates in flooded rice fields or natural wetlands. Although energy derived by ducks from protein-rich invertebrates may be less than half that provided by seeds (0.952 kcal/g vs. 2.5-4.0 kcal/g; Heath Hagy, Illinois Natural History Survey, personal communication; Kaminski et al. 2003), invertebrates provide critical protein and other nutrients (e.g., calcium) for all waterbirds and comprise the primary dietary items of shorebirds year-round. Additional research is needed to quantify the contribution of aquatic invertebrates to shorebird and other waterbird carrying capacity of MBHI and other managed wetlands. To accomplish this task, researchers must estimate invertebrate food abundance per unit area and habitat type, total area of different habitats, giving-up food density for major invertebrate taxa consumed by these birds (e.g., Greer et al. 2010, Hagy 2010), TME values of major invertebrate prey, and daily existence energy needs of target bird species. This research was beyond the scope of the MBHI evaluation but is necessary to estimate carrying capacity of wetlands by shorebirds and other waterbirds.

WATER QUALITY BENEFITS



Northern pintails and green-winged teal on Vermilion Parish MBHI in October 2010 (photo by John Pitre, NRCS).

Concentrations of nutrients and sediments in runoff from WRP and other moist-soil wetlands were significantly less than in runoff from adjacent row-crop agriculture fields during the winter. Total phosphorus, particulate phosphorus, nitrate-nitrogen, and total suspended solid concentrations were 42%, 50%, 86%, and 89% less, respectively, in moist-soil runoff than runoff from active crop fields. Loads of total suspended solids exported from moist-soil wetlands were 50% lower than loads exported from agriculture fields and a majority of the sediments exported from wetlands occurred during fewer than 15% of the total discharge events. Estimates of total loads of phosphorus from moist-soil wetlands were 2.13 lb/ac/year and were greater than the assumed 0.89 lb/ac/year phosphorus loading rate used to estimate the contribution from wetlands in Mississippi to nutrient pollution in the Mississippi River basin. Because ours is the first empirical estimate of phosphorous loading from natural moist-soil wetlands in Mississippi, replication is needed for validation.

CRAYFISH PRODUCTION

Moist-soil wetlands are important habitats for waterbirds and aquatic invertebrates, including native populations of crayfish. Landowners that harvest crayfish from moist-soil wetlands can realize another economic benefit. Landowners managing moist-soil wetlands in the MAV of Arkansas, north Louisiana, Mississippi, and southeast Missouri can attain average daily harvests of 2.2 lb/ac of crayfish for a typical 40-50 day season (mid-April-May or early June). Operating costs for harvesting crayfish in moist-soil wetlands are estimated to be \$215/ac compared to \$589/ac for traditional rice-crayfish harvest practices in Louisiana. If landowners create an enterprise (within legal bounds of any Farm Bill conservation wetland contract), they may realize an average of ~\$5/lb selling crayfish to local markets, which was a competitive price in central Mississippi markets in recent years. Thus, Farm Bill conservation wetlands and idled catfish ponds, wherein moist-soil vegetation is managed, are important wetlands for waterbirds and other wetland organisms, including crayfish that can provide an alternative income generating resource for landowners in the MAV.



Amy Alford Spencer, MSU Ph.D. student

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