

Project Title: Evaluation of Fish Habitat Structures in Missouri Reservoirs

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Stakeholders: Ozark, Kansas City, and Southwest regional MDC fisheries management biologists, Arkansas Game and Fish Commission: District 2

Problem/issue statement

An extensive National Fish Habitat Initiative (NFHI) project was completed on Table Rock Lake by the National Fish and Wildlife Foundation, Bass Pro Shops, and the Missouri Department of Conservation. Following this project, a second fish habitat enhancement project on the Missouri portions of Bull Shoals and Norfolk Lake was also completed. Since 2009 fish habitat structures have also been consistently added to Truman Reservoir. These projects were very effective but also require significant funding, extensive planning, and long-term maintenance. Management staff have identified several questions that need to be addressed to help define future funding, planning, and long-term maintenance needs.

The proposed project will primarily address information needs related to the longevity and fish use of these structures.

The proposed project seeks to:

1. Define the current condition and physical longevity of fish habitat structures installed in Table Rock, Bull Shoals, Norfolk, and Truman reservoirs.
 - a. How long do hardwood and cedar structures persist?
 - i. What is the current condition of the individual fish habitat structures?
 - ii. Generally, how many years after placement before these structures will require maintenance?
 - iii. Which structure locations are not suitable for continued maintenance?
 - iv. Which structures are in immediate need of maintenance?
2. Define overall and seasonal fish use of hardwood and cedar habitat structures based on structure location, design, and size.(optional and depends on funding for the Garmin LiveScope sonar unit and receiver).
 - a. How effective are these structures in attracting fish for the angling public?
 - b. Fisheries managers can influence the location, design, and size of habitat structures.
 - i. Do these variables influence the use of these structures by fish?
 - ii. Should these variables be considered in future project planning?
3. Provide information to management staff to use to inform anglers and promote management efforts.
 - a. What is required to maintain angler expectations of this valuable management tool?
 - b. What percentage of time and what percentage of structures are providing increased angling opportunities?

Previous evaluations of the Table Rock Lake NFHI habitat enhancement project have provided valuable information that is provided in the MDC Final Report: A Comprehensive Approach to Reservoir Habitat Management in Table Rock Lake (Allen et al. 2014). Boat electrofishing evaluations determined that habitat enhancement projects were successful in attracting local fish for spawning. Structures installed in Table Rock Lake were also shown to be used by bass and crappie during summer months, with covariates of temperature, visibility, and depth playing a role in fish use. In addition, angler surveys indicated that fisherman support habitat enhancement and that angler catch rates are higher among those fishing habitat enhancement structures.

The proposed evaluation seeks to complement these previous findings by providing additional information related to seasonal fish use and structure longevity. Results from this proposed project will ultimately inform project planning and help define maintenance needs of fish habitat projects in these reservoirs.

Project Goal

1. Inform planning, installation, and maintenance of reservoir habitat enhancement projects in Missouri reservoirs.

Project Objectives

1. Define the current condition and physical longevity fish habitat structures in Missouri reservoirs.
2. Define seasonal and annual fish use of cedar and hardwood fish habitat structures in Missouri reservoirs. This will require the Garmin LiveScope and would include evaluations based on structure attributes, such as location, design, and size.
3. Provide project findings to management staff that will assist in informing anglers and promoting management efforts related to reservoir habitat enhancements.

This research project addresses Goal 1, Outcome 2, and Strategy 1 (1.2.1) of the MDC strategic plan. Fish habitat structures provide cover for various fish species while simultaneously creating fishing opportunities by attracting game fish to these locations. This is an important management tool that helps MDC staff maintain sustainable fish populations in reservoirs and provide the opportunity for anglers to harvest fish at biologically and socially acceptable levels.

Successfully addressing the project objectives will define important considerations for fish habitat enhancement projects in Ozark reservoirs (Figure 1). This project will focus on evaluating the controllable factors that can improve effectiveness and efficiency of fish habitat projects. Management staff have already identified several controllable factors that seem to positively effect longevity and fish use of these structures. Identifying the ability of these factors to increase the effectiveness of fish habitat enhancement projects will have direct application to future decision making and will directly benefit the anglers using our reservoirs.

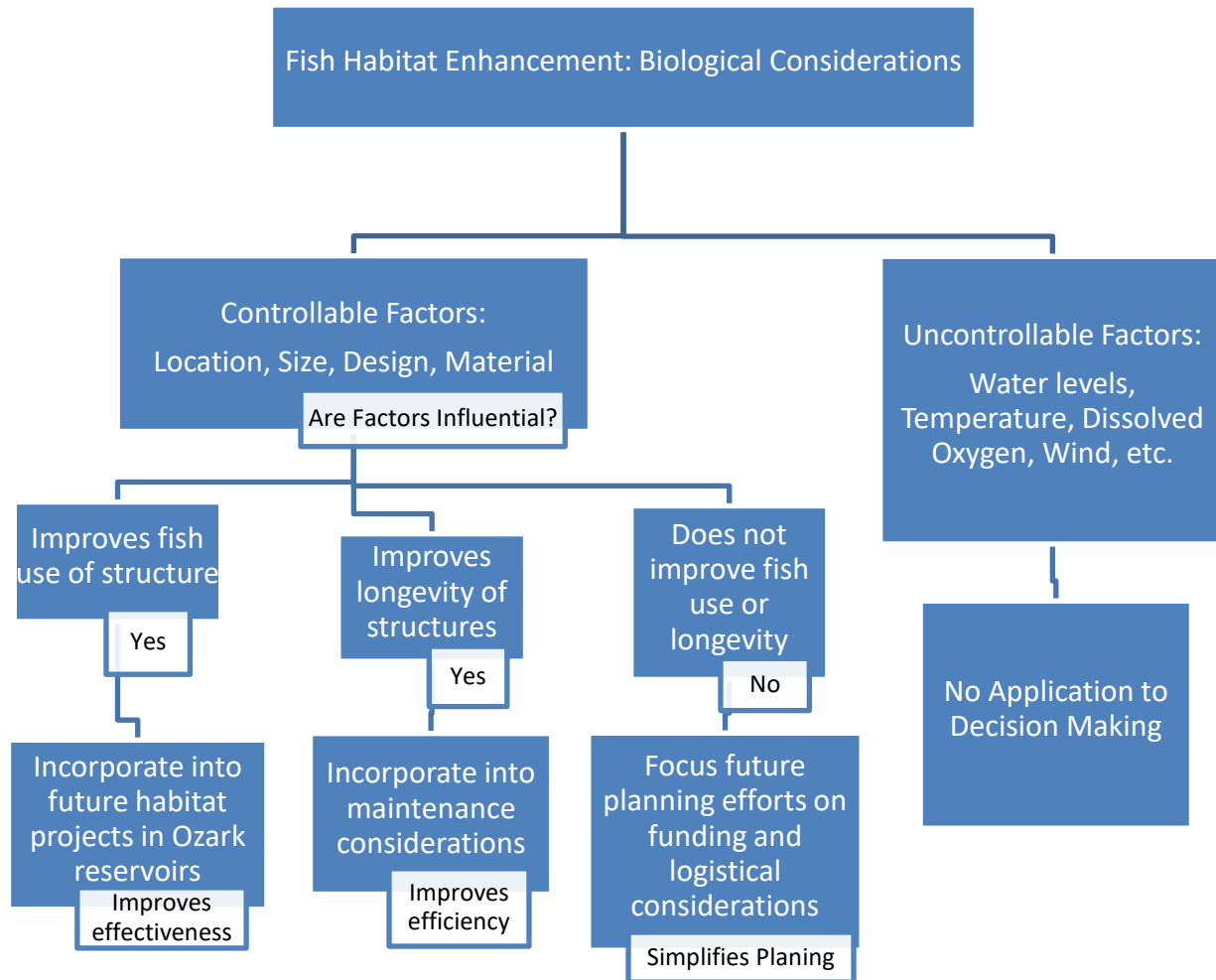


Figure 1: Decision making flow chart based on outcomes of the proposed evaluation of habitat structures in MissouriReservoirs.

Experimental Design

Evaluations of each structure will be required one time during the duration of the project while fish use evaluations would be made a minimum of once each season (spring, summer, fall, winter). Structural evaluations will, at a minimum, require images that capture the length, width, and height of each structure. Evaluation of fish use will require a minimum of one sample per season; however, every effort will be made to increase annual and seasonal replicates as time allows. Additional structural images may also be included as time allows and control sites will be included in the fish use evaluations. Control sites will consist of randomly selected areas without structure and will provide a baseline estimate of fish use at sites lacking structural habitat.

Fish habitat structures recently placed (2007-2013) in Table Rock Lake (Figure 2) will be used to identify current condition and longevity by structure type (hardwood and cedar) and

installation year (Figure 3). A minimum of 10 structures of each type installed, in each year of the habitat enhancement project (2007-2013) will be included in this evaluation.

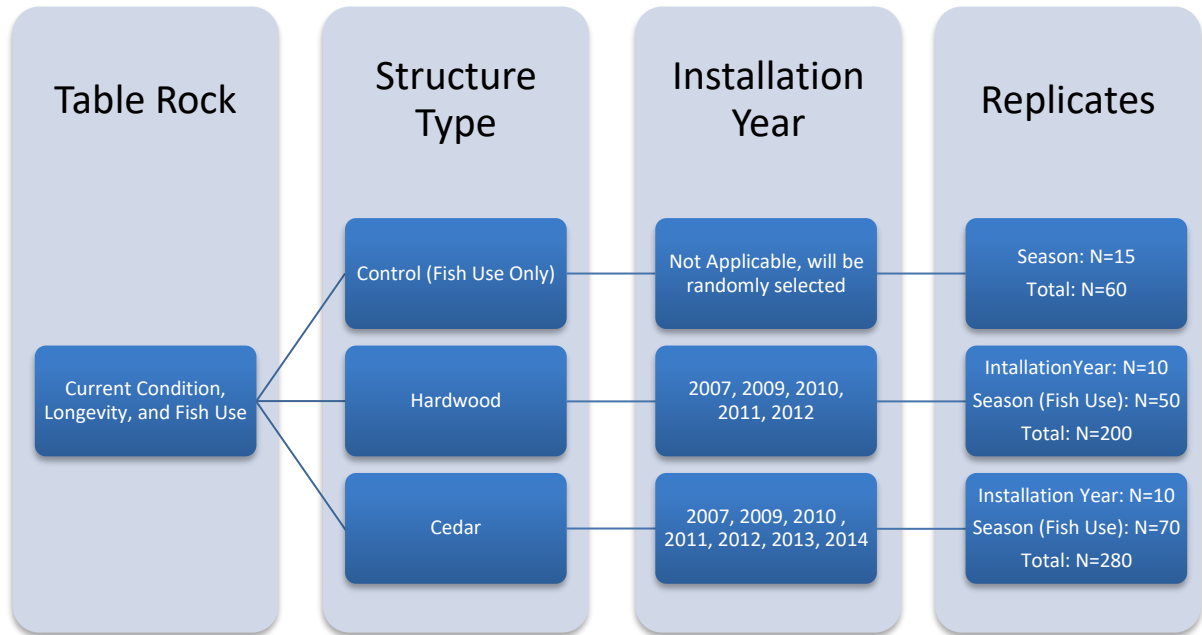


Figure 2: Experimental design for evaluation of longevity and fish use of habitat structures placed in Table Rock Lake.

Cedar structures placed in Bull Shoals and Norfolk lakes will be evaluated to define current condition, longevity, and fish use based on location, design, and structure size. A total of 193 structures are available for inclusion in the proposed project.

Combinations of structures to be evaluated include location, design, and size factors.

The three locations to be evaluated are:

- 1) coves
- 2) main lake flats
- 3) main lake points

Design factors are split into two categories:

- 1) single depth structures
- 2) multi depth structures

Size factors consist of:

- 1) Small
- 2) Large

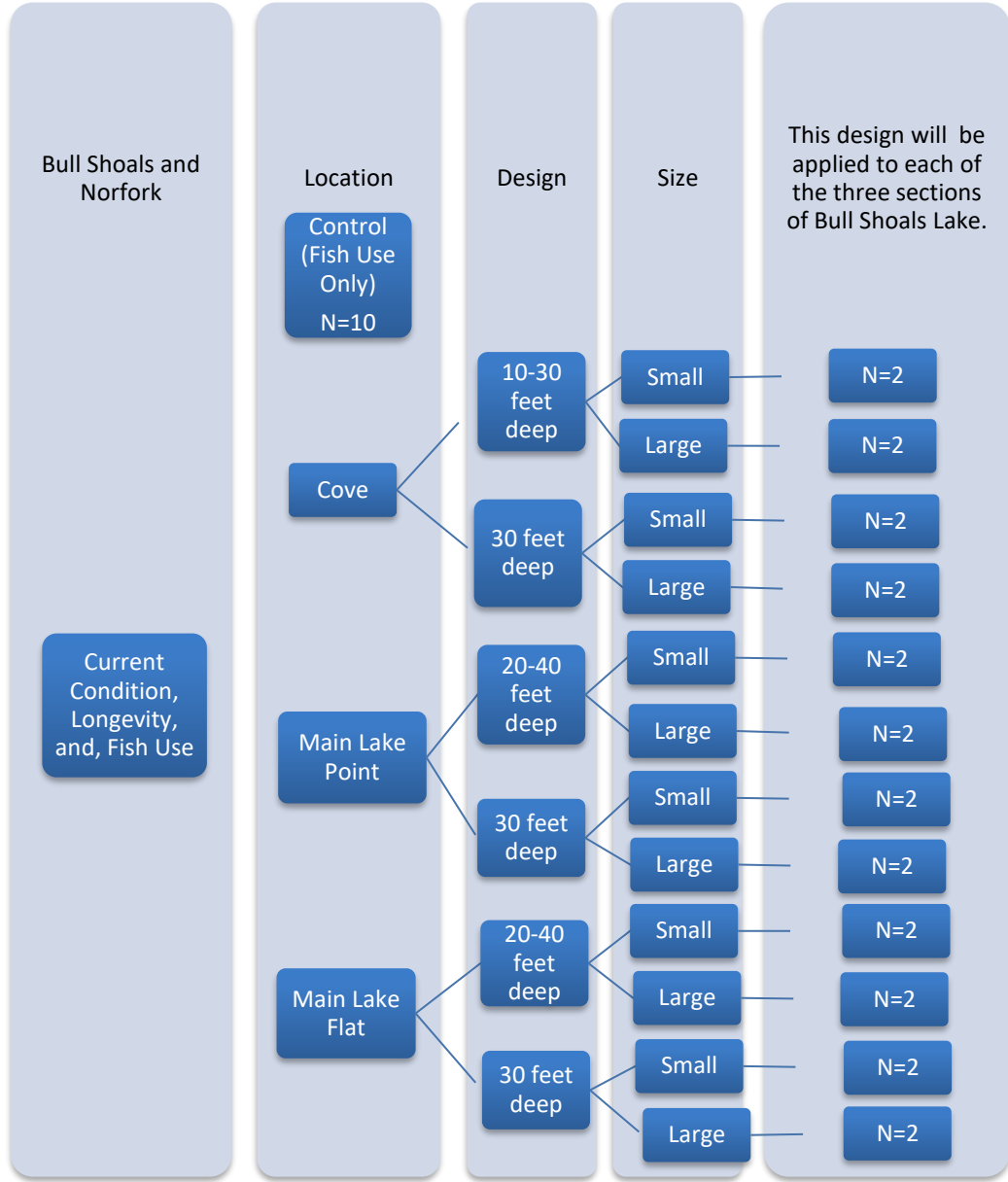


Figure 3: Experimental design for evaluation fish use and longevity of habitat structures to be installed in each section (Mincy, Big Creek, and Theodosia) of Bull Shoals Lake.

Fish habitat structures placed in Truman Reservoir from 2009-2020 will be used to identify current condition and longevity based on installation year (Figure 4). A minimum of 10 structures of each type installed, in each year of the habitat enhancement project (2009-2020) will be included in this evaluation.

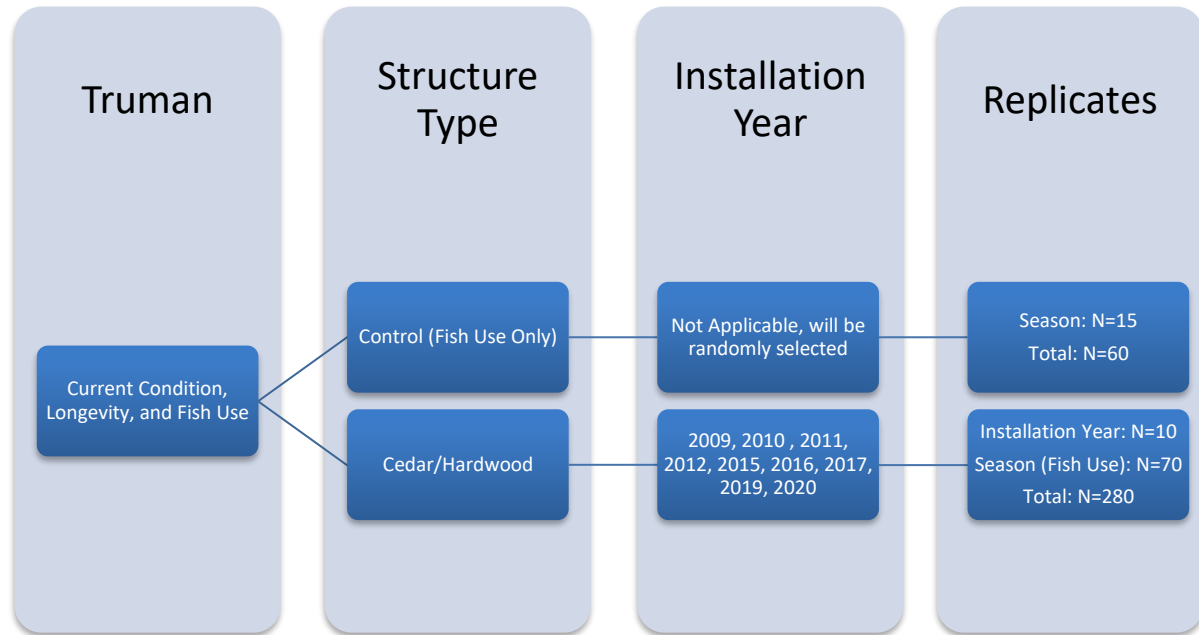


Figure 4: Experimental design for evaluation of longevity and fish use of habitat structures placed in Truman Reservoir.

Sampling Techniques

Sonar Imaging Technology

Structural evaluations for this project will be completed using sonar imaging. Our current equipment provides three different views of underwater structure: sonar, down scan, and side scan (Figure 4). Sonar takes images directly below the transducer and produces images that provide a definition of hardness (which is denoted by a blue-red color scheme) that is useful in providing overall structure volume and a low precision identification of fish. Down scan also provides an image directly below the transducer but is a much more picture like image that shows a more detailed view of the condition of a habitat structure. Side scan uses the same technology as the down scan but provides a view of what is to the left and right of transducer. This image gives broad view of the overall structure and can be used to define the physical dimensions of each structure.

Structure condition and longevity will be assessed primarily by defining each individual structure's volume, height, length, and width through time and relative to the condition of other structures of various ages. The image provided by sonar can be used to quantify these metrics, allowing for an estimation of structure volume that can be compared from one sample date or structure to the next.

Data collected for each sample will consist of:

- Date, waterbody, access point, reservoir arm, current water level
- GPS location, location type (cove, main lake point, main lake flat)
- Min and max depth of structure, min and max depth at conservation pool

- Structure height, length, width, and volume
- Number of trees per structure
- Minutes to locate structure
- Sonar, down scan, and side scan image of each structure
- Comparable images of control sites for each structure (if applicable)
- Side scan recording to map structure and adjacent area (optional)

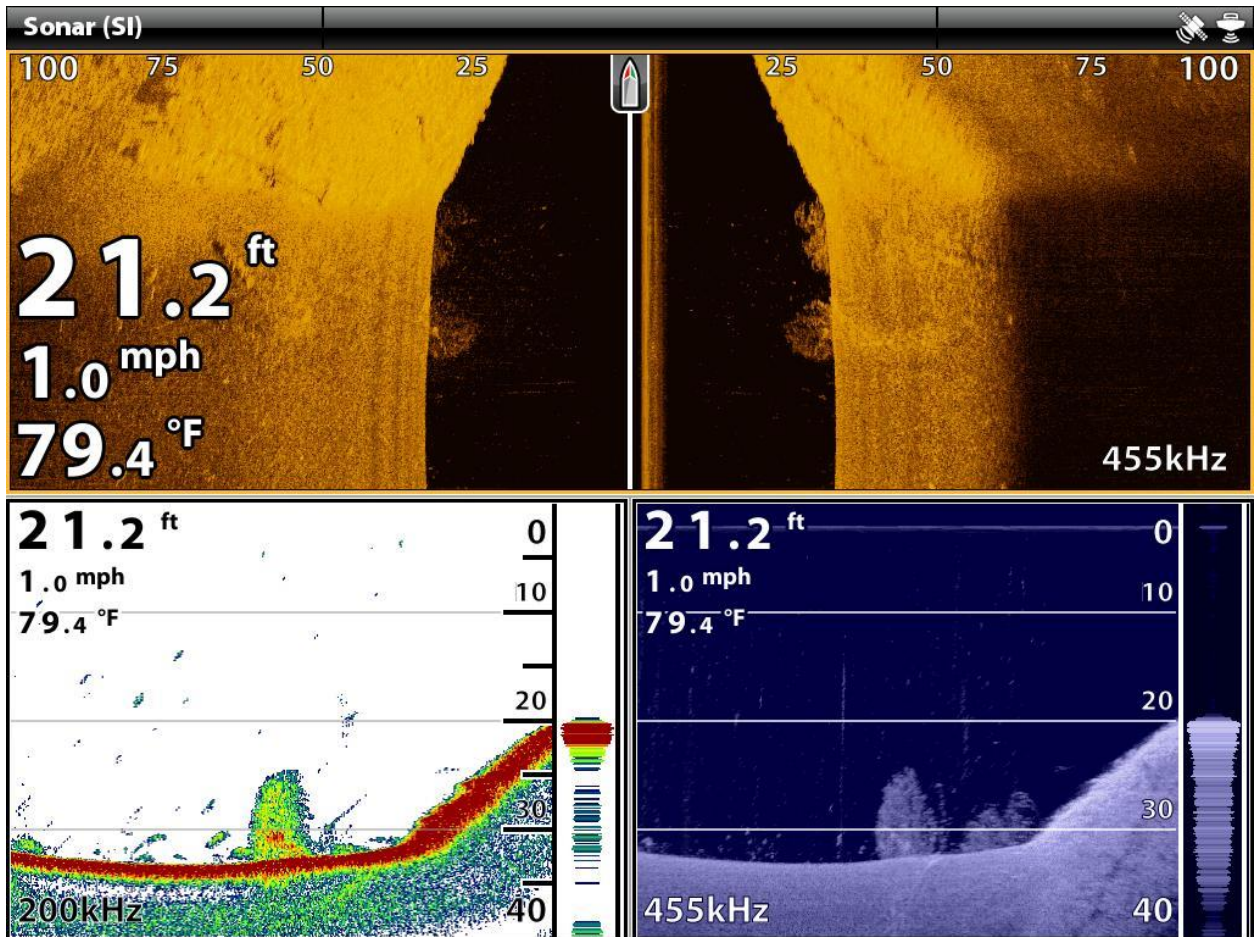


Figure 5: Examples of a sonar image (bottom left), down image (bottom right), and side image (top) from the Humminbird Solix 12.

Fish Use

Fish use of structures will primarily be assessed using the Garmin LiveScope technology. Without this equipment the accuracy of assessing fish use will be greatly limited and may not be possible. Presence/absence will be defined for each structure by viewing the structure and adjacent area for a pre-defined amount of time. Numbers of fish and presence of baitfish will also be recorded.

Additional metrics will also be recorded including date, time, air temperature, surface water temperature, structure depth, reservoir water elevation, and wind speed and direction. These metrics are likely to influence fish use of structures and will further inform project findings.

References

- Allen, M., S. Bush, M. Siepker, I. Vining, J. Harris, C. Paukert, and G. Borchelt. 2010. MDC Final Report: A comprehensive approach to reservoir habitat management in Table Rock Lake.
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