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## AQUATIC MACROHABITAT CLASSIFICATION

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General Information:

Method:

### I. General:

#### A. Two categories: Continuous and Discrete

1. Continuous macrohabitats are habitats that are found in every river bend and lack a definitive beginning and end, hence longitudinal boundaries are difficult to specify. For our purposes, lines delimiting the upstream and downstream limits of the channel crossover area (see section II. A. 1. a.) can be used as longitudinal boundaries for continuous macrohabitats. Discrete macrohabitats are not necessarily found within every river bend and have a distinctive beginning and end.

### II. Continuous Macrohabitats:

#### A. Main Channel cross-over (CHXO)

1. The main channel conveys the majority of the river discharge, and is defined as the thalweg of the river. Fish and habitat data will be collected in the channel crossover area. The channel crossover area is defined as the inflection point of the thalweg (i.e., location where the thalweg crosses over from one concave side of the river to the other concave side)(Leopold and Langbein 1966) or the area carrying the greatest water volume between two river bends. Lateral boundaries include the apparent shorelines. Longitudinal length of the crossover area generally does not exceed 1.5-2 times the stream width (i.e., about 1 stream width above and below the inflection point) (Figure 1, Appendix 1).

#### B. Outside Bend (OSB)

1. The outside bend in a river is the concave side of a river bend. In the lower Missouri River, this macrohabitat is usually characterized by rock rip-rap to protect the bank from erosion. In the upper river, outside bend macrohabitats are characterized by steep cut banks, that are continuously eroding. Longitudinal boundaries are the channel cross-overs defined in Part II. A. 1. a. The macrohabitat extends laterally from the bankline to the thalweg. (Figure 1, Appendix 1).

### C. Inside Bend (ISB)

1. The inside bend macrohabitat is the convex side of a river bend. Longitudinal boundaries are the channel cross-overs defined in Part II. A. 1. a. The macrohabitat extends laterally from the bankline to the thalweg. (Figure 1, Appendix 1). Inside bends are further divided into 4 mesohabitats; bars, pools, steep shorelines, and the channel border area.
  - a. Bars (BARS)

Sand bar/shallow shoreline mesohabitats are the terrestrial/aquatic interface area of deposited sediment lying within the spatial boundaries of the inside bend macrohabitats. These areas do not exceed 1.2 m water depth.
  - b. Pools (POOL)

Pool mesohabitats are areas immediately downstream from dikes or inside bend bars that have formed a scour hole. Specific depth varies by location, but should exceed 3 m (ie., deeper than the average main channel depth).
  - c. Steep shorelines (STPS)

Steep shorelines are areas in inside bend macrohabitats where the bank is too steep to effectively seine. Water depth exceeds 1.2 m within 5 m of the bank and in the middle and lower river, includes rock and wood dikes.
  - d. Channel border (CHNB)

The channel border area lies between the thalweg and the 1.2 m depth interval. These macrohabitats need to be visually determined in the field. Channel border areas include submerged sand bars. (Figure 1, Appendix 1).

### III. Discrete Macrohabitats

- A. Tributary Mouth (TRM): Tributary mouth macrohabitats are further divided into two mesohabitats based on size; large and small.
  1. Large Tributary Mouth (LRGE)
    - a. Large tributary mouth macrohabitats are found in association with tributaries with an average annual discharge exceeding  $20 \text{ m}^3/\text{s}$  ( $700 \text{ ft}^3/\text{s}$ ) and/or drainage areas larger than  $2,600 \text{ km}^2$  ( $1,000 \text{ mi}^2$ ) as determined from United States Geological Survey (USGS) stream gauges or 7.5 minute topographic maps. These tributaries are large enough for boats to sample fishes with trawls and drifting trammel nets and must be at least 30 m wide. Longitudinal distance begins at a line drawn across the downstream limits of the apparent shorelines and extends 200 m upstream.
  2. Small Tributary Mouth (SMLL)
    - a. Small tributary mouth macrohabitats (Figure 2,

Appendix 1) are associated with tributaries with an average annual discharge less than  $20\text{m}^3/\text{s}$  ( $700\text{ft}^3/\text{s}$ ) and/or drainage areas less than  $2,600\text{ km}^2$  ( $1,000\text{ mi}^2$ ) as determined from USGS stream gauges or 7.5 minute topographic maps. These tributaries must be at least 6.1m (20 ft) wide and deep enough to allow boat passage for a distance of 45 m (150ft) upstream from a lower boundary line drawn across the downstream limits of the apparent shorelines.

B. Secondary Channel:Non-connected (SCN)

1. Secondary channel non-connected macrohabitats (Figure 2, Appendix 1) are channels that are blocked at one end by either dry land, closing rock/pile dikes, or thick aquatic vegetation such that water velocities are essentially 0.0 m/s and fish movement is not permitted out of the channel at that end. In some cases in the lower river, velocity may not be 0.0 m/s because of water trickling through the closing dike. The opposite end of most non-connected secondary channels usually permits fish movement into and out of the macrohabitat. Non-connected secondary channels extend from a boundary line drawn across the downstream limits of the apparent shorelines, upstream to the first encountered water flow impediment. Laterally, these habitats are bounded by the apparent shorelines.

C. Secondary Channel:Connected (SCC)

Secondary connected channel macrohabitats are flowing water channels that carry less flow than the main channel. Their upstream and downstream ends are connected to the main channel and permit water and fish movement. (Figure 2, Appendix 1) They are divided into two mesohabitats based on water depth; shallow and deep.

1. Secondary Channel Connected:Shallow (SHLW)
  - a. Maximum depth in SCC-Shallow habitats, commonly does not exceed 1.2 m. Lateral boundaries are the apparent shorelines. Upstream and downstream boundaries are a line drawn between the apparent shorelines perpendicular to flow at the point where the secondary channel is connected to the main channel.
2. Secondary Channel Connected: Deep (DEEP)
  - a. Average depth in deep secondary channels exceeds 1.2 m. Lateral boundaries are the shorelines. Upstream and downstream boundaries are a line drawn between the apparent shorelines perpendicular to flow where the secondary channel joins the main channel.

D. Wild (WILD)

1. All other macrohabitats or fish collection procedures not covered by descriptors above or SOPs 3.1 - 3.5 are designated with this code. Identify mesohabitat in the comment section on *Habitat Measurement Sheet* if not one of the following mesohabitats. The choice of fish sampling gears in WILD macrohabitats is at the discretion of the crew leader.
  - a. Dam tailwaters (TLWT)
  - b. Embayments/oxbows/scour holes and vegetated backwaters with only one river connection (BAYS)
  - c. Shallow tributary mouths (STBM)

References:

Leopold, L. B. and W. B. Langbein. 1966. River meanders. *Scientific American*. 214:60-70

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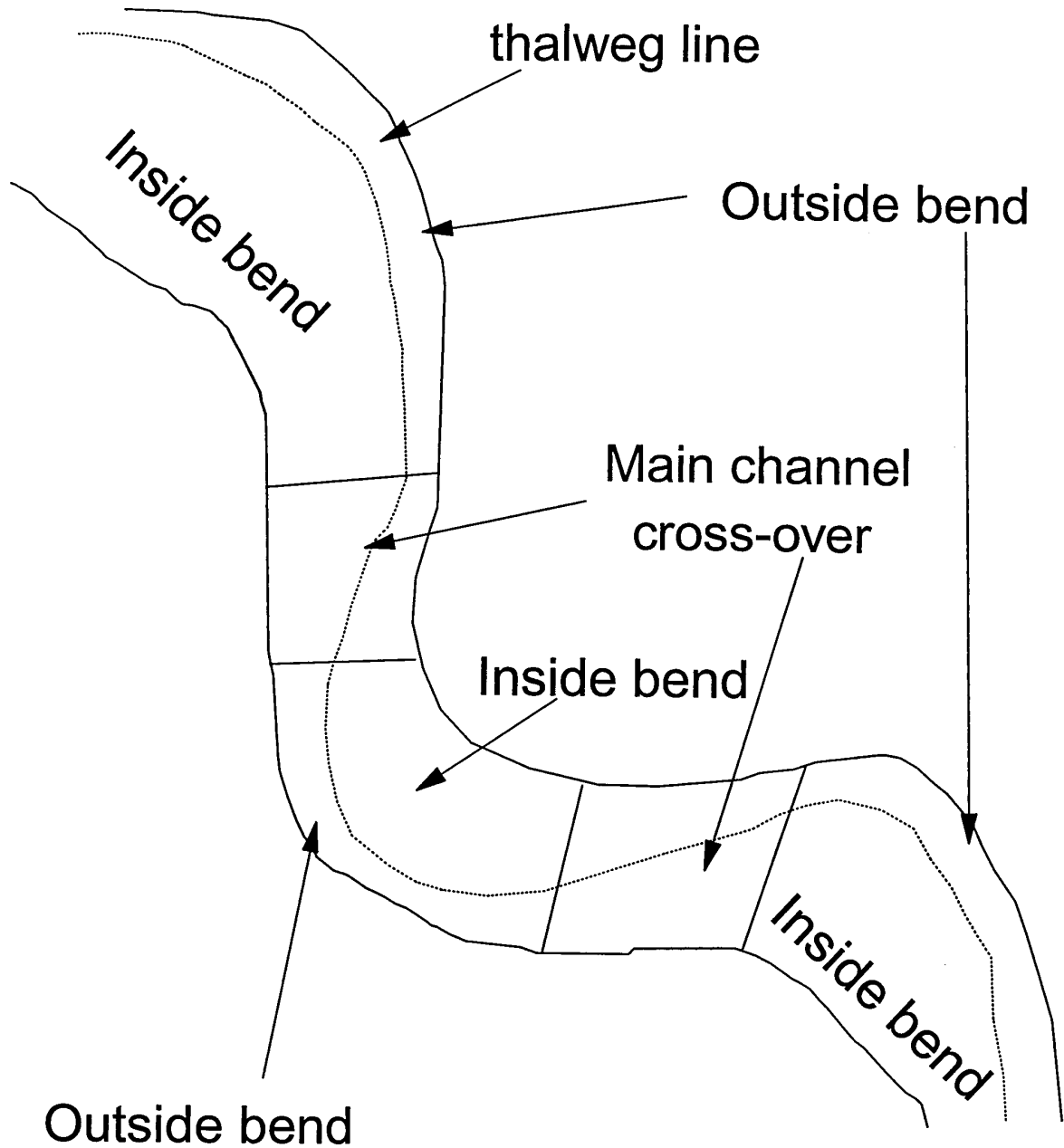
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Appendix 1.



Figure

Figure 1. Hypothetical map of the Missouri River showing boundaries of continuous macrohabitats.

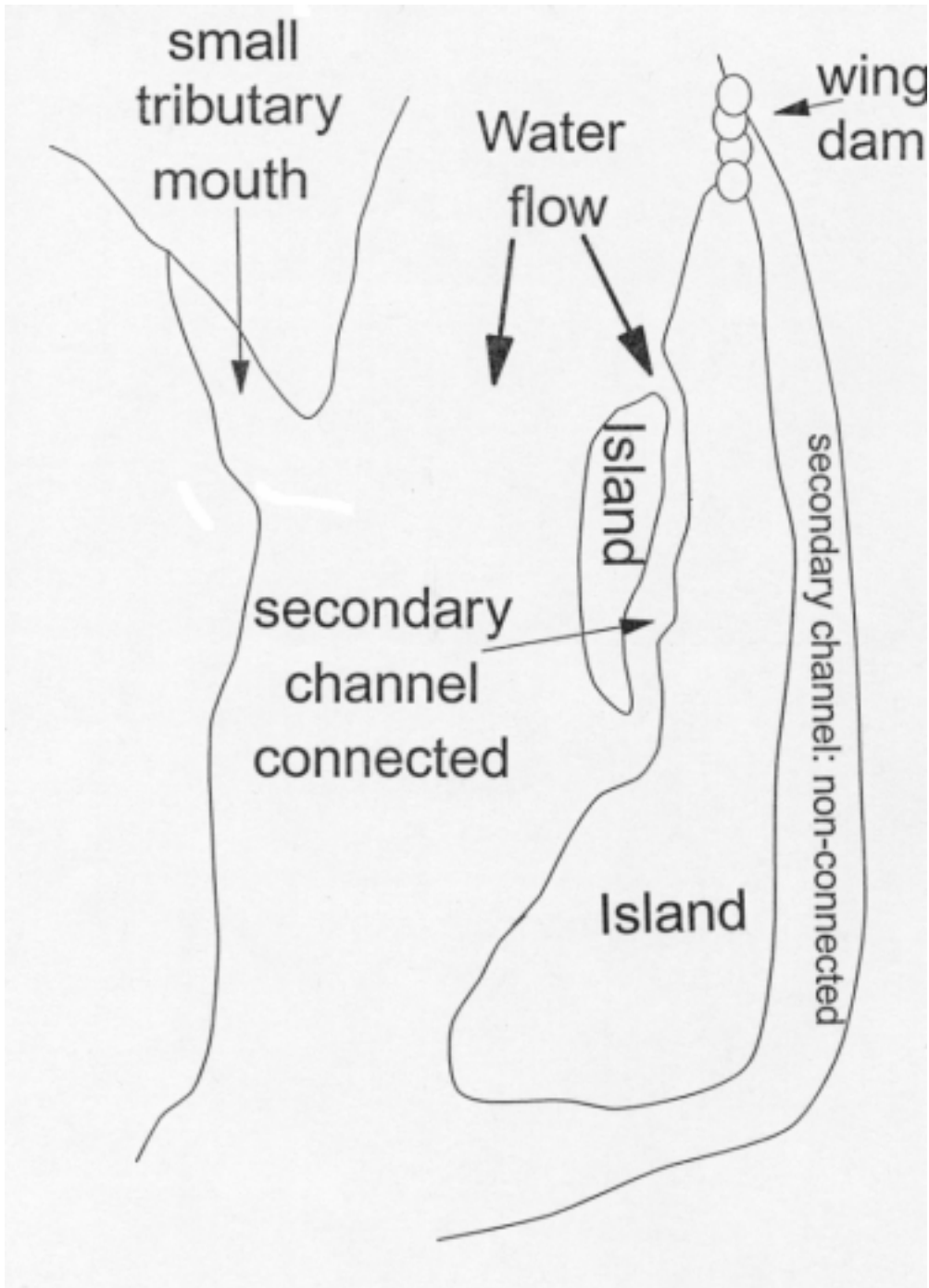


Figure 2. A hypothetical map of the Missouri River showing three discrete macrohabitats: small tributary mouth, secondary channel connected, and secondary channel non-connected.