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Predicting the (active) width of gravel-bed braided rivers

Walter Bertoldi[1] | Peter Ashmore[2] | Victoria Barlow[2]

[1]Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy

[2]Department of Geography and Environment, University of Western Ontario, London, Ontario, Canada

Correspondence
Walter Bertoldi, Department of Civil, Environmental and Mechanical Engineering, University of Trento, Via Mesiano 77, 38123 Trento, Italy.
Email: walter.bertoldi@unitn.it

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Abstract

The bankfull width of single-thread gravel-bed rivers (W_{bf}) can be effectively predicted by empirical and theoretical equations. However, applying these width predictors to multithread rivers is more challenging, and channel width is often underpredicted. Field and laboratory studies indicate that in braided rivers, only a small portion of the wetted width—referred to as the active width—is involved in sediment transport or shows morphological change, over short time periods like that of a single flood event. In this study, we compile results from various laboratory experiments to test the hypothesis that single-thread bankfull width predictors better estimate the active width rather than the total channel width in braided rivers. Our dataset, which spans a range of stream power and degrees of flow confinement, confirms that active width does not depend on the available river corridor space and the width estimators align closely with active width measurements. Prior research has shown that for gravel-bed braided rivers active width is typically 15% to 40% of the wetted width suggesting that a minimum corridor width about three times W_{bf} is necessary to sustain a braided morphology for stream power conditions under which braiding could occur. We further tested these findings taking advantage of a recently published dataset of historic trajectories of braided rivers in the Canterbury region, Aotearoa New Zealand. On average, braided reaches exhibit channel widths greater than three times W_{bf}. In contrast, wandering reaches have widths roughly twice W_{bf}, and single-thread reaches correspond closely to the estimated bankfull width. These findings offer a robust physical and theoretical basis for channel corridor design criteria that have been applied in restoration and conservation efforts for braided rivers in this region and are relevant to controls on the occurrence, and to conservation and restoration, of braided morphology more generally.

KEYWORDS
active channel width, braided rivers, braiding intensity, channel pattern change, lateral confinement

1 | INTRODUCTION

Braided rivers have distinctive morphology and dynamics compared with single-thread channels. One established characteristic of braiding is that the total wetted width (sum of the width of all branches) and number of wetted branches are much larger than the active (defined by bedload movement) width and number of active branches (Ashmore, 2001; Ashmore et al., 2011; Bertoldi, Ashmore, & Tubino, 2009; Carbonari et al., 2020; Peirce et al., 2018). The total and active width and braid index have been shown to be functions of total stream power (Bertoldi, Zanoni, & Tubino, 2009; Egozi & Ashmore, 2009), and their ratio is a function of non-dimensional specific power (Bertoldi, Ashmore, & Tubino, 2009).

In single channels, in which the distinction between active and total wetted width is minimal, regime predictions and empirical relations between width and the dominant variables of discharge, gradient and bed particle size have been extensively analysed (Dunne & Jerolmack, 2020; Griffiths, 1981; Parker et al., 2007). In braided rivers, these relations apply to individual branches but not to the whole river cross-section (Ashmore, 2022; Gaurav et al., 2017; Métivier et al., 2016), and consequently, the prediction of total and active width for braided channels, and the relation between them, is more problematic.

For a given discharge, total braided channel width is much larger than single channel width (Ashmore, 2022; Eaton et al., 2010; Ferguson, 1993; Mosley, 1983). Observations of changes in braided morphology induced by lateral constraint have shown that there is a critical available width for braiding below which braided patterns change to single thread or transitional channel pattern types (Brierley, 2010; Fotherby, 2009; Garcia Lugo et al., 2015; McDowell, 2001; Scorpio et al., 2024; Stecca et al., 2019; Surian & Rinaldi, 2003). One implication is that total width for braided channels, and the occurrence of braiding, while a function of total stream power (Leopold & Wolman, 1957; van den Berg, 1995), is also partially a function of the potential for lateral instability and the 'room' for braiding and multiple channels to be maintained. This observation has been used for control of braiding and is also a basis for restoration of 'strangled' braided rivers (Barlow & Ashmore, 2025; Brierley et al., 2023; Hicks et al., 2021). However, there is currently little quantitative basis for understanding braiding in terms of river width and for restoration of braiding using this principle.

The objective of this paper is to establish whether single-thread bankfull width predictors can provide a physically meaningful estimate of the active width of braided rivers. We hypothesize that bankfull width estimates for single-thread rivers (e.g., Parker et al., 2007) are an approximate predictor of the active width of braided rivers, but not the total wetted width, which is significantly larger than the active width. We use published experimental flume data to test these hypotheses, and then, we use a large field dataset on New Zealand rivers to assess their applicability to explaining historical changes in channel pattern and for developing principles for restoration of braided channel pattern and geomorphic functioning.

2 | METHODS

2.1 | Laboratory experiments

We used existing data on laboratory experiments performed at the Hydraulic Laboratory of the University of Trento, where the wetted width and the instantaneous active width were measured. The experiments reproduced hydraulic and morphological conditions that are common in gravel-bed rivers and did not represent a model of a specific field prototype. Three sets of experiments were considered (Garcia Lugo et al., 2015; Bernard et al., 2026, plus a further unpublished set), all performed on the same flume (25 m long and 2.9 m wide) filled with a uniform sand, with a mean diameter of 1 mm, and scraped at a constant longitudinal slope of 0.01 m/m. The flume width was restricted to different values with vertical banks, to reproduce the effect of different lateral confinement. The width ranged from 0.15 to 1.6 m. Table 1 reports the experimental conditions for all the considered runs. Each experiment was run with a constant value of discharge and an upstream sediment feeding equal to the exiting bedload flux, to keep the longitudinal slope constant. Runs lasted for long enough for the channel morphology to reach an overall equilibrium, estimated from continuous measurements of the bedload flux and direct observation of the wetted width, the channel morphology and the number of anabranches (see Garcia Lugo et al., 2015 for further details). When the equilibrium morphology was reached, the wetted width was directly measured on a set of cross-sections. The instantaneous bedload active width (i.e., the width where sediment where transported) was measured from direct observations on the same cross-sections as for the wetted width in the Garcia Lugo et al. (2015) experiments. In the other experiments, the automatic procedure reported by Redolfi et al. (2017) was used, measuring the instantaneous bedload active width from 1-min timelapse images of the last 7 m of the flume (see also Bernard et al., 2026).

2.2 | Field data

We used the dataset recently published by Barlow and Ashmore (2025) who considered nine gravel-bed braided rivers from the Canterbury region (Aotearoa New Zealand) and compared their change in width, planform type and braiding intensity between the mid-1900s and 2016–2018. More than 600 km of river length were mapped from aerial images, with the channel course segmented into 250, 500, or 1000 m reaches, depending on the average width of the river, resulting in more than 1000 reaches. Each reach was assigned a longitudinal slope, computed from a lidar 1 m resolution DEM, supplemented by a national 8 m resolution DEM and a mean annual flow discharge, derived from the open-source NIWA (now Earth Science New Zealand Ltd) New Zealand River Flood Statistics dataset (Henderson et al., 2018; Henderson & Collins, 2016).

Width was measured as the sum of wetted channels and bare gravel, connected dry channels and/or sparsely vegetated bars. This approach defined the extent of the active channel during high flows and can be considered a reasonable estimate of the wetted width at bankfull stage.

Channel pattern was classified as single, transitional 'wandering' (one to three channels) or braided (more than three channels). Braiding intensity was defined using a simple average cross-sectional count of wetted and dry channels. Extensive lengths of all rivers underwent narrowing between the two time periods along with reduction in extent and intensity of braiding, primarily because of a combination of flood control stop banks, and vegetation and agricultural encroachment (Barlow & Ashmore 2025). The reaches with largest relative width reduction had the most significant loss or reduction of braiding showing a link between river width and the probability of braiding and of braiding intensity (Barlow & Ashmore, 2025, fig. 13). The analysis in this paper extends this result by assessing it in the light of predicted regime widths and associated width and channel pattern and the observed temporal morphological changes in these rivers.

2.3 | Single-thread bankfull width computation

Values of wetted and active width measured in the laboratory experiments and the Aotearoa New Zealand dataset are compared with bankfull width estimates for single-thread channels characterized by the same discharge (Q) and median grain size (d_{50}). We adopted the formulation of Parker et al. (2007), who derived an empirically based and scale-independent equation to estimate the bankfull width (W_{bf}) of single-thread gravel-bed rivers. Their relation is

TABLE 1 Experimental conditions for the runs in the three considered datasets.

Dataset	Q (l/s)	Flume width (m)	Wetted width (m)	Active width (m)	Observed morphology
Garcia Lugo et al. (2015)	1.5	0.15	0.15	0.15	Single thread
	1.5	0.2	0.20	0.20	Single thread
	1.5	0.3	0.30	0.30	Single thread
	1.5	0.4	0.40	0.32	Single thread
	1.5	0.6	0.57	0.33	Wandering
	1.5	0.8	0.73	0.33	Braided
	1.5	1	0.87	0.35	Braided
	1.5	1.25	0.96	0.39	Braided
	1.5	1.5	1.07	0.30	Braided
	2	0.15	0.15	0.15	Single thread
	2	0.2	0.20	0.20	Single thread
	2	0.3	0.30	0.30	Single thread
	2	0.4	0.40	0.36	Single thread
	2	0.6	0.59	0.41	Wandering
	2	0.8	0.74	0.46	Wandering
	2	1	0.90	0.39	Braided
	2	1.25	1.02	0.45	Braided
	2	1.5	1.15	0.41	Braided
	2.5	0.15	0.15	0.15	Single thread
	2.5	0.2	0.20	0.20	Single thread
	2.5	0.3	0.30	0.27	Single thread
	2.5	0.4	0.40	0.36	Single thread
	2.5	0.6	0.59	0.42	Single thread
	2.5	0.8	0.75	0.56	Wandering
	2.5	1	0.91	0.48	Braided
	2.5	1.25	1.04	0.53	Braided
	2.5	1.5	1.22	0.50	Braided
Bernard et al. (2026)	0.5	0.6	0.51	0.09	Braided
	0.7	0.6	0.54	0.15	Braided
	1	0.6	0.58	0.26	Braided
	1.5	0.6	0.59	0.32	Wandering
	2	0.6	0.6	0.39	Single thread
Unpublished UNITN	0.8	0.8	0.6	0.16	Braided
	1.2	0.8	0.65	0.29	Braided
	1.6	0.8	0.7	0.37	Braided
	2	0.8	0.73	0.41	Braided
	2.4	0.8	0.75	0.44	Wandering
	0.8	1.6	0.99	0.13	Braided
	1.2	1.6	1.06	0.24	Braided
	1.6	1.6	1.13	0.39	Braided
	2	1.6	1.22	0.36	Braided
	2.4	1.6	1.27	0.48	Braided

Note: All runs had the same longitudinal slope (0.01 m/m) and mean grain size (1 mm).

$$W_{\mathrm{bf}} \cong 4.63 \frac{Q^{0.4667}}{g^{0.2333} d_{50}^{0.1667}}, \qquad (1)$$

where g is gravitational acceleration.

This equation does not depend on channel slope and, importantly for our case, is only weakly dependent on grain size. Because Barlow and Ashmore (2025) do not report grain size data for the rivers they examined, this formulation helps reduce uncertainty associated with unknown grain size. Assuming a representative range of median grain size for large gravel-bed rivers (0.02–0.06 m), the resulting estimates of bankfull width vary by less than 20%.

In addition, Equation (1) was derived using dimensionless variables, making it inherently scale independent. It can therefore be applied directly to laboratory experiments without specifying a geometric length-scale ratio.

3 | RESULTS

3.1 | Laboratory experiments

We first present the results of the laboratory experiments by Garcia Lugo et al. (2015), as they provide a dataset where experiments have been repeated with the same flow conditions, but changing the flume width from, that is, the available space for the channel or the lateral constraint. Figure 1 reports the value of wetted width (a–c) and instantaneous bedload active width (d–f) as a function of the flume width, for three discharge values, increasing from left to right. As the flume widened, the morphology transitioned from single thread (red symbols) to wandering (yellow symbols) and eventually to braiding (green symbols). Data show that the wetted width continuously increased as more space became available. For the narrower flume widths (approximately in the range 0.15–0.6 m), the channel occupied the entire flume, and the wetted width is equal to the flume width. Wetted width points deviated from the 1:1 line only when the flume width significantly exceeded the estimated bankfull width (W_{bf}) for an equivalent single-thread rivers (from Equation 1, black horizontal line). Only at this point, bar tops started emerging, and the river morphology shifted from single thread to wandering and then braiding. In contrast, the instantaneous bedload active width increased only up to a value approximately corresponding to the single-thread bankfull width, and did not widen further, even when additional space was available (Figure 1d–f).

In Figure 2, wet, instantaneous bedload active and flume width were all normalized by dividing them by the single-thread bankfull width (W_{bf}). The two additional experimental datasets were also included in this case. The plots confirmed that the wetted width was significantly lower than the flume width only for normalized flume widths larger than approximately 3. At this value, the emerged bar area was approximately 0.5 times the bankfull width. When the normalized flume width reached a value equal to four, the emerged area approached one W_{bf}.

In contrast, the normalized instantaneous bedload active width deviated sharply from the 1:1 line once the normalized flume width exceeded 1 and then remained in the range 0.7–1 for most runs, with a few runs showing lower values around 0.5. These results suggest that the single-thread bankfull width estimated with the Parker et al. (2007) formulation could be used as a good predictor of the instantaneous bedload active width for wandering and braiding morphologies.

Experimental data can be plotted also highlighting the ratio between wetted width and instantaneous bedload active width, as a function of the dimensionless stream power, defined as

$$\omega^* = \frac{QS}{W_w\sqrt{g\Delta d_{50}^3}}, \tag{2}$$

where S is the longitudinal slope, W_w the wetted width and Δ the relative submerged sediment density (Bertoldi, Ashmore, & Tubino, 2009). The plot in Figure 3 shows that experimental braided rivers invariably have a wetted width/active width ratio larger than 1.5, with most points larger than 2, up to about 8 for very low values of the dimensionless stream power. Considering that the wetted width is lower than the available space (flume width) when the width is larger than (W_{bf}) (Figure 2a), a minimum normalized flume width of approximately 2.5 is needed to allow for the formation of a braided river.

3.2 | Application to the Aotearoa New Zealand rivers

For all the reaches in Barlow and Ashmore (2025), we computed the ratio between the measured width (historic and recent) and

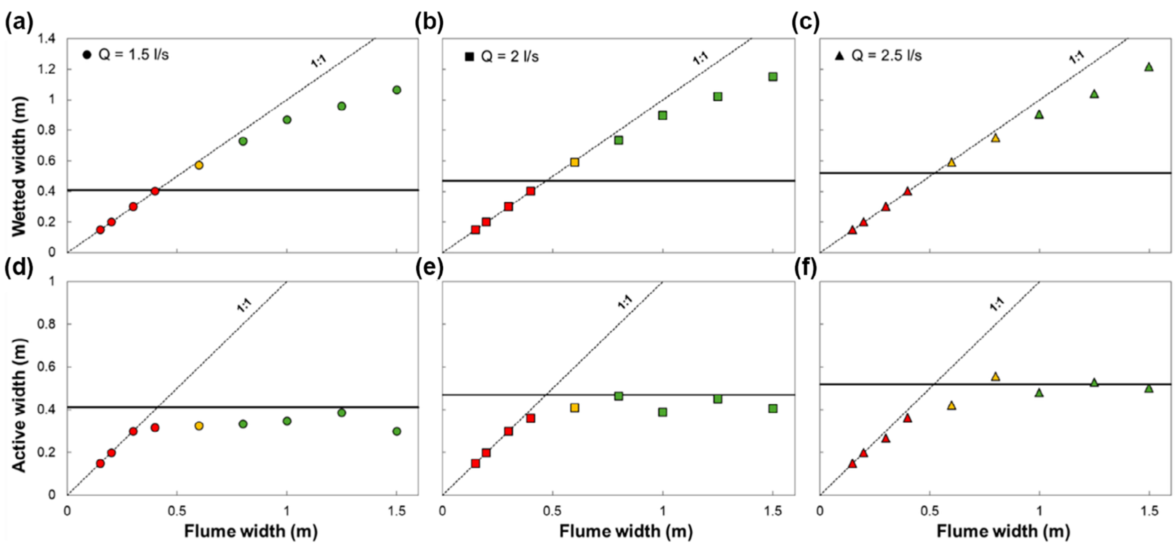

FIGURE 1 Wetted width (a–c) and active width (d–f) for the Garcia Lugo et al. (2015) experiments, as a function of flume width (lateral confinement) and discharge. The horizontal continuous line represents the single-thread bankfull width (W_{bf}) estimated with Equation (1). Colour of the symbols represents the observed morphology: single thread (red), wandering (yellow) and braiding (green).

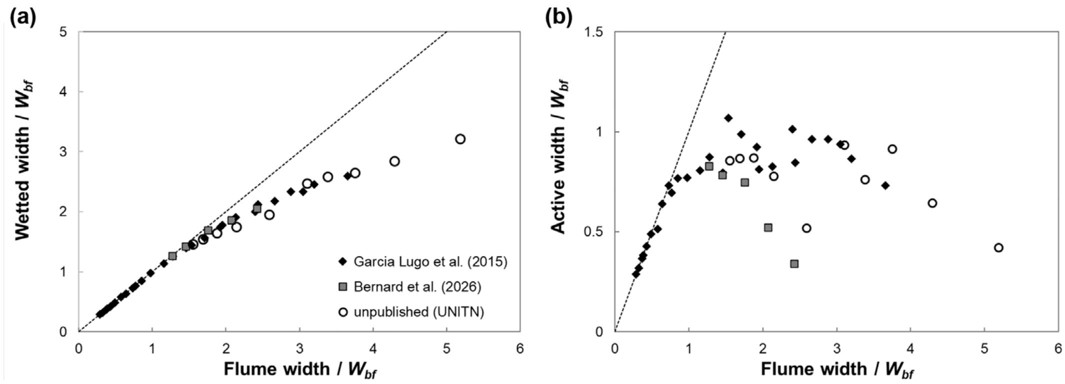

FIGURE 2 Wetted and active width normalized with the single-thread bankfull width (W_{bf}) as a function of the normalized flume width (lateral constraint) for experiments at the hydraulic laboratory in Trento (Garcia Lugo et al. 2015; Bernard et al., 2026; unpublished).

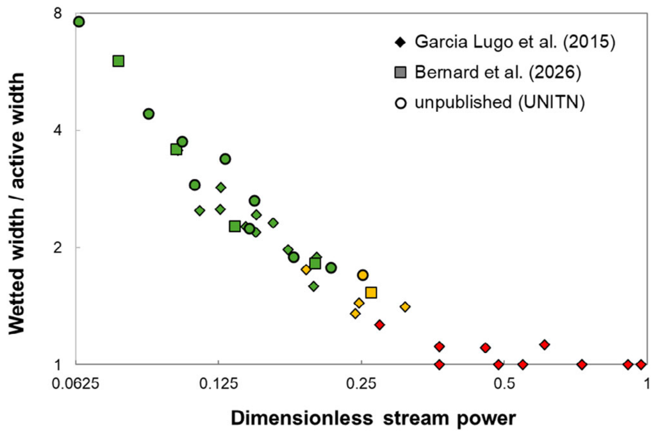

FIGURE 3 Wetted width over instantaneous bedload active width for the three sets of experiments as a function of the dimensionless stream power. Colour of the symbols represents the observed morphology: single thread (red), wandering (yellow) and braiding (green).

the single-thread bankfull width estimated with Equation (1). In the following plots, the same median grain size equal to 0.04 m has been used to compute the regime width, for all the reaches. Different values, in a reasonable range for those rivers (i.e., 0.02–0.06 m), would change the results only in a minor way. The choice of this grain size range is supported also by the regional estimates in Haddadchi et al. (2018). Plots using different values for the median grain size are reported in the Supporting Information. It is worth pointing out that the measured width is not perfectly equivalent to what we measured in the laboratory experiments, as in this case it is not directly the wetted width in formative conditions (available images were acquired at low flow), but the width of the low flow channels plus the width of the emerged, unvegetated bars. Considering that it is not common to have images of large rivers at bankfull conditions, the combined width occupied by the low flow channels and the exposed, bare bars is the best approximation we can get for the wetted bankfull width.

Figure 4 shows the ratio between observed width and (W_{bf}) for the nine rivers, as a function of the distance from their mouth. Two dashed lines at values of the ratio equal to 1 and 2.5 (red and yellow, respectively) have been added to help the visualization. The points are scattered, but it is clear that there is a trend, where single thread reaches plot around the red line, wandering reaches plot around the yellow line and braided reaches plot above. Similar plots, where (W_{bf}) was computed with smaller and larger values of median grainsize (0.02 and 0.06 m, respectively), are reported as Figures S1 and S2.

In Figure 5, we examine the distribution of normalized width for all reaches, classified according to their morphological type (single thread, wandering and braiding) for both historic and recent configurations. The box-and-whisker plots show clear and systematic differences among the six groups, with median normalized widths ranging from approximately 0.8–1.4 for single thread, 2.7–3.8 for wandering and 5.6–7.6 for braiding. Separate box plots for each single river are reported in Figure S3.

Because the distributions were strongly non-normal and heteroscedastic, we used nonparametric statistics. A Kruskal–Wallis test confirmed significant differences among the six groups ($p < 10^{-16}$), and Dunn's post hoc tests with Bonferroni correction indicated that every pair of groups was statistically distinct, consistent with the well-separated medians observed.

The plots show also that observed recent widths are on average lower than historic values, for each morphology. Present day wandering and braiding reaches are narrower and therefore on average closer to a change in morphology type.

Moreover, we compared reaches that changed morphology (from braiding to wandering and from wandering to single thread) with reaches that did not change morphology. Figure 6 reports the box plots of the four possible combinations. Results confirm a significant difference between reaches that changed morphology and reaches that did not. In particular, reaches that changed from braiding to wandering experienced a decrease of the median normalized width from 6.4 to 2.7, and reaches that changed from wandering to single thread decreased from 3.5 to 0.8. Also, reaches that did not change morphology experienced strong narrowing but keeping the ratio above the threshold for that morphology. Reaches that stayed braided narrowed from a normalized width equal to 9.4 to 5.6 and wandering reaches from 3.7 to 2.5.

Furthermore, we investigated the relationship between the normalized width and the observed number of anabranches, for each reach (Figure 7). The plot shows an increase in the ratio for larger values of the braiding index. In particular, considering both historic

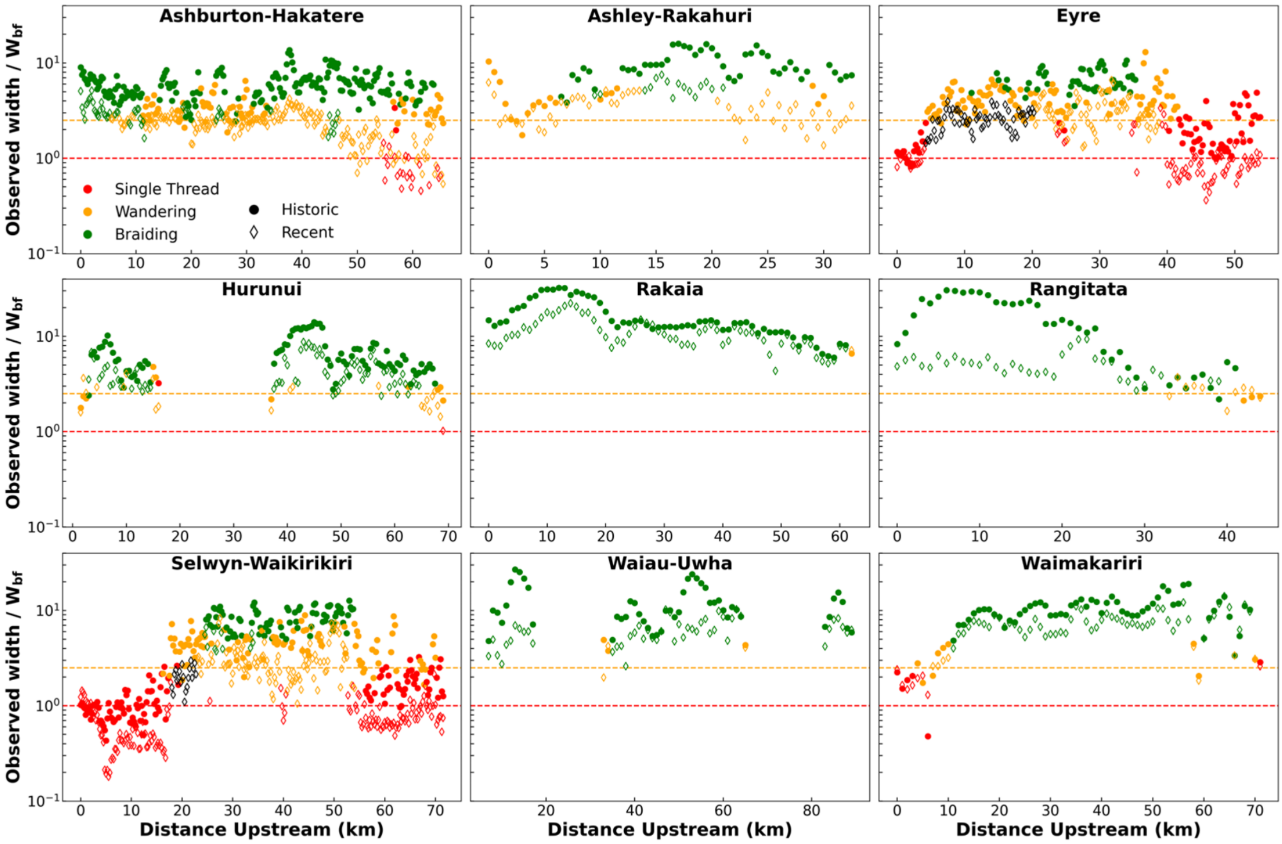

FIGURE 4 Ratio between measured width and W_{bf} (computed with a median grain size equal to 0.04 m) for the nine rivers, as a function of the distance from the mouth. Points are colour coded to represent the observed morphology (single thread = red, wandering = yellow and braiding = green) and differentiating between historic values (closed symbols) and recent values (open symbols). The dashed red line denotes a ratio equal to 1, and the dashed yellow line denotes a ratio equal to 2.5.

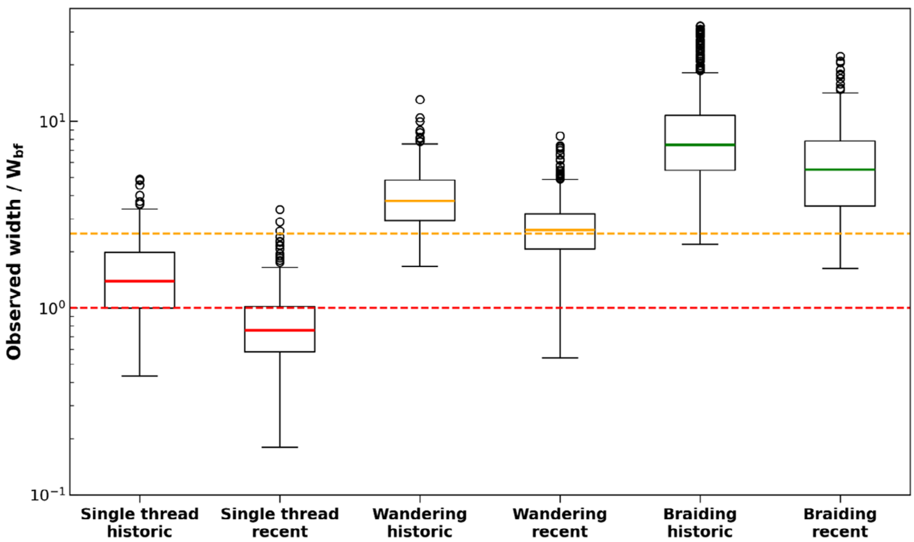

FIGURE 5 Boxplot of the ratio between observed width and predicted single-thread bankfull width for the different morphologies and periods. The dashed red line denotes a ratio equal to 1, and the dashed yellow line denotes a ratio equal to 2.5.

(Figure 7a) and recent data (Figure 7b), reaches with an average of 1.5 anabranches are characterized by a ratio in the range 2–3 and reaches with 3 anabranches have a ratio in the range 3–5. Recent data show consistently lower values of the ratio (i.e., are narrower) for similar values of the braiding index, or from the other point of view, have a larger braiding index for similar values of the normalized width. It is worth noting that the observed number of anabranches were not measured at formative discharge, but on the available images, likely at low flow. As reported by Barlow and Ashmore (2025), they included prominent dry channels, to limit the effect of river stage; nevertheless, values are affected by this limitation.

This analysis confirms that each morphology type is characterized by a specific range of width/regime width ratio. From a different point of view, this also suggests that there are thresholds for river width below which it is more likely the morphology will change, from braiding to wandering or from wandering to single thread.

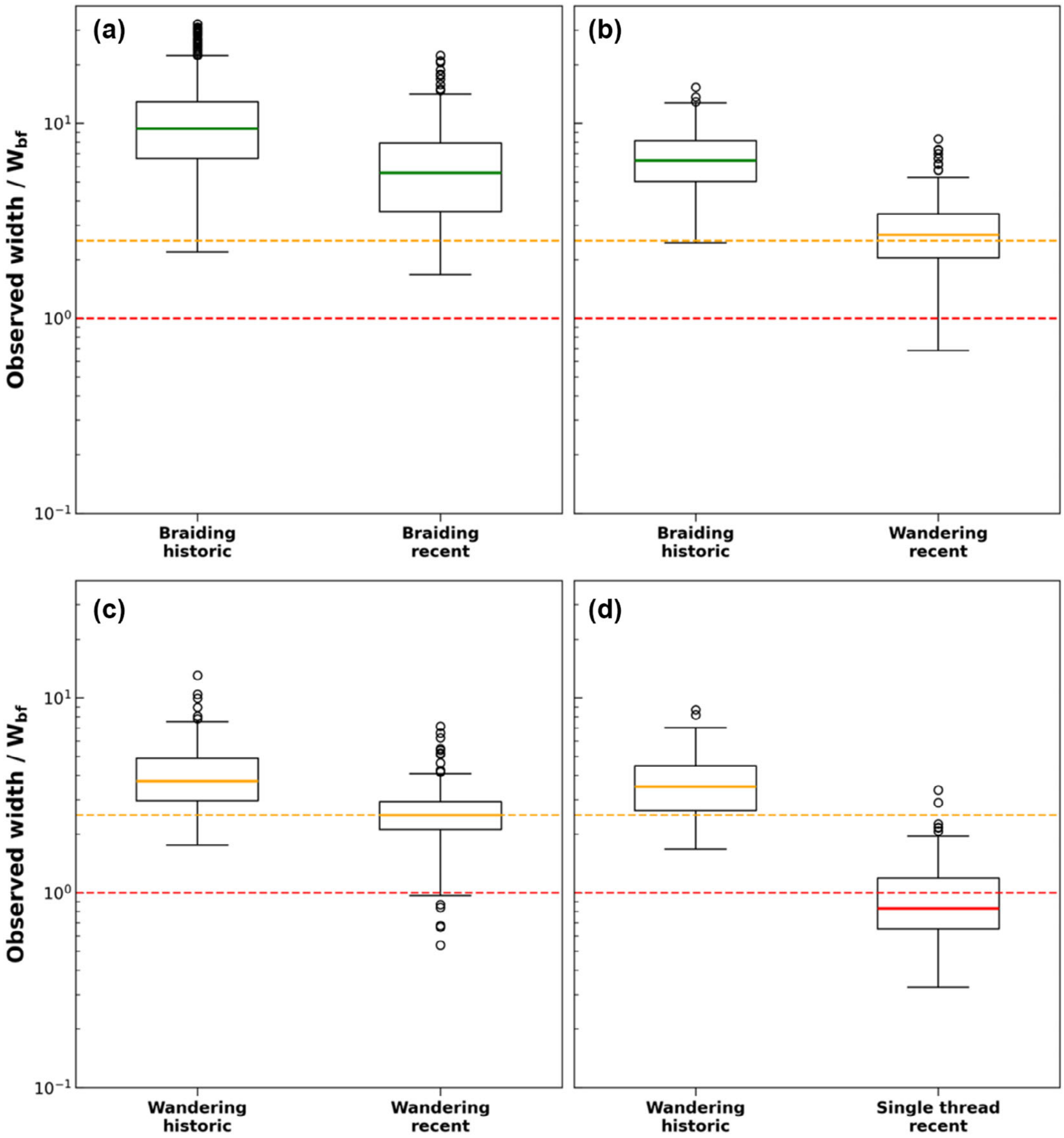

FIGURE 6 Boxplot of the normalized width for the reaches that (a) maintained a braiding morphology, (b) changed from braiding to wandering, (c) maintained a wandering morphology and (d) changed from wandering to single thread. The dashed red line denotes a ratio equal to 1, and the dashed yellow line denotes a ratio equal to 2.5.

4 | DISCUSSION

The results from laboratory experiments show that active width (but not total wetted width) of braided channels is mostly independent of lateral confinement and is similar to predicted width (Parker et al., 2007) for single-thread gravel-bed rivers, consistent with the primary hypothesis. Carbonari et al. (2020) reported comparable results: Three experimental runs with similar flow and sediment conditions but different flume widths (0.50, 0.25 and 0.12 m) produced distinct river morphologies (braided, alternate bars and single-thread plane bed) while maintaining the same active width (0.12 m). Also, in their experiments, they observed a braided morphology with a ratio between the flume width and the active width equal to approximately 4 and a wandering morphology with a ratio equal to 2. Field data are consistent with this result showing that braiding is associated with ratios of total width/active width greater than about 2.5.

The detailed results will depend on choice of the regime equation for channel width, and we would expect some variation in exact results from this choice. The Parker et al. (2007) empirical equation is based on a large sample of single-thread gravel-bed rivers covering a wide range in scale and grain size. Sensitivity to grain size is one important effect on which we have limited data from the field cases and on which some deviation in predicted active width is expected depending on the reliability of the grain size assumption (see Figures S1 and S2). An important assumption of the empirical relation is that channel gradient is a dependent variable governed by sediment supply. In addition to empirical equations for bankfull width, such as Parker et al. (2007), various theoretical formulations exist, typically based on threshold channel assumptions (e.g., Griffiths, 1981) that incorporate hydraulic consideration of gradient, roughness and critical bed shear stress. These threshold approaches may yield a better estimate of total channel width for braiding (predicting a wide and shallow channel) but not of active width. The effects of these contrasting approaches and predictions warrants further investigation in the context of the prediction of braided channel morphology.

In the laboratory data, the channel total wetted and active width parameters are readily measured. However, in the case of the field data, we have no direct information on the actual active width of

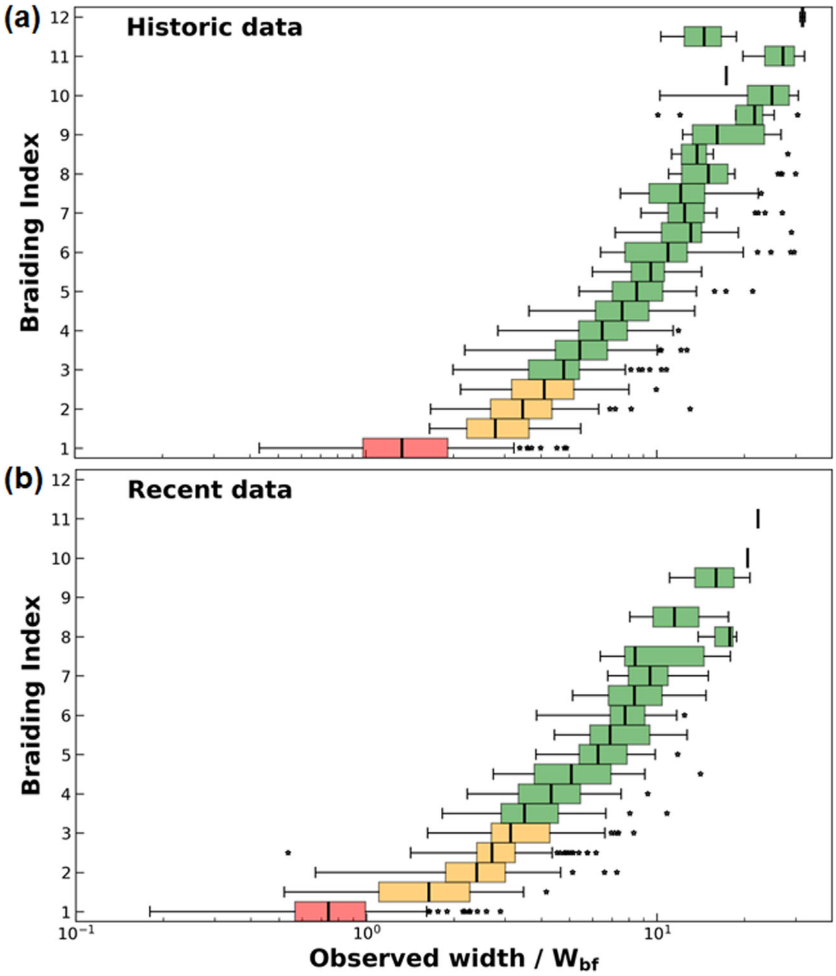

FIGURE 7 Relationship between braiding index and the ratio between observed width and predicted single-thread bankfull, for all the considered reaches. Boxplots are colour coded to represent the observed morphology (single thread = red, wandering = yellow and braiding = green).

these rivers and make the assumption that the wetted width is equivalent to the observed width of bare gravel assumed to be wet at channel-forming flows. For these reasons, it is reasonable to think of the field predictions as a general demonstration of the overall relationship and trends between regime and wetted width consistent with the trends in the laboratory data, rather than strictly precise results.

Bernard et al. (2026) analysed three field case studies of braided rivers, where repeated DEMs and flow regime data were available. The three cases are the Rees (Aotearoa New Zealand; Williams et al., 2015), the Sunwapta (Canada, Ashmore & Sauks, 2006; Ashmore et al., 2011) and the Tagliamento (Italy; Bernard et al., 2026; Capito, 2024). In all three cases, the single-thread bankfull widths estimated from Equation (1) are of the same order of magnitude as the active width and much smaller than the observed wetted width for a 2-year return interval discharge, as a proxy for channel-forming conditions. These data give some initial support from field data that regime width corresponds to active width and is much less than total channel width. Repeated topographic surveys, and the resulting DoDs, of braided rivers have become increasingly common due to advances in photogrammetry and UAV-based technologies (e.g., Bakker et al., 2019; Mancini et al., 2024). The growing availability of observations of morphological active width in braided rivers, combined with appropriate scaling of the time interval between surveys, has the potential to improve estimates of active width and, consequently, bedload flux.

The regime analysis provides a basis for understanding and predicting the effects of width reduction and channel confinement on channel pattern in terms relative width (channel width proportional to regime width) and, conversely, helps provide a basis for anticipating effects of widening braid belt for restoring braided river function. Experimentally, braiding only begins to occur when available flume width begins to exceed twice the regime width of the river, at which point there is sufficient space for bar deposition and emergence to begin the process of braid formation. In the context of our field case, regime approaches to river channel engineering and management have been used in Aotearoa New Zealand for many years. Various regime equations have been proposed (summarized by Christensen, 2023) and applied. One ‘rule of thumb’ has been that braiding occurs at corridor widths 2.5–3 times regime width. It is not clear how these regime width predictions relate to those from Parker et al. (2007), but our results provide some experimental and theoretical basis for this general rule of practice which needs further refinement and testing with more-thorough evaluation of regime width approaches to support river management and restoration projects.

While braided river occurrence and width appear to follow general empirical hydraulic geometry relationships (e.g., width increasing as a function of discharge or stream power) (Ashmore, 2022), it is clear that available width is also an important control on braiding to allow sufficient space for lateral instability and formation of multiple anabranches and bars across a braided river. Previous field observations on downstream changes between braiding, wandering and single-thread morphologies in mountain catchments highlighted the role of lateral confinement in controlling braiding occurrence (Croissant et al., 2019; Misset et al., 2020; Mueller & Pitlick, 2014). For a given stream power and particle size, this implies that a range of channel widths and braid intensity is possible, depending on available width, and it is not clear what the upper limit might be for given hydraulic conditions, but total width/regime width ratios are above 10 in the most-braided Canterbury rivers (Figures 4–7) and varies along river reaches with no significant changes in discharge or gradient depending on available space.

5 | CONCLUSIONS

The analysis of laboratory data in terms of wetted width, active width and flume width (i.e., lateral confinement) shows that the wetted width of gravel-bed braided rivers strongly depends on the available space and therefore is not controlled uniquely by the flow and sediment conditions. In contrast, the active width does not increase when more lateral space is available and can be estimated by single-thread bankfull width predictors, such as the one proposed by Parker et al. (2007). Moreover, data show that the wetted width of braided rivers is at least two to three times the active width, and therefore, considering that braiding is characterized by exposed sediment bars also at bankfull level, the corridor space able to sustain a braided morphology has to be at least three times the single-thread bankfull width estimated by the Parker et al. (2007) equation.

These observations have been further supported by the analysis of a large dataset of gravel-bed rivers in the Canterbury Plains, Aotearoa New Zealand. The measured width of more than 1000 reaches was normalized by the estimated single-thread bankfull width, resulting in significantly different ranges for braided (4 to 10), wandering (2 to 5) and single-thread (0.6 to 2) reaches.

These findings provide a consistent framework for quantifying the necessary space for river corridors, improving the management and restoration of gravel-bed braided rivers.

AUTHOR CONTRIBUTIONS

Walter Bertoldi: Conceptualization; funding acquisition; methodology; investigation; writing—original draft; writing—review and editing. **Peter Ashmore:** Conceptualization; methodology; investigation; writing—original draft; writing—review and editing. **Victoria Barlow:** Methodology; resources; writing—review and editing.

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DATA AVAILABILITY STATEMENT

Most data have been already used in previous publications, please refer to those for data availability. The unpublished UNITN dataset is available upon request from corresponding author.

ORCID

Walter Bertoldi https://orcid.org/0000-0003-1158-2379
Victoria Barlow https://orcid.org/0009-0007-4600-9835

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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