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Is in-stream macrophyte growth predictable and what are its impacts on channel-averaged flow characteristics?

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Understanding how the growth of aquatic vegetation impacts stage-discharge coupling is vital for river management planning. This study presents an annual record of monthly spatial distribution surveys of the in-stream macrophyte *Ranunculus penicillatus* coupled with channel form and flow velocity measurements, within a 50 m-long reach of a gravel-bed river. Whereas stage has varied by up to 0.4 m, there has been little change in channel form over the monitoring period (ongoing since 23/07/2014). Macrophyte growth continued from the start of the monitoring period until October 2014 when mean patch area was 6.74 m^2, and then decreased throughout a decay phase until January 2015 when mean patch area was 1.12 m^2. There was a 75.2% loss of macrophyte surface area between October 2014 and January 2015. The largest patches that remained in January 2015 continued to decay until February. Conversely, new macrophyte patches also began to recolonize the channel during this time. To our knowledge, this is the first evidence of a transition period during which aquatic vegetation is in both decay and recolonization phases simultaneously. In total 69% of patches present in January exhibited regrowth without further decay to form a base for recolonization. Therefore, the spatial distribution of macrophyte patches could be determined to be somewhat persistent. Despite this, due to several different growth factors, there are recognisable differences in both macrophyte patch shape and distribution when comparing data from July 2014 and July 2015, emphasising the unpredictability of macrophyte growth. The decay period of the *Ranunculus p.* coincided with seasonal high discharges in this catchment. Discharge remained high from January until March 2015, but then began to decrease, reflecting annual peaks in historical records for the study area. Large discharge variations were not matched by a large stage range. Displacement of water by vegetation growth maintained the stage height when discharge rates fell. Greater understanding of the relationship between discharge and growth is therefore necessary for determining appropriate reference conditions for river management planning. Results from this multi-season study will provide the base for future work in quantifying temporal changes to patch shape in addition to quantifying the organisation of patches within the channel.