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Effects on fish communities of Owen Creek bank stabilisation and habitat improvement works – Engineered Log Jams

Final Report

June 2015

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Cover photo: Bank stabilisation and habitat improvement site – post construction 2014, Inset – pre construction 2013, Owens Creek – Pioneer Catchment

Contents

Background

Pioneer Catchment Landcare Group had undertaken a bank stabilisation and habitat improvement project in Owens Creek, a tributary of Cattle Creek in the upper Pioneer Catchment (Figure 1). Works included bank restoration, the installation of a series of engineered log jams and riparian revegetation. Catchment Solutions was contracted to assess the effect of these works on the fish communities of the site. To assess changes in fish communities three rounds of sampling were conducted including, preconstruction 2013, post wetseason 2014 and post wetseason 2015. This report contains the study methodology, results, interpretation and discussion on the effects of the engineered log jam on fish communities of Owens Creek. Photos of site conditions taken at the time of each round of sampling are included in Appendix 1.

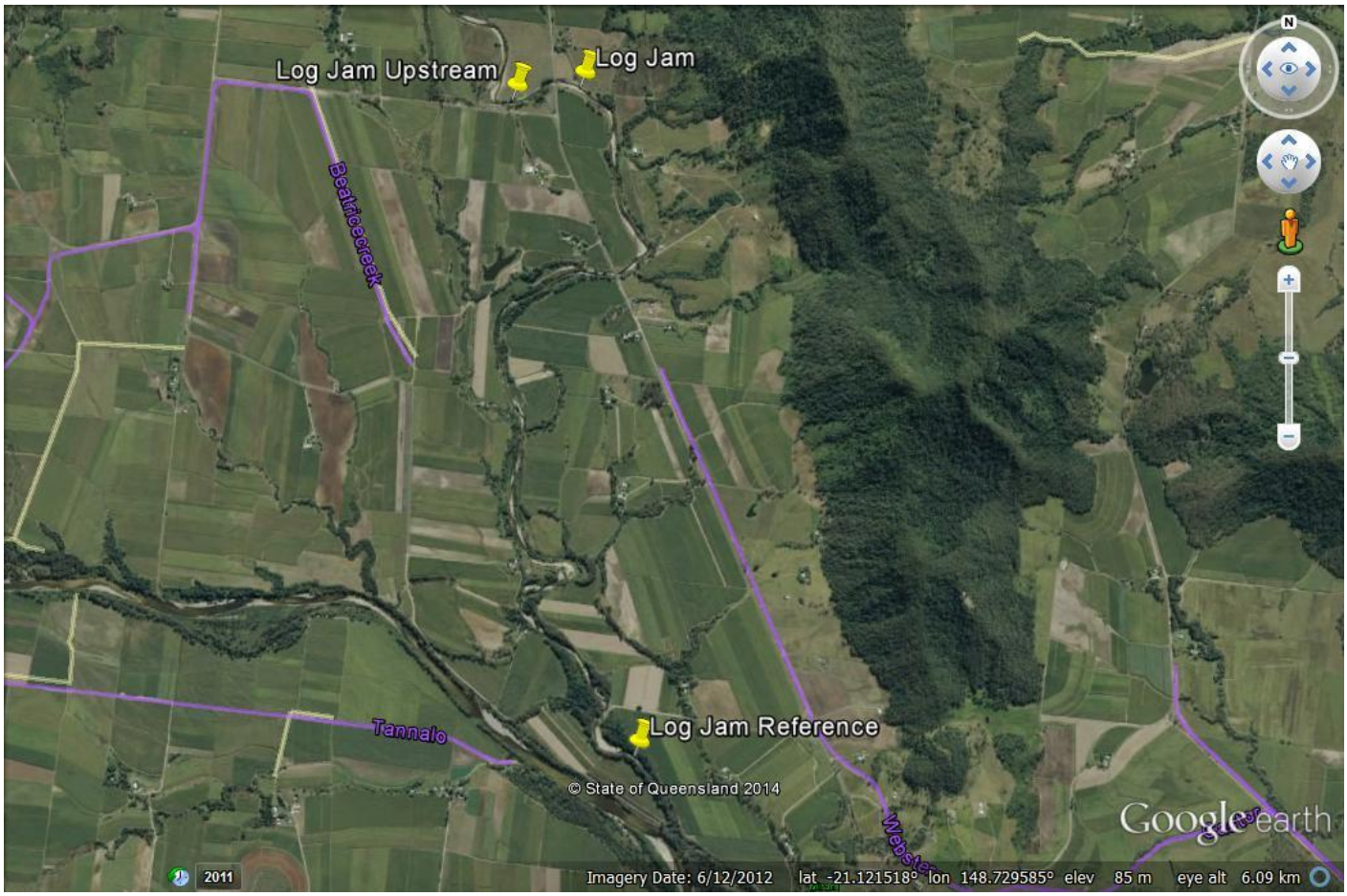

Figure 1. Owens Creek site locations sampled as part of the fish community assessment resulting from proposed bank stabilisation and habitat improvement works. Base image QLD Glob, Google Earth.

Methods

Site selection

Three sites were chosen for data collection for this study, the construction site as well as one site upstream and one site downstream (Figure 1). The downstream site (Logjam Reference) consists of a natural streambed that contains good riparian vegetation, pools, riffles and good levels of instream habitat complexity (Appendix 1). This site provided reference data to compare the other impacted sites against. Prior to construction, the logjam site was highly disturbed with considerable bankside erosion, very poor riparian vegetation, a single riffle zone that extended the entire length of the site and very low instream habitat complexity. Post construction the site incorporated a series of pools with large woody debris, each pool was separated by a riffle section (Appendix 1). The upstream site (Logjam US) has previously undergone improvement works that consisted of bank restoration (rock revetment wall) and the installation of instream rock structures (rip-raps) to create a series of pools and cascades. The site contains moderate riparian vegetation, a series of instream pools separated by rock cascades and moderate instream habitat complexity (Appendix 1).

Sampling

Fish community data was collected using a Smith-Root LR24 backpack electrofisher. Sampling protocol involved a series of 'shots' that consisted of altering power-on and power-off periods encompassing all instream habitat types present within the site. Power-on time was recorded to standardise results by Catch Per Unit Effort (CPUE). An operator used a sweeping motion as they moved through the pool while a netter followed behind collecting stunned fish. Fish were collected for identification and abundance records. Observation of uncaptured, positively identified fish were also recorded and included in abundance records. All fish were released immediately after processing back to the site of capture.

Water quality parameters including temperature, pH, dissolved oxygen and conductivity were measured using an Aqua Read AP-2000. Parameters were recorded from the main channel at each site during the period electrofishing surveys were being conducted. The water quality sampling method involved placing the probe into the water at a depth of 0.1 m. After readings had stabilised, values were recorded for each of the water quality parameters. Secchi depths were obtained by lowering a 200 mm secchi disk into the water column until the disk could no longer be seen. The disk was then raised until the contrast between the black and white portions was discernable and the depth value recorded. At sites where the secchi disc could be seen when on the bottom of the pool, secchi depth was recorded as greater than the pool depth. To account for localised variability, water quality readings and secchi depths were averaged from readings taken at three locations within each sample site.

Results

Species Diversity

A total of 14 species were recorded during the three rounds of sampling (Table 1). Diversity was greatest at the Log Jam Reference (LJR) site with 13 species recorded, while the Log Jam (LJ) and Log Jam Upstream (LJU) sites recorded 12 and 11 species respectively, diversity at LJR fluctuated between 10-12 species. A marked increase in species counts was observed at LJ over the course of the study, increasing from 5 species in round 1 to 11 species in round 3. Conversely a decrease was observed at LJU between round 1 and round 2 sampling events (Table 1), 7 species were recorded during both round 2 and round 3.

While several species were recorded at all three sites, purple-spot gudgeon and pacific blue eye were the only fish to be identified at all sites during each sample round. Flyspeckled hardyhead and eastern rainbow fish were also well represented, being absent from only one of the sites during one of the sample events. Site distribution of the remaining species varied between the rounds (Table 1).

Table 1. Species counts and distributions recorded during preconstruction sampling from three sites in Owens Creek, October 2014. * Gudgeon sp. may be *Hypseleotris sp1.* or *Hypseleotris compressa*

	Log Jam Reference			Log Jam			Log Jam Upstream			
Common Name	**Sep-13**	**Oct-14**	**Apr-15**	**Sep-13**	**Oct-14**	**Apr-15**	**Sep-13**	**Oct-14**	**Apr-15**	**Species Name**
Agassizis Glassfish	✓	✓	✓			✓	✓			*Ambassis agassizii*
Barred Grunter	✓	✓	✓							*Amniataba percoides*
Long-finned Eel	✓		✓			✓	✓	✓	✓	*Anguilla reinhardtii*
Flyspecked Hardyhead	✓	✓	✓	✓	✓	✓	✓	✓		*Craterocephalus stercusmuscarum*
Mouth Almighty	✓	✓	✓			✓			✓	*Glossamia aprion*
Sooty Grunter	✓	✓	✓		✓	✓	✓	✓	✓	*Hephaestis fuliginosous*
Gudgeon sp.*			✓			✓	✓		✓	*Hypseleotris sp.*
Spangled Perch	✓	✓	✓		✓	✓	✓	✓		*Leiopotherapon unicolor*
Eastern Rainbowfish	✓	✓	✓	✓	✓	✓	✓		✓	*Melanotaenia splendida splendida*
Purple-spot Gudgeon	✓	✓	✓	✓	✓	✓	✓	✓	✓	*Mogurnda adspersa*
Hyrtl's catfish	✓									*Neosilurus hyrtlii*
One-gilled eel						✓				*Ophisternon bengalense*
Pacific Blue-eye	✓	✓	✓	✓	✓	✓	✓	✓	✓	*Pseudomugil signifera*
Eel-tailed Catfish	✓	✓	✓	✓	✓		✓	✓		*Tandanus tandanus*
Sub Total	12	10	12	5	7	11	10	7	7	
Total	13			12			11			14

Abundance

Log Jam Reference (LJR)

Pacific blue-eye and eastern rainbowfish were the two most abundant species recoded from LJR across the three rounds of sampling (Figure 2). Catch rates of these species varied considerably between rounds with both species recording higher abundance during round 1 compared with the other two rounds (Figure 2). Comparatively, the remaining species were present in considerably lower abundance (Figure 2).

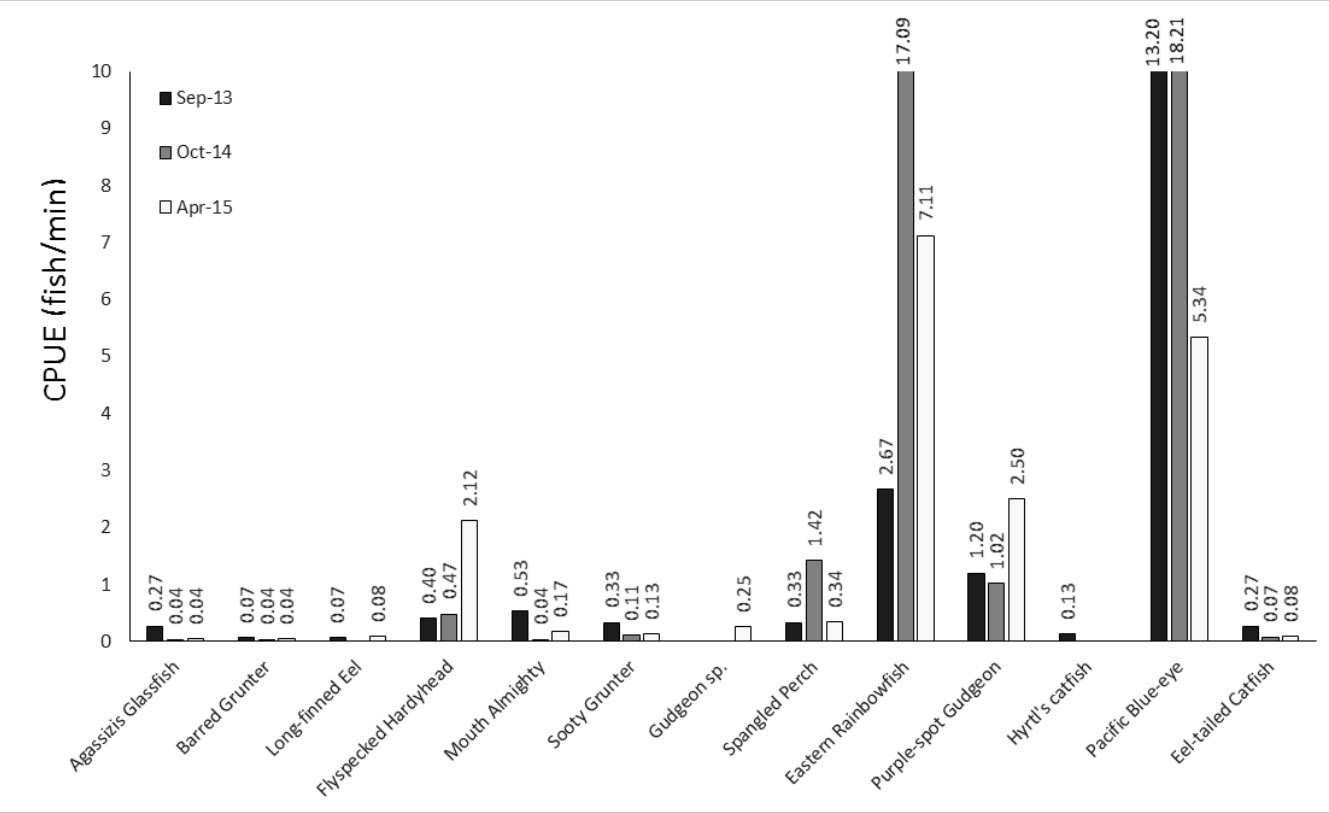

Figure 2. Catch Per Unit Effort (fish/min) recorded during three rounds of sampling at the Log Jam Reference site, Owens Creek. Sampling ocured between September 2013 and April 2015

Log Jam (LJ)

Four species (flyspecked hardyhead, eastern rainbowfish, purple-spot gudgeon and pacific blue-eye were well represented in catches at LJ (Figure 3). Catch rates of these species varied between rounds with no discernable patterns observed. Abundance of Pacific blue-eye increased substantially from round 1 to round 2, then fell in round 3. Flyspecked hardyhead and eastern rainbowfish displayed the opposite pattern though to a lesser degree. CPUE of purple-spot gudgeon in round 3 was more than triple that of the previous rounds (Figure 3). The remaining species recorded from this site were present in low abundance (Figure 3).

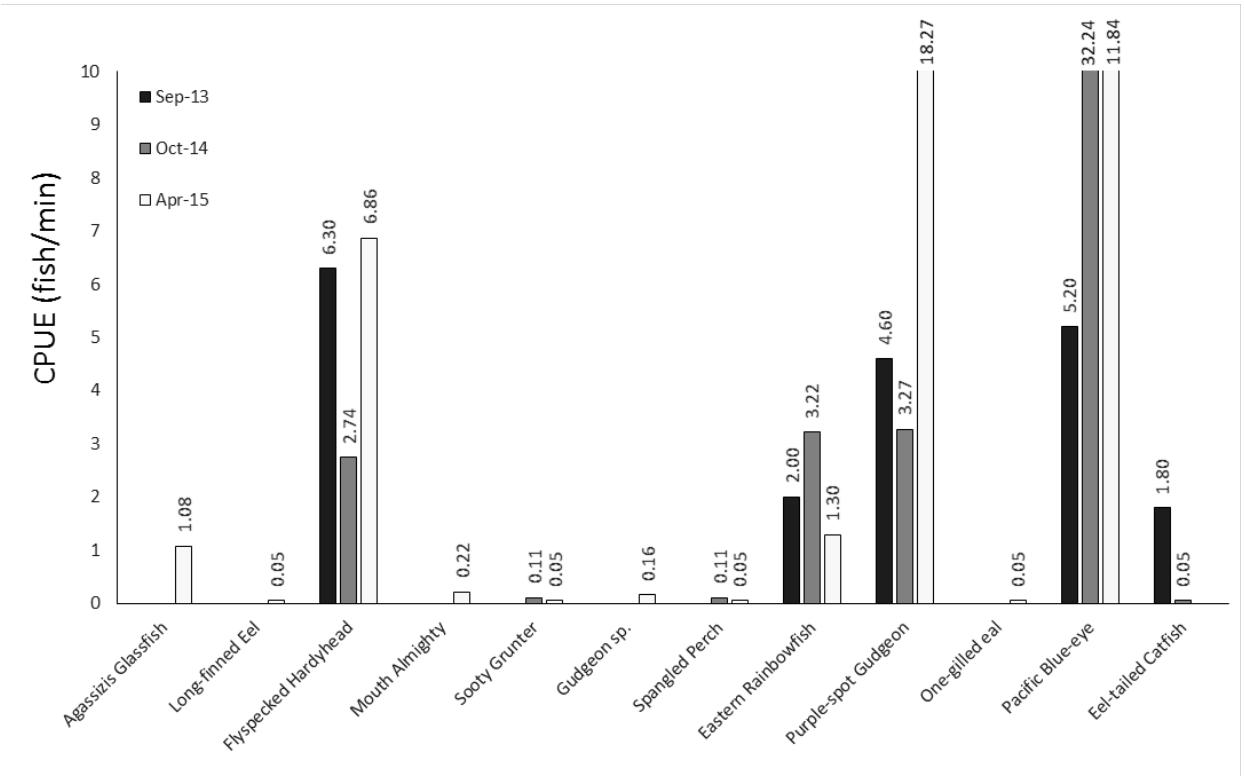

Figure 3. Catch Per Unit Effort (fish/min) recorded during three rounds of sampling at the Log Jam site, Owens Creek. Sampling ocured between September 2013 and April 2015

Log Jam Upstream (LJU)

Purple-spot gudgeon and pacific blue-eye were well represented in catches across the three rounds (Figure 4). Purple-spot gudgeon were most abundant in round one and pacific blue-eye were most abundant in rounds 2 and 3. Three species, fly-specked hardy head, spangled perch and eastern rainbowfish, were present in moderate abundance, however were absent from at least one round of sampling (Figure 4). Although present in low abundance, long-finned eel, sooty grunter and gudgeon sp. were present during each round of sampling. The remaining species were recorded in low abundance and absent from at least one round of sampling.

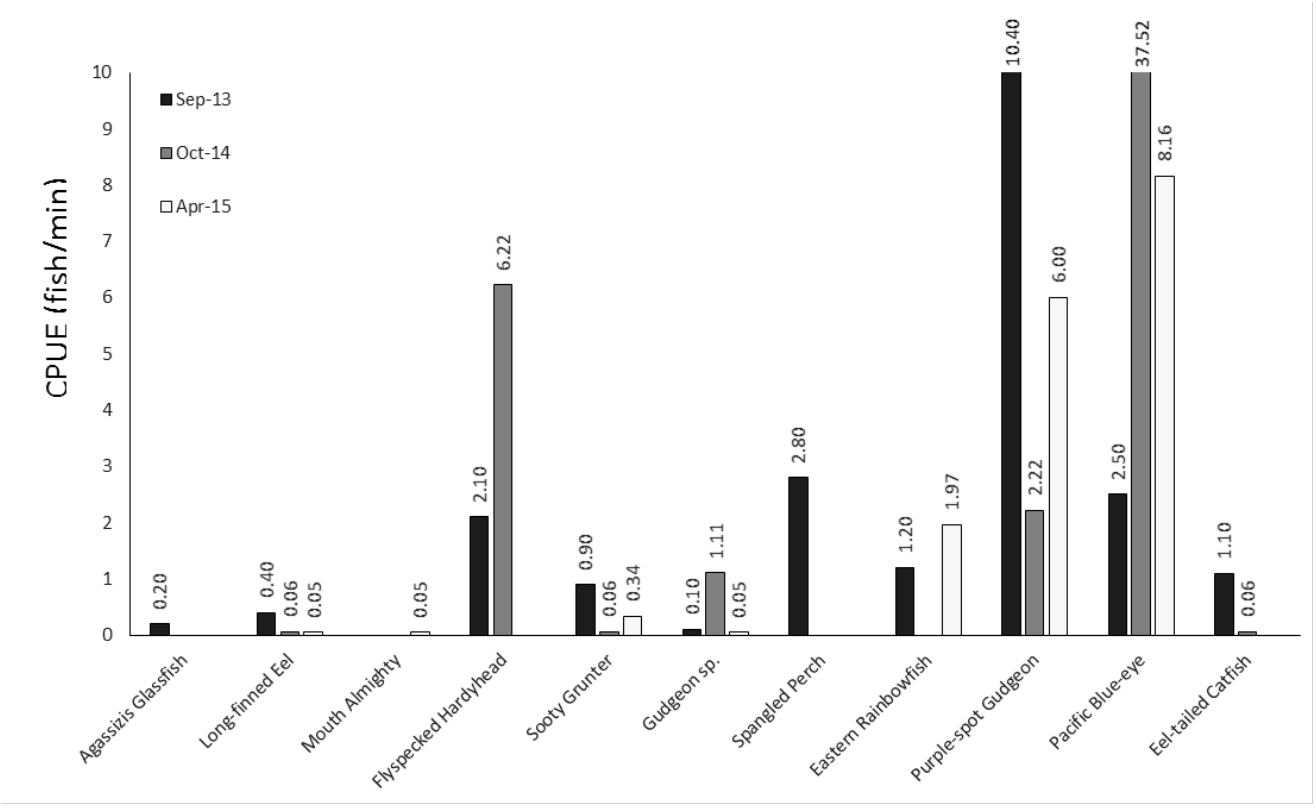

Figure 4. Catch Per Unit Effort (fish/min) recorded during three rounds of sampling at the Log Jam Upstream site, Owens Creek. Sampling ocured between September 2013 and April 2015

Water Quality

Review of the field notes revealed a fault in the water quality meter during sampling in round 1, resulting in the data being omitted from the report. Water quality parameters recorded during rounds 2 and 3 (Table 2) were typical of habitat, time of day and season and were all within acceptable levels for healthy fish communities.

Table 2. Water quality readings recorded during preconstruction sampling from three sites in Owens Creek, October 2014

Site ID	Round	Temperature °C	pH	EC us/cm	DO %sat	Secchi depth m
Log Jam	**1**	-	-	-	-	-
Log Jam	**2**	29.0	6.9	25.7	116.7	>1.5
Log Jam	**3**	33.6	7.2	10.3	132.2	1.5
Log Jam Reference	**1**	-	-	-	-	-
Log Jam Reference	**2**	26.9	7.0	81.0	87.5	>1.0
Log Jam Reference	**3**	26.6	7.2	62.7	86.9	1.0
Log Jam Upstream	**1**	-	-	-	-	-
Log Jam Upstream	**2**	28.2	7.0	5.3	123.9	1.7
Log Jam Upstream	**3**	29.8	7.5	59.3	119.0	-

Discussion

The increase in species diversity within the reach of the Log Jam location was an encouraging result. The additional species recorded over the course of sampling were previously recorded from the Log Jam Upstream site and/or the downstream Log Jam Reference site. Captures of these fish at the Log Jam site provide evidence of increased habitat utilisation. Studies investigating changes in fish communities after the installation of similar engineered log jams also recorded increases in species diversity (Nagayama & Nakamura, 2010; Brooks et al. 2004; Brooks et al 2001). In these studies it was suggested that increased habitat complexity due to the geomorphological changes in the stream bed as well as the reintroduction of large woody debris contributed to the increased utilisation of the reach by fish species present in the system. Interestingly the work carried out by Brooks et al. (2006) reported no further increase in species richness after four years of the structure being installed. Further monitoring would be required to determine if a similar plateau in species richness would occur at the Owens Creek site.

Two predatory species, sooty grunter and spangled perch, recorded at the Log Jam site in round 2 and round 3 were not present within the reach during the preconstruction sampling in round 1. Predators in general prefer habitats with increased complexity and adequate food availability (Pusey et al. 2004). The presence of these predators at the Log Jam site further suggest that the changes in stream geomorphology are improving habitat characteristics within the reach.

A study conducted by Brooks et al. (2006) recorded increased abundance for several species after the installation of engineered log jams. Abundance records at the Log Jam site were variable with some species increasing in abundance after construction in round 2 then dropping in round 3, while other species recorded their highest abundance during preconstruction sampling in round 1. The reduced abundance of some species after the installation of the log jams may indicate the subsequent change in habitats may not be preferential for all species. Similar variations in abundance between rounds were also observed at the Log Jam Reference site and the Log Jam Upstream site. Both the LJR and LJU sites can be considered stable habitats i.e. habitat characteristics remain relatively similar over consecutive seasons, suggesting that factors besides habitat may have influenced the fish abundance. Other factors which may influence fish abundance include: seasonal variation and water quality. Spot water quality readings that were taken at the time of sampling were within adequate levels for healthy fish communities. Many native freshwater fish in Northern Australia have adapted to variations in seasonal conditions with some being better suited to a particular condition than others (Pusey et al. 2004). During the time of the study the upper Pioneer catchment received below average rainfall (DNR rainfall data – accessed June 2015), which resulted in reduced flow in the streams. It is possible that some species were better adapted to these conditions and were able to continue breeding, while others may have experience reduced recruitment, resulting in the variations in abundance observed.

Conclusion

The increase in species diversity recorded after the installation of the engineered log jams is an indication that habitat improvement work such as this is of benefit to the fish communities within the system. As the geomorphology and riparian condition of the site continues increase in complexity it is expected that further improvements to fish communities will occur. Similar studies suggest that once the site stabilises, so too will habitat utilisation, resulting in a plateau of species diversity. The point at which this may occur would require ongoing monitoring at the site. Variations in fish abundance observed at all sites sampled over the course of this study indicate that factors other than habitat may be having an effect on fish communities within the system. This suggests that species diversity may be a better indicator when assessing changes to fish communities than species abundance.

Acknowledgements

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Appendix 1 – Site photos

Log Jam Reference



Round 1 – September 2013



Round 2 – October 2014



Round 3 – April 2015

Log Jam Site



Round 1 – September 2013



Round 2 – October 2014



Log Jam Upstream Site



Round 1 – September 2013



Round 2 – October 2014



Round 3 – April 2015

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