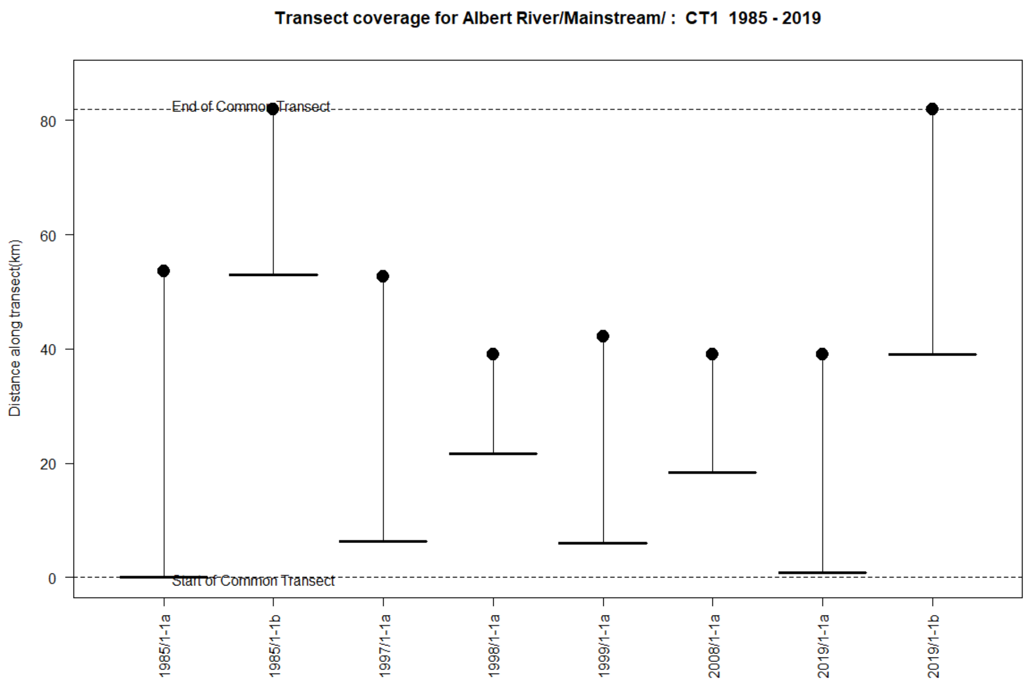
Appendix 5: Details of common transects analysis methods

1. The detailed survey results in Appendix 1 set out survey coverage over time for the subset of rivers amenable to and the different sets of common transects (labelled CT1, CT2 etc) that can be defined. Interpretation of those analyses is illustrated below with reference to the Albert River.

Stage 1 – common transect analysis

2. Figure 1 illustrates the start (solid lines) and end (dots) of mainstream transects over time. The x-axis shows a survey code and illustrates how, for example, in 1985 the 81km of navigable mainstream was surveyed over two nights (coded 1985/1-1a and 1985/1-1b), one survey covering 0-55km and the second from 55-81km. This figure also shows that only the 2019 survey covered the same transect, again over two nights. In other years only shorter transects were covered.

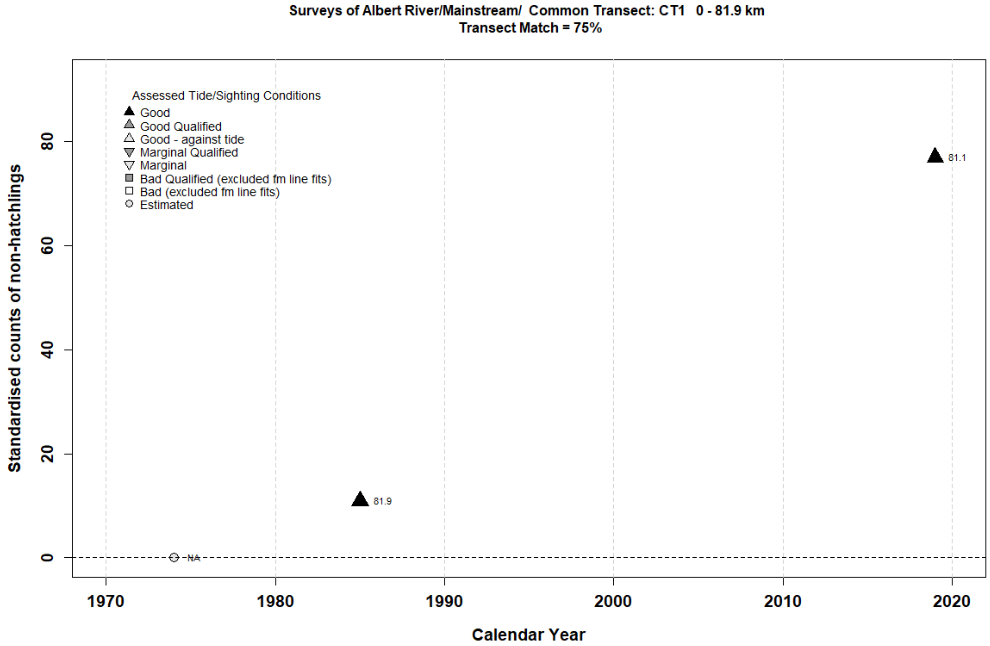
Figure 1. Start and end of mainstream transects on the Albert River over time.



3. To compare results over the longest transect possible, only two data points are available, but they cover the whole navigable mainstream and show unequivocal signs of a considerable increase in numbers (Figure 2). The data point for 1974 is an assumed residual count at the time of protection at a guesstimated density of 1 non-hatchling per 10km.

4. Note that Figure 2 identifies a 'Transect Match' parameter set at 75%. This parameter permits any transect that covers 75% or more of the common transect distance to be included, but excludes those covering less than 75%. The 75% threshold was adopted as a reasonable measure to avoid losing perfectly good data from transects that fell a little short of the full transect distance, while not risking "chalk-and-cheese" comparisons between very long and very short transects.

Figure 2. Common transect analysis of surveys conducted in 1985 and 2019. The point from 1974 is a guesstimate.



5. To compare more years, a shorter transect can be selected that captures 1997 and 1998 survey results (Figures 3, 4), giving more insight into the shape of the population growth curve but covering less than half the previous transect distance.

Figure 3. Start and end of mainstream transects on the Albert River showing the common transects for 1985, 1997, 1999 and 2019.

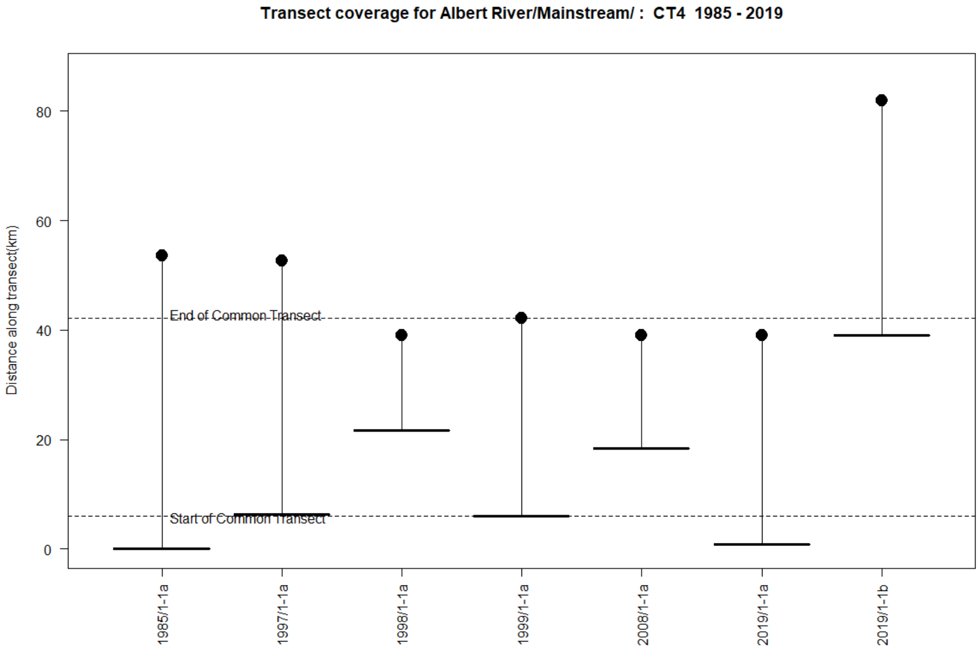
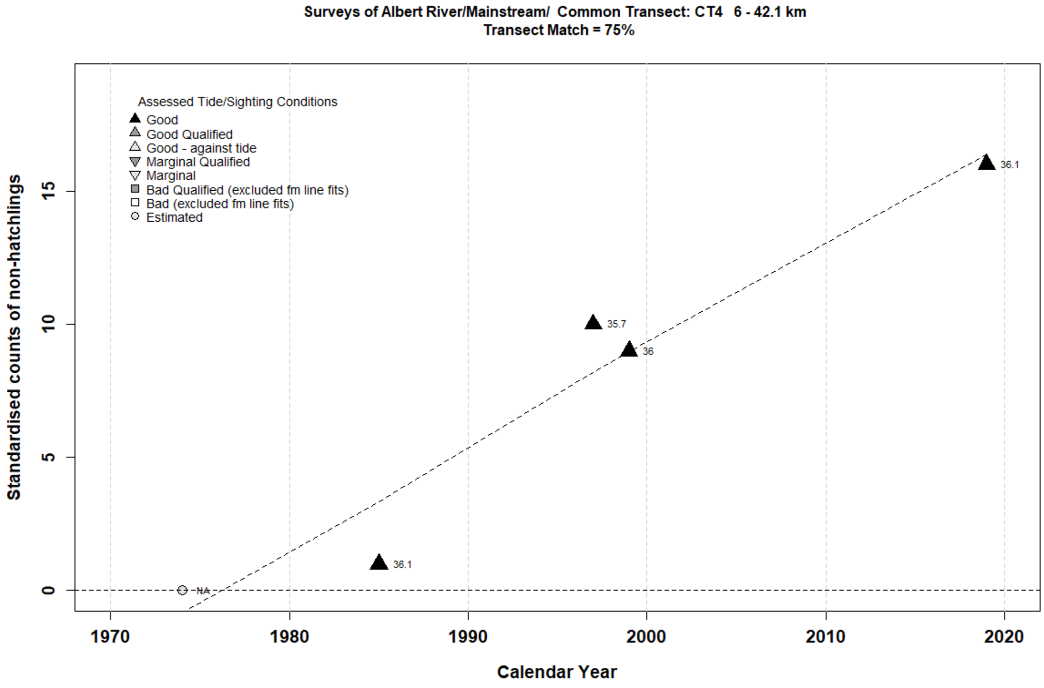


Figure 4. Survey results for conducted in 1985, 1997, 1998, and 2019.



6. Going a step further gives more points on the population trajectory, but a common transect distance of only one quarter the total surveyable distance (Figure 5). We also get some more insight into the variability between counts in consecutive years (Figure 6).

Figure 5. Start and end of mainstream transects on the Albert River over time showing common transects for 1985, 1997, 1998, 1999, 2009, and 2019.

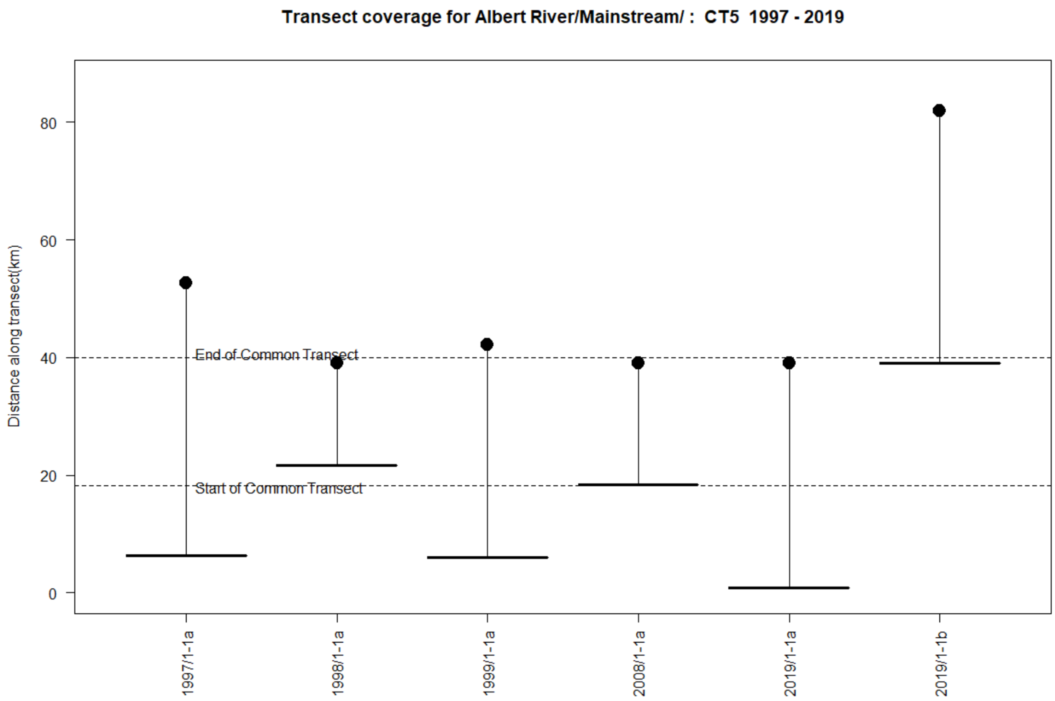
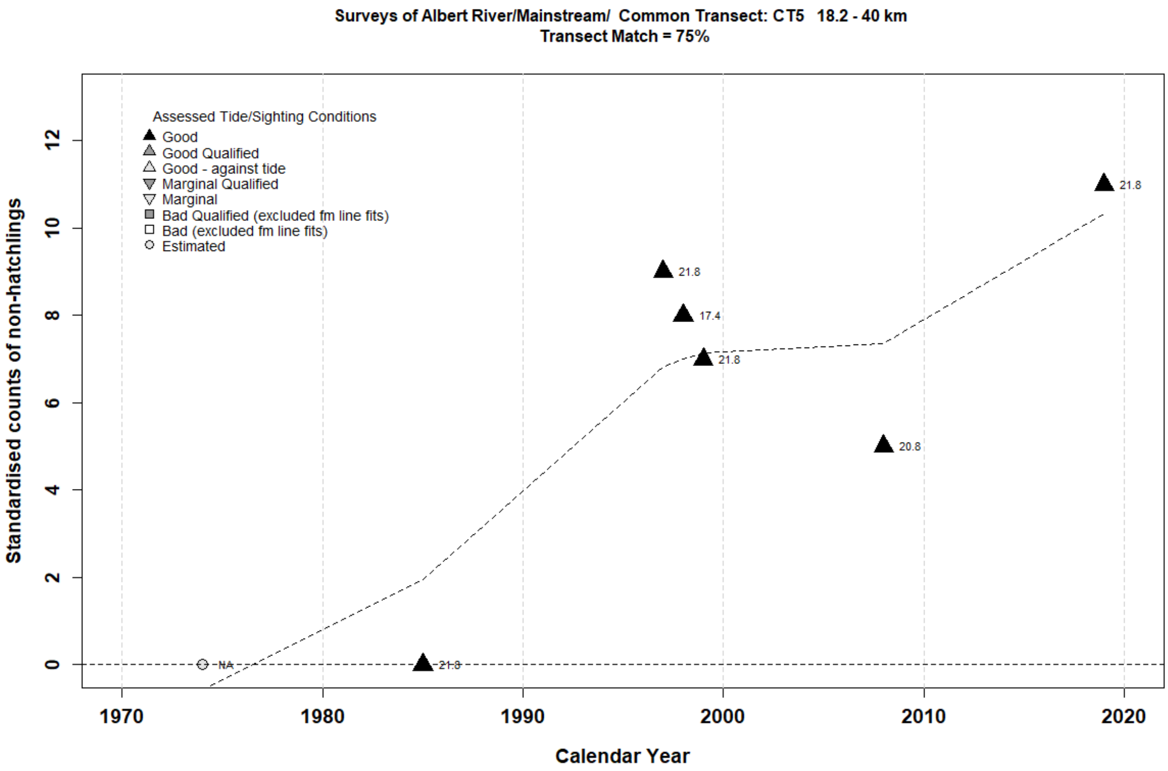


Figure 6. Common transect results for surveys conducted in 1985, 1997, 1998, 1999, 2009, and 2019.



7. Note that the population trajectory graphs above have a 'Transect Match' parameter in the title, set here at 75%. This parameter permits any transect that covers 75% or more of the common transect distance (21.8km in this example) to be included, but excludes those covering less than 75%. Thus, the 1998 survey of 17.8km (82% coverage) is included, even though it falls short of the full common transect distance.

8. The 75% matching chosen for these comparisons was based on the need to:

   8.1. set some threshold less than 100% to ensure that a transect 49.9 km long was not excluded from a common transect of 50km, which would clearly make no sense at all; and

   8.2. at the same time, ensure that transects falling well short of the common transect distance were excluded, so as to ensure like-for-like comparisons.

   Coverage of at least three-quarters of the common transect was considered likely to give a good representative estimate of density for the transect as a whole, based on extensive examination of the data and transects in the database. It was not considered worthwhile to do comparative tests of different thresholds given the many other sourcs of uncertainty in the data.

9. Note also that on the Y-axis the standardised count of non-hatchlings reduces as the common transect distance decreases. That arises because the count is simply the total NH count expected had surveyed the average transect distance every year. Graphing counts rather than density has several advantages for our purposes:

   9.1. It shows directly the number of crocodiles we would expect to have encountered – i.e. fewer sightings in shorter transects.

9.2. The graph precisely replicates a plot of relative density over time – but relative density can be misinterpreted when comparing a river system only a few km long with one extending over scores or hundreds of km.

9.3. The graph lends itself to the illustration of error bars around the data points based on a negative binomial distribution and appropriate value of theta (illustrated in Taplin, 2017). These have been omitted here for clarity.

10. The Albert River has several tributaries, but only its Saltwater Arm has been surveyed sufficiently to allow cross-year comparison. Figures 7 and 8 show the one exploitable common transect on the Saltwater Arm and its population trajectory, which is similar to that of the mainstream.

Figure 7. Start and end of mainstream and Saltwater Arm transects on the Albert River over time.

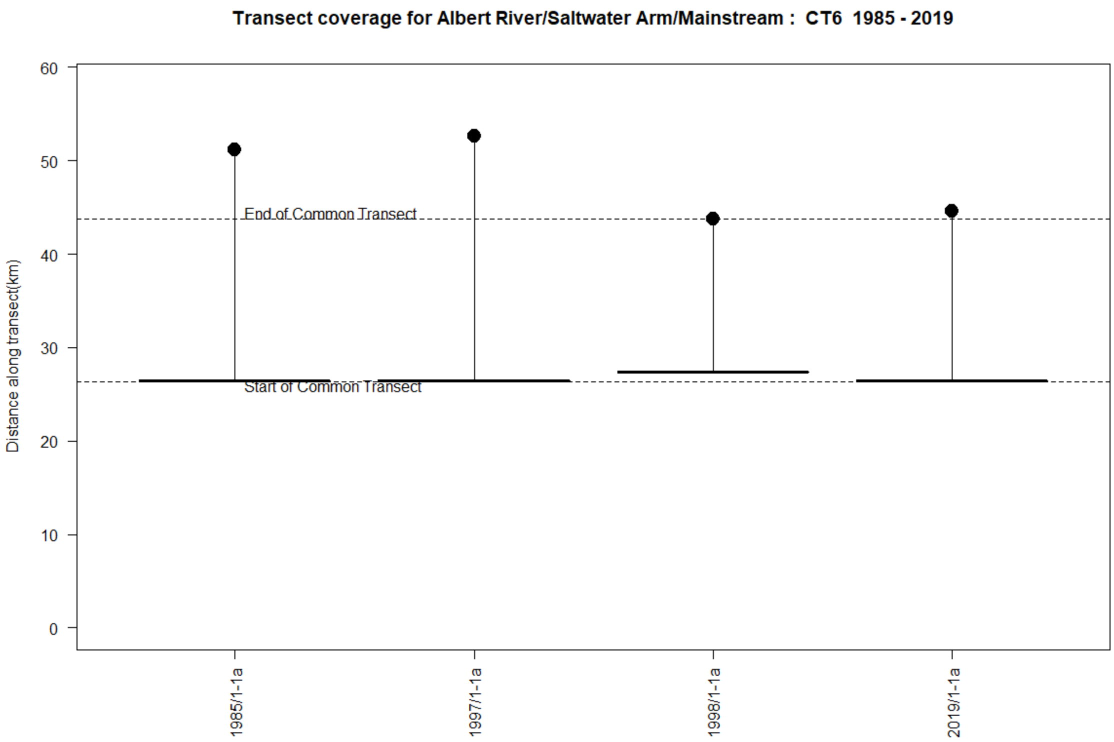
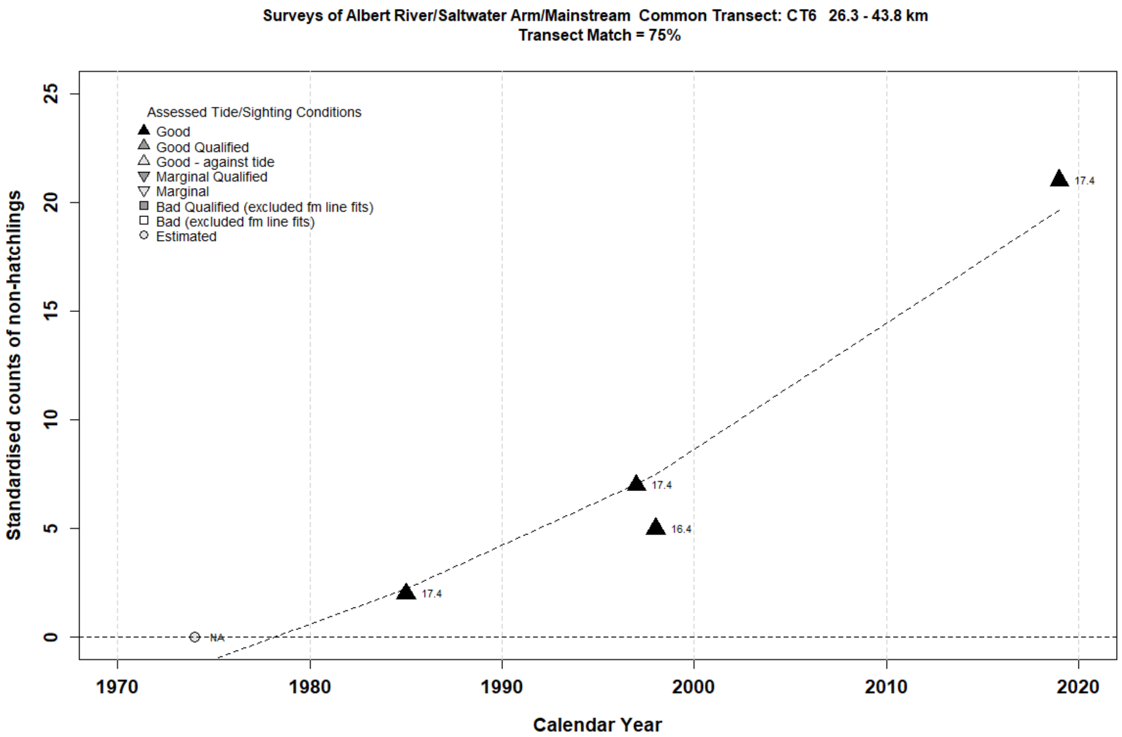


Figure 8. Surveys conducted on the mainstream of the Albert River's Saltwater Arm in 1985, 1997/1998, 2009, and 2019. The point from 1974 is estimated.



Stage 2 - combined common transect analysis

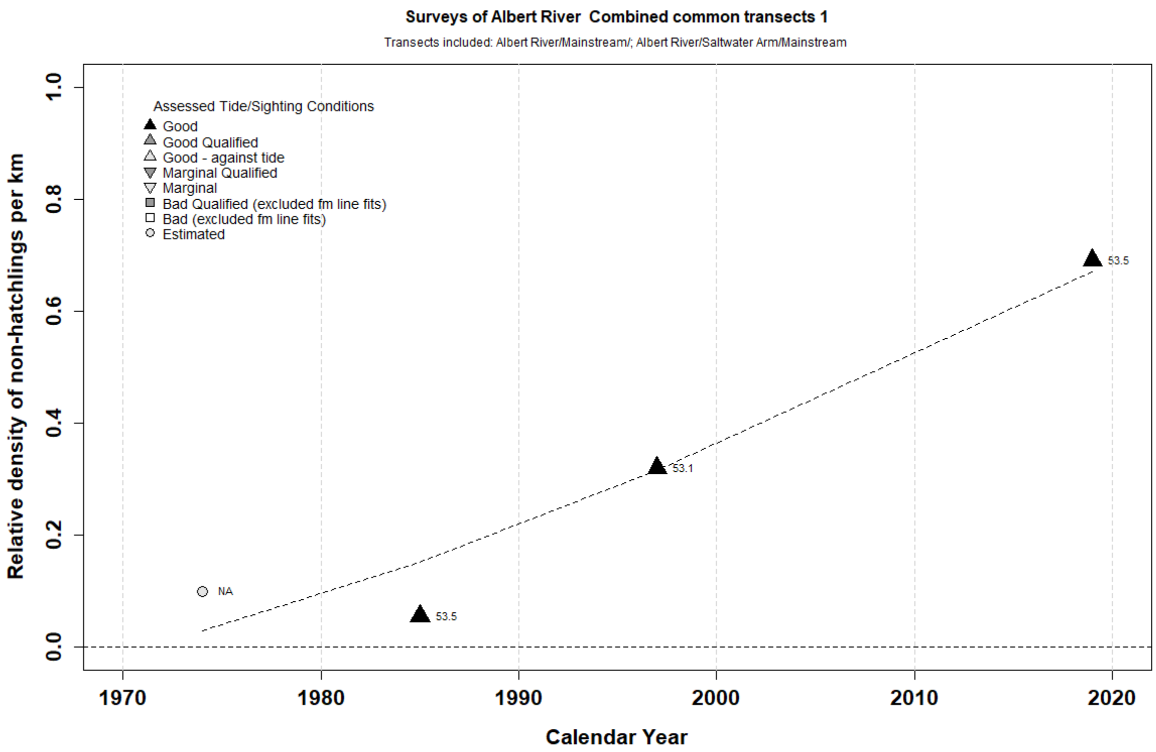
11. To examine the river system as a whole, combine common transects for both the Mainstream and Saltwater Arm have to be combined. This, once again, tends to reduce the number of years for comparable coverage of both arms is available, but increases coverage of the system as a whole (Figure 9). In this case, a combination of CT2 (covering 0 - 40km on the mainstream – refer Appendix 1) and CT6 (covering 26.3 – 46.8km on Saltwater Arm – refer Appendix 1) appears optimal. The combined coverage is plotted in terms of relative density of non-hatchlings per km, to provide an alternative view of the same data. The pertinent data for the combined common transects is in Table 1.

12. The combined common transect shows a 17-fold increase in counts since 1985 and also some evidence that the guesstimate of just a handful of sightable crocodiles in this system in 1974 is perhaps not far off the mark.

Table 1. The combined common transect estimates for the Albert River.

Survey	Year	Actual km	Standardised km	Count NH	Standardised Count NH	NH Density (km)
1974/1	1974	NA	53.1	5	5	0.10
1985/1-1	1985	53.5	53.1	3	3	0.06
1997/1-1	1997	53.1	53.1	17	17	0.32
2019/1-1	2019	53.5	53.1	37	37	0.69

Fig 9. Surveys of the combined common transect on the Albert River, encompassing the mainstream and the Saltwater Arm.



13. This relatively simple example illustrates the process used to derive like-for-like transects for comparisons of population trajectories. The process is similar but more complex for bigger and more extensively branched river systems like Port Musgrave and the Escape River/Jackey Jackey Creek complex. To obtain common transects across years for Port Musgrave as a whole, we have to combine common transects for each of its three major systems (Wenlock River, Ducie River, and Namaleta Creek) and then, once again, combine the common transects for these three systems into a single one. That process is set out for Port Musgrave and all other amenable systems in Appendix 1.