

## **List of MAJOR changes, bug fixes, and other improvements to AquaTracker from v2.2 to v2.4**

- 1) Prompts user if last data file analyzed should be loaded upon startup each time the program runs
- 2) Map is refreshed after water color is "picked"
- 3) After georeferencing map is refreshed
- 4) Accepts decimal coordinates for increased precision of map georeferencing
- 5) Increased "excursions" for excursion analysis from 1k to 5k
- 6) Fixed a couple of windows that didn't respond to CANCEL
- 7) **Refactored the GROUP creation function so that when receivers groups are created, no bugs occur. There was a persistent bug that was related to a problem with the way groups were implemented internally. The bug caused some problems with certain user actions.**
- 8) Fixed Navigation String window bug which caused the wrong segment to be highlighted
- 9) **Bug was introduced in version 2.0 and later in which the last track segment was not displayed properly sometimes.**
- 10) Added random walks
- 11) Now shows distance calculated from random walks and shoreline/fish corridors.
- 12) If a receiver is landlocked, random walk / land avoidance is not performed for that receiver pair. This is to prevent the LA algorithm from crashing or halting.
- 13) **Changed "Invisible" to "Exclude" and "Visible" is to "Include" to avoid user confusion**
- 14) Added code to ensure that if a blank canvas is selected, auto-scale is always asked...
- 15) Added code so that zoom can work with Random Walks
- 16) Expanded Zoomed mode compatibility internally. Zoom is now available for any drawing action performed in the canvas.
- 17) Also now you can move a receiver while on zoom mode and also can draw or perform land avoidance while zoomed

- 18) Limited value of "p" in Minkowski's distance because any  $p < 1$  yields a non-metric space
- 19) Per reviewer request, I added "Ignore All" option when encountering an error in the imported file**
- 20) Now program asks if MC-analysis should include all "excluded" receivers.
- 21) Fixed random walk issues with grouped receivers
- 22) Fixed text box for date not showing the whole date when "Animate All" was used
- 23) Fixed bug in which residence data did not show up when switching fish tracks
- 24) Detection scatter plot range limit changed from 3 years to 10 years. Eliminated error that caused program to crash if date range was exceeded**
- 25) Added native format support. New format is called AQN
- 26) Fixed bug related to some export functions in which data for fish #0 (First fish loaded) was not getting exported**
- 27) Overlap analysis throws exception when too many overlaps ( $>>300?$ ). I changed the limit to 5,000 for now.
- 28) Refactored code to deal with a small bug related to receiver groups (only some of the receiver-based analysis, such as Fish Groups, Density Detection, etc. were affected...)
- 29) Changed the way grouped receivers are shown when trying to include/exclude them from analysis. This was related to an annoyance when attempting to exclude/include grouped receivers, in which a window pop-up letting user know that the receivers that are part of a group are not visible. Now that only group name shows, I was able to eliminate this annoying window...
- 30) Fixed a bug in selecting/deselection of groups for analysis
- 31) Now the float window controls are disabled when selecting an excluded track. Also the message "Track Is Not Visible" now moved to main canvas and changed to "Track Excluded".

- 32) Fixed scroll bar for Excursion window so it scales with data size...
- 33) Revised the algorithm for Excursions so that now the algorithm outputs something that makes a lot more sense in terms of what I have defined in the program elsewhere as a residence. The new rule is as follows:
  - If Time between detections is larger than the Excursion Threshold and the fish has had at least one "residence" event, it counts the excursion and adds it to the total
  - The excursion ends when the fish comes back to the receiver
  - If the time between detections is smaller than the Residence Threshold, then a residence event occurs and the residence time count is incremented
  - Excursions of fish that have not "resided" in the receiver, will not count.
  - Thus, now the column "PREV RESIDENCE" always reads something...

The algorithm had a couple of issues which I fixed. Wouldn't say they are bugs, but just really a matter of a different interpretation... (In the previous version, residence where all counted regardless of how long)...

- 34) Added a warning in case user decides to use the same number for Residence and Excursion Thresholds... Or if the residence is >> than the excursion TH
- 35) Added a tab order and now allow user to use ENTER as OK for land-avoidance parameters
- 36) Added "persistence" parameter to land avoidance for random walks
- 37) **Fixed a bug in the geo-tag that was returning the percentage with the wrong decimal point (e.g. 88.88% was shown as 8888.89%)**
- 38) Enabled purge of singletons. Singletons now become "invalid" stamps internally...
- 39) **Fixed bug: Ping density not calculated at all.**
- 40) Added new heat-maps using different color gradients, including the popular green to yellow to red.
- 41) **Enabled the show stamps radial button which was non-functional in previous versions. When selected, it**

**shows a verbose description of each stamp in the fish track, including number of times detected at site, time detected, etc.**

- 42) Fixed a small annoyance: when the data file did not had a column for "release site" or "group", it showed a blank checkbox in the exclude/include track window
- 43) Disabled all mouse-over and mouse-button functions in canvas when an excluded track is selected
- 44) Fixed more AQN-format compatibility issues.
- 45) Fixed a small annoyance: "Track Excluded" was still shown even after selecting to make your own reference track.
- 46) Added auto-detection of land-locked receivers. Should now enhance the speed and reliability of all land-avoidance algorithms... Defaults to non-land avoidance if receiver is land-locked...**
- 47) Fixed minor bug involving overlap detection. If overlap had occurred at midnight during a date transition, it didn't count it as overlap. Only same-day overlaps were counted...
- 48) Added error trap to overlap receivers to make sure no unhandled exceptions occur during overlap analysis due too many overlaps
- 49) Also, increase the max number of receiver pairs for overlap analysis that can be analyzed from 300 to 1,000 pairs. Total possible pairs is  $(n-1)(n)$ , so this is not a lot but it will probably work for most arrays.
- 50) Reference track: Fixed a couple of user interaction issues... Most notable problem was that the button didn't work when selecting a reference track instead of defining it by drawing it on the map...
- 51) Markov chains were not displaying actual chain generated**
- 52) Corrected an issue with this version (may not have been in previous releases) in which the diel pattern of detections for groups was not properly calculated (showed only one detection).
- 53) Added a verbose description of what is being calculated on the diel histogram window's title (what fish, what receiver, etc.)

- 54) Added trichromatic color scale. Green->Yellow->Red; Blue to purple; two-color;
- 55) Added highlighting to singleton and fixed window so verbose description is more intuitive...
- 56) User can now select a singleton and show it in the canvas as well as delete it...
- 57) Added a warning window if a track changes after singleton deletion
- 58) Re-did the interface for the Color Scale window.
- 59) Changed layout of FILE menu
- 60) Changed layout of COPY menu
- 61) Enabled ctrl-c on main canvas (to copy canvas image via shortcut)
- 62) Fixed issues with land-avoidance when working under zoom
- 63) Eliminated incorrect base date when IGNORE date was used
- 64) Auto-Refresh canvas after selecting a land-avoidance option
- 65) MAJOR changes to the GROUP window (to group receivers), including internal changes to code to make it so that CANCEL works in the window!
- 66) In Receiver Information Window, added Exclude checkbox to make receivers excluded/included right at this window instead of having to go to the menu
- 67) Receiver Information Window now allows for wrapping around Receiver list on both directions (get to 1, then wrap to the last receiver or get to the last receiver and wrap around to 1)
- 68) Zooming issue with map on Receiver Information Window which was NOT scaling the coordinates. I choose to make the map in the Receiver Information Window zoomable.
- 69) Now have to fix some compatibility issues I have created with the new zooming and grouping... Tons of stepping thru the code in a couple of different functions to ensure compatibility
- 70) Changed the highlight effect for the colorbin to make it more obvious that the color is being highlighted

(now uses ORing with the HIGHLIGHT color fill the bin and give it a shading effect)

- 71) A couple of changes to the way autogrouping works (overlap detection)... Now autogroups, then shows users groups, CANCEL doesn't not cancel autogroups (it never did)...
- 72) Fixed a minor issue in which if a receiver group existed and a receiver was added to a group, it would nest the group into it, now such an action is internally invalid so that a receiver can only be part of ONE group
- 73) Added "Groups" to the RECEIVER menu. I think it makes sense there.
- 74) Fixed bug related to not updating the diel histogram when different tracks are selected if the RESIDENCE option button was selected on the Actions window
- 75) This last fix also changed the way residence is displayed; now show tracks as well... (Before tracks were not shown when residence time option was selected on the Actions window)
- 76) **Fixed bug: Was going back to default residency threshold on the InputBox for it even after successfully changing it.**
- 77) Fixed problem relating to detection scatter plot persistently showing the message "Analyzing receiver and fish" even after analysis was completed...
- 78) **Big error: Last fish in fishdatabase does not show on ComboBox list. There was a -2 where it should be a -1, probably I changed something internally and then forgot I had added that fix in the code? Unknown which version had this issue, but most likely only the latest non-official release (2.3).**
- 79) Further work on making AQN internally compatible... Most problems related to issues regarding how Detection\_TTL is used throughout the program. Bad choice of how the whole thing is implemented... Needing a do-over...
- 80) Similarly, solved some compatibility issues with Receiver Groups and AQN files...

- 81) New feature: Added stamp verbose description (was a non-working option before on the Action Window radial option buttons)... Stamp explorer tool allows you to look at a specific date range... activated from stamp verbose desc.
- 82) I think it was just this version but there was an error in which the program was not showing the grouped receivers in the scatter plot. This is now fixed. In addition, mousing over a day with excluded receivers will reveal the plot information although nothing shows on the plot itself. Not sure if this is good or bad but I am keeping this "bug" as an intentional feature... It's kind of useful...
- 83) Fixed a minor issue: During multi-select, the screen contents (showing all receivers) did not persist.
- 84) More AQN problems... Bug related to AQN file compatibility with Grouped Receivers fixed: Flawed logical expression caused the fakereceiver number to be ignored when executing a STORE of the receiver information into the receiver object, instead hashing function was called and receiver was assigned a number (hashing table is empty and should remain empty when AQN file is loaded)...
- 85) OK, after fixing that bug, I found more issues between AQN and CSV files and decided to do a step-thru to make sure the entire code was OK. There are a couple of functions within a couple of classes that you have to step thru but I finally traced the problem to two issues...

**The first issue could have affected earlier versions of AT. I don't know how the bug got there but basically when a grouped receiver's stamps was read, the wrong stamps were coming out after the first receiver was read within the group...**

The second issue was unique to the AQN file loader. I was using the wrong call to read the stamps and the wrong call to read the total number of stamps within the receiver (DETECTIONS\_TTL).

I think that I would like to do a more complete revision of the stamp table class by loading a smaller file and checking that its all good... Otherwise, I think that the step-thru makes me confident that the system is now clean of any bugs. There is also room for improvement with the grouped receiver stamp reading function... In fact, I would say the entire concept needs revision as it needs to be sped up...

At the moment, I am implementing it as a simple look-up table. I think I need to implement it as a ring-like linked-list

- 86) **Fixed alignment issues between dates and plot points in Scatter Plot. I hope this works in other resolutions.. I use twips but then use a guesstimate of twips/character to line up the text...**
- 87) Added and fixed a disable functionality: Show Grid/Hide grid in Scatter Plot (from the popup context menu)
- 88) Highlights receivers on Scatter Plot by using the same ORing technique I use elsewhere. This allows you to mouseover a receiver point in the plot and see where else this receiver shows in the plot. Particularly useful if one colors the receivers all the same color but wants to know which one is which without mousing over each individual point in the plot...
- 89) AQN was not loading color and marker info... Fixed
- 90) Fixed issue of refreshing canvas after mousing over receiver... Was not doing the right thing and kept "highlighting" the receivers... Also changed the highlighting effect to make it more obvious...
- 91) **Changed just a couple of things on the ShowTrack function and have just increased the rendering of a track by 1000%! I found out what the problem was: DoEvents is slowing down the rendering of the canvas. Apparently, releasing the timeslice to Windows instead of allowing Windows to preempt when necessary causes undue overheads (my guess is that Windows switches the whole task not just the Thread). Learned my lesson and changed the code all around to make sure I took out any un-needed DoEvents... The consequences of this could be**



stability and user-response issues but I have tested it and nothing thus far... I think I made some good choices of where I placed the DoEvents but I may need to go back and make sure I am not too conservative as clearly the program can slow down because of this...

- 92) Fixed timeline window and changed a couple of things related to its animation to make it smoother... It's still not very "pretty" but it works to convey a sense of time and location
- 93) Fixed a bug related to pings/fish densities so that now when fish is selected or deselected from excluded list, pings and fish densities are affected...
- 94) Added warning about changing land avoidance params. Warns user that land-avoidance algorithms shouldn't be switched during a session
- 95) Added warning about illegal land avoidance params. If illegal parameters are selected, it warns the user and then allows a do-over.
- 96) Fixed other minor issues associated with all the changes made to the program... This version had a lot of internal changes so for example, the filtering of detections by date was not working properly. The receiver color and marker was not getting updated properly on the Receiver Information screen...
- 97) Moved exclude menu to EDIT instead of OPTIONS
- 98) Added a ReDo Option to the Canvas context menu which allows a land-avoidance track to be rebuilt. The idea is that when using Randomwalks, if the user doesn't like the walk, the user can issue a ReDo to get it to work properly. The "ReDo" term is a throwback to the old BASIC which would ask for the user to REDO? an entry if the input was characters and the computer was expecting a string... In GWBasic, it was "Redo from start"... This is exactly what this option does in AT...!
- 99) Fixed load time not showing up after AQN file load. Added one panel to status bar to fix problem above.
- 100) STOP was not working properly with ANIMATE ALL**
- 101) Fixed bug, animation slowed down when selecting Timeline/Compress animation

- 102) Made a change in the way dates are printed on canvas so that the date shows up when capturing video or copying canvas
- 103) Autorecover and notify when subgroups exceed max\_subgroups
- 104) Added code to ensure that once data is loaded, other data can be loaded too....
- 105) New Smart loader, decides what type of file is being loaded... Allows user to choose on window if its csv or aqn
- 106) Changed how the data is printed on the Analysis window. Made it prettier looking.
- 107) Redid the Select Analysis window so that its more intuitive (added arrows instead of checkmarks to include/exclude analysis). Also changed a couple of things to make it easier and more intuitive to change the field names and field attributes... Also added more validation to that window...
- 108) Corrected a problem with geographic tags not working properly when zoomed**
- 109) Added a mouseover event to alternate plot on scatter plot (hard to explain but its when a fish is in more than one receiver in a day)
- 110) Fixed a compatibility issue with some resolutions where About Window picture was not properly displayed...**
- 111) Some people use databases that output strings enclosed in "", so I added a filter to take the "" out.
- 112) Added support for split time/date columns. This also makes the files produced by the converter, 100% compatible with AT now. That was a small but gaping hole in the design.
- 113) Added some new error trapping to ensure user gets info about wrong file formats when detected. Also will allow user to run converter from AT**
- 114) Fixed issue with zooming and grouping receivers, just another issue of having to scale the coordinates...
- 115) Allow user to change fish id column on Excursion window too... This makes it more unified...

- 116) Added horizontal scroll bar to ShowPings and also made the name of the receiver and receiver group (if any) both come up on the ping desc.
- 117) Solve some issues with scaling and scroll bars on Scatter Plot**
- 118) AT now can run converter from within to convert any csv file
- 119) Changed context menu for canvas... Added a submenu for "show stamps"
- 120) Changed position of showstamps scrollbar (horizontal to vertical, see #116)
- 121) Fixed grid in scatter plot and some issues related to how the grid "snaps" to the plot
- 122) Corridor LA now works with auto-refresh on canvas
- 123) Auto-refresh now changes all the track params in Actions window
- 124) "Land-avoidance" is now "Land avoidance" in all menus
- 125) Fixed issue with AQN not having extra group info for release groups
- 126) Added more error trapping to AQN loader to prevent program crashes
- 127) Changed name of colorscale menu: from "Clipboard" to "Edit"
- 128) Added a feature to enable/disable bin in color scale which is useful when trying to not have the lower or upper range show up on the plot
- 129) Fixed an old issue with null values causing the color scale window to crash**
- 130) Fixed other issues with scale (max-min was reversed when having more bins than values)
- 131) Added auto-set value option to scale
- 132) Added a "misc." info to stamp explorer. Works by having the user click on the stamp, which opens another window showing each individual detection
- 133) FIRST STAMP NOT SHOWN ON TRACK STRING! Fixed this! This is the reason I had developed the stamp explorer: to cross-reference program data**
- 134) Added a "track highlight" tool to the Scatter Plot
- 135) Some issues with the plot not properly scaling etc..  
.. Fixed..

- 136) Added context menu to receiver info window so that tracks can be excluded or colored by receiver
- 137) In Minkowski clustering, total distance was hard-coded to be excluded out of calculations. I have now changed it to be included but by default, I set the weight to 0.
- 138) Stamp verbose list and misc list are truncated at 32k lines to prevent errors
- 139) Fix cancel button not working for map loader
- 140) Stamps belonging to Receiver groups were not properly plotted because of a bug I introduced with new receiver grouping feature on this version (i.e. This bug never made it to a release version!)
- 141) Change all Export dialogs to "Save" instead of "Open". I think using the word save or save as is better so as not to confuse the user**
- 142) Fixed zooming error not compatible with Land Avoidance (error introduced with random walks)
- 143) Also fixed some old autorefresh issues with the fish exclude/include tool
- 144) Stamp valid flag state saved instead of just having the flag decide which stamp gets saved....**
- 145) Issue with deleting singletons was resolved by eliminating some old code that created a wrong stamp to be returned upon trying to read a deleted stamp.
- 146) Added "Save as AVI" for avi export
- 147) Timeline was not erased between fish when using timeline animation**
- 148) Fixed an issue with the histogram axis not being refreshed when animating**
- 149) Histogram window is now fixed border
- 150) Cancel was not working on map loader (I thought I fixed this in all of them!)
- 151) Clicking on a fish in several places in the program now changes the fish selected in the Actions window and refreshes everything else automatically.
- 152) Textbox for trackstring now changes size when you change the size of the window.
- 153) Fixed a small issue having to do with deleted stamps and track string generation in which if the first stamp

in a string was not valid (deleted), the program gave a phony looking string. Now scans until first valid stamp is found then begins string.