



In short

- Fish excrete ammonia. One group of bacteria converts ammonia to nitrite; a second converts nitrite to nitrate. They establish in that order, so a new pond shows an ammonia spike first, then a nitrite spike, and only then settles with nitrate slowly accumulating.
- Typically four to eight weeks, strongly temperature dependent. The bacteria work far more slowly in cold water, so a fall or winter start takes much longer than a summer one.
- Add very few fish at first and add more only slowly, feed lightly, test ammonia and nitrite daily through the spikes, and use partial water changes with dechlorinated water to hold the peaks down rather than to stop the cycle.
- Seeding the new filter with mature media, squeezings or water from an established system shortens it dramatically. A mature filter can be knocked back to square one by a tap-water rinse, over-cleaning, a power outage or certain medications.

PHASE	WHAT THE TEST KIT SHOWS	WHAT IT DOES TO KOI	YOUR MOVE
Ammonia wave	Ammonia climbing, nitrite at zero, nitrate at zero	Free ammonia burns gill tissue and irritates skin; fish go off food	Stop or cut feeding, partial water change, test daily
Nitrite wave	Ammonia falling back toward zero, nitrite now climbing	Nitrite crosses the gill and blocks the blood from carrying oxygen	Keep testing daily, water changes, hold a supportive salt level
Settled	Ammonia and nitrite both at zero, nitrate slowly rising	Normal processing; nitrate is the manageable end product	Add fish gradually, resume normal feeding, water changes for nitrate

Both intermediate stages are acutely toxic, not merely stressful. The fraction of total ammonia present as free ammonia (NH₃) rises sharply with pH and with temperature, so the same total ammonia reading in ppm (equivalently mg/L) is far more dangerous at pH 8.6 on a warm afternoon than at pH 7.4 at dawn. Nitrite is taken up across the gills and disables the blood's oxygen-carrying capacity, so fish can suffocate in water that tests perfectly well for dissolved oxygen. Gasping at the surface, sitting on the bottom, clamped fins, reddened gills and refusing food are all late signs. Test before the fish tell you.

H2Koi is continuous early warning from industrial-grade sensors. It measures ammonium (NH₄) and nitrate (NO₃) directly along with temperature, pH, dissolved oxygen, conductivity and turbidity, with ORP available as an option, and it derives NH₃, nitrite, carbonate hardness on a 0-20 dKH scale, salinity, TDS. A self-cleaning wiper keeps the sensors clear. General hardness (GH) is not reported at all.

During a cycle that combination is genuinely useful: you see the ammonia wave building overnight rather than at the weekend, you see the derived nitrite start to move as the second population comes online, and you see alkalinity being consumed before it turns into a pH problem. What it will not do is diagnose disease or parasites, tell you why a filter stalled, or prevent anything on its own. It tells you sooner; you still make the call.

While a pond is actively cycling, use the continuous readings to see how the trend is moving, and act on the number in front of you before you change feeding, dose salt or start a water change.

We also build bespoke automated water changes, which is a natural fit for the drip-and-dilute part of this problem. We have never found another system that does it, and neither have our clients.