FISHERY CHEMICALS (PARASITES, PISCICIDES, AND OTHER TREATMENTS)[1]

Gary J. Burtle, Extension Aquaculture and Fisheries

	CHEMICAL	APPLICATION RATE	CATEGORY OF USE[2]	COMMENTS
Fish Parasites	*formalin* Parasite-S Formalin-F Formacide-8	15–25 ppm in ponds (4.5–7.5 gal/A-ft)	Approved	Use in warm weather may cause oxygen depletion. Provide aeration during treatment to prevent low oxygen. Use with extreme caution when dissolved oxygen is 5 ppm or lower.
		125–250 ppm (1–2 pt/1000 gal in tanks for 1 hour)		In tanks, if stress is excessive, flush with fresh water. Use lower rate in water above 50°F.
Piscicides	*rotenone* (Restricted Use) Prenfish toxicant	0.005–0.25 ppm active ingredient (depends on species)	Not Approved	**Restricted Use pesticides can only be purchased or used by individuals who have, or are directly supervised by, commercial pesticide licensees who are engaged in commercial production and sales of an agricultural commodity.** Do not use in waters colder than 65°F. Rotenone products are restricted use pesticides.
Miscellaneous Aquatic Treatment	*calcium hypochlorite* (disinfectant & sterilant)	10 ppm available chlorine (38.8 lb/A-ft)	Approved	Kills all fish and some parasites. Turbid water affects treatment.
	florfenicol Aquaflor	10–15 mg/kg fish per day in feed for 10 consecutive days	Approved	A veterinarian must prescribe florfenicol. Wait 15 days prior to harvesting fish for human consumption. Approved for use on catfish, salmonids and freshwater finfish for select bacterial infections.
	hydrated lime (disinfectant)	1,338 lb/A burnt lime	Approved	Drained pond treatment. Standing water reduces effect.
		1,784 lb/A slaked lime		Drained pond treatment.
	hydrogen peroxide Perox-aid PAK-27 GreenClean Phycomycin	Warm water at 700–1,000 mg/L for 15 minutes, once per day. Cold water at 500–1,000 mg/L	Approved	0 day withdrawal time.
	ormetropin + sulfadimethoxine Romet 30 (bactericide)	2.3 g ai/100 lb fish per day for 5 days in feed	Approved	A veterinarian must prescribe Romet under the Veterinary Feed Directive. 3-day preslaughter withdrawal period for catfish, do not use on trout within 6 weeks of marketing or release as stocker fish.
	oxytetracycline Terramycin (bactericide)	2.5–3.75 g ai/100 lb fish per day for 10 days in feed	Approved	A veterinarian must prescribe Terramycin under the Veterinary Feed Directive. 21-day pre-slaughter withdrawal period.
	potassium permanganate Proline Potassium Permanganate, 97%	2 ppm (5.4 lb/A-ft) Pond treatment of fish that are not intended for human consumption. For aquaria and ornamental ponds.	Not Approved	Not approved for use on fish intended for human or animal consumption. Treatment may have to be repeated within 24 hours to be effective. Turbid water has a higher permanganate demand and requires either repeat treatment or higher rates of application. Residual manganese is limited to 0.05 mg/L or less for drinking water.
	salt (sodium chloride) Brightwell Aquatics Fish Haul-C	0.5–3% (83 to 250 lb/1000 gal) In live fish hauling tanks.	Approved	Do not use iodized salt with fish. Various purities and mixes include sodium chloride for fisheries uses. When applying to ponds for indefinite treatment, a concentration of 50–100 mg chloride/liter is targeted. A low regulatory priority chemical.
	tricaine methanesulfonate Tricain-S (anesthetic)	15–66 ppm active ingredient for 6–48 hours for sedation; 50–330 ppm active ingredient for 1–40 minutes for anesthesia	Approved	21-day pre-slaughter withdrawal period.

1 Adapted from Approved Drugs for use in Aquaculture, 2010. US Fish and Wildlife Service, Aquatic Animal Drug Approval Partnership Program, American Fisheries Society Fish Culture Section, and US Food and Drug Administration Center for Veterinary Medicine.

2 Approved for use on fish intended for human or animal consumption or not approved for use on fish intended for human or animal consumption.

USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Algae	*copper chelates*** *** Cutrine-Plus 0.9L or Cutrine Ultra 0.9L		0.6–1.2 gal*	0.2–0.4 ppm*	Several formulations are marketed, so check labels for use restrictions. Tank mixing with diquat may allow effective control of vascular plants and copper resistant algae. Granular Cutrine-Plus is for spot treatment at the rate of 1 lb/720 sq ft. Cutrine Ultra has adjuvant to enable penetration into dense algal mats.
	Cutrine-plus 3.7G		60 lb/A		
	K-Tea 8L		0.7–1.4 gal*	0.2–0.4 ppm*	
	*copper sulfate*** (denatures protein) AP Brand Copper Sulfate Crystals		0.85–5.4 lb/A-ft	0.25–2 ppm*	Copper algaecides may be toxic to fish at high rates. Use the low rate in acid waters and the high rate in alkaline waters. Under heavy infestations, treat only ¼–⅓ the water body at any one time to avoid fish suffocation caused by oxygen depletion. Products containing copper may be used for spot treatments of algae.
	*copper sulfate + alum*** SeClear 15G		3.6–18.1 lb/A-ft	0.54–2.7 lb/A-ft	SeClear G is 58.9% copper sulfate pentahydrate or 15% elemental copper and has alum to sequester phosphate from the pond water column. Use early in the year or after burn-down of filamentous algae infestations. Use low rates when alkalinity or hardness are less than 40 mg/Liter.
	*copper sulfate*** acidified liquid Earthtec 20L		1–40 pt*	0.06–2.5 lb	Dosage is variable according to algae species, pH and water temperature. Tank mixing with diquat may allow effective control of vascular plants and copper resistant algae.
	*diquat**** (REI 24 hr) Reward 2AS	22	1–2 gal*	2–4 lb	Diquat is effective for filamentous algae control. Apply diquat as recommended in the SUBMERSED WEEDS section. Use 1 gal Reward per surface acre in water with an average depth of 2 ft. The higher rate may be used in water with an average depth greater than 2 ft. Repeat applications will be necessary.
	Diquat 2AS				
	Weedtrine D 0.4AS		3.4–10.2 gal*	0.5–1.5 ppm*	The Re-Entry Interval after using diquat is 24 hours. Use sinking adjuvants for deep water infestations.
	dyes and colorants*** Aquashade Crystal Blue Blue Vail		1 gal/4 A ft	1 ppm	Dye controls filamentous algae by blocking light penetration for up to 6 weeks after application. Apply when weeds may be seen on bottom of pond. Additional applications will be necessary through the year to maintain an acceptable level of dye in the water. Do not apply to water that will be used for human consumption. Water may be used for swimming after complete dispersal of the dye in water. Aquashade is non-toxic to livestock.
	endothall-dimethylalkylamine (dessicates plant cells) Hydrothol 191 5G		3–81 lb/A-ft	0.05–1.5 ppm	**Hydrothol formulations are toxic to fish and should be used only on sections by a commercial applicator at rates below 0.3 ppm unless fish kills are not objectionable.**
	Hydrothol 191 2EC		0.6–1.8 pt/A-ft	0.05–1.5 ppm	
	*flumioxazin*** Clipper 51WG Propeller 51G	14	6–12 oz/surface-A	0.36–0.71 lb	Disperse in 50–100 gal/A and buffer pH 5–7. Apply in early morning when pond pH tests between 7.0 and 8.5.
	sodium carbonate peroxyhydrate (oxydizes chlorophyll) Green Clean Pro 27.6G PAK-27 27G GreenClean Liquid 5L Phycomycin 27G		3–170 lb/A-ft 3–100 lb/A-ft 2.8–28 gal/A 3–100 lb/A-ft	0.8–47 lb 0.8–27.5 lb	Liberates hydrogen peroxide when wet. Wide range of application rates indicate variable response by algal species. Filamentous algae require higher rates than planktonic algae. This product does not have residual effect on algae longer than 24 hours. May improve herbicidal effect of copper-containing algaecides when used on algal species with mucilaginous coating. Apply evenly and early in the morning.

* Indicates rate per acre foot of water. All other formulation rates are based on amount per surface area. ** Test water for hardness or alkalinity before copper treatment. *** Other trade names are sold in Georgia with similar composition.

USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Floating Weeds (*Also see Floating Plants*)	*2,4-D**** Weedar 64 3.8EC or other liquid formulations	4	2–4 qt/A	1.9–3.8 lb/A	Treat ⅓–½ of the water body to avoid oxygen depletion problems.
	carfentrazone Stingray 1.9EC	14	3.4–13.5 oz	0.025–0.2 lb	Use a non-ionic surfactant and 100 gal of dilution water per surface acre. 80% of foliage should be exposed to treatment. Use tank mixes with *2,4-D*, *glyphosate* or *diquat* products for better control at the lower rates of application.
	*diquat**** Diquat 2AS		1 gal	2 lb	Spray to wet exposed plants with 50–150 gal of water per acre plus 1 pint of nonionic surfactant/100 gal of spray mix. Do not apply to muddy water. Labeled also for commercial fish production ponds. Consider tank mixes with chelated copper formulations for resistant duckweeds.
	Reward 4AS				
	Weedtrine D 0.4AS		5 gal	2 lb	
	flumioxazin Clipper 51G Propeller 51G		6–12 oz/A	0.36–0.71 lb	Disperse in 50–100 gal/A and buffer to pH 5–7. Up to 14.8 lb/surface A of Clipper 51G is labeled for use on submerged aquatic weeds. (See submersed weeds).
	*fluridone**** Sonar AS 4EC	12	0.25–2 qt	0.25–2 lb	Apply Sonar AS as a surface application to duckweed at labeled rates. Apply only once per year when duckweed is present. Apply Sonar to bladderwort as suggested in the EMERSED WEEDS section. See REMARKS AND PRECAUTIONS for Sonar as listed in the EMERSED WEEDS AND SUBMERSED WEEDS sections. Watermeal control requires the highest rate of application.
	*glyphosate**** Rodeo	9	1 gal + activator	5/4 lb/A	Apply with spreader-activator like AquaKing plus in 25 to 100 gallons of dilution water per acre for duckweed control.
	*imazapyr**** Habitat 2AS	2	See label	See label	Use of spreader-stickers will improve results. Ensure complete coverage by applying with 100 gal water/A.
Emersed Weeds (*Also see Floating Plants*)	*2,4-D* Aqua-Kleen 19G		100–200 lb	19–38 lb	Spray to wet foliage or spread granules uniformly in infested area in spring or early summer. Read the label for specific weeds controlled and special precautions. Do not apply to more than ½ the pond in any one month. Do not apply to waters used for irrigation, agricultural sprays, watering dairy animals, or domestic waters. This group of products is also labeled for commercial fish production ponds. Applications made after September may be less effective depending on water temperatures and weed growth.
	Navigate 19G		100–200 lb	27.6–55.2 lb	
	Renovate Max G 14+4G (*2,4-D* + triclopyr)		20–100 lb/A	See label	
	Weedar 64 3.8EC		2–4qt/A	1.9–3.8 lb	
	carfentrazone Stingray 1.9EC		3.4–13.5 oz	0.025–0.2 lb	Use a non-ionic surfactant and 100 gal of dilution water per surface acre. 80% of foliage should be exposed to treatment. Use tank mixes with *2,4-D*, *glyphosate* or *diquat* products for better control at the lower rates of application.
	fluridone Sonar 4AS Alligare Fluridone 4AS		1–2 qt/A	45–90 ppb	Apply *fluridone* liquids as a surface spray, or near the bottom with weighted trailing hoses, or meter into pumping system. Trees or shrubs growing in water treated with *fluridone* may be injured. Thirty to 90 days are required before desired weed control is achieved. The emersed weeds treated with *fluridone* are spatterdock and water lily.
	*glyphosate**** Rodeo 5.4EC Alligare Glyphosate 5.4EC AquaNeat 5.4EC ShoreKlear 5.4EC	9	See label. 0.75–1.5% solution is typical for spot treatment.	See label for rates matched to specific plants.	Apply after drawdown or when water is present. Allow 7 or more days after drawdown treatment before reintroduction of water (apply within one day after drawdown). Add 2 qt of a manufacturer-approved surfactant per 100 gal of spray solution. Water lily and floating islands respond to glyphosate treatment but repeat when regrowth is observed.

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AQUATIC WEED CONTROL

USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Emersed Weeds (*cont.*; *also see Floating Plants*)	*imazapyr* Habitat 2SL, Imazapyr 4SL, Arsenal 2SL		1–6 pt/A, See label	See label	Use of spreader-stickers will improve results. Ensure complete coverage by applying with 100 gal water/A.
	*triclopyr**** Renovate 3 3EC	4	0.25–3 gal	0.75–9 lb	Do not spray open water. Use non-ionic surfactant for foliar application according to surfactant label. Not for water intended for irrigation. Avoid overspray to open water.
Submersed Weeds	*2,4-D**** Aqua-Kleen 19G				See comments for granular formulations in "Emersed Weeds" section. Effective on parrotfeather, coontail and Eurasian watermilfoil. Also labeled for commercial fish production ponds. Renovate Max G rate depends on weed and water depth.
	Navigate 19G		100–200 lb	19–38 lb	
	Renovate Max G 14+4G		5–375 lb/A	See label	
	Weedar 64 3.8EC		2.5–10 gal/A	4.3–17 lb/A	
	bispyribac Tradewind 80SP	2	0.8–2.4oz/A-ft 1–2 oz	20–45ppb 0.8–1.6 oz	Use when pond has limited outflow. Up to 2 months for full effect on target plants. Best when applied to actively growing plants. Not recommended for ponds with irrigation or livestock watering.
	*copper ethylenediamine complex*** Komeen 8L		1.7–3.3 gal/A-ft	0.5–1 ppm	Use Komeen for ponds with crop irrigation on most submerged aquatic weeds.
	diquat Reward 2AS		1–2 gal	2–4 lb	Apply in early season where submersed growth has not reached the surface by pouring directly from the container into the water while moving slowly over the water surface in a boat. Distribute in strips 40 feet apart. In late season or where submersed weed growth has reached the surface, use the high rate indicated on the label for the weeds present. Also labeled for commercial fish production ponds. Do not apply to muddy water.
	Diquat 2AS				
	Weedtrine D 0.4AS		5–10 gal	2–4 lb	
	*dyes and colorants**** Aquashade Crystal Blue Blue Vail		1 gal/4 A ft	1 ppm	Dye controls several submersed weeds, such as naiads, by blocking light penetration for up to 6 weeks after application. Apply when weeds are seen on bottom of pond. Additional applications will be necessary through the year to maintain an acceptable level of dye in the water. Do not apply to water that will be used for human consumption. Water may be used for swimming after complete dispersal of the dye in water. Aquashade is non-toxic to livestock.
	endothall Aquathol 10.1G		13–81 lb*	0.5–3 ppm*	Aquathol and Aquathol K are contact killers and must be applied as early as possible after weeds are present. Water temperature should be a minimum of 65°F. Water containing heavy weed growth should be treated in sections 5–7 days apart. Apply on a calm day. **Hydrothol formulations are toxic to fish and should be used only on sections by a commercial applicator at rates below 0.3 ppm unless fish kill is not objectionable.** Hydrothol formulations are not recommended for commercial fish production ponds. Aquathol formulations are also labeled for commercial fish production ponds. Apply Aquathol Super K evenly over the treatment area and as early as possible after weed growth is observed.
	Aquathol Super K 63G		0.3–1.9 gal*	0.5–3 ppm*	
	Aquathol K 4.2AS		3–27 lb*	0.05–0.5 ppm*	
	Hydrothol 5G		0.6 pt–0.7 gal	0.05–0.5 ppm*	
	Hydrothol 191 2AS				

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USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Submersed Weeds (*cont.*)	*fluridone**** Sonar AS 4, Alligare Fluridone		1–2 qt/A	45–90 ppb	Check label for susceptible weeds. Trees or shrubs growing in water or having roots growing in water treated with fluridone may be injured. Thirty to 90 days will be required before desired weed control is achieved. Multiple applications may be needed where dilution of the treated area occurs.
	Sonar One 5G		Up to 5 lb/A-ft	30–90 ppb	
	flumioxazin Clipper 51G Propeller 51G		Not more than 14.8 lb/surface A	0.1–0.4 ppm	Disperse in 50–100 gal/A and buffer to pH 5–7.
	imazamox Clearcast 1AS		128 oz/A	Up to 500 ppb	Treat submerged vegetation by spraying under water but over the weed bed using 25 to 100 gallons of dilution water per acre.
Floating Plants	*imazamox* Clearcast 1AS	2	16–128 oz/A	Up to 500 ppb	Spot spray foliage with 0.25–5% solutions in water with a surfactant. Granules for shoreline and spot treatment.
	Clearcast 2.7G		5–20 lb/A-ft		
	penoxsulam Galleon SC 2		2–5.6 oz	0.031–0.087 lb	Do not use pond to irrigate food crops unless analyses show less than 1 ppb residue. Do not use in successive years.
Emersed Weeds	*imazamox* Clearcast 1 AS		32–64 oz	0.24–0.5 lb	Spot spray foliage with 0.25–5% solutions in water with a surfactant.
	penoxsulam Galleon SC 2	2	2–5.6 oz	0.031–0.087 lb	Do not use if pond is used to irrigate food crops unless analyses show less than 1 ppb residue. Do not use in successive years.
Drawdown Application	*glyphosate* Rodeo, Touchdown Pro, Aquaneat		See label		After draw down and glyphosate application wait 7 days before filling pond with water.
	imazamox Clearcast 1 AS		64 oz	0.5 lb	Wait 2 weeks before re-flooding the pond.
	penoxsulam Galleon SC 2		5.6–11.2 oz	0.087–0.175 lb	Mix with up to 100 gpa water and a surfactant for post- or pre-emergence use.
Commercial Applicator Systems	ProcellaCOR EC 2.7% AI	4			The rate of ProcellaCOR EC application is by Prescription Dose Unit and is determined by plant species, water depth, and area of pond treated. Trained Commercial Applicators associated with SePro Corporation can obtain and apply this herbicide system for homeowners or homeowner associations. Long-term control of a broad spectrum of aquatic plants is achieved including bacopa, hydrilla, watermilfoil, alligatorweed, and azolla. Irrigation restrictions apply to treated water.

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RESPONSE OF COMMON AQUATIC WEEDS TO HERBICIDES[1]

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WEED	*copper complexes, copper sulfate*	*2,4-D dimethyamine*	*diquat*	*endothall*	*flumioxazin*	*fluridone*	*glyphosate*	*carfentrazone*	*triclopyr*	*imazapyr*	*imazamox*
MOA		**4**	**22**	**NC**	**14**	**12**	**9**	**14**	**4**	**2**	**2**
ALGAE											
planktonic	E	NR	P		G	NR	NR	NR	NR	NR	NR
filamentous	E	NR	E	G[2]	E	NR	NR	NR	NR	NR	NR
chara	E	NR	G	G[2]		NR	NR	NR	NR	NR	NR
nitella	E	NR	G	G[2]		NR	NR	NR	NR	NR	NR
FLOATING WEEDS											
bladderwort	P	G[3]	E			E		—		NR	
duckweeds	P	P	G[5]	P	E	E	G[6]	G	P	G	
salvinia	G[5]	P	G	P	E	E	G	G	P	P	E
water hyacinth	P	E	E			P	F	G	P–E	G	
watermeal	P	P	P[5]		E	G	P	P	NR	NR	
EMERSED WEEDS											
alders	P	E	F	P		P	E	—	—	—	G
alligatorweed	P	F	P	P	E	G	E	F	G	G	E
American lotus	P	E	P	P		F	G	—	G	G	G
arrowhead	P	E	G	G			E	—	—	—	G
buttonbush	P	E	F	P		P	G	—	—	—	G
cattails	P	G	G	P		F	E	—	F	E	E
fragrant & white waterlily	P	E	P	P		E	E	—	G	E	E
frogbit	P	E	E		E						E
maidencane	P	P	F			F	E	—	—	—	—
pickerelweed	P	G	G			P	F	—	NR	E	E
pond edge										—	
annuals	P		G	P		F	E	—	—	E	E
sedges/rushes	P	F	F			P	G	—	NR	G	G
slender spikerush	P	P	G[5]		G	G	P	—	NR	—	G
smartweed	P	E	F			F	E	—	EF	E	E
spatterdock	P	E	P			E	G–E	—	—	E	E
So. watergrass	P	P				G	E	—	NR	—	—
torpedograss	P	P	P			F	G	—	P	E	E
watershield	P	E	P	P		G	G	—	—	P	E
water pennywort	P	G	G			P	G	—	G	—	—
water primrose	P	E	F	P		F	E	F	—	E	E
willows	P	E	F			P	E	—		—	G
SUBMERSED WEEDS											
watermilfoil	P	G	E	E		E	NR	—	G	NR	G
coontail	P	P	G	F		E	NR	—	NR	NR	G
egeria	P	P	E	F		E	NR	—	NR	NR	—
elodea	P	E	E	E		E	NR	—	E	NR	—
eurasian watermilfoil	P	F	G	E		E	NR	G	NR	NR	G
fanwort	F[4]	P	G	G		E	NR	—	NR	NR	—
hydrilla	P	F	E	E		E	NR	—	NR	NR	G
naiads	P	E	E	E		F	NR	—	E	NR	—
parrotfeather	F[4]	E	E	E		E	NR	—	E	NR	G
pondweeds (Potamogeton)	P	P	G	E		E	NR	NR	NR	NR	G

E excellent control (90–100%)
G good control (80–89%)
F fair control (70–79%)
P poor control (<70%)
NR not recommended

— Insufficient data
☐ A blank space indicates weed response is not known.
2 Hydrothol formulations only.
3 Granular 2,4-D formulations.
4 Copper complexes only.
5 Cutrine Plus: Reward, 3:2 tank mix will improve response.
6 Use a spreader-activator adjuvant.

AQUATIC WEED CONTROL USE RESTRICTIONS[1]

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NUMBER OF DAYS AFTER TREATMENT BEFORE USE

COMMON NAME TRADE NAME	COMPANY	CONC. PPM	HUMAN		
			DRINKING	SWIMMING	FISH CONSUMPTION
copper sulfate[2]					
Copper Sulfate G	Tenn. Chem.	—	0	0	0
Copper Sulfate Snow	Tenn. Chem.	—	0	0	0
Copper Sulfate Crystal	Tenn. Chem.	—	0	0	0
Triangle Copper Sulfate	Triangle		0	0	0
copper complexes					
AquaCure	PBI Gordon	—			
Cutrine-Plus	Applied Biochemists	—	0	0	0
Cutrine-Plus G	Applied Biochemists	—			
K-Tea	Griffin	—			
Komeen	Seapro Corp.	—	0	0	0
2,4-D					
Aquakleen	Rhone-Poulenc	—	NL	0	0
Hardball	Helena		—	0	0
diquat					
Reward[5]	Zeneca	—	1–3	0	0
endothall		—	7	1	3
Aquathol G	Atochem	0.5	7	1	3
Aquathol K	Atochem	1–3	14	1	3
Hydrothol 191	Atochem	< 0.3	7	*	3
Hydrothol 191G	Atochem	0.5	14	*	3
fluridone[3]					
Sonar AS	DowElanco	—	0	0	0
Sonar SRP	DowElanco	—	0	0	0
glyphosate[4]					
Rodeo	Monsanto	—	0	0	0
Pondmaster	Monsanto	—	0	0	0
trichlopyr					
Renovate 3	Dow Agrosciences	2–8 qt./A	**	0	0
carfentrazone					
Stingray	FMC	—	0	0	0
imazapyr					
Habitat	BASF	—	2	0	0
penoxsulam					
Galleon SC	Seapro Corp.	10–30 ppb	0	0	0
imazomox					
Clearcast	BASF Corp.	0–500 ppb	0	0	0
flumioxazin					
Clipper	Valent	100–400 ppb	0	0	0
bispyribac					
Tradewind	Valent	20–45 ppb	0	0	0

1 Algae control may result in a fish kill due to oxygen depletion if herbicides are applied to large areas, or when dissolved oxygen levels are low, or if fast-acting contact herbicides are used (*diquat*, *copper sulfate*, etc.). Similar hazards exist when vascular plants or floating weeds are rapidly killed in large masses with *diquat* or other herbicides used on emersed or submersed weeds.

2 If water is used for drinking, the elemental copper concentration should not exceed 1 ppm (i.e. 4 ppm *copper sulfate*).

3 Do not apply within 0.25 mile of any potable water intake.

4 Do not apply within 0.5 mile upstream of potable water intakes.

5 Drinking water restriction depends on rate of application. Refer to Reward label.

NL NOT LABELED FOR APPLICATION TO BODIES OF WATER WITH THIS INTENDED USE.

* Herbicide label does not prohibit use of water for this intended use.

** Drinking water restrictions depend on laboratory analysis, see Navigate or Renovate Max G or *triclopyr* product label.

AQUATIC WEED CONTROL USE RESTRICTIONS

NUMBER OF DAYS AFTER TREATMENT BEFORE USE

COMMON NAME TRADE NAMES	COMPANY	CONC. PPM	ANIMAL DRINKING		IRRIGATION		AGRIC. SPRAYS
			DAIRY	LIVESTOCK	TURF	CROPS	
copper sulfate[2]							
Copper Sulfate G	Tenn. Chem.	—	0	0	0	0	0
Copper Sulfate Snow	Tenn. Chem.	—		0	0	0	0
Copper Sulfate Crystal	Tenn. Chem.	—		0	0	0	0
Triangle Copper Sulfate	Triangle		0	0	0	0	0
copper complexes							
Cutrine-Plus	Applied Biochemists	—	0	0	0	0	0
Cutrine-Plus G	Applied Biochemists	—					
K-Tea	Griffin	—					
AquaCure	PBI Gordon	—					
2,4-D							
Aquakleen	Rhone-Poulenc	—	NL	0	NL	NL	NL
2,4-D Granules	Riverdale	—	0	0	0	**	7
Hardball	Helena	—	0	0	0	**	**
diquat							
Reward[5]	Zeneca	—	1	1	1–3	5	5
endothall		—	7	7	7	7	7
Aquathol G	Atochem	0.5	7	7	7	7	7
Aquathol K	Atochem	1–3	14	14	14	14	14
Hydrothol 191	Atochem	< 0.3	7	7	7	7	7
Hydrothol 191G	Atochem	0.5	14	14	14	14	14
fluridone[3]							
Sonar AS	DowElanco	—	0	0	30	30	*
Sonar SRP	DowElanco	—	0	0	30	30	*
glyphosate[4]							
Rodeo	Monsanto	—	0	0	0	0	0
Pondmaster	Monsanto	—		0			
trichlopyr							
Renovate 3	Dow Agrosciences	2–8 qt/A	0	0	NL	NL	NL
carfentrazone							
Stingray	FMC	—	0–1	0–1	1–14	1–14	1–14
imazapyr							
Habitat	BASF	—	0	0	120	120	0
penoxsulam							
Galleon SC	Seapro Corp.	10–30 ppb	0	0	0	1 ppb	1 ppb
imazomox							
Clearcast	BASF Corp.	0–500 ppb	0	0	1 d pr 50 ppb	1 d pr 50 ppb	0
flumioxazin							
Clipper	Valent	100–400 ppb	0	0	5	5	5
bispyribac							
Tradewind	Valent	≤ 1ppb	≤ 1ppb	≤ 1ppb	≤ 1ppb	≤ 1ppb	≤ 1ppb

1 Algae control may result in a fish kill due to oxygen depletion if herbicides are applied to large areas, or when dissolved oxygen levels are low, or if fast-acting contact herbicides are used (*diquat*, *copper sulfate*, etc.). Similar hazards exist when vascular plants or floating weeds are rapidly killed in large masses with *diquat* or other herbicides used on emersed or submersed weeds.

2 If water is used for drinking, the elemental copper concentration should not exceed 1 ppm (i.e. 4 ppm *copper sulfate*).

3 Do not apply within 0.25 mile of any potable water intake.

4 Do not apply within 0.5 mile upstream of potable water intakes.

5 Drinking water restriction depends on rate of application. Refer to Reward label.

NL NOT LABELED FOR APPLICATION TO BODIES OF WATER WITH THIS INTENDED USE.

* Herbicide label does not prohibit use of water for this intended use.

** Drinking water restrictions depend on laboratory analysis, see Navigate or Renovate Max G or *triclopyr* product label.

CALCULATING PESTICIDE CONCENTRATIONS IN AQUATIC SITUATIONS[1]

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Depending on the chemical, pesticides are applied as a surface acre, bottom acre-foot or total water volume treatment. Total water volume treatments are expressed on a part per million by weight (ppmw) basis. Water volume can be measured in gallons, cubic yards, cubic feet, etc.; however, the most commonly used unit of water volume measurement is acre-feet. The following formula may be used to determine the amount of pesticide formulation required to obtain a desired final concentration (ppmw) in the water of a pond or lake on an acre-feet basis:

1. **Concentration based on part per million by weight (ppmw) amount of formulation** $= \frac{A \times D \times CF \times ECC}{I}$

A = area of the water surface in acres (Use precise measurement or measure from aerial photos).

D = average depth of the pond or lake in feet.

CF = 2.72 lb/acre foot. The Conversion Factor (CF) when total water volume is expressed on an acre-feet basis.

2.72 lb of a pesticide per acre-foot of water is equal to one ppmw.

ECC = Effective Chemical Concentration of the active ingredient of a pesticide needed in the water to achieve control of the pest.

I = The total amount of active ingredient divided by the total amount of active and inert ingredients. Liquid products usually list the amount of active ingredients as pounds per gallon. For such products:

$$I = \frac{\text{pounds of active ingredients}}{\text{one (1) gallon}}$$

Non-liquid formulations usually list active ingredients as a percentage of the total formulation. For non-liquid formulations:

$$I = \frac{\text{percent active ingredients}}{100\%}$$

The following formula may be used to determine the amount of pesticide formulation on a surface acre basis.

1. Amount of pesticide formulation per surface acre.

Amount of formulation = (Surface acres) x (Broadcast formulation

1 For additional information, refer to UGA Extension Bulletin 866 – "Using Chemicals in Pond Management."