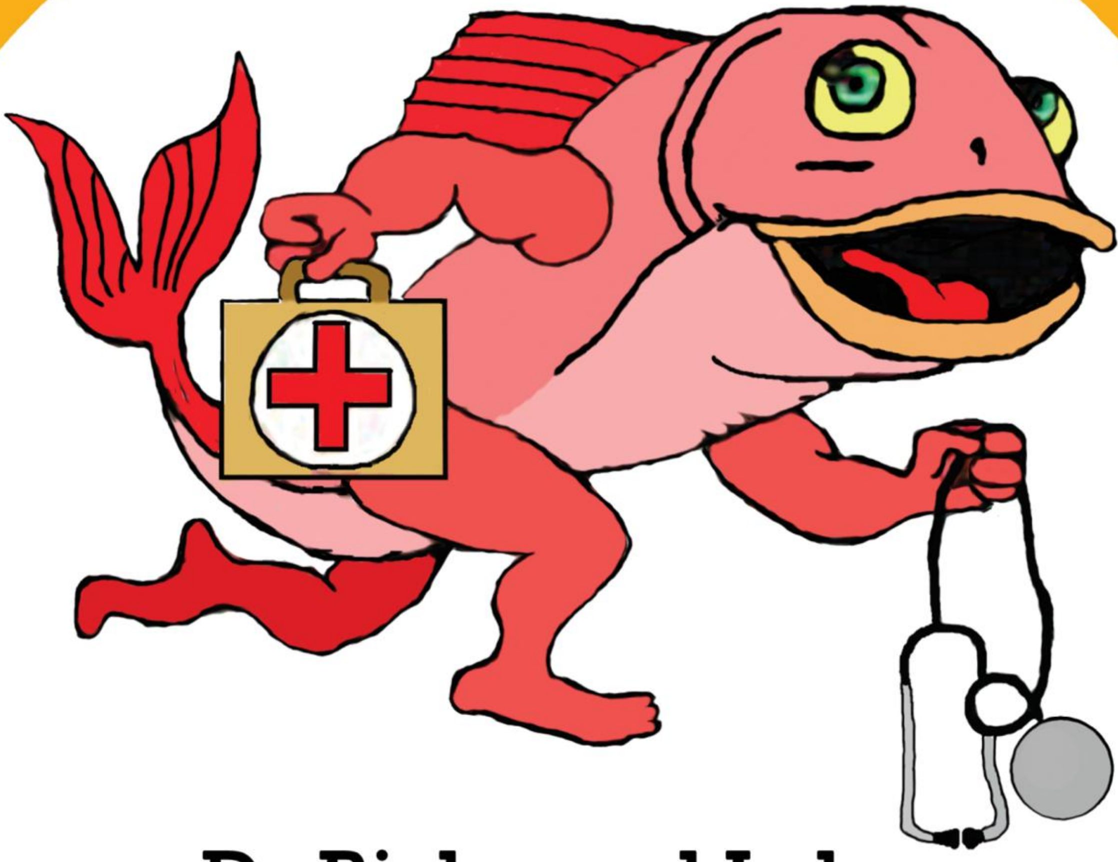
FISH VETTING ESSENTIALS



Dr Richmond Loh
&
Dr Matt Landos

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For orders
Phone: +61 (0)421 822 383
Email: thefishvet@gmail.com
Web: http://www.thefishvet.com.au

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Front cover: The Fish Vet's logo. Part fish, part vet.

FOREWORD

This is a revised version of the self-published "Australian Fish Vetting Essentials" (2007) by Drs Richmond Loh & Matt Landos. The purpose of this manual is to collate the knowledge that aquarists, aquaculturalists, public aquaria, local fish shops and veterinarians already have, and to filter out misinformation and then provide this information in a readily digestible form. The information contained in this publication has been in the process of compilation since 2001. This manual is not prescriptive, but rather, it is a collection from our combined knowledge to promote to the industry that veterinarians are best equipped to deal with aquatic animal health.

Worthy of note is that many diseases found in aquatics can be classified as emerging diseases since an "emerging disease" is one that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence of geographic range.

The Authors

The Fish Vet
Dr Richmond Loh
BSc, BVMS, MPhil, MANZCVSc (Aquatics & Pathobiology), DipPM, CMAVA
+61 (0)421 822 383
thefishvet@gmail.com
http://www.thefishvet.com.au

Future Fisheries Veterinary Service
Dr Matt Landos
BVSc HonsI, MANZCVSc (Aquatics)
+61 (0)437 492 863
matty.landos@gmail.com

Contributors

Dr Michael Chia

Dr Stephen Pyecroft

Dr Judith Handlinger

Dr Shane Raidal

Dr Fran Stephens

ABOUT THE AUTHORS

Dr Richmond Loh

Dr Loh has always been interested in animals, nature and medicine, so naturally he studied to become a veterinarian at Murdoch University. However, his passion for all things fish was strong and so his first job was as a veterinary fish pathologist for the Tasmanian state laboratory, providing diagnostic services for the large aquaculture farms including species such as salmon, trout, ornamental fishes, abalone and oysters. At the same time, he was offering veterinary services to owners of ornamental fishes.

In 2006, he passed the examinations for Aquatic Animal Health for the Australian & New Zealand College of Veterinary Scientists (ANZCVS). In the same year, he was awarded a Master of Philosophy degree for cancer research in Tasmanian devils, publishing the seminal papers on Devil Facial Tumour Disease in Veterinary Pathology. To increase his depth of knowledge in the area of diseases, he studied for and passed the examinations for Pathobiology for the ANZCVS in 2009.

So far, he has given numerous talks at seven National Veterinary Conferences and also to the Pet Industry Australia Association delegates and at the New Zealand Companion Animal Conference. He regularly writes for aquarium and pet publications. These are an initiative to generate interest within the respective professions and industry to apply scientific reasoning for the better health and management of fishes. Through his veterinary career, he has appeared on TV (Creature Features, Stateline, Catalyst, ABC news), been interviewed on radio (Curtin FM), appeared in newspapers (The Sunday Times UK, Herald Sun, The Examiner, Sunday Tasmanian, The Cairns Post, Canning Times), magazines (Australian Aquarium Magazine, Aquarium Keeper Australia, TIME Australia Magazine, Your Pet Magazine, Woman's Day, Pets – Taking Care of Your Family's Best Friend, Animals' Voice) and appears on several local and international websites (ABC Online).

He is the consultant veterinarian to AQWA (the Aquarium of WA), is an adjunct lecturer at Murdoch University, is a founding member of the World Aquatic Veterinary Medical Association (WAVMA), is the secretary for the Aquatic Animal Health Chapter of the ANZCVSc and provides advice on fish health and welfare to several universities and the RSPCA. His clients are diverse and range from individual pet fish owners, to retailers, farmers (ornamental and food cultured fishes) and exporters.

Dr Matt Landos

Dr Landos is the Founding Director of Future Fisheries Veterinary Service, is an honorary lecturer in aquatic animal health and associate researcher at the University of Sydney, Faculty of Veterinary Science and in 2011 he was the president of the Aquatic Animal Health Chapter of the Australian & New Zealand College of Veterinary Scientists.

Dr Landos commenced his consultancy practice in aquatic animals in 2005 after a 5 year stint with the NSW DPI as the Veterinary Officer in Aquatic Animal Health. The client base is located throughout Australia, and it ranges from small native fish hatcheries to 3,000 tonne sea cage operations. He works with all aquatic species including molluscs, crustacea and finfish. He reviews emergency disease preparedness plans and develops health management plans for aquaculture industries. He has had a prominent media profile in recent years associated with investigation of the impacts of environmental pollutants on fisheries in relation to the notorious two-headed Australian bass larvae case from the Noosa River.

Ammonia

Ammonia (NH_3) is produced by fish respiration and by the decomposition of waste products (excessive organic matter and excessive feeding). Peaks of ammonia excretions have been shown to occur 4-6 hours after feeding fish, but this is usually tolerated if the biofilter is properly cycled. It can be present in two forms: highly soluble toxic unionised ammonia (NH_3, also known as free ammonia nitrogen – FAN), or the less dangerous ammonium ion (NH_4^+), the sum of which is known as TAN (total ammonia nitrogen).

Toxicity affects fish in several ways[7]:

1. The presence of high ammonia leads to increased water absorption by the gills, with subsequent stress on the kidneys which, if severe enough, can lead to renal failure;
2. To a large extent, ammonia is excreted by the gills across a diffusion gradient. However, high environmental ammonia prevents this method of excretion, leading to hyperammonaemia, resulting in neuro/cytological failure;
3. Ammonia is a strong cell poison and can cause damage to the gills at levels as low as **0.2-1.0mg/L FAN**. Impaired gas exchange can lead to suffocation;
4. High ammonia concentrations inhibit bacteria involved in nitrite oxidation.

Clinical signs include (but are not limited to) increased mucus production, red or bleeding gills, darkening of body colouration, 'gasp' for air at the surface and increased respiration rate.

$$NH_3 + H^+ \Leftrightarrow NH_4^+$$

The levels of free ammonia nitrogen (FAN) can be influenced by pH, temperature and salinity. However, the pH of water is the most important factor that determines the ratio of NH_3 & NH_4^+. When the pH is high (alkaline), more of the ammonia will be in the toxic form. Toxic ammonia will increase exponentially with increasing pH levels and temperature. Water test kits usually measure total ammonia nitrogen (TAN) and they come with a chart so that you can determine whether toxic levels of free ammonia nitrogen (FAN) is present. Fish kills have been recorded at levels of 0.2 – 1.0 mg/L of FAN. Most aquarium test kits are not suitable for detecting low levels of ammonia causing suboptimal fish production, but they are more than adequate for detecting lethal levels.

The best course of action for ammonia toxicosis is an immediate, large, partial water change (25-50%) and utilise chemical filtration (e.g. zeolite for freshwater set-ups) and consider lowering the pH but not exceeding the lower limit of the tolerance range.

If the fish species tolerates it, recent literature suggests calcium chloride should be added to soft water to raise the general hardness to 100 mg/L in order to reduce fish mortalities.

Source: Influence of pH, salinity, calcium, and ammonia source on acute ammonia toxicity to Golden Shiners (*Notemigonus crysoleucas*). Journal of the World Aquaculture Society, Vol41, No 3 (June 2010), p411-420.

Table. Toxicity of ammonia at different pH in freshwater. Table sourced from the Hagen water test kit.

pH	NH4+ (mg/L)	0.25	0.50	1.00	2.00	4.00	6.00
7.0							
7.5							
8.0							
8.2							
8.4							
8.6							
8.8							
9.0							

KEY	
	Safe level.
	May be harmful to sensitive fish & young fry.
	May be harmful to adults; very harmful to fry.
	Very harmful to adult fish.
	Absolutely lethal to all fish.

Table. Percentage of un-ionised ammonia in aqueous solution ($NH_{3(aq)}$) at different pH values and temperatures in water (Akiyama, 1989 and Emerson et al.,1975)

	Temperature (°C)												
pH	**16**	**18**	**20**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**32**
6.0			0.04	0.046	0.049	0.053	0.057	0.061	0.065	0.070	0.075	0.080	
6.5				0.145	0.156	0.167	0.180	0.193	0.207	0.221	0.237	0.254	
7.0	0.30	0.34	0.40	0.46	0.491	0.52	0.566	0.60	0.651	0.70	0.747	0.81	0.95
7.2	0.47	0.54	0.30	0.72		0.82		0.95		1.10		1.27	1.50
7.5				1.43	1.54	1.65	1.77	1.89	2.03	2.17	2.32	2.48	
7.6	0.74	0.86	0.99	1.14		1.30		1.50		1.73		2.00	2.36
7.8	1.17	1.35	1.58	1.79		2.05		2.35		2.72		3.13	3.69
8.0	2.88	3.32	3.83	4.37	4.70	4.99	5.38	5.71	6.15	6.55	7.00	7.52	8.77
8.2	4.49	5.16	5.94	6.76		7.68		8.75		10.00		11.41	13.22
8.4	6.93	7.94	9.09	10.30		11.65		13.20		14.98		16.96	19.46
8.5				12.7	13.5	14.4	15.3	16.2	17.2	18.2	19.2	20.3	
8.6	10.56	12.03	13.68	15.40		17.28		19.42		21.83		24.45	27.68
8.8	15.76	17.82	20.08	22.38		24.88		27.64		30.68		33.90	37.76
9.0	22.87	25.57	28.47	31.37		34.42		37.71		42.23		44.84	49.02

Causes of ammonia spikes: increased feeding rate (e.g. in spring time when fishes' appetite increase with increasing temperatures, but biofilter has not had the chance to respond), increased stocking density (increased fish size or numbers faster than the biofilter can adapt), damage to biofilter (pump stopped for a significant time, filter clogged, filter washed too thoroughly, chemicals including antibiotics used), etc.

*Formalin can interfere with the commonly used methods for measuring ammonia and thus accurate ammonia readings are not possible.

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The original handbook, published in 2007, is widely used in veterinary schools, labs, clinics and even zoos. The revised 2011 edition is a comprehensive resource that incorporates elements of fish keeping, clinical medicine and fish pathology.

Important information for fish vets in this revised edition include:

- How to diagnose common fish diseases?
- How to medicate fish?
- How to treat fish diseases using drugs available in your surgery?
- How to interpret water quality results?
- How to anaesthetise fish?
- Notes on surgery and imaging.
- How to identify fish into their broad categories?
- How to breed fish using hormones?

This truly is an essential manual for veterinarians dealing with fishes.