

HYPERBARIC OXYGEN CHAMBERS

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ORIGINS AND DEVELOPMENT 1990 – 1996

Pressure chambers were developed for two main reasons :

1. To treat barotrauma in new specimens captured at depth.
2. To treat various traumas and diseases in the aquarium.

Barotrauma is a serious limiting factor when collecting at depths which exceed 10 meters.



Severe barotrauma in a fish caught from 40 meters. This fish is unlikely to survive without a chamber.

Traditional methods of treating barotrauma:



Hypodermic needles are used to deflate distended swim bladders. Losses can occur with small or sensitive species and persistent buoyancy can be a problem.



Divers place captured specimens in underwater cages. The cages are slowly raised to the surface. (Six hours from 20 meters). Impractical from small craft in rough sea conditions.

RECENT PROGRESS 2005 – 2012

The prototype chambers worked well and were used for 10 years. However they could not handle very big fish and they were not legal pressure vessels.

Between 2005 and 2009, Sea World at uShaka invested in 3 professionally built chambers. These were officially hydrostatically tested and are Lloyds registered pressure vessels.



Certified hyperbaric oxygen chambers.

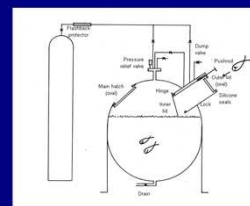


Diagram of chamber with lock.

Type	Plain	Lock	Lock
Volume	66 litres	250 litres	1100 litres
Shape	50cm sphere	88 x 82cm capsule	160 x 110 cm capsule
Empty weight	45 kg	84 kg	325 kg
Working pressure	1.5 bar	1.5 bar	1.5 bar
Test pressure	3.9 bar	2.6 bar	4 bar
6 Hr safe bio load	1kg fish	5 kg fish	20 kg fish
Usage	small specimens	diver collecting light tackle angling	heavy tackle angling shipboard use



Fish placed in 1100L chamber using the lock.



250L chamber on small craft.

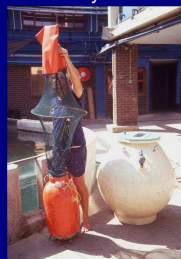
PROTOTYPE CHAMBERS

Between 1990 and 1996, staff at Sea World, Durban built four fibreglass prototype chambers. All were pressure tested to 3 bar (twice the 1.5 bar working pressure).

There were 2 types of chamber:

Plain chambers are suited to hospital use, or when caged fish arrive at the surface in batches.

Chambers with locks permit admission of new specimens when already pressurised. Useful for angling when specimens arrive intermittently.

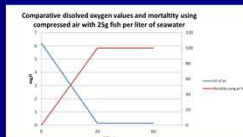
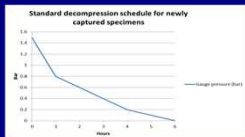


Prototype chambers. Volumes 50 and 375 litres.

Operating procedure :

1. add water to 70 % of chamber volume
2. add specimens and close
3. pressurise with oxygen
4. decompress for 6 hours (partial water changes can be made via the lock)

NOTE: It is not necessary to recompress to the full depth at which the fish were caught. Fish from 40 meters are fine when recompressed to 1.5 bar.



Compressed air is ineffective. 100% mortality occurred in 20 minutes due to low oxygen. With a similar bioload using oxygen: DO remained above 20mg/l; 50% mortality rate occurred at 21 hours. Mortality was due to other pollutants, not low oxygen

FUNCTIONS IN HOSPITAL / QUARANTINE

All three chambers are regularly used in the aquarium hospital.

The chambers are mainly used to correct exophthalmia, caused by either gas embolism or bacterial infection. Successful treatments have also been performed on seahorses with subcutaneous gas blister disease. Pressure treatment may be used in conjunction with antibiotics or other medication.

Fish may be placed under pressure for up to 5 days. The condition of the specimen is monitored through a viewing port.



Example: Correction of extreme exophthalmia in *Pomadasys olivaceum*.

Potential hazards	Precautions
mechanical failure	annual visual inspection 4 yearly hydrostatic test calibrated pressure relief valve
fire in oxygen rich atmosphere	only use when 70% water filled no smoking or naked lights
cylinder safety	use flashback protector
operator safety	only trained staff operate

Warning

Hyperbaric pressure vessels are potentially hazardous. They should be professionally designed and constructed; and only operated by trained personnel.

Reference: Ballard, J. A. 2008. Therapeutic pressure chambers for fish. *Drum and Croaker*. vol 39. pp40-47.