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THE ASSESSMENT OF SEVEN NORTHERN
TERRITORY GASTROPOD SPECIES FOR USE
AS BIOLOGICAL MONITORS OF RANGER
URANIUM MINE RETENTION POND WATERS

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The Supervising Scientist for the Alligator Rivers Region has research, supervisory and co-ordination responsibilities related to effects on the environment of uranium mining in the Alligator Rivers Region and research and supervisory responsibilities related to effects on the environment of non-uranium mining in a conservation zone declared within the Region.

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**Supervising Scientist for the Alligator Rivers Region** 

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#### **ABSTRACT**

Seven species of freshwater snails were examined for potential as use for the biological monitoring of Ranger Uranium Mine retention pond waters. Uranium is the main source of toxicity in this water, and because molluscs in general display a sensitivity to, or otherwise react to metal contamination, they were considered likely to respond. To test this, several stages of the life cycle of the species were examined. It was found that some species were unsuitable for use as biological monitors because of handling, rearing or other reasons not related to toxic response. One of the species tested was relatively insensitive to the toxicant. Two species of Amerianna were sensitive to low concentrations of Ranger RP2 waters, and the most sensitive and consistent endpoints were related to fecundity. To persue this effect, electron microscopy was carried out on a selection of tissues possibly affected by toxicants in the waters; it was found that uranium had accumulated in the ovotestis. Other endpoints in the literature commonly seen to be sensitive indicators of metal contaminated conditions, such as juvenile and embryonic mortality, were not observed to be as sensitive as the fecundity endpoints in this series of trials.

# INTRODUCTION

A large temporal gap exists between the first bioassay performed by Aristotle testing seawater effects on freshwater organisms and the single species fish bioassay formulated by Hart in 1945 (Cairns and Pratt, 1989). Aristotle's curiosity probably did not encompass the environmental effects of mining, but by the sixteenth century concern had already been expressed. The world's first mining textbook, *De Re Metallica*, by Georguis Agricola in 1556 (Down & Stocks, 1978), contains reference to damage and dissent: "...The strongest argument of the detractors is that the fields are devastated by mining operations...the woods and groves are cut down, for there is need of an endless amount of wood for timbers, machines and the smelting of metals. And when the woods and groves are felled, then are exterminated the beasts and birds, very many of which furnish a pleasant and agreeable food for man. Further, when the ores are washed, the water which has been used poisons the brooks and streams, and either destroys the fish or drives them away... Thus it is said, it is clear to all that there is greater detriment from mining than the value of the metals which the mining produces". *De Re Metallica* does not specify ownership arrangements or ultimate responsibility in those early days.

Mankind's use of metals has increased to the extent at which mineral extraction and associated processes have significantly affected on our natural heritage (Down & Stocks, 1978; Moore & Winner, 1989).

Initially, (partially because classical biologists did not regard industry as a relevant study area,) monitoring of aquatic pollution was physico-chemical, dealing with such parameters as dissolved oxygen, biological oxygen demand, temperature and dissolved solids. In 1945, Hart published the first single species toxicity test protocol, subsequently accepted by the American Society for Testing and Materials (Cairns & Pratt, 1989). In 1948, Ruth Patrick (under Hart) was to convince regulatory authorities in the USA that biological methods should be used alongside physico-chemical ones, to adequately protect aquatic ecosystems (Cairns & Pratt, 1989). The rationale was (and is) as follows: physico-chemical methods did not account for periods between sampling; the toxicity of complex mixtures could not be instrumentally quantified; biological effects often occurred below the level of chemical detection; and, the results were in themselves meaningful only in terms of human use of the system (Cairns, 1982). Biologists reply thus: the species inhabiting the water body provide a static, temporal record of events therein; organisms will be exposed to and therefore react to any contaminants present; consistently sensitive endpoints exist; and meaningful extrapolations to any ecological level, including man's needs, are possible. This argument was accepted by industry, regulatory authorities, and the scientific community. After the 1951 establishment of Doudoroff's protocol (using the test formulated by Hart), many single species toxicity tests were developed, including tests upon invertebrates and algae (Cairns & Pratt, 1989), and were used to some extent in the establishment of emission limits (ie. effluent-based standards).

In the 1970's, a growing awareness on the part of industry and legislators of contamination problems produced pollution-limiting technology. A technological philosophy was particularly attractive to these groups, and the terms Best Available Technology (BAT) and Best Practicable Technology (BPT) were soon encountered in legislative documents (Cairns & Pratt, 1989). BPT (= affordable technology) was often implemented without consideration of an industries local situation. Criticisms of BAT and BPT practices included: the size and assimilative capacity of an ecosystem was not considered; each discharge was regarded uniquely, without factoring other discharges into the same receiving system; there was a chance of over-treatment of no benefit to the ecosystem; there was no incentive to develop better technology, once a BPT was in place (Cairns & Pratt, 1989). The shortfalls inherent in effluent-based and technology-based standards have belatedly resulted in the incorporation of biological evidence to hazard evaluation (Cairns & Pratt, 1989). As such, biological monitoring is in its infancy.

In all, biological monitoring assesses the impact of pollutants and, in association with appropriate regulation, derives standards of release limitation. As well as its regulatory role, biological monitoring should be predictive (Stephan, 1986). By this is meant that conclusions drawn under one regime should be applicable to another, perhaps after some form of transformation.

# MINING AND HEAVY METALS

Although mining accounts for only a small percentage of total societal water use (in the US 1960's, 2% of industrial water use, or around 1.8 billion litres/day), and returns around 78% of this to the environment, the water used in the various stages of processing is often highly contaminated. Mining effluent can contain 2 to 10 times the amount of contaminant metal than untreated ore (Down & Stocks, 1978).

Contamination due to metal extraction *per se* of aquatic systems is of several forms:

- dissolved solids soluble salts
- organic reagents frothers, collectors, flocculants etc
- suspended solids
- acidic drainage
- heavy metals (Down & Stocks, 1978).

Other impacts of the mining process can arise from site runoff water, mine drainage, pumped mine water, contamination of ground water flows and deposition into the aquatic system of airborne contaminants from smelting (Down & Stocks; 1978, Humphrey *et al.*, 1990). Estimations of anthropogenic mobilisation of heavy metals into the biosphere is presented below (Nriagu & Pacyna, 1988).

Estimated annual heavy	metal input into biosph	ere	
•	Total input	Mining and processing	
Arsenic	120kt	6kt	
Cadmium	20kt	2kt	
Chromium		11kt	
Copper	2150kt	14kt	
Manganese		43kt	
Mercury	11kt	.01kt	
Molybdenum	110kt	.5kt	
Nickel	470kt	13kt	
Lead	1160kt	6kt	
Antimony	72kt	4kt	
Selenium	79kt	12kt	
Vanadium	71kt	1.2kt	
Zinc	2340kt	28kt	

The total toxicity of these metals (in terms of water needed to dilute to safe drinking standard) is more than radioactive and organic waste toxicity combined (Nriagu & Pacyna, 1988).

## THE FATE OF METALS IN THE AQUATIC ECOSYSTEM

Heavy metals are generally less toxic in hard waters (high  $Ca^{2+}$ , high  $CO_3^{2-}$ ) due, in some part, to competition between the heavy metal and  $Ca^{2+}$  for membrane binding sites (Persoone *et al.*, 1989; Rozsa & Salanki, 1989).

Many of the toxic mechanisms of heavy metals remain uncertain although some work has been carried out.

Inhibition of metabolic coupling via gap junctions was demonstrated using cell culture (Loch-Caruso *et al.*, 1991). The metals investigated were arsenic, cadmium, lead and zinc. Wild-type Chinese hamster V79 cells proficient in the phosphorylation of 6-thioguanine (6-TG) by hypoxanthine phosphoribosyltransferase were cultured with mutant V79 cells lacking the enzyme. The phosphorylation of 6-TG produces a toxic compound, and inhibition of the gap junction transfer of 6-TG was shown by an increased survival of the mutant cells compared to the proficient cells. This implies that heavy metals inhibit the intercellular transfer of metabolites and possibly other types of molecules.

The junction membrane permeability of the silivary glands of *Chironomus* sp. (Diptera) was investigated in terms of the divalent cations of the alkaline earth metals, barium, calcium, magnesium and strontium (Oliviera-Castro & Lowenstein, 1971). It was found that the permeability of the membrane was depressed in the order  $Ca^{2+} > Mg^{2+} > Sr^{2+} > Ba^{2+}$ . This explains the mitigating role  $Ca^{2+}$  (and to a lesser extent  $Mg^{2+}$ ) displays in the toxicity of heavy metals, in that it has a higher membrane binding potential than the heavier elements in the series. Spehar *et al.*, (1978) also attribute the effect of cadmium on gastropods and trichopterans to a disruption of membrane permeability.

Heavy metals also produce teratogenic effects. Paulij et al., (1990) investigated the effects of copper on the embryogenesis of the squid Sepia officinalis. They reported a shortening of the developmental period, but a lowered embryonic viability. Sublethal exposure of lead to Green Frog (Rama clamitans) tadpoles was seen to inhibit acquisition and retention of discriminant avoidance learning, (Strickler-Shaw & Taylor, 1990) implying a neurological pathology.

Hyne et al., (1991) report on the deposition of uranium in the discharged nematocyst of Hydra viridissima. This was thought to inhibit the growth of new nematocysts resulting in a decreased ability to catch prey. Wrenn et al., (1985) review the literature of uranium toxicity in mammals, including humans. They report no evidence of bone sarcoma having been induced by uranium ingestion, but do report bone sarcomas caused by decay chain products of uranium, and soft tissue sarcoma at sites of particulate uranium deposition. Most damage by uranium ingestion occurs in the proximal renal tubule cells. If the dose is not great enough to cause mortality but massive renal failure, the tubule cells are replaced, although displaying differences from original cells. Uranium in sublethal quantities is rapidly excreted (95% removal over 24hrs), but a small amount may be deposited throughout the skeleton, where it appears to be immobilised. The metabolism of uranium was said to resemble that of the alkaline earth metals.

Because many of the heavy metals are essential trace elements (Chromium, cobalt, copper, iron, manganese, molybdenum, nickel, vanadium) cellular mechanics operate to facilitate their uptake. Therefore, in higher concentrations the uptake of excess metal is guaranteed.

# FACTORS AFFECTING THE SPECIATION OF METALS IN THE AQUATIC SYSTEM

In general, it is the speciation of the metal ions which determines the toxicity in a given situation, as well as total metal concentration. Complex organic and inorganic reactions, under the influence of edaphic factors, determine the speciation and toxicity of metals in the aquatic system.

Acidity determines the carbonate activity, and at low pHs the usually stable carbonate/heavy metal complex is largely absent. Low oxygen levels can favour the formation of insoluble sulphides (Kelly, 1988). Naturally occurring organic substances (fulvic and humic acids of plant origin, and various microbial and algal products) are capable of complexing metals, and to varying degrees determine bio availability (Moore & Winner, 1989; McKnight, 1981; McKnight & Morrel, 1979). Clays and silts have a metal binding capacity indirectly proportional to particle size. Norris *et al.*, (1981) observed high metal concentrations in stream water, where the stream bed was sand. A corollary is that the biota of oligotrophic acidic (pH 5 to 6.5) streams are much more sensitive to metal contamination than mesotrophic neutral stream biota.

What follows is a short discourse on the speciation of selected heavy metals, namely copper, lead, zinc and nickel. Uranium is discussed in the last section of this introduction.

#### Copper

The aqueous chemistry of copper is complex because it can exist in three stable oxidation states. Copper as the divalent cation, tends to disappear quickly, due to complexation, precipitation and adsorption with inorganic, and complexation with organics (Effler *et al.*, 1980). Taub *et al.*, (1986) demonstrated that 25% of the copper recoverable from a laboratory microcosm was adsorbed to quartz sand. In some instances, the chemistry of copper added to natural ecosystems is controlled largely by humic substances. Modelling the speciation  $Cu^{2+} + HA \rightarrow CuA^+ + H^+$ , McKnight and Morrel (1979) derived an equilibrium constant  $K_{eq}=10^{1.5}$ . Certain chlorophytic algae are capable of releasing humic material which is a weak copper complexing agent, and the blue-green algae can produce both weak and strong complexing agents (Moore & Winner, 1989). These reactions render the copper biologically unavailable, and reduce toxicity.

The general consensus is that most copper is adsorbed under normal conditions and the concentration of the free ion is very low. The concentration in the filterable fraction (<0.4um) may range from 3 to 80% of total copper, and is largely bound to organics (Kelly, 1988). The tendency for copper to bind to inorganics is more pronounced when the particles are modified by manganese or iron oxide coatings. Concentrations typical of unpolluted rivers range widely (0.6 to 400ppb), with most median concentrations from 5 to 10ppb (Kelly, 1988). Historically, the copper content of available ore has decreased from 40% to around 0.2% processed today (Down & Stocks, 1978).

#### Lead

Lead, a group IV element along with carbon, germanium, silicon and tin, is capable of forming organoderivatives. These derivatives are considerably more toxic than the free stable ion (Kelly, 1988). Under anaerobic conditions *in vitro*, lead methylation has been observed. This has not been observed in the field (Kelly, 1988). Background levels of lead have been measured as low as 0.006 to 0.05 ppb, although in pristine mineralised areas, concentrations two or three orders of magnitude greater have been measured (Kelly, 1988) The divalent cation is most stable under oxidising conditions, forming carbonate above pH 7.2 and hydroxide above pH 10. The carbonate is assumed to act as the major factor controlling the free ion concentration, although at acidic pH the sulphate may assume this role. Lead and zinc often occur together.

#### Zinc

Zinc exists in only one stable oxidation state, and its chemistry is more easily understood. Wide use of zinc makes analysis of very dilute solutions difficult because of micro-

contamination, but measures of filterable fractions in pristine waterbodies range from 1.8 to 20ppb. Adsorption onto particulates is the major factor in determining free ion concentration. Hydroxides and carbonates formed above pH 8 remain readily soluble. Adsorption is strongly pH dependant, almost nil at pH 6, and increasing with pH (Kelly, 1988).

#### **Nickel**

In most natural waters, pH 5 to 9, the most prevalent nickel ion is Ni<sup>2+</sup> or the carbonate, with hydroxide, chloride, sulphate and ammonium also present. A large proportion (5 to 80%) of the total nickel concentration is found in the non-filterable fraction, probably adsorbed onto particulate material. Particulate adsorption, rather than precipitation, is thought to control free ion concentrations (Kelly, 1988).

Particulate phases of the metal, as organic or inorganic precipitant complexes, can enter the sediment (n3). Disturbance, both physical and biological (benthic macroinvertebrates) can at any time remobilise these sediment-bound metals (m8). For both rivers and lakes the nature of the sediment is an important factor in controlling sedimental adsorption. Adsorption and precipitation are functions of surface area, and the capacities of the sediments increase as the particle size decreases (Kelly, 1988). Where there is little retention of fine clay and organics, the concentrations of heavy metals in the sediment is likely to be low (Norris *et al.*, 1981).

# **BIOLOGICAL MONITORING - METHODOLOGY**

A current source of contention in the biological monitoring field centres around the aptness or otherwise of traditional single species toxicity tests to accurately reflect effects in the field. Proponents hold that natural variability in the field precludes use of wider ranging studies for regulatory purposes, that information gained from multispecies testing is difficult to interpret and that the results of the two methods are in any case mostly comparable (Tebo, 1985). Critics say that it cannot predict effects at the population and community levels, that an allencompassing standard of toxicant limitation is not effective in protecting diverse systems (Tebo, 1985), and that unanticipated effects can be observed in multispecies testing (Cooper & Stout, 1985). All acknowledge that effects of contamination on populations and communities is but poorly understood, and emphasise the need for an escalation of effort in this area (Tebo, 1985; Cairns & Pratt, 1989; Loewengart & Maki, 1985).

Current methodologies in biological monitoring include (Humphrey et al. 1990):

- Bioassays the use of defined species to estimate toxicity *in vitro*;
- Early detection systems physiological, behavioural biochemical and histopathological techniques (bioassays) used *in situ*;
- Indicator organisms the presence or absence of sensitive or resistant organisms thought to characterise particular conditions *in vivo*
- Autecological (population) studies the natural history of populations of species that provides essential baseline data;
- Community structure and function how species and populations interact in terms of niche structure and energy movement *in vivo* and *in vitro*; and
- Bioaccumulation the accumulation of contaminants in exposed organisms, serving as a record of ambient contaminant concentrations over time.

There is no ideal biological monitoring method. An ecological impact study or monitoring program should include those methods considered appropriate to the task.

There is a large literature on single species toxicity tests that cover all levels of community structure of the aquatic ecosystem. Extensive reference lists can be found in Phillips, (1980)' Kelly, (1988) and Krenkel, (1975). The literature of vertebrate biological monitoring will not be discussed.

#### Microorganisms

A commercially available microbial (Microtox) assay uses luminescent bacteria. The bacteria are freeze dried and resuspended for use. Light production is measured for a range of dilutions of the toxicant, and toxicological parameters can be then estimated. Chang *et al.*, (1981) describe the use of this system for pesticides, and Loewengart and Maki (1985) provide results using Microtox in comparison to multispecies methods. In the latter instance, Microtox took 5% of the time, was cheaper, yielded fairly reproducible results, required no culturing and was standardised and easy to handle.

#### Algae

Algae, the primary producer in many aquatic systems, have been well investigated in terms of metal susceptibility. Also, due to copper sulphate treatment of algal blooms in eutrophied water bodies, copper relations with a variety of alga are well understood. Although a micronutrient requirement, copper sensitivity becomes important at concentrations higher than 10mg/L, beyond which more resistant species may become dominant (McKnight & Morrel, 1979; McKnight, 1981). Accidental inoculation of a copper resistant strain of alga into a multispecies trial using ten algae, resulted in a more complex co-dominance pattern compared with those not so treated, with several species able to maintain populations under the dominance of the resistant strain (Taub et al., 1986).

Some authors recommend against the use of algae in single species toxicity tests because they may increase production under stress *et al.*, 1980), and in stationary growth phase are known to release metal binding substances (McKnight & Morrel, 1979). It is also difficult to maintain mono-species cultures in many situations, and there are problems associated with agglutination (Effler *et al.*, 1980). Other authors have reported excellent results and recommend their use as biological monitors (Kallqvist, 1984)Algae tend to be included in most multispecies tests, particularly in microcosm and mesocosm trials, to determine how effects at the bottom of the food chain are transmitted upward, and also how events at higher levels affect the algae (Carpenter *et al.*, 1987).

Copper inhibition of nitrogen fixation by the blue-green algae was investigated by Horne and Goldman (1974), and was more sensitive than either photosynthesis or chlorophyll a for the whole lake. Inhibition was seen to occur at 10 ug/L.

#### **Macroinvertebrates**

Macroinvertebrates have become important in single species toxicity tests, *in situ* sampling and in multispecies tests. They have a wide range of sensitivities and are involved in complex interactions, and hold promise as the best group for biological monitoring purposes (Hellawell, 1986).

Various members of the cladoceran *Daphnia* genus have well established protocols (Mount & Norburg, 1984). The cladocerans as a group are excellent subjects for short-term testing, because they have a rapid life cycle of 4 to 7 days, during which they may produce up to three broods. A 4-day *Ceriodaphnia* test recently published (Masters *et al.*, 1991), shows comparable sensitivity to the 7-day test of Mount and Norburg.

Hydra species have been used in various situations. OSS uses Hydra viridissima in its seasonal testing of retention pond waters from Ranger Uranium Mine (OSS, 1988). Goss et al., (1986) provide a protocol for Hydra sp. in human health hazard evaluation.

#### **Aquatic Insects**

In the past, aquatic insects have been extensively used to assess the status of water bodies Indices such as the Trent Biotic Index (Woodiwiss,1964) and the Chandler Score (Chandler, 1970) were devised to assess organic pollution and are generally disfavoured today, although the concept of indicator species maintains its importance. Multivariate analysis and methods applied to presence/absence or species abundance is the most common contemporary analysis. Several Australian publications report success using this approach (Marchant, 1990: Norris et al., 1981; Weatherly et al., 1967). However, the aptness of accepted methodology and mathematical technique has been questioned, with some authors preferring distance measures such as the Brau-Curtis over the Chi-squared measures used in detrended correspondence analysis, among others (D. Faith pers comm., 1991). Also, natural background fluctuations can often swamp trends if sufficient data through time are not present in the analysis (C. Humphrey pers comm., 1991).

Apart from extensive use as *in situ* biological monitors, aquatic insects have received scant attention. Their size and complex life history (which usually includes several moults) make them unacceptable in single species testing (Smock, 1983). Several authors have included aquatic insects in multispecies microcosm testing, with variable results, and in some cases, tenuous endpoints, e.g. avoidance behaviour (Pontasch & Cairns, 1991).

#### Gastropods as biological monitors

Much pollution work has been carried out on the marine molluses, particularly bivalves in the genera *Mytilus*, *Perma* and *Crassostrea*. These species have a broad marine distribution, permitting their use for wide-ranging metal pollution studies. Marine gastropods have been used to a lesser extent, and freshwater gastropods still less.

Ravera (1977) examined the effects of heavy metals on *Biomphlaria glabrata*, a freshwater pulmonate, in terms of mortality and fecundity of the adults, and the viability of the embryos. It was seen that the species was sensitive both as adult and embryo. Larval survival after exposure to chrome and copper at higher concentration (>1.0ppm) was of the same order as adult survival, but was greater than adult survival at concentrations from 0.1 to 0.5ppm. He concluded that the species should be used in toxicity testing because it was easily reared and was sensitive to the heavy metals.

Other early testing includes that of Borgman *et al.*, 1978 (lead effects on *Lymnaea palustris*), Rehwoldt *et al.*, 1973 (copper, zinc, nickel, cadmium, mercury and chromium effects on *Amnicola* sp.) while reference lists can be found in Mance (1987), Phillips (1980) and Simkiss and Mason (1983).

Holcombe et al. (1984) provide methods for conducting embryo through to adult exposures. They tested the effects of cadmium and reduced pH on the pulmonate Aplexa hypnorum and concluded that the species was suitable for use as a biological monitor in all its life stages. Brown (1980) showed that Hydrobia jenkensi responded (mortality) to in situ metal levels, but not to dieldrin levels, which reached 30ppb. Marigomez et al., (1986) demonstrated feeding suppression and weight loss in the terrestrial pulmonate (slug) Arion ater. Percentage weight loss was linear at high concentrations and exponential at the lower concentrations, suggesting the failure of a compensatory mechanism after 15 days. Watton and Hawkes (1984) report on a series of copper and ammonia trials conducted on the prosobranch Potamopyrgus jenkinsi. Juveniles were seen to be less tolerant than adults, and were generally less tolerant than most other invertebrates reported in the literature. They concluded that the species would be useful as a biological monitor of copper and ammonia in the various ionic forms. Munzinger and Guarducci (1988) report on the exposure of Biomphlaria glagrata to low levels of zinc. The embryo was seen to be the most sensitive stage. Juveniles were roughly 3 times more sensitive (comparing percentage mortalities after 33 days exposure) than the adult. They concluded that the species was a successful laboratory indicator of low level zinc pollution. Russell et al., (1981) investigated the effect of cadmium on *Helix aspersa* and its accumulation and entry into the food chain.

Among other observations, they noted a disruption of gametogenesis. Ramesh Babu and Venkateswara Rao (1985) investigated the biochemical basis of copper toxicity in *Lymnaea luteola* and concluded that copper altered the redox potential of the snails metabolism by reducing the activity of cytochrome oxidase and NADH to NAD ratio. Skidmore *et al.*, (1988) demonstrated a reduction in fecundity of *Physastra gibbosa* following static exposure to copper concentrations above 16ppb. They recommend the fecundity endpoint as a means of measuring sublethal toxicity of substances to Australian aquatic species.

Although the work performed to date on the pulmonates does not comprise a large part of the molluscan metal-related literature, what does exist indicates their sensitivity to heavy metals and authors frequently recommend them as biological monitors of heavy metals.

#### **URANIUM AND URANIUM MINING**

The extraction and on-site processing of uranium ore poses risks to the aquatic environment through the release of uranium and its decay chain products into local systems. On-site processing is invariably carried out because of the saving of transport costs of a semi refined product over raw ore. The Alligator Rivers Region, area of operation for the Ranger Uranium Mine (RUM), receives a highly seasonal rainfall. Dams have been constructed around the mine and mill to receive runoff water during the wet season. Because the rainfall can be intense, RUM is licensed under recommendations of the Fox Report (1977), to release water from its Retention Pond #4 once the flow rate in the nearby Magela Ck exceeds  $20\text{m}^3$ /sec. This retention pond receives runoff from the waste rock dump, and is low in uranium (40ppb) (Hyne, 1989). Retention Pond #2 receives runoff from the milling area and has highly variable uranium concentrations (660-3000ppb). In the 1991 wet season, values of between 1300 and 1700ppm were recorded. RUM is licensed to release from RP2 once every ten years. Release from this dam would only occur if there was a possibility of overflow during the wet season. There has been no release from RP2 to date (Diagrams 1 and 2 show respectively, a map of the Alligator Rivers Region and layout of RUM).

The environmental chemistry of uranium is complicated by the variety of forms the uranyl ion may take. In Magela Ck, slightly acid conditions (pH 6) and low alkalinity (as CaCO'<sub>3</sub>1.6mg/L) (OSS, 1988) favour UO<sub>2</sub>OH+ (50%) and UO<sub>2</sub><sup>2+</sup> (10%) over neutral or amnionic forms, the remainder comprising complexed forms of UO<sub>2</sub> (S. Machett *pers. comm.*, 1991). The toxicity of the cations is much higher than the anions because of membrane permeability (R. Hyne *pers. comm.* 1991).

Giesy et al., (1986) report stability constants for various species of the uranyl ion complexed with Aldrich<sup>R</sup> humic acid. The stability constant (K=[ML]/([M][L]) of the neutral and amnionic carbonate forms were 2 to 3 times larger than those of the free uranyl anions. They determined the percentage presence of the various species in a soft, acid, humate rich water (pH=5.5, Ca=5.2mg/l, TDOC=14mg/l). 77.1% of the uranyl ion was present as the free anion (31.1) or the mono-hydroxide (46.0). The remainder (22%) was bound to humic acid, with 0.6 bound to sulphate. These figures compare reasonably well with Machett's figures above, and apart from having a lower dissolved organic carbon level, Magela Ck water is fairly similar to the water used in the Giesy et al., report.

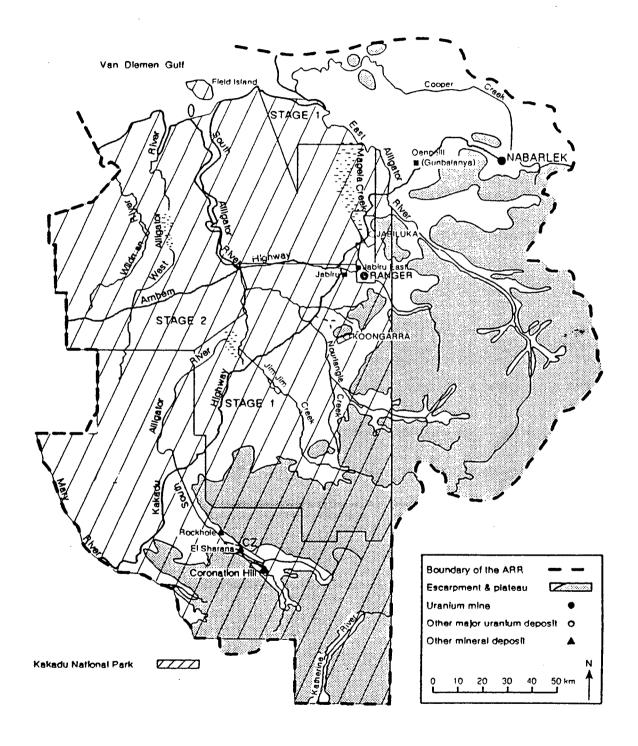


Diagram 1. The Alligator Rivers Region

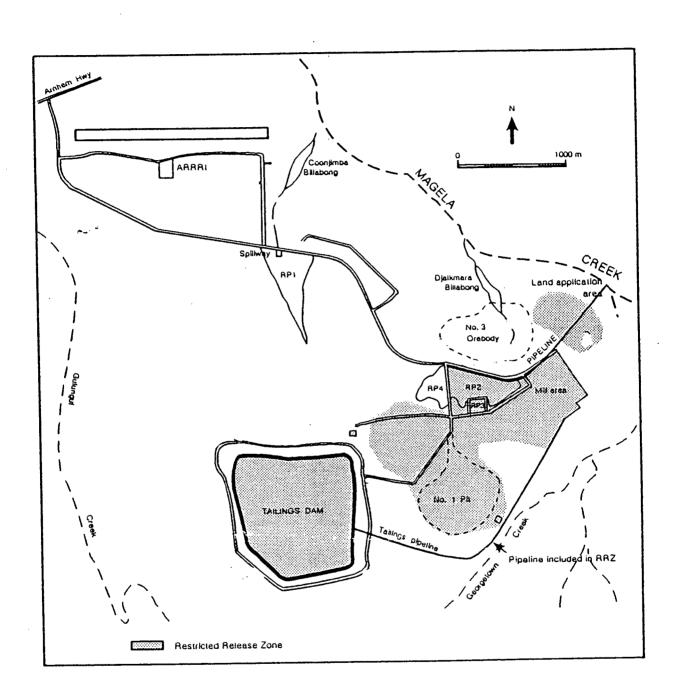


Diagram 2. Layout of operations and water management system at Ranger

Hydrous oxides of iron and manganese may also remove the uranyl ion from solution. Soluble manganese will co-precipitate with heavy metals under oxidising conditions. Under slightly acidic and reducing conditions, the manganese will redissolve and release the bound heavy metal back into the water column (OSS, 1988).

Uranium present in retention pond waters released into Magela Ck will be present to a significant extent in toxic cationic forms. Precipitation and remobilisation will presumably occur along the length of the stream. In the cationic form the uranyl ion poses a potential threat to fauna of the creek and floodplain system.

# MATERIALS AND METHODS

#### **Species descriptions**

The seven local gastropod species selected for assessment are distributed amongst the freshwater bodies of the region. They were:

Amerianna carinata
Pulmonata:Planorbidae
Amerianna cumingii
Pulmonata:Planorbidae
Gabbia sp.
Prosobrancha:Bithyniidae
Glyptophysa sp.
Pulmonata:Planorbidae
Gyraulus sp.
Pulmonata:Planorbidae
Helicorbis sp.
Pulmonata:Planorbidae
Pulmonata:Planorbidae
Pulmonata:Planorbidae

A. carinata is sinistral with a flattened carinate spire. It measures around 10 mm in length by 8 mm in width at full size. The shell is moderately robust. It is monoecious.

A. cumingii is sinistral with a rounded depressed spire. Mature individuals measure from 8 to 12 mm in length and 8 mm in width. Growth continues into senescence where individuals may be up to 15 mm in length. The shells are moderately robust, slightly stronger than those of A. carinata. It is monoecious.

Gabbia sp. is dextral and turbinate. It measures up to 5 mm in length and 4 mm in width. It is dioecious and not sexable by gross morphology. The shell is robust.

Glyptophysa sp. is sinistral with a tall pointed spire. It measures 20 mm in length and 13 in width, although larger individuals are commonly encountered. It is monoecious. The shell is robust but without distinctive sculpturing typical of the genus.

Gyraulus sp. is dextral and discoidal. It measures up to 6 mm in diameter. It is monoecious. The shell is fragile.

Helicorbis sp. is dextral and discoidal. It is up to 7 mm in diameter, and is flattened on the underside. It is monoecious. In habit it is very similar to Gyraulus sp., and both species were observed in the wild to be epiphytic grazers on the underside of water lily leaves. The shell is fragile.

Lymnaea sp. was the largest species assessed. It is dextral and turbinate. It measures 30 mm in length by 25 mm in width at full size. It is monoecious. The shell is fragile, and care was needed in handling this species. It produced copious slime and excreta. Individuals tended to cluster together and necrophagy apparently occurred.

#### REARING CONDITIONS

All species were fed washed outer lettuce leaves as required. An extra calcium source was not supplied. Fine to medium sand (<2mm) was added to the rearing tanks. All rearing tanks were aerated with oil-free compressed air using aquarium stones.

The larger species were reared in wide, slightly tapered, circular tanks 1.5m in diameter and up to 0.6m deep (Plate 1b). The conductivity varied according to the degree of evaporation and the period between cleaning and half replacement which occurred on an irregular basis. No attempt was made to hold conductivity at any particular level. Measurements made indicated 80µS/cm as an average value. Species reared successfully in these tanks were A. carinata, A. cumingii, Glyptophysa sp. and Lymnaea sp..

Tanks 1.5m deep by 0.6m square and tanks 0.4m deep by 0.8m by 0.4 m were also used for rearing. The 1.5m deep tanks were quite suitable for A. carinata, Gabbia sp. and Glyptophysa sp., but best conditions appeared to prevail in the wider shallower tanks. A. carinata and A. cumingii were successfully reared in the 0.8m X 0.8m X 0.4m tanks.

Gabbia sp., Gyraulus sp. and Helicorbis sp. were reared in Magela Ck water in 20L aquaria. For the large tanks, the rearing water was from the town main supply, which was much higher in conductivity and carbonate than Magela Ck water. Populations of A. carinata, A. cumingii and Glyptophysa sp. were maintained in 40L aquaria of Magela Ck water to provide acclimated adults for sub-lethal testing. This procedure was not wholly successful; cleaning by siphonation sometimes injured individuals and recruitment was low, possibly because (of loss of) juveniles during siphoning.

A. carinata, A. cumingii, Glyptophysa sp. and Lymnaea sp. were in adequate supply throughout the period of testing. The smaller species were not successfully maintained in sufficient numbers. Gabbia sp. and Helicorbis sp. stocks dwindled to zero.

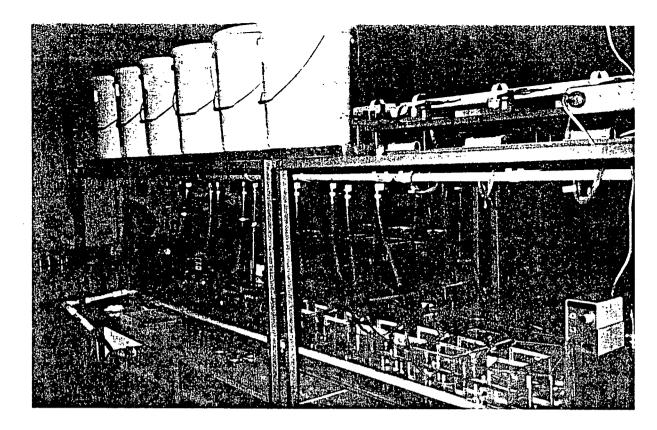


Plate 1a. Dosing apparatus

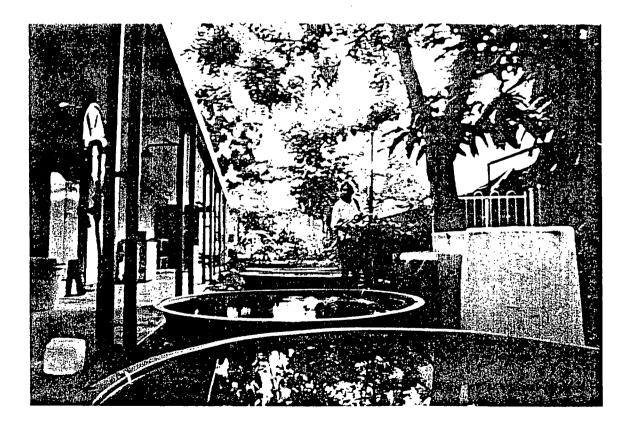


Plate 1b. Rearing tanks



Plate 1c. Magela Ck. High flow



Plate 1d. Magela Ck. Low flow

Confinement of snails, for exposure to toxicant or to obtain eggs for observation or exposure, was in clear open-ended 50 mL plastic sample jars. It had previously been established at OSS that the snail species readily oviposited on the inner surface of the vials. This allowed unobstructed observation of the developing embryos. In the case of adult confinement, open ends were covered with nylon mosquito netting (around 2mm gauge), held in place with rubber bands. For juvenile exposure, nylon netting of between 0.4 and 0.5mm gauge was used.

When confined, pairs of snails were fed daily a standard disc (20mm diameter) of washed outer lettuce leaf. Observations of egg masses were made under a dissecting microscope. To prevent desiccation or overheating of the egg masses during observation, vials were transferred into a glass histology box containing rearing water.

#### PRELIMINARY OBSERVATION #1

Prior to the commencement of toxicity testing, preliminary observations were undertaken to become familiar with the various species in terms of reproductive capacities and developmental characteristics in the laboratory.

The first observation involved A. carinata, A. cumingii, Glyptophysa sp., Gyraulus sp. and Helicorbis sp. Four replicates per species were used except for A. cumingii, which had seven replicates. Each replicate was a vial containing a pair of snails. These were placed into the breeding tanks. Observations of egg mass and egg numbers were made daily for 5 days, commencing 19/1/91. Plates 2a to 2h show the developmental stages of A. carinata, which are typical for the other species examined. Plates 3a to 3d show some of the irregularities seen during embryonic development.

### PRELIMINARY OBSERVATION #2

This was conducted in a similar manner to the previous observations (#1) and commenced 25/1/91. At the end of the 5 day laying period, the development of each egg mass was followed through to hatching by taking daily counts of the developmental stages present. This meant that on the first day of developmental observation (i.e. after 5 day laying period), early stages were present from only the previous day's laying, and later stages were from days prior to this. However, since the age of each egg case was known, it was possible to derive percentage data relating to the duration of each stage. The species observed were A. carinata, A. cumingii, Gabbia sp., Glyptophysa sp., Gyraulus sp. and Lymnaea sp..

Preliminary observations #1 and #2 provided information on the reproductive output and developmental characteristics (such as duration and %mortality) of each embryonic stage, and the variation associated with these parameters. In terms of the ensuring toxicity trials, the variation associated with each parameter was considered to be as important as the mean value. On the basis of these observations, it was possible to "score" each species and parameter as:

Good (+=low variability and sufficient quantity of eggs/egg cases)

Moderate (0=moderate variability and sufficient quantity)

Poor (-=high variability and/or low quantity).

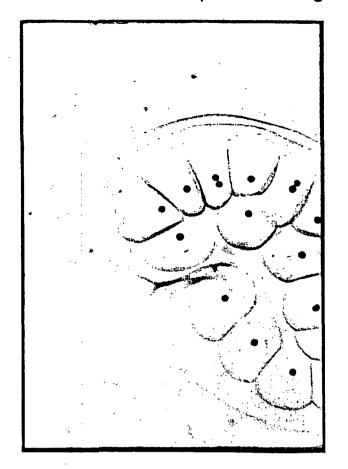


Plate 2a. Gastrula

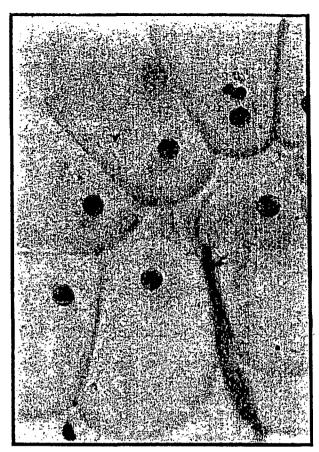


Plate 2b. Early trochophore

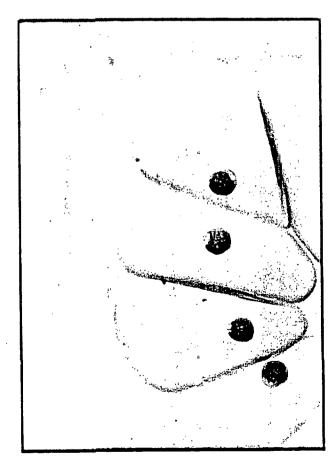


Plate 2c. Late trochophore

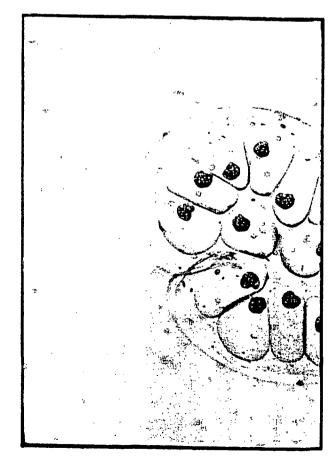


Plate 2d. Veliger

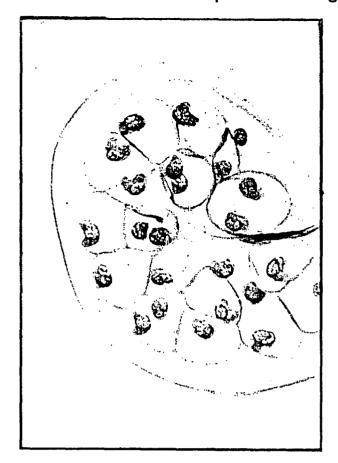


Plate 2e. Hippo



Plate 2f. Early hatchling

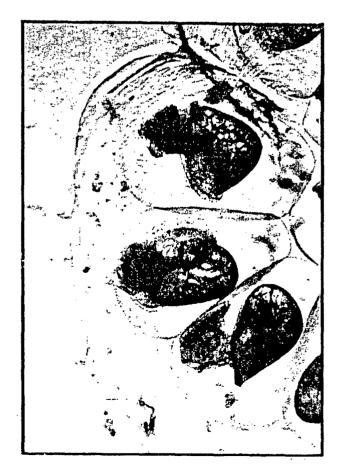


Plate 2g. Mid hatchling



Plate 2h. Late hatchling

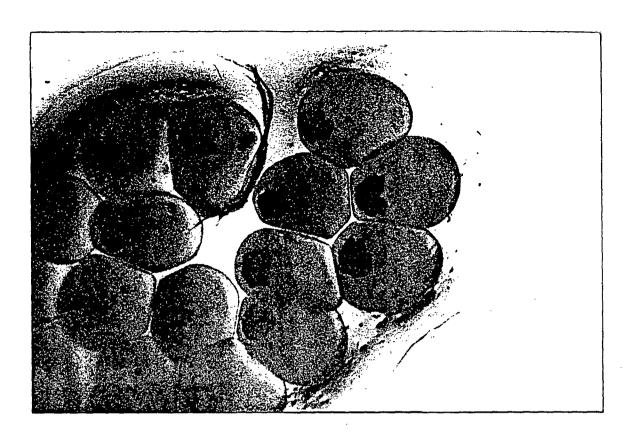


Plate 3c. Coagulation at hippo stage. A.cummingii

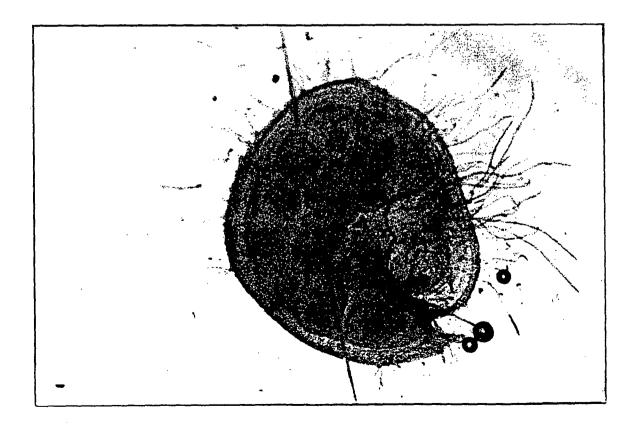


Plate 3d. Fungal infection. Glyptoplysa sp.

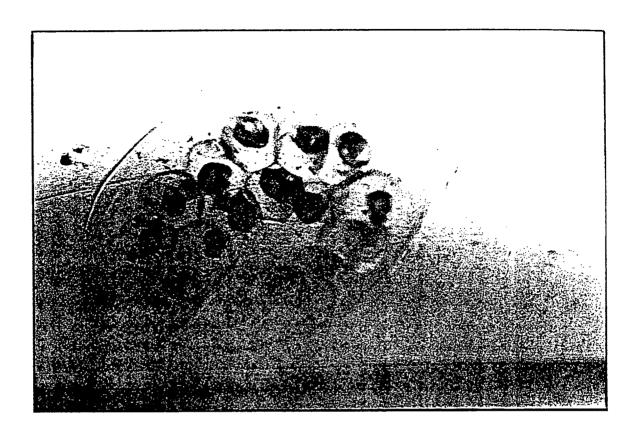


Plate 3a. Normal and ghost hatchlings. A.carinata

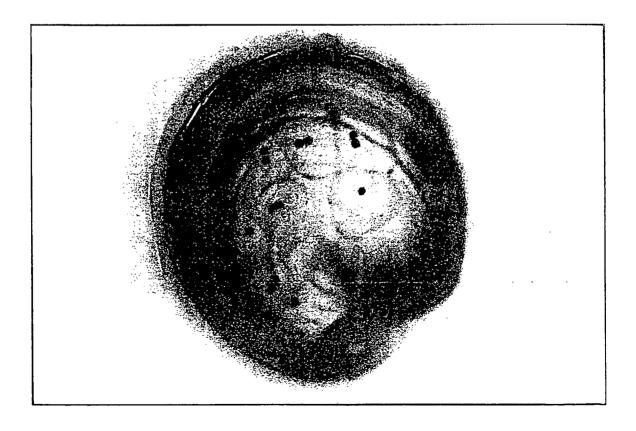


Plate 3b. Polyvitelliny. A.carinata

# **TOXICITY TRIALS**

# SCHEDULE 1 CONDUCT OF TOXICITY TRIALS

Trial no.	Endpoints tested	Specie	es tested	Toxicant re	gime
1	Developmental period	A. carii	nata	Control	
	Juvenile mortality	A. cum	ingii	0.3% RP4	
		Glyptop	ohysa sp.	1.0% RP4	
				3.2% RP4	
				10% RP4	
		G		32% RP4	
		Commenced 18/2/91		ed 27/2/91	
2	Developmental period	A. cum	-	Control	
	Embryonic mortality	Gyrauli	us sp.	1.0% RP2	
	Juvenile mortality	Lymnae	ea sp.	3.2% RP2	
	•			10% RP2	
				32% RP2	
				100% RP2	
		Commenced 28/2/91	Terminat	ed 12/3/91	
3	Developmental period	A. carii	nata	Control	
	Embryonic mortality	A. cum	ingii	1.0% RP2	
	Juvenile mortality	Glyptop	ohysa sp.	3.2% RP2	
				10% RP2	
				32% RP2	
				100% RP2	
		Commenced 13/3/91	Terminat	ed 25/3/91	
4	Developmental period as:	A. carii	nata	Control	
	pre-hatchling	A. cumi	ingii	32% RP2	
	hatchling	Glyptop	ohysa sp.	42% RP2	
	total			56% RP2	
				75% RP2	
				100% RP2	
		Commenced 17/3/91	Terminat	ed 31/3/91	pto

SCHEDUL	E 1 contd CONDUCT OI	F TOXICITY TRIALS	
Trial no.	Endpoints tested	Species teste	d Toxicant regime
5	Egg mass laying	A. carinata	Control
	Egg laying	A. cumingii	1.0% RP2
			3.2% RP2
			10% RP2
			32% RP2
			100% RP2
		Commenced 31/3/91	Terminated 7/4/91
6	Egg mass laying	A. carinata	Control
	Egg laying	A. cumingii	1.0% RP2
	Adult weight change	Glyptophysa	sp. 3.2% RP2
	Juvenile mortality		10% RP2
	Control reared		32% RP2
	juvenile mortality		100% RP2
		Commenced 12/4/91	Terminated 29/4/91
Known par	ent		
	Fertility	A. carinata	32% RP2
	Juvenile mortality	A. cumingii	
		Commenced 11/4/91	Terminated 13/4/91
7	Egg mass laying	A. carinata	1.0% RP2
	Egg laying	A. cumingii	17ppb totU
	Juvenile mortality		10% RP2
	Control reared		170ppb totU
	juvenile mortality		32% RP2
			540ppb totU
		Commenced 1/5/91	Terminated 15/5/91
Algae/size	Juvenile mortality	A. carinata	32% RP2
		A. cumingii	
		Commenced 2/5/91	Terminated 14/5/91

## Water collection

Control water was collected from Magela Ck, upstream from the Ranger outlet pipe at the Georgetown creekside monitoring site. This was pumped into a 2,000L tanker and transported back to the lab. This tanker, pump and hoses was used exclusively for collecting control water. The retention pond waters were collected similarly, using a tanker, pump and hoses expressly for that purpose, or in an acid washed, 500L polythene tank, using the same pump and hoses collected, the water was transferred via the appropriate pump and hoses from the tankers into 3,000L polythene storage tanks. These had been thoroughly scrubbed and rinsed, and were flushed out between trials with town supply water. The stored water was aerated with a rapidly bubbling aquarium stone, using oil free compressed air. It was assumed that this would keep redox precipitation of manganese to a minimum, but htis was not tested at any stage.

The toxicity testing was carried out using the apparatus depicted in Diagram 1 and Plate 1. During trials, the header tanks were refilled daily with freshly prepared solutions of designated dilution water. Water from each 20L header tank flowed by gravity into two 4L replicate testing chambers. In Trial #1, the header tanks were aerated with oil free compressed air, but in subsequent trials, the replicate chambers were aerated. Dissolved oxygen concentrations in vials covered with the smaller mesh were measured and observed to be near saturation. Flow rate to each chamber was 7mL per minute. This resulted in around 93% replacement in 24hrs.

During trials, pH, dissolved oxygen concentration and conductivity were measured daily using electronic instruments. The pH of test waters was difficult to determine precisely because of the poorly buffered nature of Magela Ck water. A standard time interval (15 seconds) passed between the time at which the electrode was placed in the solution sample and the time at which the pH valve was read.

Uranium and manganese concentrations were analysed for Trials 1,2, 3, 5, 6, and 7. Uranium was measured by Scintrex Time Delay Flourimetric technique and manganese was measured by Graphite Flameless Atomic Absorption Spectroscopy.

Whole snails and dissected tissue which had been exposed to a range of retention pond water concentrations were preserved for electron microscopy and EDS (Energy Dispersive X-ray Spectroscopy) analysis. Dissection of organs and tissues was carried out using diagrams in Barnes The preservation solution was a double phosphate buffered glutaraldehyde solution.

## ELECTRON MICROSCOPY AND EDS

	Treatment	Time
TEM series	Phosphate buffer 0.1M/1%OsO <sub>4</sub> 1hr Phosphate buffer	3X5min. washes
Dehydration for		
EDS and TEM		
	50% acetone	2X5min.
	70% acetone	1X5min.
	0.5% Uranyl acetate/70% acetone 1X60min.	
	(TEM only)	
	70% acetone (EDS only)	1X60min.
	90% acetone	2X10min.
	Abs acetone	2X10min.
,	Propylene oxide	2X10min.
	Propylene oxide:Spurrs (film)	2hr
	Cured overnight at 70°C	

Sections were cut with a Reichert - Jung Ultracut E microtone to approximately 80nm. These were stained with Reynolds lead citrate for 10min and #5 uranyl acetate for 10 min. The instrument was a Phillips EM300 set at 60kV. This was fitted with a goniometer and minilens. X-rays generated from the unstained specimens were collected in an EDAX 9100 detector. Background radiation was minimised by a beryllium ring insert. The analogue signal was converted to digital for display and analysis.

Operating voltage	60kV.
Probe diameter	Approx. 1µm.
Count live time	200 sec.
Goniometer angle	35°

## **DETAILS OF TRIALS**

### Procurement of egg masses

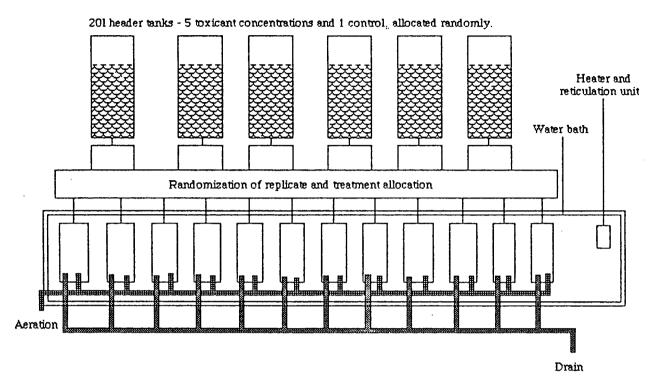
Diagram 3 represents the continuous flow dosing apparatus used throughout most of the trials. For Trials #1 through to #4, egg masses were procured by confining adult pairs in the manner described for a period of 24hrs in control water. An initial suppression of oviposition following confinement was often observed. In order to obtain sufficient embryos (>20 per sample) it was necessary to confine at least twice the number of pairs than samples required. At the start of the trial, the embryos were mostly at the gastrula stage, although some at the blastula stage were also used. Before exposure, the position on the vial wall, the developmental stage and embryo number of each egg mass were determined. Each egg mass was then observed daily and the numbers of embryos at each developmental stage were noted.

When it was necessary to use more than one egg mass per sample, egg masses of similar developmental stage were sought. The vials were distributed across replicates such that similar numbers of embryos were exposed to each treatment.

The developmental period was the interval from the first day of exposure (day 1=1 day of development) until observation of egg mass rupture. For developmental endpoints, termination of the trials occurred when either all egg masses had ruptured (hatching), or it was obvious that rupture would not occur in those still intact. In the appendices, the latter circumstance is denoted by "Termination". Exposure of adults was over an arbitrary period: 7 days for Trial #5; 5 days for Trials #6 and #7.

In Trials 1,2,3,6,7 and `Known parent', juvenile exposure was performed on neonates hatched from exposed egg masses. Trials 6.7 and Algae/size used neonates hatched from egg masses that had been laid and reared in control water. At the observation of egg mass rupture, neonates were exposed for a 48hr period. Trial #7 included both 48 and 96hr exposure. Mortality was determined by subtracting the number of alive at the end of the exposure period from the numbers expected to hatch, as indicated by the last prerupture count. In the case of moribund individuals, the criterion of survival was the retraction of the foot in response to prodding by a dissection needle. Numbers of dead neonates did not appear to be a reliable measure of mortality, possibly because of rapid decay.

# DIAGRAM 3. THE DOSING APPARATUS.



For Trials #1 through to #3, 2 vials per replicate were exposed to each treatment. Because of difficulties in pooling data within and amongst replicates, this was increased to 3 vials per replicate in Trials #5 though to #7. Unless otherwise, all tests and control rearing were carried out at 30°C and aeration was by oil free compressed air. A representation of the continuous flow dosing apparatus is shown in Diagram 3.

#### Trial #1

Trial #1 was undertaken to assess the sensitivity of *A carinata*, *A. cumingii*a and *Glyptophysa* sp. The sensitivity of developmental retardation and juvenile mortality in *A carinata* were observed using RP4 water, RP2 water was used in all subsequent trials, with a 100% treatment replacing the 0.3% treatment.

#### Trial #2

Trial #2 was undertaken partly to address the problems encountered in Trial #1. This trial also involved the exposure of control laid egg masses. Egg masses were derived from A. cumingii, Gyraulus sp. and Lymnaea sp.. The endpoints examined were the same as Trial #1, but more care was taken in following the embryos through their development. Embryonic mortality in egg masses was quantified at the various stages by daily counts.

### Trial #3

Trial #3 was essentially a repeat of Trial #1 using the altered toxicant regime. The species tested were A. carinata, A. cumingii and Lymnaea sp.. The endpoints tested were Developmental period, Embryonic mortality and Juvenile mortality.

#### Trial #4

Trial #4 was undertaken to determine the toxicant concentration at which developmental retardation would first occur. Since a LOEC had previously been established at 100% RP2, a regime which bracketed 32% and 100% RP2 was used. This series descended by a factor of 0.75 between successive treatments. The trial used control laid egg masses and was conducted as a static test without treatment replication in 4L aquaria with daily half replacement.

#### Trial #5

In previous trials, a single vial each containing one A. carinata pair had been exposed to the treatments and an effect of egg laying depression had been observed. Trial #5 aimed to quantify this effect. The species tested were A. carinata and A. cumingii. Three pairs of snails of each species were used.

## Known parent

The 'Known parent' trial was conducted to investigate the influence that parentage might have on embryonic development and juvenile mortality during and after exposure of egg masses and juveniles to RP2 water. The species used were *A. carinata* and *A. cumingii*. Several pairs of snails were confined individually in vials in control water. Snails were observed daily and placed into new vials once egg masses had been deposited. The egg masses, from known parents, were then exposed to 32% RP2 and ensuing development and juvenile mortality recorded in the manner previously described.

#### Trial #6

To determine the applicability of results from toxicity tests in the laboratory, trial #6 was conducted concurrently in creekside and laboratory trials using the same species and endpoints at each location. Flow rates in the creekside trial were 49mLs/min (cf 7mLs/min in the laboratory), and water temperature at this site was ambient Magela Ck water temperature, (28° to 32°C). Creek aeration was by oil-free compressed air.

#### Trial #7

Trial #7 aimed to determine whether or not the observed effects of RP2 water were attributable solely to total uranium concentration. No control (creekwater) was run with this trial because of equipment limitations and, within the context of the experiment, a control was deemed unnecessary. Estimates of the total uranium levels of RP2 water were based on Scintrex determinations from previous trials. 100% RP2 was assumed to have a total U level of 1700ppb. Daily solutions using AR grade uranyl sulphate and Magela Ck water were made to correspond to 1% 10% and 100% RP2 total U levels. At the end of day 1, the 100% U treatment was replaced with a 32% treatment, following mortality of all A. carinata individuals in that treatment.

#### Algae/size

The 'Algae/size' trial was carried out to determine whether the presence or absence of algae or the size of the vial, were contributing to variability observed in juvenile mortality. It was similar to the Known parent trial. Two sizes of vial were used: Small - 50mL clear plastic sample jars; large - 400mL sample jars. Vials were placed in the open in control water, and allowed to accumulate epiphytic algae for a few weeks. 20 neonates hatched in control water were used per sample and 4 samples used per treatment (large/small \* with/without algae). The species tested were A. carinata and A. cumingii. Snails were exposed to 32% RP2 in a 40L aquaria with daily half replacement and was for 48hrs.

## STATISTICAL ANALYSIS

Time limitations did not permit full statistical treatment of the data set. In particular Chisquared testing for sample and replicate homogeneity was dispensed with.

Instead, data from replicates of each treatment were pooled and the data assumed to be normally disturbed for analysis of variance testing. The dangers in this approach involve an increased chance of committing a Type 2 error, where the null hypothesis of equality is not rejected when in fact differences do exist. However, in the context of the project, this conservative measure served to highlight significant differences.

Where analysis of variance testing indicated significant differences amongst the treatments of a trial, Dunnett's test was applied to the treatment means. Zar (1984) recommends that the number of replicates in the control treatment be the integer below the square root of the treatment degrees of freedom [(k-1)<sup>1/2</sup>] times larger than the treatment replicate number. This was not done in these trials, and the discriminatory power of the statistical tests conducted on the data may not have been optimal.

Student-Newman-Keuls testing was employed when significant differences were found using a single treatment (eg fecundity parameters in the preliminary observations).

Statistical testing was performed at the 5% level. Although for regulatory purposes testing at the 10% significance level may be adopted (C. Humphrey pers comm, 1991), the assessment of species and endpoints at 5% makes the final distinctions more complete.

# RESULTS

# PRELIMINARY OBSERVATIONS #1 COMMENCED 19/1/91.

The first series of preliminary observations on snail reproduction and early development were carried out in the breeding tanks (conductivity around  $80\mu$ S/cm). Tabulated data are shown in Appendix 1a. Table 1a shows statistics derived from the pooling of all replicate data. In the context of the project, the variation associated with these absolute values was as important as the means.

Table 1a. Egg and egg mass means and coefficients of variation associated with the means.

Data taken over five days. Commenced 19/1/91.

	No. of	•	Egg/egg m	ass	Eggn	nass/pair/day	
Species	Reps	n	Mean	C.V.%	n	Mean	C.V.%
A. carinata	4	41	13.4	53.0	20	1.85	89.1
A. cumingii	7	117	29.9	47.5	35 -	3.23	82.0
Glyptophysa sp.	4	55	9.36	33.7	16	3.50	101
Gyraulus sp.	4	150	6.55	39.1	20	3.78	55.3
Helicorbis sp.	4	83	4.66	36.1	20	2.1	83.3

Figures 1a to 1e display means across replicates for eggs per egg capsule. Means, the slopes of the cumulative daily means, and r<sup>2</sup> values appear in Table 1b. These values were derived from daily means of pooled replicate data.

Table 1b. Eggs per egg mass statistics.

Using data across replicates over five days.

Species	Mean	Slope of line for	$(r^2)$	
		cummulative data		
A. carinata	12.43a	. 12.19	0.942	
	15.54 <sup>b</sup>	15.17	0.998	
A. cumingii	29.62	28.32	0.998	
Glyptophysa sp.	8.87	9.26	0.990	
Gyraulus sp.	6.24	6.66	0.999	
Helicorbis sp.	4.50	4.45	0.992	

a Includes zero value of day 5. b Excludes zero value of day 5.

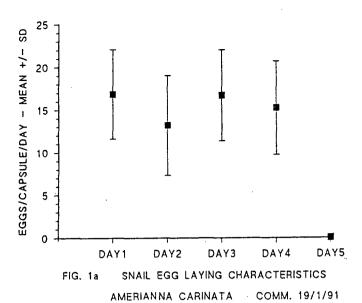
Correlation coefficients indicated a degree of predictability associated with egg numbers/capsule over the five days of observations. No species showed large variation except A. carinata, whose four replicate pairs did not oviposit on day 5. This species otherwise displayed similar variabilities to the others (Figures 1f to 1h). Discounting this observation showed *Helicorbis* sp. to be slightly more irregular in egg and egg mass production than the other species (Table 1b).

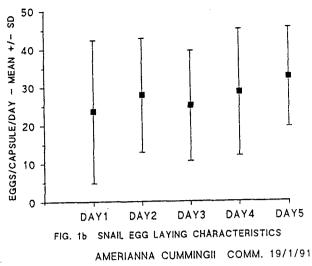
Figure 1f illustrates the variation associated with egg mass laying over four days across replicates. Analysis of variance performed on the coefficients of variation for each replicate over the days of observation revealed no significant difference between species (P>F=0.9305). This was also the case for total daily egg production for each species/replicate (Figure 1g.), and for eggs per eggmass (Figure 1h.).

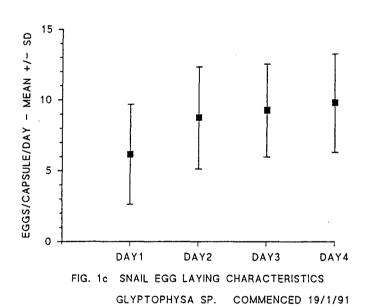
When replicates were pooled species differed in the mean values of eggs per egg mass and egg masses per day ( P>F=0.016 and 0.002 respectively), but no significant difference was found in eggs per day.

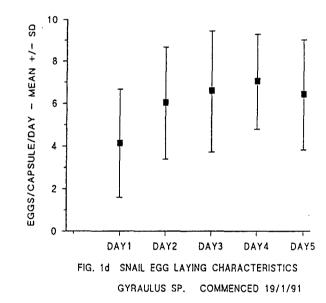
Table 1c presents results of Student-Newman-Keuls (SNK) testing on the significantly different parameters.

Parameter	5 day replicate mean		
Egg masses/day	· · · · · · · · · · · · · · · · · · ·		
•	Gyraulus sp.	7.73	
	Helicorbis sp.	4.15	
	A. cumingii	3.19	
	Glyptophysa sp.	2.9	
	A. carinata	2.75	
Eggs/egg mass			
	A. cumingii	29.3	
	A. carinata	15.43	
	Glyptophysa sp.	8.95	
	Gyraulus sp.	6.36	
	Helicorbis sp.	5	









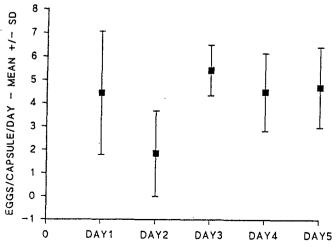


FIG. 1e SNAIL EGG LAYING CHARACTERISTICS HELICORBIS SP.

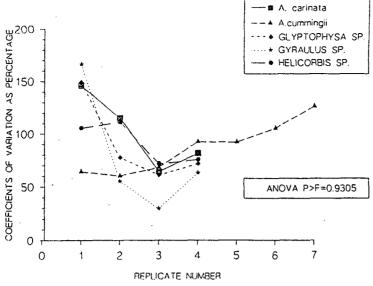


FIG. HE FGG MASS LAYING COEFFICIENTS OF VARIATION COMM. 19/1/91

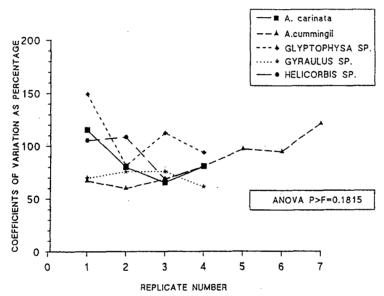


Fig. 1G EGG LAYING COEFFICIENTS OF VARIATION COMM. 19/1/91

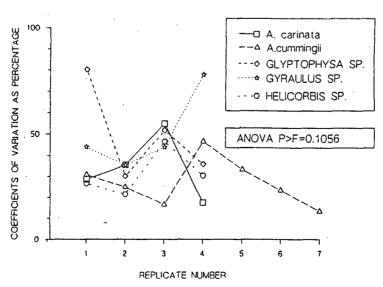


Fig. 1H EGG PER EGGMASS COEFFICIENTS OF VARIATION COMM. 19/1/91

#### PRELIMINARY OBSERVATIONS #2 COMMENCED 25/1/91

These were performed using Magela Ck water (conductivity of around 20 usem/cm). Tabled data for these observations appear in Appendix 1b. Simple statistics appear in Table 2a. As in the case of Table 1a, these values were derived from pooled data of all replicates and all days.

Table 2a. Egg and egg mass means and coefficients of variation.

Data taken over five days. Commenced 25/1/91.

		No. of		Egg/egg mass	Egg	mass/pair/day	y	
Species	Reps	n	Mean	C.V.%	n	Mean	C.V.%	
A. carinata		4	46	3.51 22	.8	20	2.3	49.1
A. cumingii		4	26	8.90 28	.4	20	1.3	90.3
Gabbia sp.		4	17	0.24 2	2.9	20	0.85	203
Glyptophysa sp.	•	4	16	4.38 42.0	20	2.15	5	165
Gyraulus sp.		4	77	1.84 20.2	20	3.7	54.8	-
Lymnaea sp.		4	14	32.2 53.9	20	0.7	132	

Means, the slopes of cummulative daily means, and r<sup>2</sup> values of eggs per egg mass appear in Table 2b. These values were derived from daily means of pooled replicate data.

Table 2b. Eggs per egg mass statistics.

Using data across replicates over five days.

	Mean	Slope of line for	$(r^2)$	
Species	Species cummulative data			
A. carinata	14.6	14.5	0.9997	
A. cumingii	29.3	30.2	0.997	
Gabbia sp.	1.02	1.03	0.9998	·
Glyptophysa sp.	8.65	6.89	0.970	
Gyraulus sp.	9.16	9.20	0.9999	
Lymnaea sp.	54.3	49.9	0.996	

Analysis of variance was performed on replicate data summed over five days. The results of these analyses appear in Table 2c.

TABLE 2C. RESULTS OF ANALYSIS OF VARIANCE BETWEEN THE SIX SPECIES.

Probab	ility values	· · · · · · · · · · · · · · · · · · ·		
Parameter:				
	Egg masses/day	Eggs/day	Eggs/eggmass	
Means	0.0001**	0.0017**	0.0006**	
Coefficients of variation	0.0018**	0.0006**	0.0002**	

Student Newman Kuels testing was performed on the significantly different data. The results of this appear in Table 2d.

Table 2d. Results of comparisons from SNK testing.

Parameter	5 day replicate means	
EGG MASSES PER DAY.		
Means		

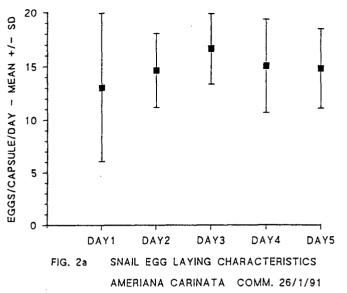
Gyraulus sp.	3.75
<sup>3</sup> A. carinata	2.30
<sup>3</sup> A. cumingii	1.30
<sup>3</sup> Glyptophysa sp.	0.80
<sup>3</sup> Gabbia sp.	0.70
<sup>3</sup> Lymnaea sp.	0.70

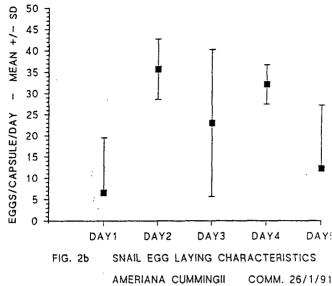
## Coefficients of variation

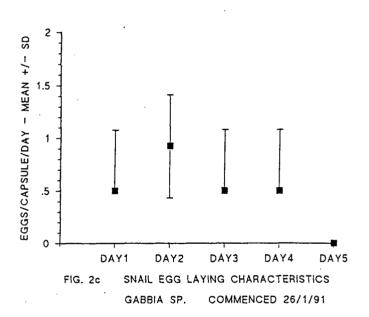
Gabbia sp.	165
Glyptophysa sp.	153
Lymnaea sp.	111
A. cumingii	96.3
A. carinata	50.4
Gyraulus sp.	45.2

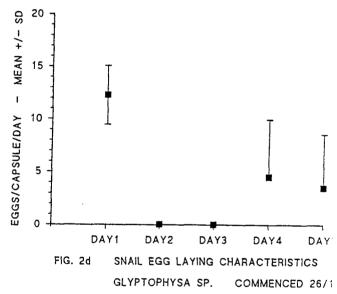
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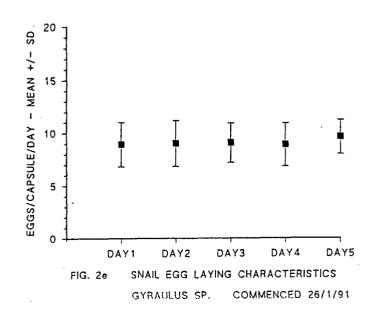
Table 2d. contd. Means comparison from S	-	
Parameter:	5 day replicate means	
EGGS/DAY		
Means		
Lymnaea sp.	41.9	
A. cumingii	40.8	
A. carinata	35.5	
Gyraulus sp.	34.0	
Glyptophysa sp.	8.35	•
Gabbia sp.	0.90	
Coefficients of variation		
Lymnagaan	126	•
Lymnaea sp.	120	
Glyptophysa sp.	40.2	
A. cumingii	25.3	
A. carinata	21.8	
Gyraulus sp.	19.6	
Gabbia sp.	11.0	
EGGS/EGGMASS		
Means		
Lymnaea sp.	80.3	
A. cumingii	31.4	
A. carinata	15.3	
Glyptophysa sp.	10.4	
Gryptophysa sp. Gyraulus sp.	9.33	
Gabbia sp.	1.05	
Coefficients of variation		
Glyptophysa sp.	178	
Gabbia sp.	170	
Lymnaea sp.	126	
A. carinata	51.2	· · · · · · · · · · · · · · · · · · ·
A. cumingii	98.5	
Gyraulus sp.	42.1	

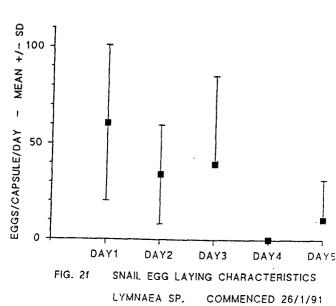












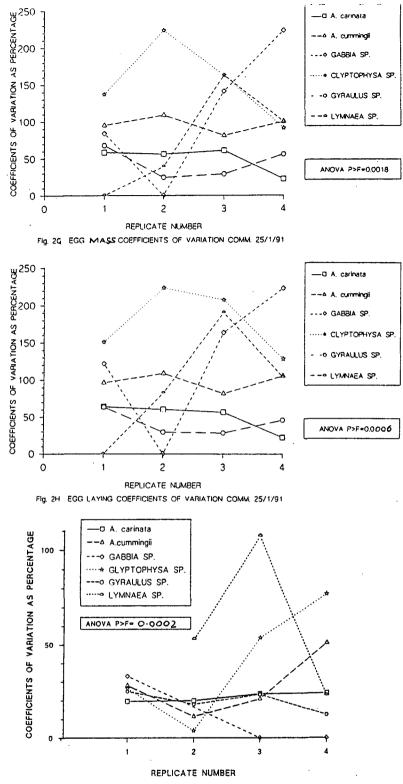
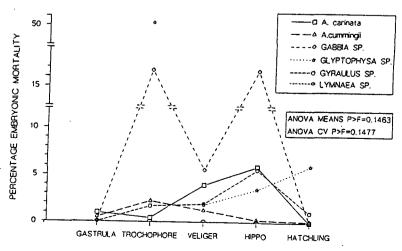


Fig. 21 EGG PER EGGMASS COEFFICIENTS OF VARIATION COMM. 25/1/91



DEVELOPMENTAL STAGE Fig. 2J PERCENTAGE EMBRYOMC MORTALITY COMM. 25/1/91

One way analyses of variance performed on embryonic mortality across embryonic stages and species failed to reveal significant differences (P>F=0.1463 and P>F=1477 respectively).

The difference in results between the first and second series of observations could be due to water quality. In the first series, the vials were always at the bottom of the rearing tanks, and although these were aerated, oxygen levels may have been sub optimal. The second series was performed in 20L aquaria, where the aeration produced levels near saturation. Also, as previously stated, conductivities in the two trials were different. In many ways the first trial was an exercise in familiarisation, whilst the second was more relevant to later toxicity testing, which used Magela Ck water as the control.

From the results, it was concluded that *Gyraulus* sp., *A. carinata* and lesser extent *A. cumingii* showed least variation in the parameters measured. The least variable species was *Gyraulus* sp. However the difficulties in handling and rearing this species did count against it finally for use as a monitoring animal. It strongly maintained its hold on surfaces and was often damaged during routine handling. Also, the stock population underwent a decrease once regular handling of large numbers of individuals commenced. Prior to this decrease, it had been bred to numbers sufficient for toxicity testing. Similar problems occurred more severely with *Helicorbis* sp., and in the first trial it showed a larger, but non-significant variability in comparison to the other species. *A. carinata* and *A. cumingii* were quite robust, easily handled and maintained.

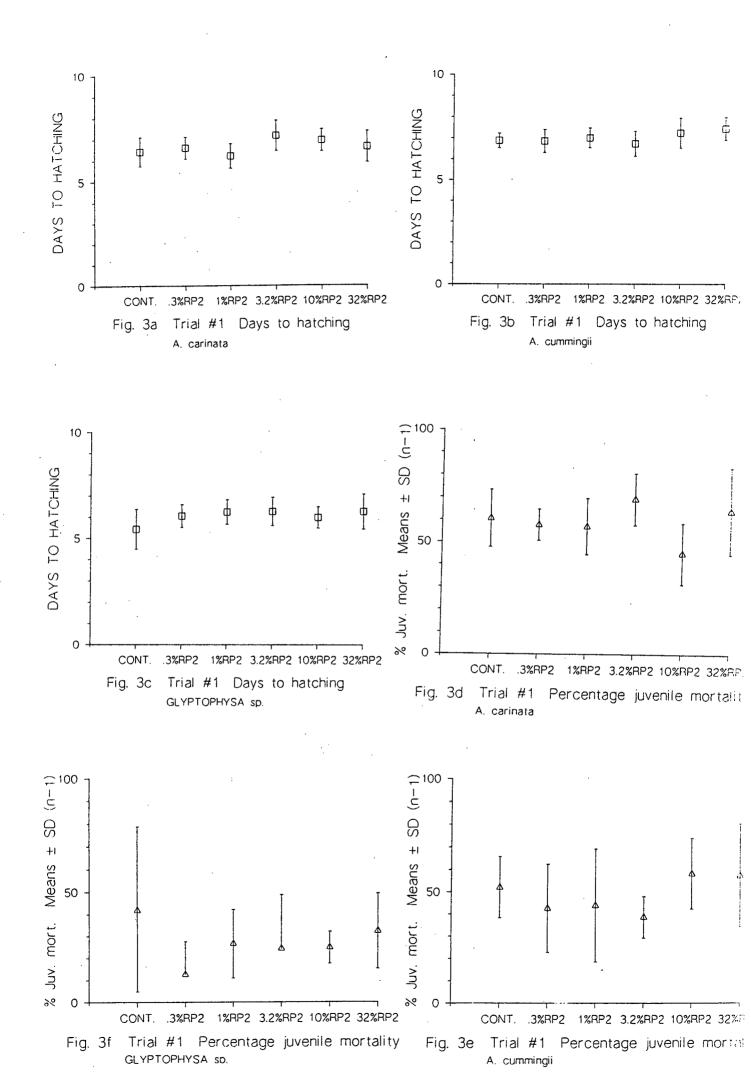
Particularly Gabbia sp., but also Glyptophysa sp., and Lymnaea sp. were seen to be variable in their fecundity parameters. Gabbia sp. along with Helicorbis sp. were not included in further trials. A. carinata, A. cumingii, Glyptophysa sp., Gyraulus sp. and Lymnaea sp. were tested further.

# TRIAL #1 COMMENCED 18/2/91

Trial #1 tested A. carinata, A. cumingii and Glyptophysa sp. The endpoints examined were developmental retardation and juvenile mortality. Full details of testing are presented in Schedule 1. Results of one way analysis of variance performed on pooled replicate data are given in Table 3a. Figures 3a to 3f present means and standard deviations for the species and endpoints assessed. Full results are in Appendix 11.1.a and 11.1.b.

Table 3a. Anova res	ults for Trial #1		
Species	Endpoint	P>F	Conclusion
	Days to hatching		
A. carinata		0.1491	No significant difference
A. cumingii		0.6071	No significant difference
Glyptophysa sp.		0.8058	No significant difference
	Juvenile mortality		
A. carinata		0.9122	No significant difference
A. cumingii		0.3855	No significant difference
Glyptophysa sp.		0.5757	No significant difference

The results from this trial indicated that neither endpoint was sensitive at the concentrations used. It was determined to remove the 0.3% RP2 treatment and use a 100% RP2 treatment as the most concentrated treatment.



## TRIAL #2 COMMENCED 28/2/91

Trial #2 tested A. cumingii, Gyraulus sp. and Lymnaea sp. The endpoint examined were developmental retardation and embryonic mortality. Tabled data appears in Appendix 3 and full results of statistical analysis appear in Appendix 11.2. Results of analysis of variance performed on pooled replicate data are presented in Table 4a.

Table 4a. Results of analysis of variance. Trial #2.					
Species	Endpoint		P>F	Conclusion	
	Development	tal retard	ation		
A. cumingii			0.308	No significant difference	
Gyraulus sp.			0.0001	Significantly different	
Lymnaea sp.			0.0001	Significantly different	
Embryonic mortality					
A. cumingii			0.6490	No significant difference	
Gyraulus sp.			0.082	No significant difference	
Lymnaea sp.			0.619	No significant difference	

Significantly different results were subjected to Dunnett's testing. The results are summarised in Table 4b, and appear in full in Appendix 11.2.c.

Table 4b. Results of Dunnett's testing. Trial #2.

Species	Endpoint	NOEC	LOEC
	Developmental retardation		
Gyraulus sp.		32% RP2	100% RP2
Lymnaea sp.		32% RP2	100% RP2

From these results it was seen that developmental retardation was a more sensitive endpoint than direct mortalities to the growing embryos. The effects of RP2 water in terms of developmental retardation were apparent at 100% concentration.

# TRIAL #3 COMMENCED 13/1/91

Trial #3 was conducted in a similar manner to Trial #2. In order to relate the results, A. cumingii was included, along with A. carinata and Glyptophysa sp. Observations on developing egg masses were not carried out on days 2 and 3, and the first developmental class included gastrula, trochophore, veliger and hippo stages. Tables results appear in Appendix 4. Analysis of variance was carried out on pooled data. Full results appear in Appendix 11.3. Table 5a presents a summary of these.

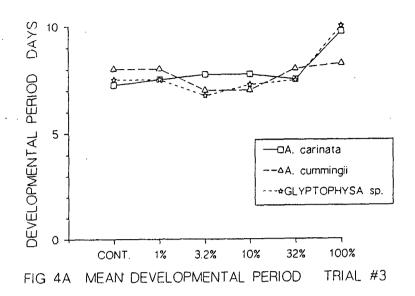
Table 5a Results of analysis of variance. Trial #3.

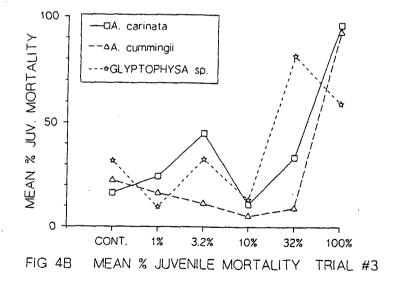
Species	Endpoint	P>F	Conclusion
	Developmental retardation		
A. carinata		0.0011	Significantly different
A. cumingii		0.027	Significantly different
Glyptophysa sp.		0.0105	Significantly different
	Embryonic mortality		
A. carinata	Treatment	0.1310	No significant diff.
	Stage	0.0872	No significant diff.
	Interaction	0.3582	No significant int'ion.
A. cumingii	Treatment	0.2682	No significant diff.
	Stage	0.7719	No significant diff.
	Interaction	0.9734	No significant int'ion.
Glyptophysa sp.	Treatment	0.8022	No significant diff.
	Stage	0.1252	No significant diff.
	Interaction	0.5397	No significant int'ion.
	Juvenile mortality		
A. carinata		0.0004	Significantly different
A. cumingii		0.0001	Significantly different
Glyptophysa sp.		0.017	Significantly different

Results of Dunnett's testing appears in Appendix 11.3 and is summarised in Table 5b.

Table 5b Results of	Dunnett's testing. Trial #3.		
Species	Endpoint	NOEC	LOEC
	Developmental retardation		
A. carinata		32%	100%
A. cumingii		100%	undefined
Glyptophysa sp.		100%	undefined
	Juvenile mortality		
A. carinata		32%	100%
A. cumingii		32%	100%
Glyptophysa sp.		100%	undefined

The species which showed undefined LOECs must derive their significant anova terms from treatments producing shorter hatching periods and lower juvenile mortality than control. For *Glyptophysa* sp., 32% juvenile mortality was significantly different from control, but because 100% mortality was not significantly different, the LOEC remained undefined. Effects are displayed in Figures 4a and 4b. From this trial *A. carinata* was seen to be more sensitive than the two other species tested, although *A. cumingii* was seen to be as sensitive in terms of juvenile mortality.





## TRIAL #4 COMMENCED 17/3/91

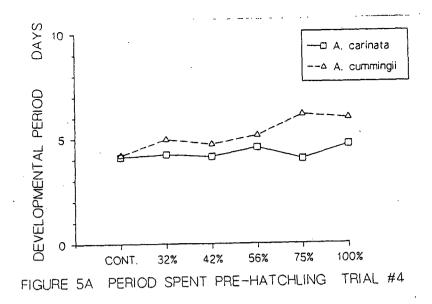
Trial #4 was conducted to determine the RP2 concentration at which developmental retardation began. For this, a geometric series a five treatments between 100% and 32% inclusive was used. It was attempted to determine the life stage at which effects commenced. Data is tabulated in Appendix 4. From considering the raw data, it appeared that most of the retardation occurred during the hatchling stage, and that stages leading up to this were not affected in that way. Results of analysis of variance performed on pooled replicate data is presented in Table 6a.

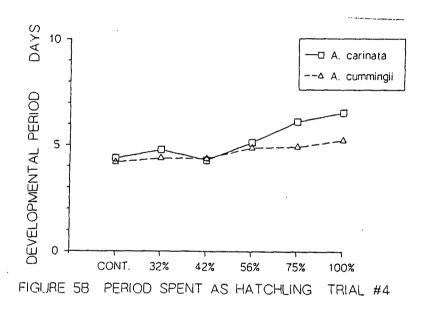
Table 6a. Results of analysis of variance. Trial #4				
Species	Endpoint	P>F	Conclusion	
	Period spent pre-hatchling			
A. carinata		0.6992	No significant difference	
A. cumingii		0.0087	Significantly different	
	Period spent as hatchling			
A. carinata		0.033	Significantly different	
A. cumingii		0.0008	Significantly different	
	Period of development			
	(Developmental retardation)			
A. carinata		0.0509	No significant difference	
A. cumingii		0.0001	Significantly different	
Glyptophysa sp.		0.0067	Significantly different	

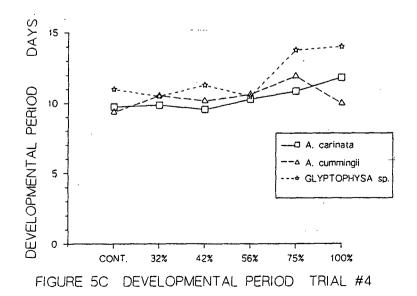
Although A. carinata showed significant difference in analysis of variance, a LOEC was not established by Dunnett's testing. The error term from analysis of variance of period as hatchling (EMSS=2.3665), was large in comparison to the error term of the same parameter of A cumingii (EMSS=0.3665). A. cumingii was retarded by the higher concentrations in pre-hatchling and hatchling stages (Dunnett's testing Table 6b.), and Glyptophysa sp. was retarded over the full developmental period, but the data was unfit for analysis. (This robust species had a low fertility rate, many eggs degenerated or were infected by a fungus). The means of replicate values are illustrated in Figures 5a, 5b and 5c. Figures 5d to f illustrate the retarding effect at the hatchling stage

Table 6b. Results of Dunnett's testing. Trial #4.				
Species	Endpoint	NOEC	LOEC	
	Period spent pre-hatchling			
A. cumingii		56%	75%	
	Period spent as hatchling			
A. carinata		100%	undefined	
A. cumingii		75%	100%	
	Developmental period			
A. cumingii		<32%	32%	

From the A. carinata results developmental retardation was seen to occur at neither the pre-hatchling nor the hatchling embryonic stage, although a strong trend towards retardation during the late stages of development was noted. A large error term associated with the analysis of variance obscured this in the Dunnett's testing. For A. cumingii, it is possible to say that effects occurred at both pre-hatchling and hatchling stages. From the analysis it would appear that effects are more pronounced at the earlier developmental stages and that effects over the developmental period are cumulative.







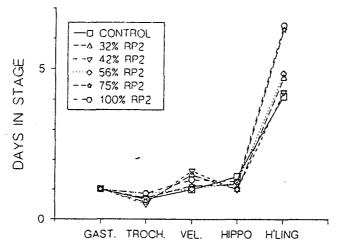


FIG. 5D DEVELOPMENTAL RETARDATION TRIAL #4
A carinata

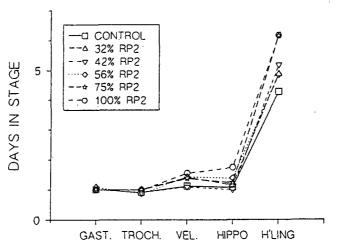


FIG. 5E DEVELOPMENTAL RETARDATION TRIAL #4
A. cummingii

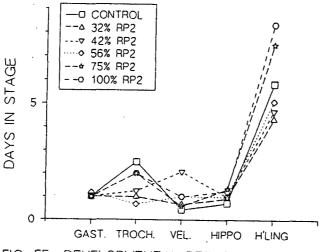


FIG. SF DEVELOPMENTAL RETARDATION TRIAL #4 GLYPTOPHYSA Sp.

## Trial #5 Commenced 17/3/91

Trial #5 investigated the effects of RP2 water on the fecundity of A. carinata, A. cumingii and Glyptophysa sp. It was postulated that the metabolic load imposed by toxicity would decrease reproductive output. Tabulated data is presented in Appendix 6. Results of analysis of variance performed on pooled replicate data is presented in Table 7a. Figures 6a to 6c display average daily egg mass production means, and Figures 6d to 6f display average daily total egg production. Full statistical results appear in Appendix 11.4.a-d.

Species	Endpoint	P>F	Conclusion
	Average daily egg mass p	roduction	
A. carinata		0.001	Significantly different
A. cummingi		0.0001	Significantly different
	Average daily egg mass p	roduction	
A. carinata		0.0001	Significantly different
A. cumingii		0.0001	Significantly different

Where significant differences were found Dunnett's testing was carried out to find difference from control means. The results appear in Table 7b.

Table 7b. Results of Dunnett's testing. Trial #5.				
Species	Endpoint	NOEC L	OEC	
	Average daily egg mass production			
A. carinata		<1% RP2	1% RP2	
A. cumingii		3.2% RP2	10% RP2	
	Average daily egg production			
A. carinata		<1% RP2	1% RP2	
A. cumingii		3.2% RP2	10% RP2	

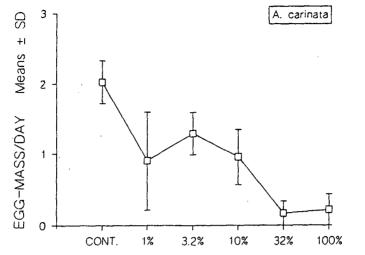


FIG. 6A AVERAGE EGG MASS PRODUCTION TRIAL #5

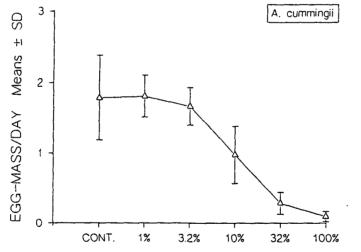


FIG. 6B AVERAGE EGG MASS PRODUCTION TRIAL #5

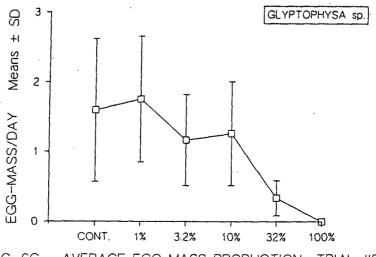


FIG. 6C AVERAGE EGG MASS PRODUCTION TRIAL #5

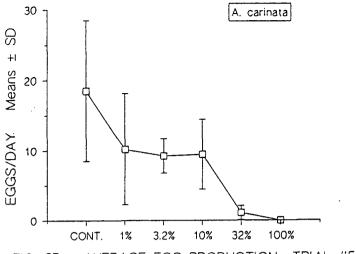
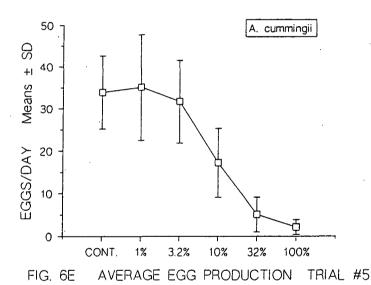


FIG. 6D AVERAGE EGG PRODUCTION TRIAL #5



GGS/DAY

Weans

120

H 20

H 20

T 10

T 1

O CONT. 1% 3.2% 10% 32% 100%

FIG. 6F AVERAGE EGG PRODUCTION TRIAL #5

The results of Trial #5 suggested that the fecundity parameters were sensitive measures of RP2 water effects, and that in terms of these parameters A. carinata was the most sensitive of the species examined.

## TRIAL KNOWN PARENT

This trial was conducted to investigate whether parentage contributed to the within treatment variation observed in Developmental retardation and Juvenile mortality. The results of analysis of variance performed on data pooled gained from the replicate samples is presented in Table 8a. Raw data appears in Appendix 9a.

Table 8a. Resu	lts of analysis of variance. Tri	ial Known parentag	e.
Species	Endpoint	P>F	Conclusion
	% Hatched/laid		
A. carinata		0.6605	No significant difference
A. cumingii		0.2137	No significant difference
	% Mortality/hatched		•
A. carinata		0.7870	No significant difference
A. cumingii		0.6290	No significant difference
	% Mortality/laid		
A. carinata		0.9955	No significant difference
A. cumingii		0.3953	No significant difference

There was no significant difference found between various parameters measured. Although sample numbers were uneven and low (A. carinata:4,4,3,3. A. cumingii:4,4,3,3,2) the trial indicated that the observed variation in other trials was not due to genetic factor in the population sampled.

The lettuce discs were weighed daily before and after each daily exposure. It was seen to be of little use as an endpoint because of vegetative decay and differences in each disc weight due to internal structure (thick veins etc).

## Trial #6. Validation commenced 12/4/91

Trial #6 involved concurrent testing in the laboratory and at the creekside monitoring station. The differences in these two situations were flow rate, temperature and light. The full results from the creekside station testing were unavailable for analysis, and basic statistics and results of T-testing to determine LOECs and NOECs only were available. Tabulated data is in Appendix 7. Results of analysis of variance are in Table 9a. Full results of statistical analysis are in Appendix 11.6. Egg mass production, egg production, weight loss and control reared juvenile mortality are illustrated in Figures 7a-j.

	of analysis of variance. Trial #6 Labora	•	Conclusio-
Species	Endpoint	P>F	Conclusion
	Daily egg mass laying		
A. carinata		0.0001	Significantly different
A. cumingii		0.0001	Significantly different
Glyptophysa sp.		0.0001	Significantly different
	Daily egg laying		
A. carinata		0.0001	Significantly different
A. cumingii		0.0001	Significantly different
Glyptophysa sp.		0.0008	Significantly different
	Adult weight change - % loss		
A. carinata		0.1631	No significant diff.
A. cumingii		0.0550	No significant diff.
Glyptophysa sp.		0.0010	Significantly different

pto

Table 9a. contd Results of analysis of variance. Trial #6 Laboratory results.

Species	Endpoint	P>F	Conclusion	
	Adult weight change - % gai	n		
A. carinata	,	0.3241	No significant diff.	
A. cumingii		0.2405	No significant diff.	
	Juvenile mortality - exposed	egg masses		
A. carinata		0.7027	No significant diff.	
A. cumingii		0.0558	No significant diff.	
Glyptophysa sp.		0.4196	No significant diff.	
	Juvenile mortality - control i	reared egg masses		
A. cumingii		0.3003	No significant diff.	

# The results of Dunnett's testing following significant differences are in Table 9b.

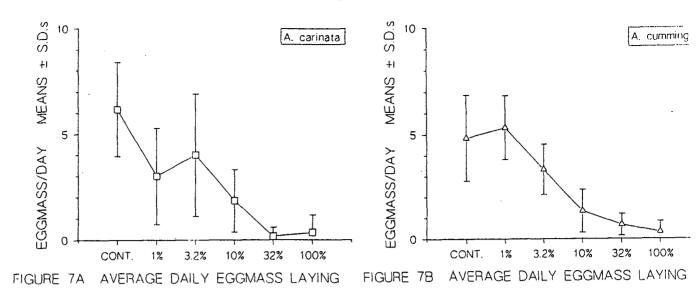
Species	Endpoint	LAB.	CREEK
	Average daily egg mass production		
A. carinata	•	10% RP2	1.0% RP2
A. cumingii		3.2% RP2	10% RP2
Glyptophysa sp.		32% RP2	10% RP2
	Average daily egg production		
A. carinata	•	1% RP2	No data
A. cumingii		10% RP2	No data
Glyptophysa sp.		32% RP2	No data
	Percentage weight loss		
Glyptophysa sp.		Undefined	No data
3	Juvenile mortality		
A. carinata		Undefined	1.0% RP2

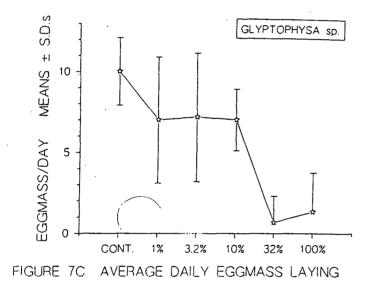
Parameters which produced significant differences from the control values were average daily egg and egg mass production. The NOEC established for *A. carinata* using egg mass production was higher in this trial than the previous. For *A. cumingii* the same parameter produced a LOEC of 3.2% RP2, as opposed to one of 10% RP2 in the previous trial. This cannot be readily explained as the error terms associated with *A. carinata* are similar for egg mass production in Trials 5 and 6 (Standard error=1.450 Vs 1.365 respectively). If the sampling period was too brief, one would expect a larger error term in the shorter period. The same variable for *A. cumingii* is lower in the shorter trial. For total egg production, the two trials yielded identical NOECs and LOECs for *A. carinata* and *A. cumingii*. In trial #6 *Glyptophysa* sp. was seen to be comparatively insensitive in terms of the fecundity parameters. The weight loss parameters presented some difficulty in analysis. The was generally no consistent trend in either weight loss or weight gain within replicates of any treatments. As well as inaccuracies associated with measurement, individual responses to osmotic and metabolic stress may make this parameter too variable for use in short term biological monitoring.

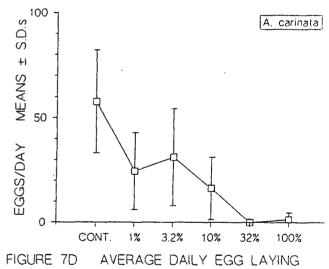
Juvenile mortality was insensitive and in the lab produced no significant differences between treatments for the three species tested. In this trial only egg mass produced by adults exposed to the toxicant were used, in many samples there were no juveniles produced. Juveniles reared in control water and subsequently exposed did not show significant differences under analysis of variance.

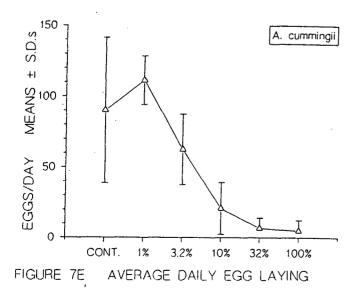
Laboratory and field results were generally similar. Fecundity parameters were higher in the field for A. carinata and A. cumingii, while Glyptophysa sp. showed similar responses in lab and field. In terms of response to RP2 water, similar decreases in fecundity were observed, although only A. carinata appeared as sensitive in the field (Figures 7k-p). Juvenile mortality did not appear to correspond well in the two situations, mortalities in the field were well above lab mortalities at the lower concentrations.

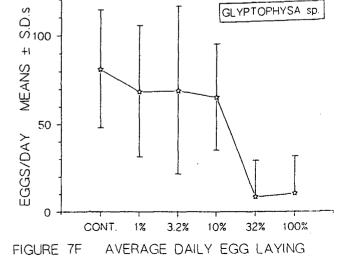
LOECs from the lab and creekside trials did not correspond exactly. However, lab results from the previous trial for

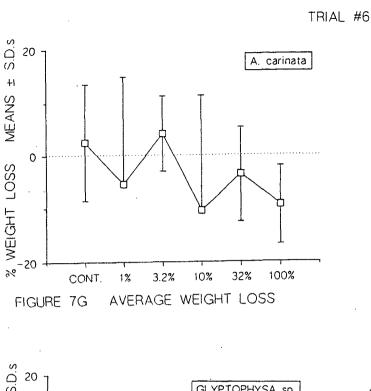


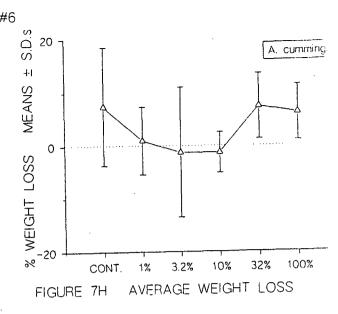


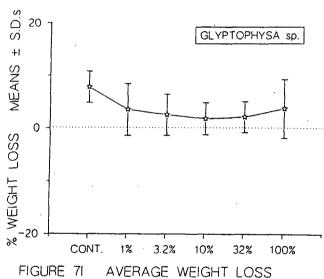


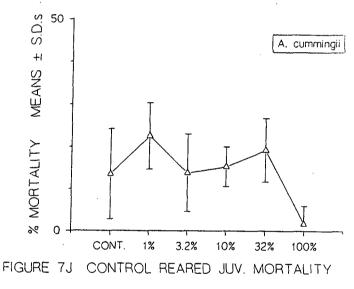




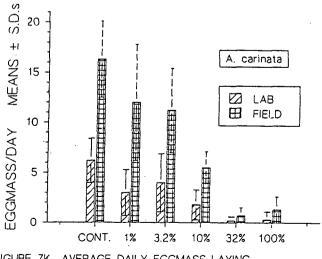


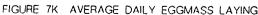






TRIAL #6 LAB/FIELD





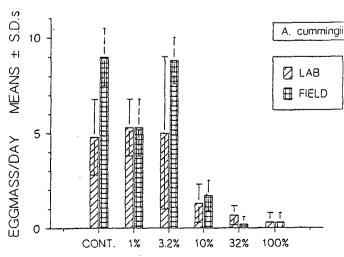
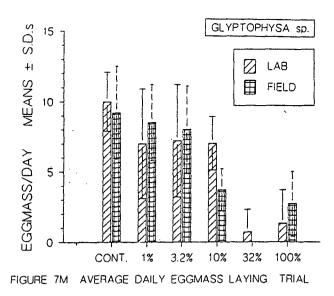
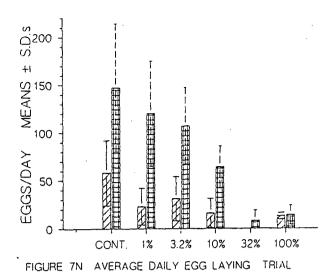
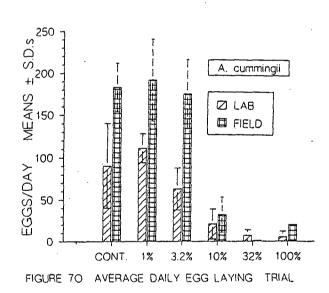
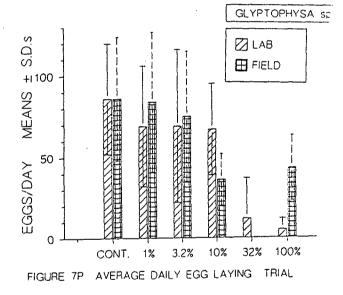


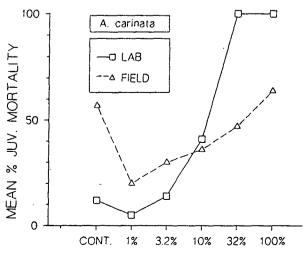
FIGURE 7L AVERAGE DAILY EGGMASS LAYING

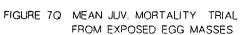












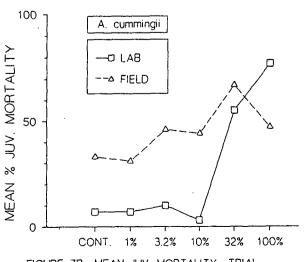


FIGURE 7R MEAN JUV. MORTALITY TRIAL FROM EXPOSED EGG MASSES

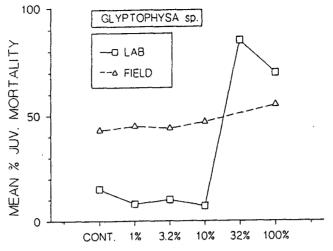


FIGURE 7S MEAN JUV. MORTALITY TRIAL #6 LAB/FIELD FROM EXPOSED EGG MASSES

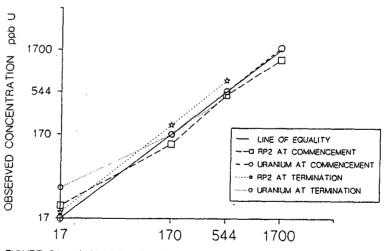


FIGURE 8A NOMINAL URANIUM CONCENTRATIONS ppb U TRIAL #7

## Trial #7 Commenced 2/5/91 RP2 - Uranium comparison

This trial was conducted to compare the effects of uranium solutions of similar concentration to the total uranium content of the RP2 dilutions. An initial 100% RP2 was changed to 32% RP2 after mortality of all adult A. carinata after 24 hours exposure to this concentration.

Tabulated data is in Appendix 8. Nominal and observed concentrations of RP2 and uranium treatments are illustrated in Figure 10a. Full Scintrex and GFAAS determinations of uranium and manganese are in Appendix 10e. Results of T-tests between the corresponding RP2 and uranium treatments are in Table 9a.

Table 10a Result	s of T-testing. Trial #7.			
Species	Treatment*	P>F	P>T	Result
		(Ho:Var's =)	(Ho:Means =)	
	Daily egg mass pro	duction		
A. carinata				
	1%	0.499	0.0524	Do not reject Ho.
	10%	1.000	0.0006	Reject Ho.
	32%	0.5345	0.5364	Do not reject Ho.
•	•			
A. cumingii				
	1%	0.7599	0.1048	Do not reject Ho.
	10%	0.4650	0.0493	Reject Ho.
	32%	0.5276	0.2560	Do not reject Ho.
	Daily egg producti	on		
A. carinata				
	1%	0.9013	0.5434	Do not reject Ho.
	10%	0.7344	0.2087	Do not reject Ho.
	32%	0.4648	0.3453	Do not reject Ho.

<sup>\*</sup> The stated treatments (1, 10 and 32%) refer to testing between RP2 and U treatments of nominally identical U concentrations.

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Table 10a contd. Results of T-testing. Trial #7.					
Species	Treatment*	P>F	P>T	Result	
		(Ho:Var's =)	(Ho:Means =)		
	Daily egg production	on			
A. cumingii					
	1%	0.7760	0.3642	Do not reject Ho.	
	10%	0.2096	0.0614	Do not reject Ho.	
	32%	0.7040	0.5477	Do not reject Ho.	

For the endpoint average daily egg masses, both species at the 10% treatment showed significant differences. In both cases the RP2 mean was lower than the U mean. The 10% RP2 uranium concentrations as determined by the Scintrex method varied from commencement to termination (130 and 170 ppb U respectively). The reasons for this were not immediately clear. Discounting contamination, a possible explanation might be coprecipitation of the uranium with manganese, and subsequent concentration as that form in the exposure tanks. The pH levels were seen to vary markedly within treatments. Although a standardised procedure was adopted to measure pH, it is unlikely that were accurate. Analysis of variance showed significant difference between replicates and treatments (P>F=0.0002, F=7.88). SNK testing grouped together the two uranium treatments and the two RP2 treatments.

## TRIAL ALGAE/SIZE

This was conducted for similar reasons as the known parentage trial. The trial sought to establish whether the presence or absence of algae in the vials, or the size of the vials, had any influence on juvenile mortality. Raw data appears in Appendix 9b. Results of analysis of variance appear in Table 11a.

Table 11a. Results of analysis of variance. Trial Algae/size.				
Species	Endpoint	P>F	Conclusion	
•	Juvenile mortality			
A. carinata				
	Size	0.0008	Significantly different	
	+/-Algae	0.8886	No significant difference	
	Interaction	0.5477	No significant difference	
A. cumingii				
	Size	0.0051	Significantly different	
	+/-Algae	0.7327	No significant difference	
	Interaction	1.0000	No significant difference	

SNK testing produced two groups for each species. The results appear in Table 11b.

Table 11b. 1	Results of comparisons from	SNK testing. Trial Algae/size	
Species	Result Parameter	Mean	SD
Juvenile me	ortality		
A. carinata	<sup>3</sup> Large +Algae <sup>3</sup> Large -Algae	66.8%	2.9%
	<sup>3</sup> Small +Algae <sup>3</sup> Small -Algae	30.9%	1.9%
A. cumingi	i <sup>3</sup> Large +Algae <sup>3</sup> Large -Algae	77.5%	5.6%
	<sup>3</sup> Small +Algae <sup>3</sup> Small -Algae	25.7%	5.9%

These results indicated that the size of the container did influence juvenile mortality, but could not apportion the observed variation in juvenile mortality of earlier trials to any one factor. Algae was seen to be an unimportant factor in this analysis.

TABLE 12 CRITERIA AND RESPONSE **SPECIES** Gl HA. у G l Α. С p i Lt С u y G а m 0 r С y а а 0 m m p b 'n i и n b b 1 n n y a g i i a S и е а a a sp. sp. sp. sp. sp. **ENDPOINT** Natural Egg mass prod. ++ ++ Egg prod. Handling + Hatchability + Rearing **Trials** 0 Adult mortality nt nt nt nt Dev'l retard'n nt nt Embryonic mort. nt nt Egg mass prod. nt nt nt nt Egg prod. nt nt nt nt Feeding nt nt nt nt 0 Juvenile mort. nt nt nt nt Weight change nt nt nt nt

## Key

- ++ Low variation or sensitivity.
- 0 Indifferent.
- -- High variation or sensitivity.
- + Moderate variation or sensitivity.
- nt Not tested.
- Low variation or sensitivity.

Table 12 indicates that the fecundity endpoints using A. carinata and A. cumingii gave the best results in terms of sensitivity and variation. Although Gyraulus sp. also showed potential with the fecundity endpoints, handling and rearing this species presented some difficulty. It is possible that these could be overcome. As previously mentioned Gabbia sp. and Helicorbis sp. were eliminated after the preliminary observations because of high variability in the fecundity parameters, and difficulties in handling and rearing. Glyptophysa sp. displayed low fertility and an insensitivity to the toxicant. Lymnaea sp. was difficult to handle and laid large egg masses unpredictably. The juveniles appeared to shelter in the egg mass after rupture.

Although some species were not assessed using several endpoints, the success of other species justified this exclusion.

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## SEQUESTRATION OF URANIUM

EDAX analysis of unstained sections of *A. carinata* from Trial 5 (exposed to 32% RP2 for seven days) identified uranium in the ovotestis. Other tissues examined which did not show uranium accumulation were the digestive gland (hepatopancreas), mantle, kidney, albumin gland, foot and hermaphroditic duct. In the ovotestis, the uranium was deposited as spindle shaped crystals in association with other electron dense amorphous material. Plates 4a to 1 show photomicrographs of sections from the ovotestis, mantle and kidney. Sections of the digestive gland were unsuitable for proper analysis because overfixation had made the tissue friable. Figure 1b, 1c and 1d show uranium crystals located in multivescicular bodies of the ciliated epithelium. Plate 4F shows typical electron dense granules in the ovotestis. Plate 4g shows mitosis with no apparent involve ment of uranium. Plate 4h shows a multivescicular body at the cell membrane, apparently involved in endocytosis or exocytosis. Plates 4i and 4j show stained and unstained sections of the mantle, the typical electron dense granules are visible in the unstained section. Plate 4k shows a stained section of the kidney. Again normal electron dense granules are present. Plate 4l shows what is probably artifactual uranium crystals associated with the cell membrane. No such deposits were observed in the unstained sections.

The results of the ultrastructural study are somewhat inconclusive. The normal pathway for the deposition of metals in molluscs is via the digestive gland (gastropods) or the kidney (bivalves) (Simkiss and Mason, 1983). It must be assumed that the uranium is taken up, either in solution or associated with a metallothein-like molecule, and deposited in the digestive gland, with which the ovotestis makes close contact. Subsequent movement of the uranium into the digestive gland must then follow.



Plate 4a Unstained ovotestes : uranium and granules

X 35,000

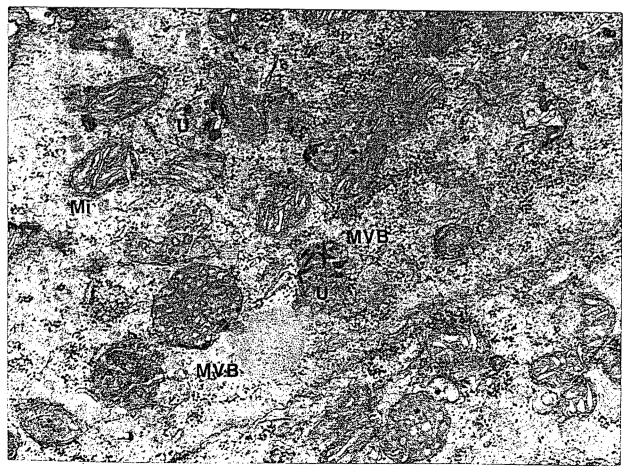


Plate 4b Stained ovotestes : uranium in multivesicular bodies

X 35,000

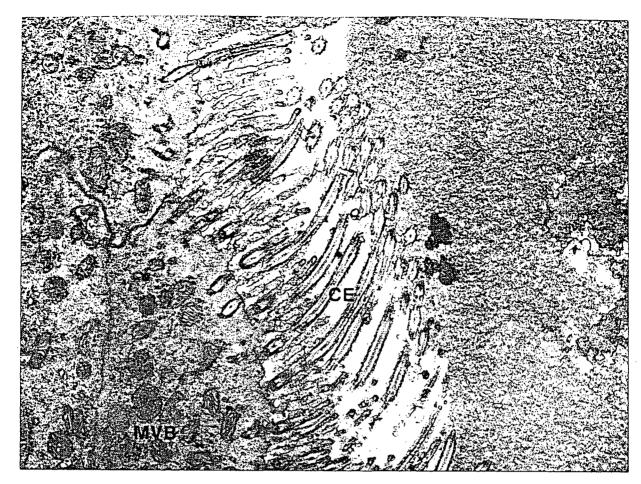


Plate 4c Uranium containing MVB in ovotestes epithelia

X 15,000

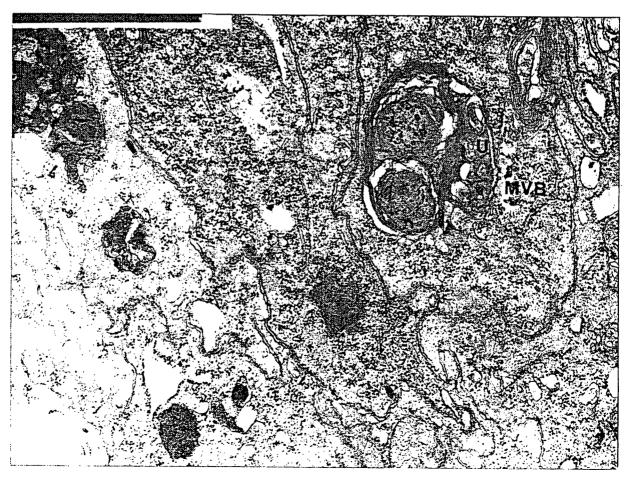


Plate 4d



Plate 4e Enlargement of Plate 4a X 90,000



Plate 4f Typical granules in the ovotestes

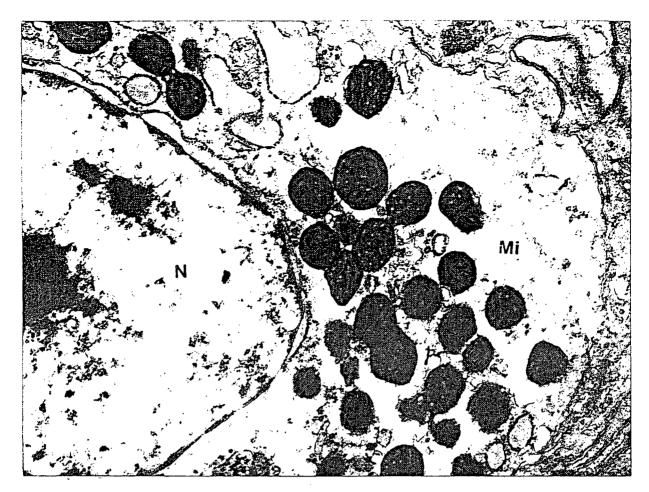


Plate 4g Cell undergoing melosis : ovotestes

X 20,000

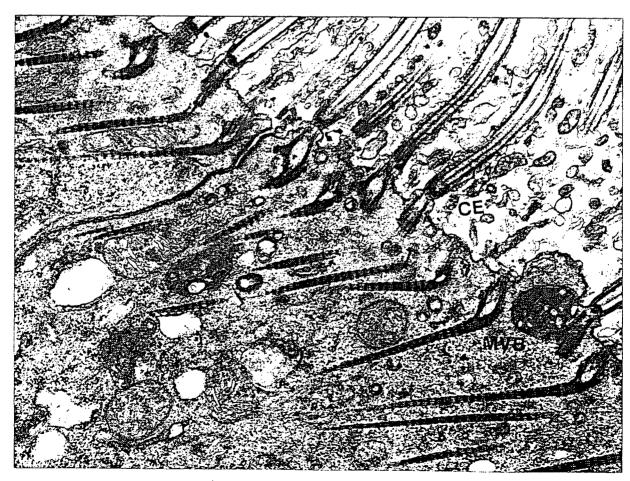


Plate 4h Multivesicular body at cell membrane : ovotestes

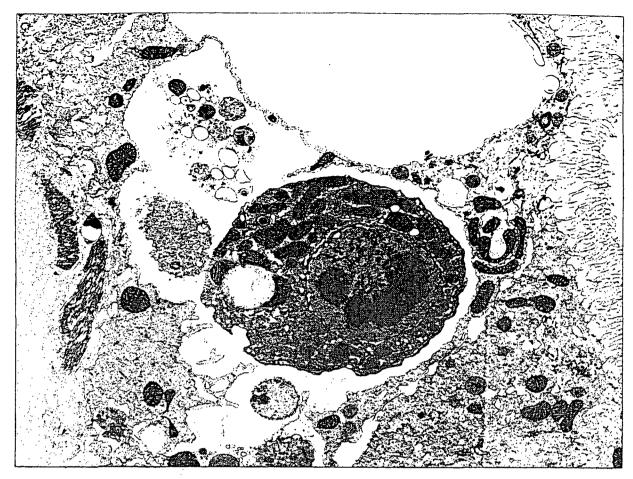


Plate 4i Mantle X 10,000



Plate 4j Mantle X 20,000

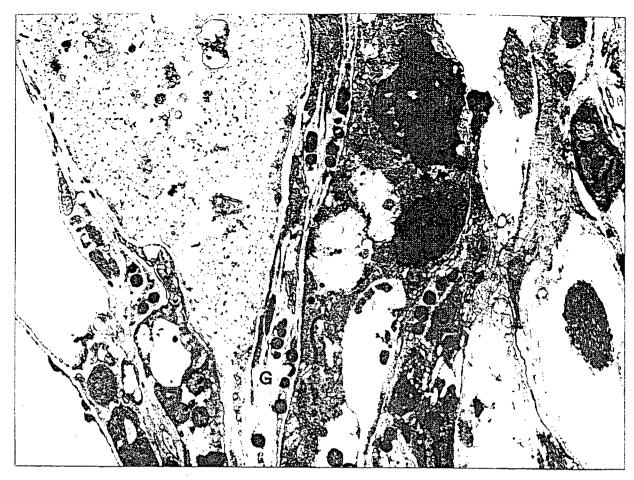


Plate 4k

Kidney

X 8,000

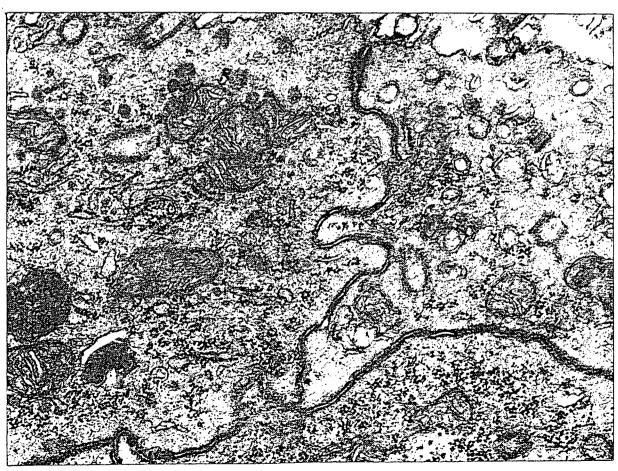


Plate 4| Uranium in the intercellular space (artifact)

X 20,000

## DISCUSSION

#### **ENDPOINTS**

#### **Adult mortality**

The mortality of all A. carinata adults after 24hrs exposure at 100% RP2 in Trial #7 and of an A. carinata individual at 100% RP2 in Trial #6 were the only instances of adult mortality throughout the trials period. Neither of these occurrences could be explained by dissolved oxygen, pH or conductivity levels, and must be due to RP2 toxicity. Generally, adult mortality was insensitive and inappropriate for short term biological monitoring of the RP2 waters using the species tested. All species tested became moribund at 100% RP2, implying a possible use for adults in longer trials.

#### **Embryonic mortality**

Of five species tested with this endpoint, none showed significant differences between treatments upon analysis of variance, although it appeared that the rate of embryonic breakdown increased with RP2 concentration. The reason for this may be that breakdown usually occurred in one of three ways:

- 1) acute breakdown and death in the transition between stages,
- 2) acute mortality during the later lengthier stages,
- 3) chronic deformation during the veliger and hippo phase (ghosting and hydro-cephaly) protracting a number of days until death.

In cases 1 and 2, the acuteness made for easy quantification and provided the bulk of embryonic mortality data. In case 3, quantification was more difficult and beyond the time resources available. Rupture of the egg mass and the hatching of healthy neonates usually occurred before the death of the deformed embryos. Only results from healthy individuals were considered as data for juvenile mortality. As no observations could be made following egg mass rupture (since the period of juvenile exposure required minimum disturbance) the fate of these deformed individuals was not recorded. Mortality due to deformation would have contributed to embryonic mortality, but might also have been a useful endpoint in its own right. Ravera (1991) states that a high proportion of embryonic deformation is common in cases of heavy metal exposure.

Generally, embryonic mortality as an endpoint was insensitive because it tended to occur regardless of concentration, and may be a response to factors outside RP2 exposure.

#### Juvenile mortality

Trials 1, 3, 6 and 7 tested *A. carinata*, *A. cumingii* and *Glyptophysa* sp. in terms of juvenile mortality. Trial 1 involved RP4 water of low toxicity. Trial 3 established LOECs of 32% for *A. carinata* and *A. cumingii*. In Trials 6 and 7 no significant differences were found upon analysis of variance. The literature emphasises the susceptibility of molluscan juveniles to various metals. In these trials juvenile mortality was seen to be variable in response to RP2 concentration. At 100% RP2, Trial 3 mortalities were close to 100% for *A. carinata* and *A. cumingii*, but in Trial 6, a mean mortality of only 5% was recorded for *A. cumingii* at 100% RP2. A possible explanation for this variability might be the pH dependent speciation and toxicity of the uranate ion  $UO_2^{2+}$ . Magela Ck water made up to 900 ppb uranium and of pH range 6.0 to 7.0, was toxic to *Hydra viridissima*, while the same solution carbonate-buffered to pH 8.5 was not toxic (R. Hyne pers comm. 1991). The dominant complex at pH 8.5 would be the tricarbonate  $[UO_2(CO_3)_3]^{4+}$ , which is membrane impermeable. At lower pHs, the uranate  $UO_2^{2+}$  or uranyl carbonate  $UO_2^{2O_3}$  would predominate. These species would be more membrane permeable and therefore more toxic than the anionic forms (R. Hyne *pers comm.* 1991).

However this may not suffice to explain the difference in juvenile mortality between Trials 3 and 6 and between the RP2 and U treatments of Trial 7, since the measured pHs are not disparate to the extent described above, unless the juveniles are particularly sensitive to pH changes.

Other possible sources of extraneous juvenile mortality were examined. Known parentage and the presence or absence of algae were seen as unimportant, while an increase in the size of the exposure vial was seen to increase juvenile mortality. It is possible that a "rim-effect" operated, since the circumference of the larger vials was twice that of the smaller. At the termination of several trials, dead juveniles had been observed between the gauze and outside wall of the exposure vial. In such a position, it was possible that they had died by mechanical damage. This complication had been considered early in the trials, but had not been satisfactorily resolved by the end. The problem of large variation in juvenile mortality within treatments, and high control mortality, will continue to receive attention at OSS. In terms of the project, the question of juvenile sensitivity remains to a certain extent unanswered. Despite these uncertainties, low mortalities observed at high RP2 concentrations counted against the use of juvenile mortality as a suitable endpoint.

### Weight change

Analysis of variance revealed a significant difference between treatments for *Glyptophysa* sp. but a LOEC was not established by Dunnet's testing. The responses of *A. carinata* and *A. cumingii* in terms of this endpoint were irregular across the treatments and did not show significant differences upon analysis of variance. Osmoregulatory effects arising from the differing conductivities of the treatments might have interacted with intrinsic RP2 toxicity. Because percentile data was considered most the appropriate form for analysis and since some values were negative, arcsine transformation of the whole data set was not possible. This endpoint might be useful in chronic trials which incorporate a longer exposure period, but in these relatively brief trials, the degree of weight change was seen to be insensitive.

## **Developmental retardation**

Trials 2, 3 and 4 investigated developmental retardation as a response to RP2 toxicity. Although this effect was apparent at 100% RP2 during the trials, Dunnett's testing did not always reveal this. The conservative nature of the statistics employed were probably producing type 2 errors, where large error terms associated with analysis of variance made the q statistic of Dunnett's test insignificant. This occurred for *A. cumingii and Glyptophysa* sp. in Trial 3 and for *A. carinata* in Trial 4. Ravera (1991) states that developmental period of embryos exposed to heavy metals can be up to 4 times the normal period. In these trials, the nature of the observation process (following each egg mass through its full development) meant there a low number (3 to 6) of egg masses available for observation, and as a result large error terms were generated. Even if larger numbers of egg masses were exposed to each treatment, it would still be doubtful whether LOECs below 32% RP2 would be established. In all, developmental retardation was a moderately sensitive endpoint, and repeatability could be increased with a larger sample size.

## Egg and egg mass production

The fecundity parameters were seen to be the most sensitive of all endpoints examined. In Trials 5 and 6, LOECs established using egg mass and egg production by A. carinata and A. cumingii were between 1 and 10% RP2, more or less an order of magnitude more sensitive than any other. However, there existed a large discrepancy between the LOECs established by the egg mass production of A. carinata in Trials 5 and 6 (1 and 10% respectively). When daily means were taken it was seen that the selected animals were more productive in Trial 5. This was probably due to the thinning of the A. carinata stocks by the time of Trial 6, when smaller, less fecund individuals were used. The 32% LOECs established by Glyptophysa sp. highlighted its relative insensitivity. It is possible that the more robust shell of this species mitigated RP2 toxicity. Beeby and Richmond (1989) report the loss of magnesium from the

shell of terrestrial pulmonate *Helix aspersa* following lead exposure and postulate that this loss is part of a heavy metal detoxification mechanism.

Considering the validation exercise Trial 6, Lab and Creek results were in reasonable agreement. The species were more fecund in the creek water. The deterioration of water quality through storage is well documented for waters of the region, and a decrease in the quality of the lab water may have been responsible for the lower fecundity. The effects of storage on RP2 water might include co-precipitation of uranium with manganese (P. Cussons. pers comm., 1991) or some change in the speciation of uranium. The higher flow rate in the creekside trial might also have contributed to this effect. But despite differences in flow rate and possible differences in water quality, effects observed in the lab were observed at the creekside. By considering the LOECs established for the fecundity parameters, it was seen that the lab results of Trials 5 and 6 were validated by the results of the creekside trial.

The uncertainties of the assumption of a normally distributed response because of low sample numbers must be taken into consideration. That consecutive and concurrent trials did establish comparatively low LOECs for *A. carinata* and *A. cumingii* indicated that the assumption of normality was not incorrectly taken.

The results of Trials 5 and 6 strongly indicated that the fecundity parameters for either A. carinata or A. cumingii were consistent and sensitive endpoints for the biological monitoring of RP2 water release into the Magela Ck system.

#### **RP2/URANIUM COMPARISON**

The results from this trial were somewhat contradictory. A significant difference existed in the 10% treatments in egg mass production for both A. carinata and A. cumingii. No difference was found at either 1% or 32% using egg mass production, and no difference was found in any of the three treatments using egg production. Juvenile mortality upon analysis of variance did not indicate significant differences between treatments for A. carinata but did indicate a significant interaction between treatments and concentrations for A. cumingii. The results indicated a greater toxicity of the 10% RP2 treatments, possibly caused by the lower average pH. In spite of this, the lack of significant difference between uranium and RP2 at 1 and 32% concentrations demonstrated that uranium and RP2 produced similar levels of effects in the species used, indicating that the observed toxicity of RP2 water was due to uranium.

### SEQUESTRATION OF URANIUM IN A.CARINATA

Ultrastructural studies showed that uranium had accumulated in the ovotestis of *A. carinata* which had been exposed for 7 days at 32% RP2 during Trial 5. The uranium was deposited in multivescicular bodies of squamous ciliated epithelial cells of the ovotestis. These are toward the opening of the acinis into the hermaphroditic duct. It appeared as spindle shaped crystals associated with other electron dense amorphous material. Some evidence suggested that the multivescular bodies were involved in either endocytosis or exocytosis. The actual mechanism of the inhibition of egg production by uranium was not elucidated by this study. The sections studied did not include regions toward the bottom of the acinis where germ cell production occurs. Ravera (1991) states that the effects of cadnium on reproduction in *Biomphlara glabrata* included degeneration of the male germ cells. Female germ cells did not show any alteration.

Other tissues analysed from 32% exposed A. carinata, were the kidney, the digestive gland (hepatopancreas), the mantle, the foot, the albumin gland and the hermaphroditic duct. Uranium was not detected in any of these tissues. A variety of metals including gold, lead and zinc was present in the mantle. The absence of uranium from the digestive gland was most probably a spurious result, possibly due to overfixation which resulted the friable sections. This organ is thought to be the site of haemoglobin production and blood processing in the pulmonates. Most of the literature on metal accumulation deals with the digestive gland, and only occasional papers investigate other tissue.

The results obtained conflict with Phillips (1980), who states that accumulation in the gonads is generally low in comparison to that in other tissues. However he cites results from Segar et al. (1971) who stated that nickel, cadmium, lead, zinc and chromium were accumulated in the gonads of the mussel *Modiolus modiolus* to a similar or greater extent than in the digestive gland.

Simkiss and Mason (1983) and Heneine et al. (1969) state that iron initially appears in the digestive gland and is progressively redistributed to the ovotestis. Johnson et al. (1962) report excretion of iron with the eggs of B. glabrata. Munzinger and Guarducci (1988) found that zinc is transferred to the embryos of B. glabrata from the parent. Developmental retardation and embryonic mortality greater than control were observed in eggs laid in control water from previously exposed adults.

The initial uptake of uranium is thought to occur in conjunction with calcium extraction from the water column (R.Jeffree *pers comm*. 1991). In the metabolic analogue hypothesis, various

metals are taken up along with calcium, especially in soft waters. (Jeffree & Simpson, 1984). Metals dissolved or transported in the blood are then removed from the animal's general metabolism by precipitation due to differential solubilities, and accumulate as granules which are not necessarily excreted. The toxicity of the xenobiotic metals is thus reduced by compartmentalisation away from the general metabolism (R.Jeffree pers comm. 1991). If this were the sole mechanism operating to deal with uranium in A. carinata, the uranium should be present in association with immobilised granules in the digestive gland or mantle, and not appear in tissues away from the major blood vessels, such as the ovotestis.

Although the results of microstructural analysis were tentative, the fact that uranium was located in the ovotestis indicated that the depression of fecundity was directly caused by a toxic effect of uranium on that organ. This reinforces the case for the fecundity endpoints of A. carinata and A. cumingii as endpoints for biological monitoring of RP2 waters.

## CONCLUSION

Of the 7 species examined, A. carinata and A. cumingii were most sensitive to RP2 water. When fecundity parameters were used as endpoints, LOECs of between 1 and 10% RP2 were established for these species. This was roughly equivalent to uranium concentrations of 17 to 170ppb total uranium. The endpoints embryonic mortality, juvenile mortality and adult mortality were seen to be insensitive or too variable for use in biological monitoring. Developmental retardation was a moderately sensitive endpoint and established LOECs at 32% RP2.

Other species tested were excluded on various grounds, including rearing and handling difficulties, insensitivity and variability in the measured parameter or response.

Uranium solutions of similar concentration to RP2 treatments were seen to be equivalently toxic. The depressed fecundity effect of RP2 water on A. carinata and A. cumingii was attributed to uranium accumulation in the ovotestis.

Since the fecundity parameters were linked directly to the accumulation of uranium in the snail tissue, the case is strong for the use of this endpoint in biological monitoring of RP2 release into the Magela Ck system using A. carinata or A. cumingii.

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Ar	ppendix 1.a.1.					
	PRELIMINARY OBSERVA	TION No.1 JMBERS OF	COMMENCE	ED 19/1/ D PER DAY	PAGE 1	
	19/1/91		REP. 1 20	REP.2 19	REP. 3 21 7	REP.4 15 19
	20/1/91		1,9	16	5 9 9 13	21
	21/1/91		20	15 14 18	5 22	17 16 23
	22/1/91		27 19 17 8 17	11 19 13 3	16	17 17 17 15 12
	23/1/91		0	0	0	0
	EGGHASS PER DAY MEAN STD CV		2.8 4.09 146	3 3.46 115	2.8 1.79 63.9	2.4 1.95 81.2
	EGGS PER DAY MEAN STD CV		29.4 33.8 115	25.6 20.4 79.9	21.4 13.9 65.1	37.8 30.3 80.2
	ECGS PER ECCHASS MEAN STD CV		18.4 5.24 28.5	14.2 5.02 35.3	11.8 6.51 54.7	17.2 2.99 17.4
	TOTAL EGGS PER EGGM	WSS (DSI	G EACH DA	Y REPLICA	TE)	
ECG HASS STD CV	MEAN STO CV MEAN ACROSS REPS.	19/1/91 2.5 1.29 51.6	20/1/91 1.75 1.5 85.7	21/1/91 2.25 0.96 42.6	22/1/91 7 2.94 0	29.6 14.2 47.8 23/1/91 0.25 0.5 200
EGG MEAN STD CV	S ACROSS REPLICATES	25.3 7.09 28.1	23 8.91 38.7	37.5 16.8 44.9	57 32.7 57.3	0
	IVE EGGHASS TOTAL OSS CUNN'IVE REPS.	10 2.5 1.29 51.6	17 2.215 1.36 63.9	26 2.17 1.19 55.1	54 3.38 2.73 80.9	55 2.75 2.75 100
CUMMULAT MEAN ACR STD CV	IVE EGG TOTAL OSS CUMM'IVE REPS.	101 25.6 7.09 28.1	193 24.15 7.55 31.3	343 28.6 12.5 43.8	571 35.7 22.1 62	571 28.6 24.5 85.9

Appendix	1.4.4.						
PRELIMINA A.cumming	RY OBSERVA	TION No.1 UMBERS OF	COMME!	NCED 19/	1/91 AY PAGE	1	
19/1/91	REP. 1 15	REP.2	RPE. 39 45	3 REP.	4 REP.:	5 REP. 44 39 33	6 REP.
20/1/91	18 18 11 9	12 6 18 12	31 43 29 39 31	22 47 39	24	38 44	50 57
21/1/91	23 18 15 8	10 10 16 12 13	47 45 51 41	52 21 25	13 19 26 25	40	44
22/1/91	22	16 15 11 10	54 39	24 50 21 20 9 20 41 54	12	45	50
23/1/91	30 23 28 25	15 16 15	38 37 41 41 34 54 45 45 45	38 48	12 19 6 24 26 17 12	47 35 39 24 40 27 28 23 32	43 43 50 46 37 58 44
EM/DAY	REP.1	REP.2	RPE. 3	REP.4	REP.5	REP.6	REP.7
HEAN STD CV	3,2 2.05 64	3.2 1.92 60.1	4.2 3.27 68.1	3.2 2.95 92.2	3.1 2.85 91.8	3.2 3.35 105	2.2 2.77 126
EGGS/DAY MEAN STD CV	61.2 41 67	39.4 25.6 59.8	184 126 68.4	106 85.7 80.7	55.4 53.6 96.7	115 108 94.1	104 126 121
ECCS/EM HEAN STD CV	19.1 5.86 30.7	12.3 3.05 24.8	41.3 6.78 16.4	31.8 14.8 46.5	18.5 6.14 33.2	35.5 8.26 23.3	47.5 6.3 13.3
	PER EGGMAS	S (USING	EACH DA	Y REPLICA	TE)		
HEAN STD CV						29.6 14.2 47.8	
EGG HASS HE STD CV	ANS ACROSS	REPS.	9/1/91 1 1.15 115	20/1/91 3.14 1.57 50	21/1/91 3.14 2.27 72.2	22/1/91 2.57 2.64 103	23/1/91 6.14 3.13 51
EGG HEANS A STD STD AS & OF		CATES	32.3 44.1 137	86.1 49.8 57.8	84.6 45.5 53.8	57 32.7 57.3	199 137 68.8
CUMMULATIVE MEAN ACROSS STD CV	EGGMASS TO CUMM'IVE I	OTAL REPS.	7 1 1.15 115	29 2.07 1.73 83.5	53 2.52 1.83 72.7	71 2.54 2.01 79.2	114 3.26 2.66 87.1
CUMMULATIVE MEAN ACROSS STD CV	EGG TOTAL	REPS.	226 32.3 44.1 137	829 59.2 53.1 89.7	1421 67.1 51 75.4	1934 69.1 57.2 82.8	3327 95.1 93.2 98.1

## Appendix 1.a.3.

Appendix 1.a.2.

PRELIMINARY OBSERVAT: GLYPTOPHYSA SP. NU	ION No.1 COMMENCE ABERS OF EGGS LAID	ZD 19/1/9 PER DAY	PAGE 1	
	REP.1	REP.2	REP.3	REP.4
19/1/91	0	9 9 9 8	4	4
30/1/91	o	12 10 10 10	12 12 9	7 9 5
21/1/91	5	12 12 12 11 11 13 10		8
22/1/91	1 9	9 9 10 7 11 12 12 13 13	11 13 13 11 1	11 13 9 3 9 8 9

						CYRAULUS SP.					
PRELIMINARY OBSERVATION No. 1	COMMENC	ED 19/1/9	1			EGG MASS MEAN ACROSS REPS. STD CV	19/1/91 1.75 1.71 97.6	20/1/91 9.5 3.42 36	21/1/91 7.75 5.25 67.8	22/1/91 8 1.83 22.8	23/1/91 12 2.5 20.4
GLYPTOPHYSA SP. NUMBERS OF EGGMASS PER DAY MEAN	REP.1	REP.2	PAGE 2 REP.3	REP.4	j	EGG HEANS ACROSS REPLICATE STD CV	s 8.25 9.74 118	58.25 13.8 23.8	51 36.5 71.5	56.3 13.7 24.3	82.5 16.1 19.5
STD CV	0.89 149	4.64 77.3	1.8 1.1 60.8	3.2 2.28 71.3		CUMMULATIVE ECCHASS TOTAL MEAN ACROSS CUMM'IVE REPS	7 1.75 1.71	45 5.63 4.84	76 6.33 4.84	108 6.75 4.3	156 7,8 4,49 57,6
EGGS PER DAY MEAN STD CV	4.47 149	64.4 52.3 81.2	18.8 21 112	22.8 21.6 93.2		CURRULATIVE EGG TOTAL	97.6 33 8. <del>2</del> 5	266 33.3	86 470 39.2	43.3	1025 51.3
EGGS PER EGGNASS MEAN STD CV	5 4 80	10.1 3.2 30	8.54 4.41 51.6	7.13 2.25 35.8		HEAN ACROSS CUMM IVE REPS SID CV	9.74 118	28.9	31.2 79.6	28.4	
TOTAL ECGS PER ECCHASS (USIN	IC EACH DA	Y REPLICAT	E)	8.95							
STD CV	19/1/91	20/1/91 :	21/1/91 2	3.23 36.1 22/1/91	23/1/91	Appendix 1.a.5.  PRELIMINARY OBSERVAT:					
EGG MASS HEAN ACROSS REPS. STD CV	1.5 1.73 115	2.5 1.73 69.3	3 3.37 112	1.25 1.26 101	6.25 4.99 80	HELIOCORBIS SP. NUR	BERS OF EG			REP. 3	REP.4
ECG MEANS ACROSS REPLICATES STD STD AS & OF MEAN	10.8 16.4 151	24 18.2 75.7	27.8 41.7 150	8.5 8.06 94.9	65.3 56 85.8	20/1/91		5	0	5	8 3
CUMMULATIVE ECCHASS TOTAL MEAN ACROSS CUMM'IVE REPS.	6 1.5 1.73	16 2 1.65	28 2.33 2.27	33 2.06 2.06	58 2.9 3.21	21.4.491			4	2 2	4
CUMMULATIVE EGG TOTAL	115	84.5 139	97.3	284	545	21/1/91		5	6	4 6 7 5	4 5 6 6 7
MEAN ACROSS CUMM'IVE REPS. STD CV	10.8 16.28 151	17.4 17.5 101	20.8 26.3 126	17.8 23.5 132	27.3 36.2 133	22/1/91		2 4 5	4 4	3 4 5	5 6 6
Appendix 1.a.4. PRELIMINARY OBSERVATION NO	1							5	5	2 2 2 3	5 4 3 4 5
GYRAULUS SP. NUMBERS	OF EGGS L	AID PER DA	Y	PAGE 1 REP.		÷				6 3 4	6 8 8
	ś	,	4 5 4	•		23/1/91	,	5 4	6 4	5 7	. 7 7
20/1/91	5 2 4	4 4 8 5	13 11 5 6	4 4 5 7				4 3 7 4	4 5 3 5	1 5 6 3	7 7 3 6
	11 6 1 3	5 8 6 4	5	7 8 8 4				5 6	3	3	5
	3 7 10			8		PRELIMINARY OBSERVATION No. HELIOCORBIS SP. DAILY AND	COMMENCE CUMMULATIV	D 19/1/9 E STATIST	1 PAGE 3	1	
21/1/91	9 6 2	7 3 7	5 13 5	4 3 8		EGG MASS MEAN ACROSS REPS. STD CV	19/1/91 1.5 1.29 86.1	20/1/91 : 1.5 1.28 86.1	21/1/91 4 1.41 35.4	22/1/91 7.75 3.86 49.8	23/1/91 7.75 0.96 12.4
		5	10 12 5 9 2	7 5 9 8 8		EGG MEANS ACROSS REPLICATES STD GV	7.75 7.72 99.6	2.75 4.27 155	16.3 10.6 65.2	35 23.4 66.9	36.8 4.99 13.6
			4	10 5 4 9 4 10		CUMMULATIVE EGCHASS TOTAL HEAN ACROSS CUMM'IVE REPS. STD CV	1.5 1.29 86.1	12 1.5 1.2 80	28 2.33 1.72 73.9	59 3.69 3.32 90.1	90 4.5 3.41 75.8
22/1/91	9 6 5	5 5 5	10 7 12	6 6 9		CUMMULATIVE EGG TOTAL HEAN ACROSS CUMM'IVE REPS. STD CV	31 7.75 7.72 99.6	42 5.25 6.36 121	107 8.92 9.26 104	247 15.4 17.6 114	394 19.7 18 91.4
	7 7 4 8 8	, 8 , 6 6	5 5 6	2 4 10 10							
	9 7 8	5	3	· 10		PRELIMINARY OBSERVATION NO HELIOCORBIS SP. NUMBERS	TEGGS LAI	ED 19/1/ D PER DAY REP.2	PAGE :	2 REP.4	
	8 7 7 5	6 5 7 4	5 5 6 12	9 9 7 5		EGCHASS PER DAY MEAN STD CV	4.2 2.49 59.3	2.8 3.11 111	5.4 3.91 72.4	5.6 4.44 75.3	
	6 12 4 8 11 4	9 9 12 4 9	7 11 6 5	5 5 4 10 4 8		EGGS PER DAY MEAN STD CV	14 14,7 105	12.2 13.2 1.8	21.1 15.2 71.6	31.4 25.2 80.2	
EGGHASS PER DAY				6		ECCS PER ECCMASS MEAN STD	4.67 1.23 26.5	4.36 0.93 21.3	3.81 1.92 50.4	5.61 1.69 30.1	
COGRASS FER DAY HEAN STD CV	8.32 13.8 166	6.2 3.42 55.2	6.6 1.95 29.5	9.8 6.14 62.7		CV  TOTAL EGGS PER EGGHASS (US)					
RGGS PER DAY MEAN STD CV	50.6 35.2 69.6	42 38.1 75.6	47.4 58.1 75.6	65 39.8 61.2		MEAN STD CV				4.7 1.67 35.6	
EGGS PER EGGMASS MEAN STD CV	6,17 2,7 43.8	6.16 2.16 35.3	7.18 3.14 43.7	7.52 5.84 77.6							
TOTAL EGGS PER EGGHASS (USI HEAN STD CV	NG EACH D	AY REPLICA	ATE)	6.36 2.64 41.5							

DAY 9

100

PRELIMINARY OBSERVATION No.2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES A. carinata

RAW DATA

ENDPOINT	NARY OBSERVAT I:DEVELOPMENT A. carinaca	AL CHARA	COMMENCE	0 30/1/91 S PAGE 1		AW DATA	8 YAD	19 16	11 17 16
	GASTRULA	R D TROCH	EPLICATE EVELOPMEN VEL	TAI. STACE	H'LING	N'NATE	; :	15 13 18	11 17 7
DAY 1							DAY 9		14 16 19
DAY 2		12 13	13						15 13 18
<b></b>			13 8 12						
DAY 4			13	15 12 6			PRELIMINARY OBSERVATION No.2 COMMENCED 30/1/91 ENDPOINT:DEVELOPMENTAL CHARACTERISTICS PAGE 2 SPECIES A. Carinata PERCENTILE DATA		
				8 13			REPLICATE No. 4 DEVELOPMENTAL STAGE		
DAY 5				15 13 6	13 2 9			H'LING	N'NATE
				13	11	16	DAY 2 100		
DAY 6					13 2 8	16	DAY 3 28 72 DAY 4 30 70		
•					15 13 11		DAY 5 80	20	
					4 6		DAY 6 DAY 7	100	
DAY 7					13	16	DAY 8	96 47	53
VA.1 /					9 - 15 13	ĩ3	DAY 9		100
DAY 8					•	13			
						15 13			
TN1O9GK3	NARY OBSERVAT T DEVELOPHENT A. carinata	AL CHARAG	CTERISTICS PI	0 30/1/91 5 PAGE 2 ERGENTILE			PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE L SPECIES A. cummingli	F	RAW DATA
	GASTRULA	RI DI TROCH	EPLICATE I EVELOPHENT VEL	No. 3 TAL STAGE HIPPO	H'LING	N'NATE	REPLICATE No. 1		
DAY 1	100	IROCH	*65	HIFTO	n Line	WWIE	DEVELOPMENTAL STAGE CASTRULA TROCH VEL HIPPO	H'LING	N'NATE
DAY 2		100					DAY I		
DAY 3			100				DAY 2 36 25 13		
DAY 4 DAY 5				100 55	45		DAY 3 13 34		
DAY 6					100		25 DAY 4 27 33		
DAY 7	•				63	37	DAY 4 27 33 31 31 34 13 25		
DAY 8						100	DAY 5 25 30 13 27 33 35		
ENDPOINT:	RY OBSERVATIO DEVELOPMENTAL A. carinata	N No.2 C	OMMENCED ERISTICS	30/1/91 PAGE 1	RAW	DATA	DAY 6 26	35 33	
		929	LICATE No				25	34 25 13	
	GASTRULA	DEV TROCH	ELOPMENTA	L STACE	H'LING	N'NATE	DAY 7	14	34
DAY I							•	25 13 25	
DAY 2		7 17						25 26 30 33	
DAY 3		14 11	16				DAY 8	33	34
		7	17 14						25 13 14 25 26 30
DAY 4			13 18	15					25 26
•				16 11 17					30 33
		•		7 14					
DAY 5				15 13	11 17		PRELIMINARY OBSERVATION No.2 COMMENCED 30/1/91 EMPROINT: DEVELOPMENTAL CHARACTERISTICS PAGE 2 SPECIES A. cummingle PERCENTILE		
				18 16 11			DATA REPLICATE No. 1		
				17			DEVELOPMENTAL STAGE CASTRULA TROCH VEL HIPPO	H'LING	N'NATE
D. V. 6				14			DAY 1 100		
DAY 6					19 11 16		DAY 2 100 DAY 3 18 72		
					17 15 13		DAY 4 44 56		
					18 16		DAY 5 18 72		
					11 17		DAY 6 37	63	
					7 14		DAY 7 DAY 8	85	15
DAY7					19 16	7	DAY 9		100
					11 17 15				
					13				
					16 11 17				
					14				

PRELIMINARY OBSERVATION No.2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES A. cummingit

RAW DATA

		RE	PLICATE	No. 2		
	GASTRULA	TROCH	VELOPHE	TAL STAC	H'LING	N'NATE
DAY 1						
DAY 2						
DAY 3		28				
DAY 4		25	27 31 30			
DAY 5			30	28		
561 5				34 30		
				25 31		
				26		
DAY 6				26	28 34 30	
					25 31	
DAY 7					28	
					34 30	
					25	
					. 26	
DAY 8						28 34
						30 25
						31 26
			•			
PRF1.T	MINARY ORSERVAT	TTON No. 2	COMMENC	ED 30/1/9	) 1	
ENDPO SPECI	HINARY OBSERVATINT:DEVELOPMENTES A. cummaing:	TAL CHARAC	TERISTI	CS PAGE PERCENTI	2 LE	
				DATA		
	<del>-</del>	RE DE	PLICATE VELOPHE	No. 2 NTAL STA	CE .	
DAY 1	CASTRULA 100	TROCH	VEL	HIPP	O H.FIN	G N'NATE
DAY 2						
DAY 3		100				
DAY 4		22	78			
DAY 5				100		
DAY 6				15	85	
DAY 7					100	
DAY 8						100
PRELIMI	ARY OBSERVATIO	N No.2 COM	MENCED	30/1/91	RA	W DATA
endpoint Species	A. cummingii	. CHARACTER	ISTICS	PAGE 1		
	•					
		DEVEL	CATE NO	L STACE		
-	GASTRULA	TROCH	VEL.	HIPPO	H'LING	N'NATE
DAY .1						
DAY 2 DAY 3		36				
DA1 3		27				
DAY 4			24 31			
			36 27			
			41			
DAY 5				43 24		
				41 31		
		-		36 27		
DAY 6				31 27	43 24	24
					31 46	
DAY 7					43 24	24
					41 31	
					36 27	
DAY 8						36
						27 31 41
						24 43
						24

PRELIMINARY OBSERVATION No.2 COMMENCED 30/1/91 ENDPOINT:DEVELOPMENTAL CHARACTERISTICS PAGE 2 SPECIES A. cumming11 PERCENTILE DATA

	GASTRU	▲ TROC	REPLICA DEVELOP H V	TE No. 3 MENTAL S EL HI	TAGE PPO	H'LING	N'8
DAY	1 100	)					
DAY	2						
DAY	3	100					
DAY	4		10	0			
DAY	5			1	00		
DAY	6				26	63	
DAY	7					89	
DAY	8 .						1
PRELIMI ENDPOIN SPECIES	INARY OBSERVAT IT: DEVELOPMENT A. cummings	TION No.2 TAL CHARAC	COMMENCE TERISTIC:	- D 30/1/91 S PAGE 1		RAU	DATA
		RE	PLICATE !	io. 4 Tal stage			
	GASTRULA	TROCH	VELDPHEN	HIPPO	H.F	ING 5	''NATE
DAY 1							
DAY 2							
DAY 3		43					
DAY 3			43 34				
DAY 4			34	26			
DAT 4				36 43 43			
				34			
DAY 5						43	
						43 36	
DAY 6						34	
UAT 5						43 43	
						36 34	
DAY 7							43
							43 36
							34
PRELIMIN	ARY OBSERVATION	ON No.2 CO	MMENCED	10/1/91			
SPECIES	A. cummingii	C CANGOLIE	PER DAT	CENTILE			
		REPL	ICATE No LOPMENTA	. 4			
	GASTRULA	TROCH	VEL	HIPPO	H'LI	ic n,	STAN
DAY 1	100						
DAY 2							
DAY 3		100					
DAY 4			100				
DAY 5				100			
DAY 6					100	1	
DAY 7					100		
DAY 8							100

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/,91
ENDPOINT:DEVELOPMENTAL CHARACTERISTICS PAGE 2
SPECIES GABBIA SP. PAGE 1
DATA

TERMINATION

	GASTRULA		REPLICATE 1 DEVELOPMENT VEL	AL STAGE	H.FING	N'NATE
DAY 1	100				-	
DAY 2						
DAY 3		100				
DAY 4		100				
DAY 5			100			
DAY 6			. 14	86		
DAY 7				100		
DAY 8				100		
DAY 9				14	86	
DAY 10					100	
DAY 11					100	
DAY 12					100	
DAY 13	•				100	
TERMINA	TION					

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES GABBIA SP.

RAW DATA

•		DEV	LICATE ELOPHEN	TAL STACE		
	CASTRULA	TROCH	VEL	HIPPO	H'LING	и,и
DAY 1						
DAY 2		•				
DAY 3						
DAY 4						
DAY 5		1				
DAY 6			1			
DAY 7			1			
			l l			
			1 1 1			
				1		
DAY 9			1 1 1 1 1	-		
			i			
			î 1			
DAY 10					1	
UAI IO			1 1 1 1 1			
			1			
			1 1			
DAY IL			1		ı	
• • • • • • • • • • • • • • • • • • • •			1 1 1 1 1			
			1			
DAY 12			1 1			
			1 1 1			
			1			
DAY 13			1		1	
			1			
			1			
			1			
TERMIN	ATION					

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91
ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 2
SPECIES GABBIA SP.

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91
PAGE 2
DATA

REPLICATE 3
DEVELOPMENTAL STAGE
VEL HIPPO H'LING N'NATE GASTRULA TROCH DAY 1 100 DAY 2 DAY 3 DAY 4 DAY 5 100 DAY 6 100 100 100 13 13 87 14 86 DAY 11 14 86 DAY 12 83 17 DAY 13 TERMINATION

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT:DEVELOPHENTAL CHARACTERISTICS PAGE 1 SPECIES GLYPTOPHYSA SP.

				REPLICATE	1 NTAL STAGE		
		GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAY	1						
DAY	2	11					
DAY	3		7 11				
DAY	4			8 7			
DAY	5				6 7		
DAY	6				1	5 1	13 12 5
DAY	7					ı	4 6 13 5 1
DAY	8						13 6 4 5 1

PRELININARY OBSERVATION No. 2 COMMENCED 30/1/91
ENDPOINT:DEVELOPMENTAL CHARACTERISTICS PAGE 2
SPECIES GLYPTOPHYSA SP. PERCENTILE
DATA

		GASTRULA	TROCH	REPLICATE DEVELOPME VEL	: 1 NTAL STAGE HIPPO	H'LING	N'NATE
		3/13/11/0	INOUL	¥64	nitto	u CING	N MALE
DAY	1	100					
DAY	2	100					
DAY	3		. 100				
DAY	4			100			
DAY	5				100		
DAY	6				9	16	81
DAY	7					3	97
DAY	8						100

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES GLYPTOPHYSA SP. RAW DATA

			PLICATE :			
	GASTRULA	TROCH	JEC	TAL STAGE HIPPO	H'LING	N'NATE
DAY 1						
DAY 2	2					
DAY 3		2				
DAY 4			2			
DAY 5					2	
DAY 6					2 3 3	10
					3	
DAY 7					2	2
					3	LO
B YAG					2	2 3 10
						10
DAY 9						2
						2 3 2 10

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91
ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 2
SPECIES GLYPTOPHYSA SP. PAGE 1
DATA

			REPLICATE 3 DEVELOPMENTAL STAG		
	GASTRULA	TROCH	VEL HIPPO	H'LING	H'NATE
DAY 1					
DAY 2	100				
DAY 3		. 100			
DAY 4			100		
DAY: 5				100	
DAY 6				44	56
DAY 7				29	71
B YAG				12	88

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES GLYPTOPHYSA SP.

RAW DATA

DAY 1	CASTRULA	RE DE TROCH	PLICATE 4 VELOPHENT VEL	TAL STAGE HIPPO	H'LING	N'NATE
DAY 2		1				
DAY 3		1	1			
DAY 4		1	ı			
DAY 5		1				
DAY 6			1	1 2	1	
DAY 7			-	•	1	
DAT /				1	2	
DAY 8					ι	
DAY 9				ı	1	
DAT 9					l 1	

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91
ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 2
SPECIES GLYPTOPHYSA SP. PAGE 2
DATA

				REPLICATE DEVELOPMENT	4 NTAL STAGE	:	
		CASTRULA	TROCH	VEL	HIPPO	H'LINC	N'NATE .
DAY	1						
DAY	2		100				
DAY	3		50	50			
DAY	4		50	50			
DAY	5		50		50		
DAY	6		25		50	25	
DAY	7				25	75	
DAY	8				50	50	
DAY	9					100	

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES GYRAULUS SP. RAW DATA

	GASTRULA	TROCH	REPLICATE DEVELOPME VEL	NTAL STACE	H'LING	N'NATE
DAY 1	and the Br	1110011			020	
DAY Z	9					
DAY 3			9 6 9 11	9		
DAY 4				7 9 6 9 11 9		
DAY 5				9 6 9 11	6 13 8 7 11	
DAY 6					6 9 11 8 8 15 5 13	7
DAY 7					5 9 6 9 11 13 6	5 3 7 7 5
DAY 8					13 6	9 6 9 11 5
UR1 ,						13

DAY 8

PRELIHINARY OBSERVATION No. 2 COMMENCED 30/1/91
ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 2
SPECIES GYRAULUS SP. PAGE 2
PERCENTILE
DATA

		REPLICATE 1 DEVELOPHENTAL STAGE									
		GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE				
DAY	1	100									
DAY	2	100									
DAY	3			80	20						
DAY	4				100						
DAY	5				44	56					
DAY	6					94	6				
DAY	7					69	31				
DAY	8					32	68				
DAY	9	•					100				

DAY 9						100
		RE	EPLICATE : EVELOPMENT VEL	2		
DAY 1	CASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAY 2		-				
		7 9 9				
DAY 3			7			
			9 11			
			7 9 11 9 9 6 8	•		
DAY 4			8			
			•	7 9 5 10 7 8 8 9 9 8 9 9 5 8	12 8	
				9 5		
				7 8		
				8		
				9		
DAY 5				9	7	
				. 5	9	
t				10 7	11	
				1	11 7	
					7 8	
					7 9 9 10 11 8 11 7 7 8 12 8 9 6	
DAY 6					6	
on: v					7 9 9 9 5 8 10 7 6	9 7
					9	
					. 5 . 8	
					7	
					12	
					9	
					10 11	
					11	
					7 6	
					9 7 10 11 11 8 7 6 10 8 8	
DAY 7						?
					5 8 10	9
					7 5 8 10 7 12 8	7 9 9 11 7
					8	6

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91
ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 2
SPECIES GYRAULUS SP. PAGE 1
DATA

				REPLICAT	E 2 ENTAL STAC	:F	
		GASTRULA	TROCH	VEL		H, FING	N'NATE
DAY	1	100					
DAY	2		100				
DAY	3		13	87			
DAY	4				83	17	
DAY	5				28	72	
DAY	6					92	8
DAY	7					59	41
DAY	8						100

316	.163	GYRAULUS SP	•			
		CASTRULA	TROCH	REPLICATE 3 DEVELOPMENTAL STAGE VEL HIPPO	H'LING	N'NATE
DAY	ı					
DAY	2	11	12			
DAY	3		11 9 8 8 9 9	12 6 11		
DAY				11 9 12 6 8 11 9 10 10 10 8		
DAY				11 8 9	9 12 6 8 11 9 12 10 10 9 8 9 4	
DAY	6				6 8 9 11 9 8 10 11 9 12 12 10 10	9
					9 8	
DAY	7				11 12 6 8	12 10 10

		9 8	
		11 12 6 8 8 11 9	9 12 10 10 8 9 8
8	٠	6 8 8 11 4	11 9 12 9 10 9 9
9			6

ENDPOIN	NARY OBSERVAT T:DEVELOPMENT CYRAULUS	TAL CHARA	CTERISTIC	S PAGE	PERCENTIL DATA	Ē	30 57 12	
		R	EPLICATE EVELOPMEN	3			1 124 DAY 7 46	
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N' NATE	34 30	
DAY 1	100						57 12	,
DAY 2	62						124	
DAY 3		65	35	90	10		DAY 8 46 34 30	37 124
DAY 4 DAY 5				20	80		DAY 9 46	•••
DAY 6					81	9	34 30	
DAY 7					55	45	DAY 10	40
DAY 8					29	71		34
DAY 9						100		
90E1 TVI	INARY OBSERVA	TION No.	7 COMMEN	CED 30/1	/91	RAU DATA	PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 2 SPECIES LYNNEAE SP. PERCENTILE	
ENDPOL	T: DEVELOPMEN LYMNEAE SE	TAL CHAR	ACTERISTI	CS PACE	í	idia onti	DATA REPLICATE 3	
							DEVELOPHENTAL STAGE	'NATE
			REPLICATE DEVELOPME	NTAL STA	SE .		DAY 1 100	
	GASTRULA	TROCH	Jav	HIPPO	H'LING	N'NATE	DAY 2	
	•						DAY 3	
DAY 1	•						DAY 4 100	
DAY 2							DAY 5 100	
DAY 3			42				DAY 6 100	
DAY 4			42				DAY 7 100 DAY 8 34	66
DAY 5				35 42			DAY 9 34	00
DAY 6			•	35 60	42		DAY 10	34
DAY 7					35 42			
					60 124		PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 RAW	DATA
DAY 8					35 42 60		ENDPOINT: DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES LYMNEAE SP.	
DAY 9					124 35		REPLICATE 4 DEVELOPMENTAL STAGE	
					42 60		GASTRULA TROCH VEL HIPPO H'LING N'	NATE
					124		DAY 1	
DAY 10					60	35 42	DAY 2	
DAY 11					"	124	DAY 3 76	
DAY 12					60 60		DAY 4 76 DAY 5 76	
DAY 13					•	60	DAY 5 76 30 48	
							DAY 6 30 76	
ORET THEN	ARY OBSERVAT	י בא אם	COMMENCE	n 10/1/9	,		48 46	
<b>ENDPOINT</b>	DEVELOPMENTA LYMNEAE SP	L CHARAC	TERISTICS	PAGE 2	ercentili Ata	:	DAY 7 76 30 48	
SPECIES							46 55	
SPECIES		DE	PLICATE 2 VELOPHENT	AL STAGE				
	GASTRULA	TROCH .	VELOPHENT	AL STAGE	H'LING	N' NATE	57	
DAY 1	GASTRULA 100	DE	VELOPHENT	AL STAGE	H. FING	N' NATE	DAY 8 76	
DAY 1 DAY 2		DE	velophent Vel	AL STAGE	H'LING	N'NATE	DAY 8 76 30 48 46	
DAY 1 DAY 2 DAY 3		DE	VELOPMENT VEL 100	AL STAGE	H. FING	N' NATE	DAY 8 76 30 48 46 55 57	
DAY 1 DAY 2 DAY 3 DAY 4		DE	velophent Vel	AL STAGE	H'LING	N' NATE	DAY 8 76 30 48 46 55 57 DAY 9 76 30	46 57
DAY 1 DAY 2 DAY 3		DE	VELOPMENT VEL 100	AL STAGE	H'LING	N'NATE	DAY 8 76 30 48 46 55 57 76	
DAY 1 DAY 2 DAY 3 DAY 4 DAY 5		TROCH .	VELOPMENT VEL 100	AL STAGE HIPPO	H'LING	N'NATE	DAY 8 76 30 48 46 55 57 DAY 9 76 30 48 55 55	
DAY 1 DAY 2 DAY 3 DAY 4 DAY 5 DAY 6		TROCH .	VELOPMENT VEL 100	AL STAGE HIPPO	H'LING	N'NATE	DAY 8 76 30 48 46 55 57  DAY 9 76 30 48 55  DAY 10 30 48	57
DAY 1 DAY 2 DAY 3 DAY 4 DAY 5 DAY 6 DAY 7		TROCH .	VELOPMENT VEL 100	AL STAGE HIPPO	31 100	N'NATE	DAY 8 76 30 48 46 55 57  DAY 9 76 30 48 55 DAY 10 76	57
DAY 1 DAY 2 DAY 3 DAY 4 DAY 5 DAY 6 DAY 7		TROCH .	VELOPMENT VEL 100	AL STAGE HIPPO	31 100 100	N'NATE	DAY 8 76 30 48 46 55 57 DAY 9 76 30 48 55 DAY 10 76 30 48	57
DAY 1 DAY 2 DAY 3 DAY 4 DAY 5 DAY 6 DAY 7 DAY 8 DAY 9		TROCH .	VELOPMENT VEL 100	AL STAGE HIPPO	31 100 100		DAY 8 76 30 48 48 55 57 DAY 9 76 30 48 55 55 DAY 10 76 30 48 55 50 48 55 50 48 55 50 48 50 40 50 40 50 40 50 40 50 50 50 50 50 50 50 50 50 50 50 50 50	57 55
DAY 1 DAY 2 DAY 3 DAY 4 DAY 5 DAY 6 DAY 7 DAY 8 DAY 9		TROCH .	VELOPMENT VEL 100	AL STAGE HIPPO	31 100 100		DAY 8 76 30 48 48 55 57 DAY 9 76 30 48 55 DAY 10 76 30 48 OAY 11 76 48 DAY 12 76	57 55 30

REPLICATE
3 V2L HIPPO H'LING N'NATE

DAY 1

DAY 2

DAY 3

DAY 4

DAY 5

DAY 5

DAY 6

RAW DATA

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT DEVELOPMENTAL CHARACTERISTICS PAGE 1 SPECIES LYMNEAE SP.

				REPLICATE 4	TAL STAGE		
		CASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAY	ι	100					
DAY	2						
DAY	3			100			
DAY	4			100			
DAY	5				100		
DAY	6				15	85	
DAY	7					100	
DAY	8					100	
DAY	9					67	33
DAY	10					74	26
DAY	11					81	19
DAY	12					61	39
DAY	13						100

ENDPO INT	ARY OBSERVA DEVELOPMEN A. carinat	TAL EMBR				RAW DATA
	GASTRULA	TROCH	REPLICATES VEL		4. H'LING	N'NATE
REP 1		1				
REP 2	2		3	5		
REP 3	5	2	25	37		
REP 4						
					PERGENTIL DATA	E
	GASTRULA	TROCH	VEL.	HIPPO	H'LING	N'NATE
REP 1		4.4				
REP 2	1.2		1.7	2.9		
REP 3	3.6	1.5	18.2	27		
REP 4						
TOTAL	7	3	28	42	0	0
					_	_

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91		
ENDPOINT: DEVELOPMENTAL EMBRYONIC HORTALITY	RAU	DATA
SPECIES A. cummingii		•••••

		GASTRUL	۸.	TROCH	REPLICATE: VEL		4. H'LING	N'NATE
REP	1			2	4		ı	
REP	2			2	3			
REP	3		•	. 8	2	2		
REP	4			•	1			

	CASTRULA	TROCH	VEL		PERCENTILE DATA H'LING	N'NATE
REP 1		0.9	1.8		0.4	
REP 2		1	3			
REP 3	•	3	1	1		
REP 4	2		11			
TOTAL	4	12	10	2	ī	0
PERCENT.	13.8	41.4	34.5	6.9	3.4	0

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES GABBIA SP.

RAW DATA

REPLICATE 1, 3
VEL HIPPO H'LING N'NATE CASTRULA TROCH REP 1 REP 3 1 3 PERCENTILE DATA H'LING N'NATE VEL HIPPO CASTRULA TROCH 22 REP 1 30 REP 3 10 10 TOTAL 0 3 1 0 PERCENT. 0 42 9 14.3 42.9 PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES GLYPTOPHYSA SP. RAW DATA REPLICATE 1, 2, 3, 4.
VEL HIPPO H'LING N'NATE REP 1 REP 2 39 REP 3 1 REP 4 2 PERCENTILE DATA H'LING GASTRULA TROCH VEL REP 1 32 3 11 REP 2 98 2 REP 3 50 2.8 REP 4 20 TOTAL 84 10 0 PERCENT. 81.2 2.9 PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES GYRAULUS SP. RAW DATA REPLICATE 1, 2, 3, 4777. VEL HIPPO H'LING GASTRULA REP 1 33 2 8 REP 2 1 11 30 4 REP 3 REP 4

					PERCENTIL	E DATA
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
REP 1		20.8	1.3	5	0.6	
REP 2		0.4	4.7	12.8	1.7	
REP 3		4			1	
REP 4						
TOTAL	0	42	13	38	7	0
PERCENT.	0	42	13	38	7	0

NOTE:: LYMNEAE HAD NO OBSERVABLE EMBRYONIC MORTALITY

ppendix 1.c.1.											
PRELIMINARY OBSERVATIONS	No. 2 COMM	ENCED 25/	1/91			PRELIMINARY OBSERVA A . cummingli D	TIONS No.	2 COMME	NCED 25/1	/91 PAGE	2
A. carinaca NUMBER	S OF ECGS LA	ID PER DA	Y PAG	Εl		•					
25/1/91	REP.1 18 13	REP. 2 12		.3 R:	EP.4 16 19	ECC MASS MEAN ACROSS REPS. STD STD AS % OF MEAN	25/1/91 0.25 0.5 200	26/1/91 1.75 0.5 28.6	27/1/91 2.5 L 40	28/1/91 1.25 0.96 76.6	29/1/91 0.75 1.5 200
26/1/91	16 15 17	20 17 10	1	9	17 11	ECG MEAN ACROSS REPS. STD STD AS & OF MEAN	6.5 13 200	62.5 14.3 22.9	82.3 34.2 41.6	34.5 27.1 78.6	18.25 36.5 200
27/1/91	23 23 15 17 14	18 15 12 17	1		18 13 15	CUMM'IVE ECC MASS TOTAL MEAN AGROSS CUMM'IVE REPS. STD STD AS % OF MEAN	0.25 0.5 200	8 1 0.93 92.6	18 1.5 1.17 77.8	23 1.44 1.09 76	26 1.3 1.17 90.3
28/1/91	21 20	16	1		16 11	CUMMULATIVE EGG TOTAL HEAN ACROSS CUMM'IVE REPS. STD STD AS N OF HEAN	26 6.5 13 200	276 34.5 32.5 94.2	605 50.4 39.3 77.9	743 46.4 36.5 78.5	816 40.8 37.3 91.5
29/1/91	14	18 18	1		7 14 17	Appendix 1.c.3.					
EGGHASS PER DAY				_		PRELIMINARY OBSERVA					
hean STD STD & OF Hean	2.6 1.52 58.3	2.2 1.3 59.3	1.2 61.	2 0	2.4 2.55 2.8		UMBERS OF	REP.1	D PER DAY	REP. 3	REP.4
EGGS PER DAY MEAN	45.2	34.6	27.	4 1	4.8	25/1/91 26/1/91		1	0	0	1
STD & OF MEAN	29.1 64.4	21 60.8	15.	6 7 7 2	.99 2.4			1	v	1 1 1	0
EGGS PER EGGMASS MEAN STD	3.4 19.6	3.13 19.9	3.2 23.	:3 3	1.48 24					l l	
STD % OF HEAN						27/1/91		1	0	ı	0
TOTAL EGGS PER EGGMASS MEAN	(USING EACH	DAY/REPLIC	ATE)		15.3 3.51	28/1/91		ι	0	1	0
STD & OF HEAN					22.8	29/1/91		o	o	0	0
PRELIMINARY OBSERVA	ATIONS No. 2 DAILY AND CUR				: 2	ECGMASS PER DAY Mean STD STD & OF Mean	•	1.4 1.52 108	0	1.8 2.95 164	0,2 0,45 224
GG MASS MEANS ACROSS REPS. ITD ITD AS & OF MEAN	25/1/91 26 1.25 0.96 76.7	2.75 0.5	/1/91 3.5 1.29 36.9	28/1/91 2 0.82 40.8	29/1/91 2 0.82 40.8	EGGS PER DAY Mean STD STD % OF Mean		1.6 1.95 122	0	1.8 2.95 164	0.2 0.45 224
GG HEAN ACROSS REPS. TD TD AS & OF MEAN	19.5 16.4 84.2	9.32 23.2	58.3 25.4 43.7	30 11 36.7	29.5 10.9 36.9	EGGS PER EGGHASS HEAN STD STD • OF HEAN		1.14 0.38 33		1 0 0	1 0 0
CUMM'IVE VE EGG TOTAL REAN ACROSS CUMM'IVE REPS.	1.25	16 2	30 2.5	38 2.38	46 2.3						•
TD AS & OF HEAN	76.6	53.5	1.31 52.6	1.2 50.7	1.13 49.1	total eggs per eggma Hean Std Std 1 of Hean	SS (USING	EACH DA	Y/REPLICA	re)	1.06 0.24 22.9
IUMMULATIVE EGG TOTAL IEAN ACROSS CUMM' IVE REPS. ITD ITD AS 1 OF MEAN Appendix 1.c.2.	16.4	16.6	472 39.3 23.4 59.5	592 37 21 56.9		PRELIMINARY OBSERVA GABBIA SP. D	TIONS No.	. 2 COMHI CUMMULATI	ENCED 25/1	1/91 PAGE STICS	2
PRELIMINARY OBSERVATI	ONS No. 2	OMMENCED	25/1/91			EGG MASS MEAN ACROSS REPS.	25/1/91	26/1/91	27/1/91	28/1/91	
A. cummingi NUM	BERS OF EGGS	LAID PER	DAY	PAGE 1		STO AS & OF HEAN	0.5 0.57 115	2.75 3.4 124	0.5 0.58 115	0.5 0.58 115	0
25/1/91	RE	P.1 RE	P. 2 0	REP. 3 26	REP.4	EGG HEAN ACROSS REPLICATES	0.5	3	0.5	0.5	0
26/1/91			34 28	45	37 ·	SID AS & OF MEAN	0.58 115	3.56 119	0.58 115	0.58 L15	0
27/1/91		31	31 33 25	31 41 32	32	CUMM'IVE ECG MASS TOTAL MEAN ACROSS CUMM'IVE REFS. STD STD AS & OF MEAN	0.5 0.58 115	13 1.63 2.56 158	15 1.25 2.14 171	17 1.06 1.88 177	17 0.85 1.73 203
28/1/91		0	28	27 36	43	CUMMULATIVE ECG TOTAL MEAN ACROSS CUMM'IVE REPS. STD STD AS & OF MEAN	0.58	14 1.75 2.71	2.27	18 1.3 2	18 9 1.83
29/1/91		13 25 35	0	0	0	STO AS T OF REAL	115	155	170	177	204
EGGMASS PER DAY MEAN STD STD & OF HEAN	1	.52 1		1.4 1.14 81.4	1 1 100						
EGGS PER DAY MEAN STD STD % OF HEAN	41	5.4 39	. 2	47.6 39.2 82.4	31.8 33.8 106			×.			
EGGS PER EGGHASS HEAN STD STD & OF HEAN	1	3.4 3	. 4	34 7.07 20.8	31.8 16.2 51						

TOTAL EGGS PER EGGMASS (USING EACH DAY/REPLICATE) MEAN STD 1 OF MEAN  $% \left( 1\right) =\left( 1\right) +\left( 1\right$ 

Appendix 1.0	:.4
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March   Marc	Appendix 1.c.4.						
Part		. 2 COMMEN	CED 25/1/	91			MEAN 3.4 5.4 4.6 1.0
1	GLYPTOPHYSA SP. NUMBERS C	F EGGS LAID	PER DAY	PAGE 1			STD 2.3 1.32 1.34 0.57
10   17   17   18   18   18   18   18   18	25/1/91	9 15 13	16 15	13 10			HEAN 31.3 47 40.4 10.6 STD 20.3 13.9 11.5 7.79
27/741	26/1/91	o	0	0	o		
MAYORT 10 0 2 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1	27/1/91	0	0	0	0		STD 2.3 1.56 2.04 1.31
10   1   1   1   1   1   1   1   1   1	28/1/91	7	0	0	11		
## PREJIGNAME OBSERVATIONS No. 2 COMMINIST STATUTED NO. 2 COMMINIST STA	29/1/91	11	0	2	1		STD 1.84
13	MEAN STD	1.64	1.34	1.3	0.55		PRELIMINARY OBSERVATIONS No. 2 COMMENCED 25/1/91 PAGE 2 GYRAULUS SP. DAILY AND CUMMULATIVE STATISTICS
## 15   1   1   1   1   1   1   1   1   1	STD & OF MEAN	137	224	163	91.3		
MOCS PER CORNES	MEAN STD	19.6	20.6	15	5.15		EGG MASS MEAN ACROSS REPS. 3.75 3.25 5.25 4.5 2 STD 2.06 2.22 1.71 2.38 1.15
The control   10	STO & OF REAR	.,,	114	200	,		200 VEW - 2000 -
COMPLETE COURSE (USING LICH BAY/REFLICATE)  10	MEAN STD	2.86	0.58	4.83	5.13		STD 16.7 18.3 14.5 19 11.1
TOTAL COST PER EXCHASE (USING EACH SAVYREPLICATE)  10							
PRELIMINARY OBSERVATIONS No. 2 CONNENCED 1571/91 PAGE 2  OLYTOPHYSIA DALLE MIN CHIMDLATUS STATISTICS  OLYTOPHYSIA DALLE MIN CHIMDLATUS STATISTICS  27/1/91 27/1/91 27/1/91 17/	MEAN STO	ING EACH DA	Y/REPLICA	TE)	4.83		STD 2.06 2 2.02 2.04 2.07
PRELIMENTAL SERVATIONS IN J. COMMENCED 34/1/91 1/06 2 3/1/91  SCO MASS REMARK ACROSS REP. 2.79 0 0 0.3 0.75  STO AS 1 OF MAN 16.9 16.7 16.7 16.7 16.7 16.7 16.7 16.7 16.7	310 y or many						
Appendix I.c.6.  Append						<b>?</b>	STD 16.7 16.3 17 16.9 17.4
STORY   STOR	GLYPTOPHYSA D	AILY AND CUN	BVITAJUH	STATIST	(CS		
1.   1.   1.   1.   1.   1.   1.   1.	ECC MACC MEAN ACROSE REDE						
STD AS NOT MEAN!  18-2 0 0 5,455 5,07 25/1/91 REP. 2 REP. 3 REP. 4 STD AS NOT MEAN!  25.75 11 1 11 13 15	STD	1.26			0.58	. 0.5	LYMNEAF SP MINNERS OF SEC.
COUNTY 12 FOOK MASS TOTAL   2.75	STD	18.2			5.45	5.07	25/1/91 0 97 34 55 57 57 57
CURNITATIVE BOC TOTAL  135   135   135   135   135   137   147   148   135   135   147   148   135   135   135   135   137   148   135   135   135   135   137   148   135   135   135   135   137   148   135   135   135   135   137   138   1	MEAN ACROSS CUMM'IVE REPS. STD	2.75 1.25	1.38	0.92 1.51	0.81	0.75 1.21	26/1/91
#EAN ACROSS COMMITTUR REPS. 33.8 16.9 11.3 9.56 8.35 STD STD A 16.2 12.6 19.1 16.8 15.3 28/1/91 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	STD AS & OF REAL	45.6	123	104	103	101	0 33 0 48
Appendix 1.c.5.  FRECLINIANRY OBSTRAVATIONS NO. 2 COMMENCED 25/1/91  CYTHAULUS SP. NUMBERS OF ECCS LAID FER DAY PAGE 1  REF, 1 REF, 2 REF, 3 REF, 4 S 9 11 0 0 0 1 0.5 1	HEAN ACROSS CUMM'IVE REPS.	33.8 18.2	16.9 21.6	11.3 19.1	9.56 16.8	8.35 15.3	28/1/91
PRELIMINARY OBSERVATIONS No. 2 CONNENCED 25/1/91  CYRAULUS SP. NUMBERS OF ECGS LAID PER DAY PAGE 1  REP.1 REP.2 REP.3 REP.4  10 10 9 11  25/1/91 18 10 6  8 8 9 9 11  26/1/91 11 10 9 11  8 10 9 11  9 12 9 9 10  27/1/91 13 10 5 11  8 8 7 12 8 9 12 9 9 12  8 8 8 10 9 12 9 10  8 8 8 10 9 12 9 10  8 8 8 10 9 12 9 10  8 9 12 9 10  8 8 8 10 9 10  8 9 12 9 10  8 9 12 9 10  8 8 8 10 9 10  8 9 10 9 10  8 8 8 10 9 10  8 9 10 9 10  8 9 10 9 10  28/1/91 11 9 9 7 11 11  9 9 7 11 11  9 9 7 11 11  9 9 7 11 11  9 9 7 11 11  9 9 7 11 11  9 9 9 12  10/1/91 9 7 7 11 11  11 9 8 10  12 CONNEAS PER DAY  MEAN		53.8	128	170	176	183	29/1/01
OYRAULUS SP. NUMBERS OF ECGS LAID PER DAY PACE 1  REF. 1 REP. 2 REP. 3 REP. 4  10 9 9 11  25/1/91 10 10 9 9 11  25/1/91 11 10 9 11  11 10 9 11  26/1/91 11 10 9 11  27/1/91 11 10 9 11  27/1/91 11 10 9 11  27/1/91 11 10 9 11  28 8 10 9 8 10  7 9 7 9 8 10  27/1/91 13 10 5 11  8 8 7 10 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 10 9 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		No. 2 COMP	IENCED 25,	/1/91			0 42 0 0
REF.1   REF.2   REF.3   REF.4   STD 1 OF HEAN   71   163   100	GYRAULUS SP. NUMBER	S OF EGGS LA	AID PER DA	Y PAGE	E 1		MEAN C 1 0 °
S	•						STD S OF MEAN 0.71 1.3 1
15 \$ 8 8 5TD \$ 5TD \$ 0 71.6 \$ 48.6 \$ 47.2 \$	25/1/91	8	10		5	.1	MPAN
26/1/91 11 10 9 11 1 10 9 11 1 10 10 11 11 10 11 11 11 11 11 10 11 11			8 7	ŧ			STD & OF MEAN 60 92.8 49
1	26/1/91	<b>11</b>	11	;	9		ECCS PER ECCHASS
8 7 12 8 8 10 9 TOTAL ECGS PER ECGHASS (USING EACH DAY/REPLICATE) 8 8 8 10 9 STD	27.77.03	11	7	,		11	STD STD S OF MEAN 37.9 130 10.7
28/1/91 6 12 6 12 PRELIMINARY OBSERVATIONS No. 2 COMMENCED 25/1/91 PAGE 2 LYMORAE SP. DAILY AND CUMMULATIVE STATISTICS  11 9 8 11 9 8 11 9 8 11 9 6 10 EGG HASS ACROSS REPS. 1.5 0.75 1 0 25 11 9 5 TD 1.29 0.5 1.15 0 0.5 5TD AS & OF HEAN 86.1 66.7 116 200  29/1/91 9 7 11 11 9 9 9 12 EGG HEAN ACROSS REPLICATES 106 34 59.3 0 10.5 5TD 87D 87.2 25.8 76 0 21 5TD 87.2 25.8 76 5TD 87.2 25.		8 8 8	7 8 8 12 8	1:	2 0 0 9	8	STD 59.8 STD 30F MEAN 32.2
9 9 8 11 9 8 6 8 11 9 6 10 EGG HASS ACROSS REPS. 1.5 0.75 1 0 25 11 9 9 7 11 11 9 9 9 12 STD STD BTD. 87.2 25.8 76 0 21 STD STD STD BTD. 87.2 25.8 76 0 21 STD STD STD BTD. 87.2 25.8 76 0 21 STD STD STD STD BTD. 87.2 25.8 76 0 21 STD	28/1/91		12	!		. 12	PRELIMINARY OBSERVATIONS No. 2 COMMENCED 25/1/91 PAGE 2
9 6 10 EGC MASS ACROSS REPS. 1.5 0.75 1 0 25 STD 1.29 0.5 1.15 0 0.5 STD NS % OF MEAN 86.1 66.7 116 200  29/1/91 9 7 11 11 9 9 9 12 EGC MEAN ACROSS REPLICATES 106 34 59.3 0 10.5 STD STD 87.2 25.8 76 0 21 STD STD 87.2 25.8 76 0 21 STD 87.2 STD 87.2 25.8 76 0 21 STD NS % OF MEAN 82.6 75.8 128 200  CURM-TIVE EGC MASS TOTAL 6 9 13 13 14 MEAN ACROSS CUMM-TIVE REPS. 1.5 1.125 1.08 0.81 0.7 STD STD STD NS % OF MEAN 1.29 0.99 1 0.99 0.99 1 0.99 0.99 1 0.99 0.99	•	11	. 9	)	8		
9 9 12 STD 87.2 25.8 76 0 21 STD 87.2 STD 87.2 25.8 76 0 21 STD 87.2 25.8 76 0 21 STD 87.2 STD		9		. 1	9		EGG MASS ACROSS REPS. 1.5 0.75 1 0 25 STD 1.29 0.5 1.15 0 0.5
HÉAN ACROSS CUMM'IVE REPS. 1.5 1.125 1.08 0.81 0.7 STD 1.29 0.99 1 0.98 9.92	29/1/91	q	•	)	9	11	STD 87.2 25.8 76 0 21
							HEAN ACROSS CUMM-IVE REPS. 1.5 1.125 1.08 0.81 0.7 STD 1.29 0.99 1 0.98 9.92

CUMMULATIVE EGG TOTAL MEAN ACROSS CUMM'IVE REPS. STD AS & OF MEAN

422 106 87.2 82.6 558 69.8 70.7 101 795 66.3 69.2 104

		•				
	GASTRULA	TROCH R	eplicate Vel		H, TING	N. NATE
REP L		2				
REP 3		ı	ı	3		
					PERCENTILE DATA	
	CASTRULA	TROCK	Jav	DAAIH	H, LING	H'HATE
REP 1		22				
REP 3		10	10	30		
TOTAL	o	3	ı	3		o
PERCENT.	0	42.9	14.3	42.9	0	0

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES GLYPTOPHYSA SP.

TROCH

32

98

VEL

3

REPLICATE 1, 2, 3, 4111.
TROCH VEL HIPPO H'LING N'NATE

RAW DATA

REPLICATE 1, 2, 3, 4.
VEL HIPPO H'LING N'NATE

PRELIMINARY			

Appendix 1.d.

		GASTRULA	TROCH	REPLICATES VEL	1, 2, 3, HIPPO	N'NATE
REP	ı		1			
REP	2	2		3	5	
REP	3	5	2	25	37	
REP	4					

PE	RCI	JΝT	Ί	LE	
DA	TA				

	CASTRULA	TROCH	VEL	HTPPO	H. FING	N' NATE
REP 1		4.4				
REP 2	1.2		1.7	2.9		
REP 3	3.6	1.5	18.2	27		
REP 4						•
TOTAL	7	3	28	42	0	0
IVIAL	•	•			•	•
PERCENT.	8.8	3.8	35	. 52.5	Ó	0

PRELIMINARY OBSERVATION No. 2 COMMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES GYRAULUS SP.

GASTRULA

CASTRULA

REP 1

REP 2

REP 3

JATOT

RAW DATA

PERCENTILE DATA H'LING N'NATE

11

20

PRELIMINARY OBSERVATION No. 2 CONMENCED 30/1/91 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES A. cummingii	RAW DATA
--	----------

		GASTRULA	TROCH	REPLICATES VEL	1, 2, 3. HIPPO		H' HATE
REP	1		. 2	4		ı	
REP	2		2	3			
REP	3		. 8	2	2		
REP	4	4		ı			

	GÀSTRULA	TROCH	VEL		PERCENTILE DATA H'LING	E N'NATE
REP 1		0.9	1.8		0,4	
REP 2		1	3			
REP 3		3	ı	1		
REP 4	, 2		11		,	
TOTAL	4	12	. 10	2	1	0
PERCENT.	13.8	61.6	34.5	6.9	3.4	0

REP 1		33	2	8	1	
REP 2		1	11	30	4	
REP 3		8			2	
REP 4						
•				ì	PERCENTILE	DATA
	GASTRULA	TROCH	VEL	HTPPO	H. FING	N'NATE
REP 1		20.8	1.3	5	0.6	
REP 2		0.4	4.7	12.8	1.7	
REP 3		4			ı	
REP 6						
	_				_	
TOTAL	0	42	13	38	7	0
PERCENT.	0	42	13	38	7	0

NOTE:: LYMNEAE HAD NO OBSERVABLE EMBRYONIC HORTALITY

pendix 2.a.1.		TREATMENT 3.24 RP2	3.2% RP2 A B
TRIAL 1 COMMENCED 18/1/91 PAGE L ENDPOINT: DEVELOPMENTAL PERIOD DA SPECIES A. carinaca	YS	EGGHASS 7 7 7 8 6 7	8 7 7
TREATMENT CONTROL 1	CONTROL 2	C 7 7 7 0 7 7 6 6 6 6	
ECCHASS 7 6	6 6 7 6	G 6	95 7
8 / 3 C 6 D 7 E 7	7	HEAN 6.38 7 STD 0.52 0	8.5 7 0.71 0
HEAN 6.8 5.5 STD 0.45 0.71	6.5 6.33 0.71 0.58	TREATHENT 100 RP2 A B EGGMASS	10 RP2
TREATMENT 0.3% RP2	Q.3% RP2 A B	7 7 8 8 6 6	8 7 8 7
EGGMASS 7 6 8 7 6 7	7 6 7 7 7	MEAN 7 7 STD 1	8 7 0 0
C 6  HEAN 6.33 6.5  STD 0.58 0.71	7 6.67 0 0.58	TREATHENT 32% RP2 A B EGGMASS	32% RP2 A B
		A 7 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	8 7 8 8
TOPATHENT 18 RP2	1s RP2	MEAN 7 7.33 STD 0 0.58	8 7.5 0 0.71
TREATMENT 16 RPZ  ECGMASS A B C C C C C C C C C C C C C C C C C C	6 7 6 7 7 6	Appendix 2.a.3.  TRIAL 1 CONNENCED 18/1/91 PAGE 1 ENDPOINT: DEVELOPMENTAL PERIOD D/ SPECIES GLYPTOPHYSA SP.	vys
E 5 6.33	6.33 6.67 0.58 0.58	TREATMENT CONTROL 1	CONTROL 2
STD 0.45 0.58  REATHENT 3.24 RP2 A B	3.2% RP2 A	EGGHASS A 5 5 8 4 4 C 6 6 D 5	7 6 6 6 6
CGCHASS 7 7 8 8 8 8 6	7 · 8 7 7 7	E 4 F 6 MEAN 4.5 5 STD 0.71 0.89	6.5 6 0.71 0
8 HEAN 6.5 7.4 STD 0.71 0.89	7 7.33 0 0.58	TREATMENT 0.3% RP2	0.3% RP2
TREATMENT 100 RF2	10% RP2	EGGMASS A 5 6 B 6 6	5 6 6 6
EGGHASS 7 8 8 7 7 7 8 7 7 7 7 7 7 7 7 7 7 7 7	A B 6 6 7 6	C 6 7 D 6 6 E 7	6 7 6 6 6
δ , , , , , , , , , , , , , , , , , , ,	6.5 6	MEAN 6.75 6.6 STD 0.5 0.55	5.67 6.17 0.58 0.41
HEAN 7 7.2 STD 0 0.45	0.71 0	TREATMENT 1 RP2	1% RP2 A B
TREATHENT 32% RP2	32% RP2 A 8	EGGHASS 7 6 8 7 5	6
EGGHASS 7 7 7 5 5 6 5 7 7 7 7 7 7 7 7 7 7 7 7 7	· 7 7 6	C 7 0 7 E 7 F 6 G 6	6 6
E 7 7 7 7 HEAN 7 6.33	7 6.5	HEAN 6.71 5.5 STD 0.49 0.71	6 6 0 0
Appendix 2.a.2.	0 0.45		
TRIAL 1 COMMENCED 18/1/91 PAGE ENDPOINT: DEVELOPMENTAL PERIOD	DAYS	TREATMENT 3.2% RF2	3.21 RP2
SPECIES A. cummingit	CONTROL 2	EGGMASS A 6 7 B 7 7	6 S
EGGHASS 7 7	A B 7 7	C 7 7 7 0 7 E 6 F 6	6 5
7 C	7 7	F 6 G 6 H 6	
HEAN 7 6.67 STD 0.58	7 7		6 - 5.67 0 0.58
TREATMENT 0.3% RP2	0.3% RF2 A 8	TREATMENT 10% RP2	10% RP2 A B
EGCHASS A 7 6 B 7 6 C 8 7	7 7 7 7	ECGRASS	5 6 6 6 5 6
D 7 6 E 7 MEAN 7.25 6.4 STD 0.5 0.55	, 7 7 0 0	D 6 E 6 F 6 G 6 H 7	, 6
TREATHENT 11 RP2	LN RP2 A B	I 6 MEAN 6 6.22 STD 0 0.44	5.67 6 0.58 0
EGGNASS 7 7 7 8 7 6	8 7 7 7	TREATMENT 32% RP2	324 RP2
c 7	7.5 7	ECCHASS 7 7 7	A 8
MEAN 7 6.3 STD 0 0.71	0,71 0	8 7 6 C 6 D 7	7 6 5 5
		F 7 MEAN 7 6.67	6.5 5.25
	•	STD 0 0.52	0.71 0.5

TRIAL	l JUVENILE MORTA	DATE	18/2/91	EVBEATER. E	ROM NUMBERS	0.5
SPECIES	A. carinata	LLII			NEONATES HA	
	REPLICATE 1			3		
,	LIVING	DEAD	<b>♦ HORT</b>	LIVING	DEAD	* MORT
TREATMENT	•	11	55	54	44	45
0.31 RP2	21	38	64	12	19	61
18 RP2	10	58	85	15	14	48
3.2% RP2 10% RP2	7 17	24	77 32	27 42	38 39	58 48
IOV RFZ	.,	•	32	42	39	
32	26	53	67	17	11 .	39
	REPLICATE 2			_		
	LIVING	DEAD	* MORT	LIVING	DEAD	* MORT
TREATMENT						
CONTROL 0.3% RP2	10 16	23 15	70 48	12 22	31 31	72
19 RP2	11	31	74	20	18	58 47
3.2% RP2	20	31	61	-6	25	81
104 RP2 324 RP2	22 6	13 36	37 86	16 13	27 23	63 64
pendix 2	2.b.2.					
TRIAL	1	DATE	18/2/91			
ENDPOINT SPECIES	: JUVENILE MOR A. cummingii	TALITY	., .,	EXPECTED:	FROM NUMBE NEONATES H	
	REPLICATE L			_		
TDFATME	LIVING	DEAD	1 MORT	B LIVING	DEAD	• MORT
CONTROL	r 15	17	53			
0.3% RP2	ร์เ	59	54	26 35	63 5	71 13
1 RP2	10	25	71	. 38	38	50
3.21 RP2 101 RP2	· 21 15	. 7	25	68	51	43
321 RP2	18	18 24	55 65	32 10	51 64	61 86
	REPLICATE 2					
	LIVING	DEAD	● MORT	LIVING	DEAD	• MORT
TREATMENT CONTROL						• non
0.3 RP2	32 21	23 25	43	27	19	41
1  RP2	36	28	54 44	28 27	27 3	49
3.2% RP2	30	20	40	22	28	10 56
10% RP2	36	. 23	39	10	33	77
32% RP2	26	19	42	38	21	36

## Appendix 2.b.3.

TRIAL ENDPOINT: SPECIES	I JUVENTLE MO	DATE RTALITY	18/2/91	OBSERVED: N	UMBERS REG	CORDED
	4 lyptophy:	59 SP		AT TERMINAT	ION	
	REPLICATE 1					
TREATMENT	LIVING	DEAD	* HORT	LIVING	DEAD	• MORT
CONTROL 0.30 RP2	9	15	63	1	5	83
la RP2	26	0	0	15	ň	ő
3.20 RP2	5	2	29	6	,	25
	4	6	60	ă.	i	20
10% RP2	28	11	28	6	î	14
32% RP2	2	12	14	25	. 14	36
	REPLICATE 2					
	A			R		
TREATHENT	LIVING	DEAD	* MORT	LIVING	DEAD	• MORT
CONTROL	8	1	11	•	_	
0.3% RP2	28	,	20		1	10
la RP2	14	í	20	21	9	30
3.24 RP2	- 9	•	.,	6	5	45
10 RP2	í	•	10	14	1	7
32% RP2	12	,	30	8	3	27
14 6	12	4	25	6	7	54

Appendix 2.c.
TRIAL 13 CONTRICTO 18/2/91
PHYSICO-CHEMICAL DATA

					THEMTARK							
	con.	com.	0.3%RP2	0.34877	1 \$RP2	19RP2	3.21RP2	J.29RP2	109RP2	10 MRP2	32 GRP2	32 <b>%</b> RP
DAT 1	7.1	,	6.9	7	6.8	6.0	6.9	6.4	6.8	6.3	6.5	
DAY 2	6.9	7.7	7.6	7.1	7.4	7.7	7.1	7.6	7.1	7.6	7.6	7.
CTAC	6.8	7.1	6.8	6.9	6.6	6.3	6.8	6.6	6.6	6.8	,	1.
AT4	7.1	7.1	7.2	7	6.9	7.1	6.9	6.9	7.1	7.1	7.1	7.
ATS	7.2	7.1	6.0	9.4	7	6.9	7.1	7.3	7.1	6.9	,	7.
AT6	,	6.9	6.7	7.1	1.2	6.9	7	7.1	6.8	7.1	7.1	
DAT?	6.9	7.2	7	6.9	6.4	6.9	,	6.6	6.7	7.1	,	٠.
м												
AT1	6.47	6.44	6.52	6.46	4.50	6.38	6.68	6.32	6.62	4.44	6.76	6.
AT2	6.38	6.11	6.43	6.33	6.57	4.52	6.64	6.56	4.62	6.56	6.41	6.
AT3	6.47	6.4	6.5	6.49	6.37	6.4	6.35	6.43	6.37	6.48	6.18	٤.
AT4	6.36	6.42	6.43	6.38	6.53	6.47	4.56	6.44	6.51	6.49	6.73	6.
A79	6.46	6.41	6.40	6.47	6.46	6.49	4.55	6.51	6.57	6.54	6.03	6.
AT6	6.07	6.44	6.64	6.52	4.59	6.65	4.39	6.34	6.62	6.54	6.78	6.
AT7	6.34	6.25	. 6.41	6.49	4.59	6.56	6.5	6.47	6.52	6.48	6.83	6.
ONDUCTIV	[]] uSem/e	700			THEMTABRI							
	cor.	COM.	0.31772	0.34RP7	1 SRP2	19872	3.24477	3.29972	101172	10 4RP2	334RP2	3298
AT 3	17.7	20.4	26.2	25.2	36.0	30.0	13.4	74.2	178	177	486	•
AT2	17.7	17.9	23.7	24.6	36	35.6	71.2	72	174	173	452	4
AT3	19.1	20	74.1	23.9	35.6	34.4	71.7	70.8	174	173	451	4
AT4	10.3	10.3	24.1	23.9	36.4	36.4	70	70	173	173	156	4
A75	10.2	20.0	23.9	24.3	36.3	36.1	10.7	70.3	175	114	461	
ATE	10.1	17.9	23.5	23.9	36.1	35.8	70.4	70.1	173	174	166	•
AT7	20.3	20.9	24.1	24.0	36	36.1	10.5	71	175	175	463	4

Appendix 3	3.a.1.					
TRIAL #2 ENDPOINT	CO	MHENCED 28/ VELOPMENTAL	/2/91 L CHARACTE	RISTICS	PAGE 1	W DATA
SPECIES	EG A.	C NUMBERS cummingli			χ.	- DAIA
#0 F + #KENT	: CONTROL	REP	LICATE 1	sı	AMPLE A	
IKEAINEN	: CONTROL	DEV	ELOPMENTAL	STAGE		
	GASTRULA	TROCH	VEL H	IPPO H	LING	N' NATE
DAYL	21					
DAY2		21		21		
CYAG				5	16	
DAY4 DAY5					21	
DAY6					21	
DAY7						21
		201	PLICATE 1		SAMPLE B	
TREATHEN	T:CONTROL		ELOPHENTA			
	CASTRULA	TROCH		HIPPO E	H'LING	N'NATE
DAY1	42					
DAY2		42				
DAY3			42			
DAY4			21	21	41	
DAYS					41	
DAY6					41	
DAY7 DAY8						41
DRTO						
TOCATAGN	T:CONTROL	200	LICATE 2		ample a	
CREATINES	I : CONTROL		ELOPHENTAL		AFTE A	
	GASTRULA	TROCH	VEL I	IPPO H	LING	N'NATE
DAY1	23					
DAY2		22				
· DAY3			-	21 .		
DAY4 DAY5					21 21	
DAY6					21	
DAY7					21	
DAY8	•					21
TREATHEN	T:CONTROL		PLICATE 2 PELOPHENTAI		AMPLE B	
	GASTRULA	TROCH		HIPPO H	'LING	N'NATE
DAYL	38					
DAY2		34				
DAY3	•		34			
DAY4					31 31	
DAYS DAY6					31	
DAY7					31	
DAY8						31
100,111	SMT:10 RP2	D.	EPLICATE 1		SAMPLE	
trextu	201;14 KF2		EVELOPMENT			^
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAYL	38					
DAY2	•	37				
DAY3				37		
DAYS					37 37	
DAY6					37	
DAY7					37	
DAY8						37
TOP A THE	NT:18 RP2		PDI T.C		e.un	
CKENIME	W RF2		EPLICATE 1 EVELOPHENT		SAMPLE	D
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAYL	22	•				
	••					
DAY2	••	2	20			
DAY3		2 1	20	21		
DAY3 DAY4	••		20	21	21	
DAY3			20	21	21 21 21	

21

DAY7

BYAG

IREA	INENT: IN KPZ	KE	PLICATE 2	SARPL	E A
	GASTRULA	TROCH DE	VELOPMENTAL S VEL HIP	TAGE PO H'LIN	G N'NATE
DAY1					
DAY2		24			
DAYS				24	
DAY4				2	
DAYS					4
DAY6		•		2	4
DAY7				2	4
DAY8	1				24
TREA	THENT: 1 RP2	91	PLICATE 2	SAMPI	E B
			VELOPHENTAL S		
	GASTRULA	TROCH	VEL HIE	DO H. TIN	G N'NATI
DAY	. 33				
DAY2	2.	31			
DAY3	1			31	
DAY4	•			3	11
DAYS	;			3	1
DAY	i				31
DAY					11
DAYS					3
UNI	•				,
TREAT	MENT: 3.2% RP2	Re	PLICATE 1	CAMBI	
				SAMPLI	£ A
	GASTRULA	TROCH	VELOPMENTAL S VEL HIP	TAGE PO H'LIN	G N'NATE
DAYL	22				
DAY2		22			
DAY3				22	
DAY4				22	
DAY5				22	,
DAY6				22	
DAY7					22
					22
TREAT	MENT: 3.2% RP2	REI	LICATE 1	SAMPLE	: в
	GASTRULA	DEV TROCH	ELOPMENTAL ST	AGE	
IYAD	30	***************************************	vec niri	O H. FING	N'NATE
DAY2	2	10			
DAY3	2	28			
			2	9	
DAY4				29	
DAY5				29	
DAY6				29	
DAY7				29	
DAYS					29
TREATME	T:3.2% RF2	0 6 61 1	CATE 2	SAMPLE A	
			OPHENTAL STAG		
	GASTRULA T	ROCH	VEL HIPPO	H'LING	N'NATE
DAY1	27				
DAY2		27			
DAY3		1	26		
DAY4				27	
DAY5				27	
DAY6				27	
DAY7	•			27	
DAY8					27
					• •
TREATMEN	T:3.2% RP2	REPLIC	CATE 2	SAMPLE B	
	GASTRULA TI	DEVELOR	PHENTAL STAG	3	
B. W.		ROCH \	EL HIPPO	H. TING	N'NATE
DAYL	29				
DAY2		29			
DAY3			27		
DAY4				27	
DAY5				27	
DAY6				27	
DAY7					27

TREATMENT: 1% RP2

REPLICATE 2

SAMPLE A

TRIAL #2 ENDPOINT	DE	EVELOPHE	29/2/91 NTAL CHARACTE	RISTICS	PAGE 7			TREAT	HENT:32% RP2		REPLICATE	2	SAMPLE	: A
SPECIES	A.	C NUMBE	gii	K.	M DATA				CASTRULA	TROCE	DEVELOPHEN	TAL STAC	E	
TOPATHEN	T:10% RP2		REPLICATÉ 1		SAMPLE A			DAYL	33			HIPPO	H-CINC	H'NATI
IKENINEN	1.104 KF2		DEVELOPMENTAL	STAGE				DAY2	•		31			
	GASTRULA	TROCH		IPPO	H'LING	N'NATE		DAY3			,,	31		
DAYL	34							DAY4				,,	31	
DAY2		34						DAY5						
DAY3		14	14					DAY6					31	
DAY4			4	24				DAY7					31	
DAY5					24			UA17						31
DAY6					24			TREAT	1ENT: 324 RP2		REPLICATE 2	2	SAMPLE	В
DAY7					24						DEVELOPMENT	TAL STAGE	:	
DAY8 .					26				GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAY9						24		DAY1	28					
••••								DAY2		. 28				
TREATMEN	NT:10% RP2		REPLICATE 1		SAMPLE	В		DAY3		2		23		
		-mocu	DEVELOPMENTA VEL	L STAGE	HITTNO	N' NATE		DAY4					23	
	GASTRULA	TROCH	VEL	arrio	11 411.0			DAY5					23	
DAYL	25							DAY6					23	
DAY2		25						DAY7					23	
DAY3				25				DAYS						23
DAY4					25									
DAY5					25									
DAY6					25									
DAY7					25									
DAYS						25		TREATH	ENT:100		REPLICATE 1		SAMPLE	
									-		DEVELOPMENTA			^
TREATMEN	NT:10% RP2		REPLICATE 2		SAMPLE A				CASTRULA	TROCH	VEL	HIPPO	H. LINC	N'NATE
11011110			DEVELOPMENTA	CTACE		•		DAY1	22					
	CASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE		DAY2		22				
DAY1	25							DAY3			21			
DAY2		25						DAY4					21	
DAY3				25				DAY5					21	
DAY4					25			DAY6					21	
DAY5					25			DAY7					21	
DAY6		•			25			DAYS					21	
DAY7						25		DAY9					21	
JA17						.,								21
TREATME	NT:10% RP2		REPLICATE 2		SAMPLE	В		TREATME	NT:100   RP2	1	REPLICATE 1		SAMPLE	В
	GASTRULA	TROCH	DEVELOPMENTA	L STAGE	HITTNO	N'NATE			GASTRULA	TROCK!	DEVELOPMENTA	L STAGE		
DAY1	ONSTRUCK				11 61110							HIPPU	H'LING	N'NATE
	••							DAYI		TROCH		-		
	31							DAYI	31			-		
DAY2	31	23						DAY2		20				
DAY3	31							DAY2 DAY3				20		
DAY3 DAY4		23		13		2		DAY2 DAY3 DAY4					20	
DAY3 DAY4 DAY5	31	23		4	13	2		DAY2 DAY3 DAY4 DAY5						
DAY3 DAY4 DAY5 DAY6		23			13			DAY2 DAY3 DAY4 DAY5 DAY6					20	
DAY3 DAY4 DAY5	11	23		4			<b>4.</b> 8	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7					20 20	
DAY3 DAY4 DAY5 DAY6	31	23		4	13	13	4.4	DAY2 DAY3 DAY4 DAY5 DAY6					20 20 20	20
DAY3 DAY4 DAY5 DAY6 DAY7	31	23		4	13		4.4	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	31	20		20	20 20 20 20	20
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8	31 ENT: 32% RP2	23		4	13	13	., &	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7		20 RE	PLICATE 2	20 Sa	20 20 20	20
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8	ENT:32% RP2	23	REPLICATE 1	4 4 AL STAG	13 13 Sample	13	., &	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	31	20 RE		20 Si Stage	20 20 20 20 20	
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8	ENT:32% RPZ GASTRULA	23	REPLICATE 1	4	13 13 Sample	13 . A	4. <del>4</del> .	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	31 T:100% RP2	20 RE DB	PLICATE 2	20 Si Stage	20 20 20 20 20	
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATM	ENT:32% RP2	23 17	REPLICATE 1 DEVELOPMENT H VEL	4 4 AL STAG	13 13 Sample	13	., &	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8	31 T:1000 RP2 GASTRULA	20 RE DB	PLICATE 2	20 Si Stage	20 20 20 20 20	
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATM	ENT:32% RPZ GASTRULA	23	REPLICATE 1 DEVELOPMENT H VEL	4 4 AL STAG	13 13 Sample	13	4. <del>4</del>	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATMEN	31 T:1000 RP2 GASTRULA	20 RE TROCH	PLICATE 2	20 Si Stage	20 20 20 20 20	
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATM	ENT:32% RPZ GASTRULA	23 17	REPLICATE 1 DEVELOPMENT H VEL	4 4 AL STAG	13 13 Sample	13	., &	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATMEN DAY1 DAY2	31 T:1000 RP2 GASTRULA	20 RE TROCH	PLICATE 2 VELOPMENTAL VEL H:	20 Si Stage	20 20 20 20 20	
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATM	ENT:32% RPZ GASTRULA	23 17	REPLICATE 1 DEVELOPMENT H VEL	AL STAG	13 13 Sample	13 N°NATE	4. <del>4</del>	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATMEN DAY1 DAY2 DAY3	31 T:1000 RP2 GASTRULA	20 RE TROCH	PLICATE 2 VELOPMENTAL VEL H:	20 Si Stage	20 20 20 20 20 AMPLE A	
DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATM	ENT:32% RPZ GASTRULA	23 17	REPLICATE 1 DEVELOPMENT H VEL	AL STAG	13 13 SAMPLE E H'LING	13 A N'NATE	4. <del>4</del>	DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATHEN DAY1 DAY2 DAY3 DAY4 DAY5	31 T:1000 RP2 GASTRULA	20 RE TROCH	PLICATE 2 VELOPMENTAL VEL H:	20 Si Stage	20 20 20 20 20 AMPLE A *LING	
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DAY10

DAY11

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Appendix 3.a.2.	TREATMENT: 1% RP2 REPLICATE 1 SAMPLE A
TRIAL =2 COMMENCED 28/2/91 ENDPOINT DEVELOPMENTAL CHARACTERISTICS PAGE 1 EGG NUMBERS RAY DATA	DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NATE
SPECIES CYRAULUS SP.	DAY1 4 2
TREATMENT: CONTROL REPLICATE 1 SAMPLE A	4
DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NATE	DAY2 4 2 4 4
DAYL 2 .	DAY3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
. 3 7	DAY4 4
DAY2 2 3 1	2 4
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DAY3 2	4
	DAY6
•	TREATMENT: 1 RP2 . REPLICATE 1 SAMPLE 8
5	DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NATE
2 1 5	DAY1 2 5
DAY4 2 1 5	. 5 4
3 7	DAY2 2
DAY5 2	1 5
DAY5 2 1 5 5 3	4 DAY3 2
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1 5 3	<b>5</b>
· · · · · · · · · · · · · · · · · · ·	DAY4 2 5
TREATHENT: CONTROL REPLICATE 1 SAMPLE B	1 5 4
DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NATE	DAY5 2 5 1
DAYL 3	5
6	DAY6 2
DAY2 3 6 6 6	DAY6 2 5 1 5
· 4	á
DAY3 3 6 6 6 4	TREATHENT: 1% RP2 REPLICATE 2 SAMPLE A
. рауч . 3	DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NAT
5 6 4	DAY1 5 4 5
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TREATMENT: CONTROL REPLICATE 2 SAMPLE A	. 5 3
DEVELOPHENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NATE	DAY3 2 3
DAY1 4	4 5 3
8 5 3	. 6
DAY2 4 8	4 5
\$ 3	3 6
DAY3 4 5 8	DAY5 5
8 3	5 3 6
DAY6 4	DAY6
5	DAY6
DAY5 4 8 8 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	TREATMENT: 1% RP2 REPLICATE 2 SAMPLE 8
TREATMENT: CONTROL REPLICATE 2 SAMPLE B	DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NA
DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NATE	DAYL 5
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B 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	DAY2 \$ 4 5 5 5 5 5 5 5 5 6 6 6 6 6 6 6 6 6 6 6

DAY4 TREATMENT: 3.24 RP2 REPLICATE 2 DEVELOPMENTAL STAGE
TROCH VBL HIPPO H'LING N'NATE GASTRULA DAY1 DAYS DAY2 DAY3 DAY6 TREATMENT: 3.20 RP2 SAMPLE A DEVELOPMENTAL STAGE
TROCH VEL HIPPO H'LING N'NATE CASTRULA DAY5 DAY1 DAY2 TREATMENT: 10% RP2 REPLICATE 1 SAMPLE A TROCH VEL HIPPO H'LING N'NATE GASTRULA DAY3 DAYL DAY4 DAY2 DAYS DAY3 TREATMENT: 3.2% RP2 REPLICATE 1 SAMPLE B DEVELOPMENTAL STAGE
TROCH VEL HIPPO H'LING N'NATE DAY4 GASTRULA DAY1 DAY5 DAY2 DAY6 DAY3 TREATMENT: 10% RP2 REPLICATE 1 SAMPLE 8 DAY4 TROCH VEL HIPPO H'LING N'NATE CASTRULA DAY1 DAY5 DAY2 DAY6 DAY3 TREATMENT: 3.2% RP2 REPLICATE 2 SAMPLE A DEVELOPMENTAL STAGE
TROCH VEL HIPPO H'LING N'NATE GASTRULA DAY4 DAY1 DAY2 DAY5 DAY3 Day 6 DAY4 DAYS

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SAMPLE A TREATMENT: 10% RP2 REPLICATE 2 DEVELOPMENTAL STAGE
VEL HIPPO H'LING N'NATE CASTRULA DAY1 DAY2 DAY3 DAYA DAYS DAY6 SAMPLE B REPLICATE 2 TREATMENT: 10% RP2 DEVELOPMENTAL STAGE
VEL HIPPO H'LING N'NATE твосн CASTRULA DAYL DAY2 DAY3 DAY4 DAY6 TREATHENT: 32% RP2 REPLICATE 1 DEVELOPMENTAL STAGE VEL HIPPO GASTRULA H'LING N'NATE DAY1 DAY2 DAY3 DAY5 DAY6

DEVELOPMENTAL STAGE
TROCH VEL HIPPO H'LING N'NATE GASTRULA DAY1 DAY2 DAY3 DAY4 DAYS DAY6 COMMENCED 28/2/91
DEVELOPMENTAL CHARACTERISTICS PAGE 19
EGG NUMBERS RAW DATA
GYRAULUS SP. SPECIES TREATMENT: 32% RP2 REPLICATE 2 SAMPLE A DEVELOPMENTAL STAGE
TROCH VEL HIPPO H'LING H'NATE GASTRULA DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 TREATMENT: 324 RP2 REPLICATE 2 SAMPLE B DEVELOPMENTAL STAGE
TROCH VEL HIPPO H'LING N'NATE GASTRULA DAYL DAY2 DAY3 DAY4 DAY5 DAY6

REPLICATE 1

SAMPLE B

TREATHENT: 32% RP2

DAY6 TREATMENT: 100% RP2 REPLICATE 1 DEVELOPMENTAL STAGE
VEL HIPPO H'LING N'NATE CASTRULA DAYL DAY7 DAY2 DAY3 DAY9 DAY4 DAY5 DAYLO DAY6 DAYLL DAY7 SAMPLE B REPLICATE 2 TREATMENT: 1004 RP2 DAY9 DEVELOPMENTAL STAGE
TROCH VEL HIPPO H'LING N'NATE GASTRULA DAYLO DAY1 TREATMENT: 100% RP2 REPLICATE 1 TROCH VEL HIPPO H'LING N'NATE DAY2 GASTRULA DAYL DAY3 DAY2 DAY4 DAY5 DAY4 DAY6 DAY5 DAY7 DAY6 DAY8 DAY8 DAY9 DAY 10 TREATMENT: 100% RP2 REPLICATE 2 SAMPLE A DEVELOPMENTAL STAGE VEL HIPPO H'LING N'NATE GASTRULA TROCH DAY1 DAY2 DAY3

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Appendix	3.a.3.					
TRIAL ENDPOI	#2	OMMENCED SEVELOPHE	28/2/91 NTAL CHARAG	CTERISTIC	S PAGE 1	
SPECIE		GG NUMBE	RS		R	AV DATA
					CIMBLE A	
TREATH	IENT:CONTROL		replicate Develophen		SAMPLE A	•
			DE VEIDE HEAV	IND JING	'	
		*******	VEL	HIPPO	H. TING	N' NATE
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DAY3		,		45		
DAYA					45	
DAY5					45	
DAY6						45
TREAT	MENT: CONTROL		REPLICATE	1	SAMPLE	В
TRUM!			DEVELOPHEN	TAL STAG	Б	
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAYL	88					
DAY2		40	48	82		
DAY3		5		13	70	
DAY4		,			81	
DAYS DAY6					81	
DAY7						81
•						
TREATH	ENT: CONTROL		REPLICATE :	2 .	SAMPLE A	ı
	GASTRULA	TROCH	DEVELOPHEN	TAL STAGE		
DAY1	28	IROCA	VEL	HIPPO	H'LING	N'NATE
DAY2		28				
DAY3	•		14	14		
DAY4		•			28	
DAY5					28	
DAY6	·				28	
DAY7						28
TREATH	ENT: CONTROL	;	REPLICATE 2	,	SAMPLE B	
			DEVELOPMENT		0141120	
DAYI	GASTRULA	TROCH	VEL	HIPPO	H, TING	N'NATE
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DAY3		0.5		85		
DAY4				0,5	82	
DAY5					82	
DAY6	•				82	
DAY7						82
IKEAT	THENT: 1% RP2		REPLICATE		SAMPLE	٨
	CASTRULA	TROCH	DEVELOPME	HIPPO	H. TING	N'NATE
DAY1	55					
DAY2			54			
DAY3				54		
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DAY6					54	<u>.</u> .
. UMI/						54
TREAT	MENT:1% RP2		REPLICATE	ı	SAMPLE	В
	GASTRULA	TROCH	DEVELOPMEN VEL	TAL STAG	H'LING	N'NATE
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DAY3		10		47		
DAY4		2		5	50	
DAYS				7	50	
				•	,,	
DAY6 DAY7				7	50	

DAY8

	ENT: 1% RP2		REPLICATE		SAMPLE	
			DEVELOPHEN	TAL STAGE		
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DAY2		27	2 22			
DAY3			8	36		•
DAY4					36	
DAY5					36	
DAY6					36	
DAY7					3	33
DAY8						3
DATE						,
TREATH	ENT:1% RP2		REPLICATE	2	SAMPLE	В
			DEVELOPHE			
	CASTRULA	TROCH		HIPPO	H'LING	N'NATE
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	,-					
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DAY7					70	
DAY8						70
<b>70</b> .	ELFE. 3 0		0.000.000		6440	
TREATM	ENT:3.2% RP2		REPLICATE	1	SAMPLE	٨
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		LAUCH	45L	HIFFU	" CINC	" DATE
DAYL	87					
DAY2		57	7			
DAY3		11	L 46			
DAY4			12		45	
DAY5				12	45	
DAY6				12	45	
DAY7				12		45
DAYS				0		
TREATM	ENT:3.2% RP2	!	REPLICATE	1	SAMPLE	В
			DEVELOPHE	TAL STAG	E	
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DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5	54 NT:3.2% RP2 GASTRULA	5:	REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO	52 52 52 33 SAMPLE A	19
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATHER DAY1 DAY2 DAY3 DAY3	54 NT:3.2% RP2 GASTRULA	5:	REPLICATE 2 DEVELOPMENT VEL	52  AL STAGE HIPPO  42 43	52 52 52 33 SAMPLE A	19
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5	54 NT:3.2% RP2 GASTRULA	5:	REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO	52 52 52 33 SAMPLE A	19
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	54 NT:3.2% RP2 GASTRULA	5:	REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING	19
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  DAY1 DAY2 DAY2 DAY2 DAY3 DAY4 DAY5 DAY6	54 NT:3.2% RP2 GASTRULA	TROCH	REPLICATE 2 DEVELOPMENT VEL	52 AL STAGE HIPPO 42 43 43 43	52 52 52 33 SAMPLE A H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  DAY1 DAY2 DAY2 DAY2 DAY3 DAY4 DAY5 DAY6	54 NT:3.24 RP2 GASTRULA 43 NT:3.24 RP2	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT	AL STAGE HIPPO  42 43 43 43	52 52 52 33 SAMPLE A H'LING	19 33 N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  DAY1 DAY2 DAY2 DAY2 DAY3 DAY4 DAY5 DAY6	54 NT:3.2% RP2 GASTRULA . 43	TROCH	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2	AL STAGE HIPPO  42 43 43 43	52 52 52 33 SAMPLE A H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  DAY1 DAY2 DAY2 DAY2 DAY3 DAY4 DAY5 DAY6	54 NT:3.24 RP2 GASTRULA 43 NT:3.24 RP2	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT	AL STAGE HIPPO  42 43 43 43	52 52 52 33 SAMPLE A H'LING	19 33 N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 TREATHER	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING	19 33 N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 TREATHER DAY1	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING	19 33 N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  ITREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  ITREATHER DAY1 DAY2 DAY3	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 TREATHER DAY1	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  ITREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  ITREATHER DAY1 DAY2 DAY3	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  DAY1 DAY2 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  TREATMENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING 43 SAMPLE B H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH 43	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33  SAMPLE A H'LING  43  SAMPLE B H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  DAY1 DAY2 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  TREATMENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING 43 SAMPLE B H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING 43 SAMPLE B H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING 43 SAMPLE B H'LING	19 33 N'HATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7  TREATHER DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	ST: 3. 2% RP2 GASTRULA 43 ST: 3. 2% RP2 GASTRULA	TROCH	REPLICATE 2 DEVELOPMENT VEL  1 REPLICATE 2 DEVELOPMENT VEL	AL STAGE HIPPO  42 43 43 43 43 41 FAL STAGE HIPPO	52 52 52 33 SAMPLE A H'LING 43 SAMPLE B H'LING	19 33 N'HATE

TREATMENT: 1% RP2

REPLICATE 2

								TREATM	ENT:32% RP2		REPLICATE 2		SAMPLE A	
TREATHE	T:100 RP2		REPLICATE 1		AMPLE A						DEVELOPMENTAL		JAN CE A	
	GASTRULA	TROCH	DEVELOPMENTAL VEL H	.STAGE	LING	H'HATE			GASTRULA	TROCH	VEL H	I PPO	H, CING	37AB'8
IYAD	46							DAY1	- 89					
	40	26	20					DAY2		44	32			
DAY2		20	6	40				DAY3				32		
DAY3					10			DAY4					32	
DAY4			3	4	39			DAY5					32	
DAY5			3	4	39									
DAY6					39			DAY6					. 32	
DAY7						39		DAY7						32
								TREATH	ENT: 32% RP2		REPLICATE 2		SAMPLE B	
TREATHE	NT:100 RP2		REPLICATE 1		SAMPLE I	3					DEVELOPHENTAL			
	GASTRULA	TROCH	DEVELOPHENTA VEL	L STACE HIPPO	H'LING	N'NATE			CASTRULA	TROCH	VEL H		H'LING	N'NATE
								DAY1	36					
DAY1	43 23							DAY2		. 36				
DAY2		. 43						DAY3			5	31		
		23						DAY4			•		31	
DAY3			5 5	38 18				DAYS					31	
	•		5	8	35									
DAY4			•		18			DAY6					31	
DAYS			5	8	35			DAY7					31	
					18			DAY8						31
DAY6					37 18									
					37			TREATH	ENT:100		REPLICATE 1		SAMPLE A	
DAYT					18						DEVELOPHENTAL			-
DAY8						37 18			GASTRULA	TROCH			H. FINC	H'NATE
						10		DAY1	45					
								DAY2		45				
								CYAC			20	25		
TREATM	ENT:10: RP2		REPLICATE 2		SAMPLE	A		DAY4				1	44	
			DEVELOPMENT	AL STAGE				DAY5						
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE							45	
DAYL	, 70							DAY6					45	
DAY2		70						DAY7					45	
CYAG			70					DAYS					45	
DAY4				70				DAY9					45	
DAY5	,				70			DAY10					45	
DAY6					70			DAY12					35	
	•	-			2	68						т	ERMINATIO	N
DAY7					2							•		
DAY8						2		TREATH	ENT:100% RP2		REPLIGATE 1		SAMPLE B	
TREATH	ENT:101 RP2		REPLICATE 2		SAMPLE	8					DEVELOPMENTAL	STACE		
			ACUEL ADMENT	AI STAGE					CASTRUIA	TROCH	AEF h	1550	H, LING	N'NATE
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE		DAY1	69					
DAY1	42							DAY2		. 69				
DAY2		20	22	÷				DAY3			2	67		
DAY3			6	36				DAY4			ı	1	67	
DAY4				8	34			DAY5					65	
					34			DAY6					65	
DAY5					28			DAY7					65	
DAY6					20			DAY8					65	
DAY7						28		DAY9					65	
													•	
								DAY10					65	
TREAT	MENT: 328 RP2		REPLICATE	1	SAMPLI	E A		DAY12					39	6
	ع		DEVELOPMEN	TAL STAC	8	_							TERMINA	TION
	GASTRULA	TROCH	VEL	HIPPO	H. TIM	N'NATE	•							
DAYL	81													
DAY2		8	ı					TREATH	IENT: 100 RP2		REPLICATE 2		SAMPLE A	١.
DAY3			2	79					GASTRULA	TROCH	DEVELOPMENTA VEL	L STAGE	H. TINC	N'NATE
DAY4			•		76	i		DAY1	68		<del>-</del> ,			
DAY5					76									
DAY6					76			DAY2 .		38				
DAY7								DAY3		17		51		
					26			DAY4		17			51	
								DAY5			. 1			
DAYS						26		ORIS			. •		51	
DAYS	MENT: 324 RP2		REPLICATE	1	SAMPI			DAY6			. •		51	
DAYS	HENT: 32% RP2		REPLICATE		SAMPL!		•				. •			
DAYS	MENT: 32% RP2 GASTRULA	TROCH	DEVELOPMEN	TAL STAG	3		·	DAY6					51 51	
DAYS			DEVELOPMEN	TAL STAG	3	2 B		DAY6 DAY7 DAY8					51 51 51	
DAYS TREAT	GASTRULA		developmen Vel	TAL STAG	3	2 B		DAY6 DAY7 DAY8 DAY9					51 51 51 51	
DAYS TREAT DAY1 DAY2	GASTRULA	TROCH	DEVELOPMEN VEL 2	TAL STAG HIPPO	3	2 B		DAY6 DAY7 DAY8 DAY9 DAY10					51 51 51 51	
DAYS TREAT DAYS DAYS DAYS	GASTRULA	TROCH	developmen Vel	TAL STAG HIPPO 31	H, TING E	E B N'NATE		DAY6 DAY7 DAY8 DAY9					51 51 51 51	
DAYS TREAT DAY1 DAY2 DAY3 DAY4	GASTRULA	TROCH	DEVELOPMEN VEL 2	TAL STAG HIPPO 31 2	30 H.FING	E B G N'NATE		DAY6 DAY7 DAY8 DAY9 DAY10				τ	51 51 51 51	on.
DAYS  TREAT  DAY1  DAY2  DAY3  DAY4  DAY5	GASTRULA	TROCH	DEVELOPMEN VEL 2	TAL STAG HIPPO 31	30 30 30 31 30	S B N'NATE		DAY6 DAY7 DAY8 DAY9 DAY10				τ	51 51 51 51 51	on.
DAYS TREAT DAY1 DAY2 DAY3 DAY4	GASTRULA	TROCH	DEVELOPMEN VEL 2	TAL STAG HIPPO 31 2	30 H.FING	S B N'NATE		DAY6 DAY7 DAY8 DAY9 DAY10				τ	51 51 51 51 51	)N

DAY7 DAY8

	2 REPLICATE 2	SAMPLE B	TREATMENT	32% RP2 #1
GASTRULA	DEVELOPMENTA:	L STAGE HIPPO H'LING N'NATE	EGGMASS	A B
DAYL 50		HIFTO H LING N NAIE	A B	5 5 5 6
DAY2	30 20		Ċ D	5 6 5 6
DAY3	. 50 20		E F	6 6
DAY4	6	44		
DAYS		43	MEAN STD	5.2 5.8 0.45 0.45
DAY6		42		
DAY7		42	TREATMENT	100% RP2 #1
DAYB		42	EGGMASS	A B
DAY9		42	A B	10 9 9 9
DAYLO		42	c p	10 9 10
DAY12		32	e F	a
		TERMINATION	, Mean	9.67 9
-			STD	0.58 0.71
ndix 3.b.				
TRIAL -2	DATE 1/3/91			
SPECIES A. cui	OPMENTAL RETARDATIO mmingii	N DAYS TO EGG CAPSULE RUPTURE		
	REPLICATE 1	REPLICATE 2 A B		
Treatment Control	7 7	8 8		
1% RP2 3.2% RP2	7 7 7 8	8 8 8 7		
10% RP2 32% RP2	8 9 8 8	7 8 7 8		
100% RP2	9 8	9 10		
TRIAL 2 ENDPOINT: DEVELA SPECIES LYMNEA	DATE 1/3/91 DPMENTAL RETARDATIO AE SP.	N DAYS TO EGG CAPSULE RUPTURE		
	REPLICATE 1 A B	REPLICATE 2 A B		
TREATMENT CONTROL	7 7	8 8		
1% RP2 3.2% RP2	7 7 7	8 8 7 7		
10% RP2 32% RP2	7 8 7 7	7 7 7 8		
100% RP2	14 13	13 13		
	DATE 1/3/9			
TRIAL 2 DEVELOPMENTAL SPECIES GYRAU	RETARDATION DAYS	TO EGG CAPSULE RUPTURE		
DEVELOPMENTAL SPECIES · GYRAL TREATMENT	RETARDATION DAYS	TO EGG CAPSULE RUPTURE  CONT. \$2 A B		
DEVELOPMENTAL SPECIES · GYRAU TREATMENT EGGMASS A	RETARDATION DAYS JUS SP.  CONT. #1 A B 5 6	CONT. #2 A B 5 5		
DEVELOPMENTAL SPECIES GYRAL TREATMENT EGGMASS A B C	RETARDATION DAYS	CONT. \$2 A B 5 5 5 5 5 6		
DEVELOPMENTAL SPECIES · GYRAU TREATMENT EGGMASS A B	RETARDATION DAYS JLUS SP.  CONT. #1 A B 5 6 5 6	CONT. \$2 A B 5 5 5 5 5	·	
DEVELOPMENTAL SPECIES GYRAU TREATMENT EGGMASS A B C D	CONT. #1 A B 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 6 6 6	CONT. #2 A B 5 5 5 5 5 6 5 6		
DEVELOPMENTAL SPECIES - GYRAU TREATMENT EGGMASS A B C C D E MEAN STD	CONT. #1 A B 5 6 5 6 5 6 5 6 5 6 5 6 5 6	CONT. 12 A B 5 5 5 5 5 6 5 6 5 6		
DEVELOPMENTAL SPECIES GYRAU TREATMENT EGGMASS A B C D E MEAN STD	CONT. #1 A B 5 6 5 6 5 6 5 6 5 6 5 6 0 0	CONT. #2 A B 5 5 5 5 6 5 6 5 6 0 0.55		
DEVELOPMENTAL SPECIES GYRAU  TREATMENT  EGGMASS A B C D E  MEAN STD  TREATMENT  EGGMASS A	CONT. #1 A B 5 6 5 6 5 6 5 6 5 6 7 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	CONT. #2 A B 5 5 5 5 5 6 5 6 5 0 0.55		
DEVELOPMENTAL SPECIES GYRAU  TREATMENT  EGGMASS A B C D E  MEAN STD  TREATMENT  EGGMASS A B C C C C C C C C C C C C C C C C C C	CONT. #1 A B CONT.	CONT. #2 A B 5 5 5 5 6 5 6 5 0 0.55  11 RP2 #2 A B 6 5 6 6 6 6	•	
DEVELOPMENTAL SPECIES - GYRAU TREATMENT EGGMASS A B C D E MEAN STD TREATMENT EGGMASS A B C D E	CONT. #1 A B 5 6 5 6 5 6 6 7 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	CONT. #2 A B 5 5 5 6 5 6 6 5 6 0 0.55		
DEVELOPMENTAL SPECIES - GYRAU TREATMENT EGGMASS A B C D E MEAN STD  TREATMENT EGGMASS A B C D E F G G	CONT. #1 A B 5 6 5 6 5 6 6 7 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	CONT. #2 A B 5 5 5 5 6 5 6 5 0 0.55  11 RP2 #2 A B 6 5 6 6 6 6		
DEVELOPMENTAL SPECIES - GYRAU TREATMENT EGGMASS A B C D E MEAN STD  TREATMENT EGGMASS A B C C D E E F	CONT. #1 A B 5 6 5 6 5 6 5 6 0 0  1* RP2 #1 A B 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5	CONT. #2 A B 5 5 5 5 6 5 6 5 0 0.55  11 RP2 #2 A B 6 5 6 6 6 6		
DEVELOPMENTAL SPECIES GYRAU  TREATMENT  EGGMASS A B C D E  MEAN STD  TREATMENT  EGGMASS A B C D E  MEAN  TREATMENT  EGGMASS A B C D E H I MEAN	CONT. #1 A B 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 6 5 6 5	CONT. #2 A B 5 5 5 5 6 5 6 5 0 0.55  11 RP2 #2 A B 6 5 6 6 6 6		
DEVELOPMENTAL SPECIES GYRAU  TREATMENT EGGMASS A B C D E MEAN STD  TREATMENT EGGMASS A B C D E G G H I	CONT. #1 A B 5 6 5 6 5 6 6 5 6 6 6 6 6 6 6 6 6 6 6	CONT. #2 A B 5 5 5 6 5 6 5 6 0 0.55  1% RP2 #2 A B 6 6 6 6 6 6 5 7 7 8 8 8 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9		
DEVELOPMENTAL SPECIES GYRAU TREATMENT EGGMASS A B C D E MEAN STD  TREATMENT EGGMASS A B C D E  MEAN STD  TREATMENT EGGMASS A B C TREATMENT EGGMASS A B C T T T T T T T T T T T T T T T T T T	CONT. #1 A B 5 6 5 6 5 6 5 6 6 5 6 5 6 6 5 6 6 6 6	CONT. #2 A B 5 5 5 6 5 6 6 5 6 0 0.55  1% RP2 #2 A B 6 6 6 6 6 6 7 8 7.75 0 0.5		
DEVELOPMENTAL SPECIES GYRAU TREATMENT EGGMASS A B C D E MEAN STD  TREATMENT EGGMASS A B C D E F G H I MEAN STD  TREATMENT TREATMENT TREATMENT TREATMENT TREATMENT TREATMENT TREATMENT TREATMENT	CONT. #1 A B 5 6 5 6 5 6 6 5 6 6 6 6 6 6 6 6 6 6 6	CONT. #2 A B 5 5 5 6 5 6 5 6 0 0.55  1% RP2 #2 A B 6 6 6 6 6 6 5 7 7 8 8 8 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9		

MEAN STD

TREATMENT

EGGMASS A B C D

MEAN STD 5.4 0.55

5.6 0.55

> 0

TRIAL#2COMMENCED 28/2/91
PHYSICO-CHEMICAL DATA

	UVITY u	Sem/cm '			TREATMEN	T						
	CON A	сои в	18 A	18 B	3.2% A	3.2% B	10% A	10% B	32% A	32% B	100% A	100% B
DAY1	25.9	27.7	42.2	42.2	71.1	70.7	159	160	409	413	1080	1080
DAY2	26.2	29.5	47.7	45.2	73.2	72.6	170	171	427	433	1100	1100
DAY3	27	38.7	42.7	43	74.7	77.9	173	173	437	438	1100	1100
DAY4	25.1	30	40.7	42.3	73.3	75.9	172	172	433	429	1090	1100
DAY5	26.1	34.3	42.6	42.8	76.2	77.4	177	176	445	442	1120	1120
DAY6	26.2	34.2	42.6	43.1	75.7	77.6	178	185	449	445	1120	1120
DAY7	29.2	29.8	42.2	44.2	77.5	77.5	178	185	448	448	1130	1120
DAY8	27.5	25.8	4104	41.6	75.9	76.2	175	179	447	444	1130	1130
DAY9	27.3	31.4	42.7	44.3	77.5	80.6	185	178	454	448	1150	1120
DAY10	28.3	34.3	43.8	45.6	80.6	82.1	189	188	463	471	1190	1150
DAY11	29.5	32.8	46.7	42	79.1	77.3	179	180	454	452	1130	1130
DAY12	27	30.2	42.3	42.9	76.2	75.6	177	178	450	451	1140	1130
											•	
рн					TREATMEN	ያጥ			•			
•	CON A	CON B	1% A	1% B	3.2% A		10% A	. 10% B	32% A	32% F	3 100% A	100% в
D 2 14 1			4									
DAY1	6.36	6.55		6.6	6.61	6.6	6.74	6.72	6.75			
DAY2	6.42	6.68		6.64	6.86	6.56	6.97	6.86	6.71			
DAY3	6.6	7.63	6.98	6.89	6.85	6.97		7	7.08			
DAY4	6.34	6.78	6.75	6.93	6.81	6.85	7.01	7.26	7.13			
DAY5	6.32	6.73	6.73	6.71	6.6	6.7	6.76	6.86	6.84			
DAY6	6.17	6.43	6.77	6.75	6.71	6.85	6.86	7.11	7.16	6.66		
DAY7	6.68	6.88	6.66	6.8	6.7	6.73	6.91	6.94	6.93	6.92		
DAY8	6.5	6.58	6.73	6.78	6.78	6.87	6.84	7.01	6.95			
DAY9	6.36	6.85	6.77	6.77	6.72	6.73	7.15	7.08	7.05			
DAY10	6.24	6.53	6.4	6.56	6.63	6.73	6.87	6.91	6.95			
DAY11	6.69	6.66	6.73	6.81	6.83	6.8	6.94	6.94	7.07			
DAY12	6.49		6.56	6.73	6.71	6.78	6.82	6.97	7.02	7.07	7.19	7.42
DISSOLVE	D OXYGE m	g/L		TF	REATMENT							
	CON A	CON B	1% A	1% B 3	3.2% A 3	.2% B	10% A	10% B	32% A	32% B	100% A	100% В
DAY1	7.2	7.3	7.4	7.6	7.5	7.5	7.6	7.5	7.6	7.6	7.5	7.6
DAY2	7.7	7.3	7.4	7.5	7.6	7.6	7.6	7.2	7.3	7.5	7.3	7.1
DAY3	7.5	7.3	7.7	7.4	7.5	7.4	7.4	7.4	7.4	7.5	7.2	7.3
DAY4	.7.6	7.5	7.4	7.6	7.6	7.6	7.3	7.4	7.5	7.4	7.4	7.6
DAY5	7.2	7.5	7.6	7.3	7.4	7.6	7.3	7.3	7.4	7.2	7.2	7.5
DAY6	7.2	7.3	7.2	7.5	7.6	7.4	7.5	7.5	7.5	6.9	7.1	7.4
DAY7	7.6	7.3	7.5	7.6	7.5	7.5	7.7	7.5	7.5	7.7	7.5	7.5
DAY8	7.1	7.2	7.6		7.5	7.5	7.4	7.5	7.5	7.1	7.5	7.3
DAY9	7.3	7.3	7.5	7.2		. 7.3	7.3	7.1	7.4	7.3	7.3	7.2
UMIJ												
DAT9 DAY10	7.6	7.4	7.3	7.5	7.4	7.3	7.3	7.5	7.3	7.4	7.3	7.5
		7.4 7.2	7.3 7.4	7.5 7.3	7.4 7.3	7.3 7.1	7.3 7.4	7.5	7.3 7.3	7.4	7.3 7.2	7.5 7.1

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Appendix 4.a.1.
                              COMMENCED 13/3/91
DEVELOPMENTAL CHARACTERISTICS PAGE 1
EGG NUMBERS
    TRIAL #3
                                                                                                                    TREATMENT :1% RP2
REPLICATE 1
                                                                                                                                               SAMPLE B
                                                                   RAW DATA
     SPECIES
                                                                                                                                             DEVELOPMENTAL STAGE HIPPO H'LING
     TREATMENT : CONTROL REPLICATE 1
                                                                                                                                 GASTRULA
                                                                                                                                                                        N'NATE
                                 SAMPLE A
                                                                                                                    DAY1
                                                                                                                                         2n
                              DEVELOPMENTAL STAGE
HIPPO H'LING N'NATE
                                                                                                                    DAY4
                  GASTRULA
                                                                                                                                                                  19
     DAY1
                                                                                                                    DAVE
                                                                                                                    DAY6
                                                                                                                                                                  19
     DAY4
                                                   13
                                                                                                                    DAY7
                                                                                                                                                                  19
                                                   13
11
                                                                                                                   DAYS
                                                  13
11
                                                                                                                   TREATMENT :1% RP2
REPLICATE 2
     DAY6
                                                                                                                                               SAMPLE A
                                                                                                                                            DEVELOPMENTAL STAGE HIPPO H'LING
     DAY7
                                                               13
11
                                                                                                                                GASTRULA
     TREATMENT : CONTROL REPLICATE 1
                                                                                                                   DAY1
                                                                                                                                        22
                                 SAMPLE B
                                                                                                                  DAY4
                                                                                                                                                                 22
                              DEVELOPMENTAL STAGE
HIPPO H'LING N'NATE
                                                                                                                  DAY5
                   GASTRULA
                          8
7
12
                                                                                                                  DAY6
     DAY1
                                                                                                                  DAY7
     DAY4
                                        12
                                        8
7
12
      DAY5
                                                                                                                 TREATMENT :1% RP2
REPLICATE 2
                                                                                                                                              SAMPLE B
                                         8
                                                                                                                                           DEVELOPMENTAL STAGE HIPPO H'LING
                                                                                                                               GASTRULA
                                        12
                                                                                                                 DAY1
      DAY7
                                                                                                                 DAVA
                                                                                                                                                               25
                                                                                                                 DAY5
                                                                                                                                                               24
   TREATMENT : CONTROL REPLICATE 1
                                                                                                                 DAY6
                                                                                                                                                               22
                                SAMPLE A
                                                                                                                 DAY7
                             DEVELOPMENTAL STAGE
HIPPO H'LING N'NATE
                                                                                                                                                               22
                 GASTRULA
    DAY1
    DAY4
                                                                                                                TREATMENT :3.2% RP2
REPLICATE 1
                                                                                                                                            SAMPLE A
    DAY5
                                                                                                                                       DEVELOPMENTAL STAGE
HIPPO H'LING N'NATE
    DAY6
                                                                                                                           GASTRULA
                                                                                                              DAYL
                                                                                                                                    9
14
9
                                                                                                              DAY4
     DAY8
                                                                                                             DAYS
     TREATMENT : CONTROL REPLICATE 2
                                 SAMPLE B
                                                                                                             DAY6
                              DEVELOPMENTAL STAGE HIPPO H'LING
                  GASTRULA
                                                                                                             DAY7
     DAY1
                           15
9
     DAY4
                                                                                                             TREATMENT :3.2% RP2
REPLICATE 1
                                                                                                                                         SAMPLE B
     DAYS
                                                    15
9
                                                                                                                                       DEVELOPMENTAL STAGE
HIPPO H'LING
                                                                                                                          GASTRULA
     DAY6
                                                                                                             DAY1
     DAY7
                                                                                                             DAY4
     TREATMENT :1% RP2
REPLICATE 1
                                                                                                            DAY5
                                  SAMPLE A
                               DEVELOPMENTAL STAGE HIPPO H'LING
                   GASTRULA
                                                          N'NATE
                                                                                                            DAY6
     DAY1
                           30
     DAY4
                                                    29
                                                                                                            DAY7
                                                    29
```

DAYS

DAY6

DAY7

19

22

TREATMENT REPLICATE	:3.2% RP	SAMPLE A			TREATMENT	:10% RP2	SAMPLE B		
	CACTOULA	DEVELOPMENTAL STAGE HIPPO H'LING N'	MATTE		KEPLICATE		DEVELOPMENT	TAL STAGE	
DAYL	9	HIPPO N BING N	WALE	•		GASTRULA	HIPPO	H'LING	N'NATE
•	8				DAY1	24			
DAY4		9			DAY4 DAY5			22 22	
		8 11			DAY5			22	
DAY5		9 8			DAY7			22	
		11			8 YAC			22	
DAY6	-	9 8	•		DAY9				22
		11			TREATMENT	:32% RP2			
DAY7	•	9 8		•	REPLICATE		SAMPLE A		
D1 V0		11	9	•		GASTRULA	DEVELOPMEN HIPPO	TAL STAGE H'LING	N'NATE
DAY8			8 11		DAY1	29			
					DAY4			29	
TREATMENT REPLICATE	: :3.2% RP : 2	SAMPLE B			DAY5			29	
		DEVELOPMENTAL STAGE	4345.000		DAY6			29	
DAY1	GASTRULA	HIPPO H'LING N'	NATE		DAY7 DAY8			29	
DATE	12				DATO				29
DAY4		12 12			TREATMENT REPLICATE	:10% RP2	SAMPLE B	1	
DAY5		12					DEVELOPMEN	TAL STAGE	<b>:</b>
		12					HIPPO	H'LING	N'NATE
DAYS		12			DAY1	11 13			
DAY7		12 12			DAY4			11 13	
BYAO			12		DAYS			11	
			12		511.13			12	
TREATMENT	:10% RP2				DAY6			11 2	
REPLICATE	1	SAMPLE A			DAY7			11	
	GASTRULA	DEVELOPMENTAL STAGE HIPPO H'LING N'	NATE		DAY8			2	11
DAY1	· 6	•			DATO				2
	6					r :32% RP2	SAMPLE A		
DAY4		6 9					DEVELOPMEN		:
	•	6				GASTRULA	HIPPO	H'LING	N'NATE
DAY5		6 9			DAY1	14 12			
		6			DAY4			14	
DAY6		6 9 6			DAY5			12 14	
DAY7		6						12	
		9 6			DAY6			14 12	
DAY8			6 9		DAY7				14
			6						12
TREATMENT	:10% RP2								
REPLICATE					TREATMENT REPLICATE	7 32% RP2	SAMPLE B		
		SAMPLE B			TREATMENT REPLICATE	2 2	DEVELOPMEN	TAL STACE	
		SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'	'NATE		REPLICATE	GASTRULA	DEVELOPMEN HIPPO	TAL STACE	H'NATE
DAY1	GASTRULA	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'	'NATE		TREATMENT REPLICATE	2 2	DEVELOPMEN HIPPO	TAL STACE	N'NATE
	GASTRULA 13 16	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'	'nate		REPLICATE	GASTRULA	DEVELOPMEN HIPPO	TAL STAGE H'LING	N'NATE
DAY4	GASTRULA 13 16	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13	'NATE		REPLICATE	GASTRULA	DEVELOPMEN HIPPO	TAL STAGE H'LING	N'NATE
DAY4 DAY5	GASTRULA 13 16	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16	'nate		DAY1 DAY4 DAY5	GASTRULA	DEVELOPMEN HIPPO	TAL STAGE H'LING  11 13	N'NATE
DAY4	GASTRULA 13 16	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13	'NATE		REPLICATE DAY1 DAY4	GASTRULA	DEVELOPMEN HIPPO	TAL STAGE H'LING	N'NATE
DAY4 DAY5	GASTRULA 13 16	DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16	13		DAY1 DAY4 DAY5	GASTRULA	DEVELOPMEN HIPPO	TAL STAGE H'LING  11 13 11	N'NATE
DAY4 DAY5 DAY6	GASTRULA 13 16	DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16			DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT	GASTRULA 11 13	DEVELOPMEN HIPPO	TAL STAGE H'LING  11 13 11	N'NATE
DAY4 DAY5 DAY6 DAY7 TREATMENT	GASTRULA 13 16	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16	13		DAY1 DAY4 DAY5 DAY6 DAY7	GASTRULA 11 13	DEVELOPMEN HIPPO	11 13 11 13 11 13	N'NATE
DAY4 DAY5 DAY6 DAY7	GASTRULA 13 16	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16 15	13		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA 11 13 :100% RP2	DEVELOPMEN HIPPO	TAL STAGE H'LING  11 13 11 13 11 13	11 13
DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  13 16  :10% RP2 2  GASTRULA	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16	13 16		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  11 13  :100% RP2 1  GASTRULA  9 12	DEVELOPMENT HIPPO	TAL STAGE H'LING  11 13 11 13 11 13	11 13
DAY4 DAY5 DAY6 DAY7 TREATMENT	GASTRULA  13 16  :10% RP2 2  GASTRULA 9 11	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16 SAMPLE A  DEVELOPMENTAL STAGE	13 16		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  11 13  :100% RP2 1  GASTRULA	DEVELOPMENT HIPPO	TAL STAGE H'LING  11 13 11 13 11 13	11 13
DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  13 16  :10% RP2 2  GASTRULA 9	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16 SAMPLE A  DEVELOPMENTAL STAGE	13 16		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  11 13  :100% RP2 1  GASTRULA  9 12	DEVELOPMENT HIPPO	TAL STAGE H'LING  11 13 11 13 11 13  *AL STAGE H'LING	11 13
DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  13 16  :10% RP2 2  GASTRULA 9 11	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16 15 16  LOSAMPLE A  DEVELOPMENTAL STAGE HIPPO H'LING N'	13 16		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  11 13  :100% RP2 1  GASTRULA  9 12	DEVELOPMENT HIPPO	TAL STAGE H'LING  11 13 11 13 11 13 14 17 18 19 19	11 13
DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  13 16  :10% RP2 2  GASTRULA 9 11	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16 13 16 13 16 13 16 19 11 10 11 11 11 11 11 11 11 11 11 11 11	13 16		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  11 13  :100% RP2 1  GASTRULA  9 12	DEVELOPMENT HIPPO	TAL STAGE H'LING  11 13 11 13 11 13 11 13 11 13 11 13 11 13	11 13
DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE DAY1 DAY4	GASTRULA  13 16  :10% RP2 2  GASTRULA 9 11	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16 13 16  DEVELOPMENTAL STAGE HIPPO H'LING N'  9 11 9	13 16		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE	GASTRULA  11 13  :100% RP2 1  GASTRULA  9 12	DEVELOPMENT HIPPO	TAL STAGE H'LING  11 13 14 15 16 16 16 16 16 16 16 16 16 16 16 16 16	11 13
DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE DAY1 DAY4	GASTRULA  13 16  :10% RP2 2  GASTRULA 9 11	SAMPLE B  DEVELOPMENTAL STAGE HIPPO H'LING N'  13 16 13 16 13 16  SAMPLE A  DEVELOPMENTAL STAGE HIPPO H'LING N'  9 11 9 11	13 16		DAY1 DAY4 DAY5 DAY6 DAY7 TREATMENT REPLICATE DAY1 DAY4	GASTRULA  11 13  :100% RP2 1  GASTRULA  9 12	DEVELOPMENT HIPPO	TAL STAGE H'LING  11 13 11 13 11 13 11 13 11 11 13 11 11	11 13

	_	Appendix 4.a.2.
DAY7	9 12	TRIAL #3 COMMENCED 13/3/91 ENDPOINT DEVELOPMENTAL CHARACTERISTICS PAGE
	11	EGG NUMBERS
DAYB	9	SPECIES A. cummingii RAW DA'
	12 11	TO THE THIRT I CAN THE C
	8	TREATMENT : CONTROL REPLICATE 1 SAMPLE A
DAY9	12	DEVELOPMENTAL STAGE
	11	GASTRULA HIPPO H'LING N'NATE
DAY10	8 12	DAY1 28
	. 11	DAY4 27
		DAY5 27
TREATMEN'	T:100% RP2 E1 SAMPLE B	•
	DEVELOPMENTAL STAGE	DAY6 27
	GASTRULA HIPPO H'LING N'NATE	DAY7 27
DAY1	9	DAY8 27
	11	SAMPLE B
DAY4	9	DEVELOPMENTAL STAGE
	10	GASTRULA HIPPO H'LING N'NATE
DAY5	9 10	DAY1 21
		DAY4 21
DAY6	9 10	
	. 9	DAY5 19
DAY7	10	DAY6 19
BYAC	9	DAY7 19
UAIS	10	DAY8 19
DAY9	9	<del></del>
	10	TREATMENT : CONTROL
DAY10	9	REPLICATE 2 SAMPLE A
	10	DEVELOPMENTAL STAGE GASTRULA HIPPO H'LING N'NATE
	•	
TREATMENT	T :100% RP2	DAY1 28
REPLICATI	E 2 SAMPLE A DEVELOPMENTAL STAGE	DAY4 28
	GASTRULA HIPPO H'LING N'NATE	DAY5 28
DAY1	9 9	DAY6 28
	12	DAY7 28
DAY4	7 9	****
	12	DAY8 28
DAYS	. 7	SAMPLE B
UNIS	9	
	12	DEVELOPMENTAL STAGE GASTRULA HIPPO H'LING N'NATE
DAY6	7 9	DAY1 21
	12	·-
DAY7	7	
0.517	9 12	DAY5 ·21
		DAY6 21
DAYS	7 9	DAY7 21
	10	DAY8 21
DAY9	. 7	
REPLICAT	TE 2 SAMPLE	•
	DEVELOPMENTAL STAGE	TREATMENT :1% RP2 REPLICATE 1 SAMPLE A
	GASTRULA HIPPO H'LING N'NATE	DEVELOPMENTAL STAGE
DAY1	10	GASTRULA HIPPO H'LING N'NATE
	<b>.</b>	DAY1 30
DAY4	9 10	DAY4 29
	5	•-
DAYS	9	•
525	10 5	DAY6 29
	•	DAY7 29
DAY6	9 10	DAY8
	. 5	
DAY7	9	·
	10 5	Sample B
***-	9	DEVELOPMENTAL STAGE GASTRULA HIPPO H'LING N'NATE
DAY8	10	
	5	DAY1 20
DAY9	9 10	DAY4 19
	. 5	DAY5 19
D2410	9	DAY6 19
DAY10	10 5	DAY7 19
		••
		DAYS 19

Appendix 4.a.2.

TREATMENT	:1% RP2				SAMPLE	В	
REPLICATE	2 SAMP			GASTRUL	DEVELOPME HIPPO	NTAL STAG	E
	GASTRULA HIP	PMENTAL STAGE PO H'LING N'NATE	DAY1	20		010	" "AIL
DAY1	22		DAY4		20		
DAY4		22	DAYS			20	
DAY5		22	DAY6			20	
DAY6.		22	DAY7			20	
DAY7		22	DAY8				20
DAY8		22					
,	SAMP		TREATME	NT :10% RP2	!		
	GASTRULA HIP	PMENTAL STAGE PO H'LING N'NATE	REPLICA		SAMPLE		
DAY1	27			GASTRULA	DEVELOPME HIPPO	NTAL STAGE H'LING	E N'NATE
DAY4		22	DAY1	25			
DAY5		22	DAY4			25	
DAY6		22	DAY5			25	
DAY7		22	DAY6			25	
DAY8		22	DAY7				25
TREATMENT REPLICATE	::3.2% RP2 : 1 SAMP	LE A			SAMPLE I		
	DEVELO	PMENTAL STAGE		GASTRULA	DEVELOPMEN HIPPO	ITAL STAGE H'LING	N'NATE
		PO H'LING N'NATE	DAY1	25			
DAY1	29		DAY4			25	
DAY4		27	DAY5			25	
DAY5		26	DAY6			24	
DAY6		25	DAY7				24
DAY7		25					
	SAME	LE 8					
	DEVELO	PMENTAL STAGE	TREATME REPLICAT	T :32% RP2			
		PO H'LING N'NATE	REFLICA		SAMPLE DEVELOPMEN		•
DAY1	20			GASTRULA		H'LING	
DAY4		19	DAY1	20			
DAY5		19	DAY4			19	
DAY6	•	19	DAY5			19	
DAY7		19	DAY6			19	
DAY8		19	DAY7			19	
TREATMENT	r :3.2% RP2	,	DAY8				19
REPLICATE	2 SAMP	LE A			SAMPLE 8		
	DEVELO GASTRULA HIP	PMENTAL STAGE PO H'LING N'NATE			DEVELOPMEN		
DAY1	23			GASTRULA	HIPPO	H'LING	N'NATE
DAY4		22	DAY1	31			
DAY5		22	DAY4			30	
DAY6		22	DAY5			30	
			DAY6			30	
	SAMP		DAY7			30	
		PMENTAL STAGE PO H'LING N'NATE	DAY8				30
DAY1	27	•	TREATME. REPLICA	NT :32% RP2 FE 2	SAMPLE	A	
DAY4	-,	24			DEVELOPME	NTAL STAG	E
DAYS		24		GASTRULA	HIPPO	H'LING	N'NATE
DAY6		24	DAY1	24			
DAY7		•	DAY4			21	
O,NI.		. 24	DAY5			21	
TREATMENT	:10% RP2		DAY6			21	
REPLICATE	1 SAMPL	2 A	DAY7			21	
(	DEVELOPI GASTRULA HIPPO	MENTAL STAGE O H'LING N'NATE	DAYB				21
DAY1	, 31				SAMPLE	В,	
DAY4	•	31			DEVELOPME	NTAL STAG	E
DAYS		31		GASTRULA	HIPPO	H'LING	N'NATE
DAY6		31	DAY1	23			
•			DAY4			23	
			DAY5			23	
			DAY6			23	
			DAY7			23	

DAYS

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				Appendix 4.a.3.			
TREATMEN REPLICAT	T:100% RP2	PLE A		TRIAL #3 Enopoint	COMMENCED DEVELOPME	NTAL CHARACTERISTI	CS PAGE 1
	DEVEL GASTRULA HI	OPMENTAL STAGE PPO H'LING N'N	IATE	SPECIES	GLYPTOPHY		RAW DATA
DAY1	29			TREATMENT : CREPLICATE	CONTROL	SAMPLE A	
DAY4		29				DEVELOPMENTAL STAC	E
DAYS		28			GASTRULA	HIPPO H'LING	
DAY6		28		DAY1	6 6		
DAY7 .		28			9 10	•	
DAYS		28		DAY4		6	
DAY9			28		•	9	
	SAM	PLE B		DAY5		6	
		OPMENTAL STAGE PPO H'LING N'N	NATE			6 9 9	
DAY1	20.			DAY6		6	
DAY4		19				6 9	
DAY5		19		_		9	_
DAY6		19		. DAY7			6 6 9
DAY7		19					9
DAY8 DAY9		19	19	TREATMENT : REPLICATE		SAMPLE B	
UATS	•		19		•	DEVELOPMENTAL STA	SE
TREATMEN REPLICAT	NT :100% RP2 FE 2 SA	MPLE A		DAY1	GASTRULA 9 10	HIPPO H'LING	N'NATE
		LOPMENTAL STAGE IPPO H'LING N'	NATE		12		
DAY1	27			DAY4		9 10	
DAY4		27				11	
DAYS	•	27		DAY5		10 11	
DAY6		27		DAY6		9	
. DAY7		27		·		9	
DAYS		÷	27	DAY7		9	
	· sa	MPLE 8		UNI.		9	
		LOPMENTAL STAGE IPPO H'LING N'	STAN	DAYS		9	
DAY1	24	•				10	
DAY4	•	24		DAY9			9
DAY5		24 .					10
DAY6		20		TREATMENT : C REPLICATE 2	ONTROL		
DAY7	•		20	REPLICATE 2		SAMPLE A	_
					GASTRULA	DEVELOPMENTAL STAG HIPPO H'LING	
				DAY1	9 10 . 10		
				DAY4		6	
						10 10	
	-			DAYS		6	

PMENTAL STAGE PO H'LING N'NATE 6 10 10 DAY6 TREATMENT : CONTROL REPLICATE 2 SAMPLE B DEVELOPMENTAL STAGE
HIPPO H'LING N'NATE GASTRULA DAY1 DAY4 DAY5 DAY6 DAY7 DAY8

TREATMENT REPLICATE		SAMPLE A		TREATMENT : REPLICATE		SAMPLE A	
		DEVELOPMENTAL STAGE	****		DE	VELOPMENTAL STAGE	
DAV1	GASTRULA 10		NATE	DAY1	GASTRULA 11	HIPPO H'LLING N	'NAT
DAY1	12				12 8		
DAY4		10 8		DAY4		9	
DAY5	•	10 8	,	•		7 4	
DAY6			10	DAY5		4 7	
			8	DAY6		3	
TREATMENT REPLICATE		Sample B		DATE			:
REFEICHTE		DEVELOPMENTAL STAGE					
		A HIPPO H'LING N	NATE	TREATMENT : REPLICATE		SAMPLE B	
DAY1	11	2		, COPDICATE	•	VELOPMENTAL STAGE	
DAY4		2 2			GASTRULA	HIPPO H'LING N	'NAT
DAY5		2		DAY1 DAY4	10	•	
DAY6	•	2		DAY5		9	
DAIG		. 2		DAY6		6	
DAY7		2 2		DAY7		5	
DAY8			2 2	DAY8		5	
			•	DAY9		,	4
TREATMENT	:3.2% RP2			TREATMENT :10 REPLICATE 1		MPLE A	
REPLICATE	1	SAMPLE A		REFEICHTS 1		LOPMENTAL STAGE	
•	GASTRUL	DEVELOPMENTAL STAGE A HIPPO H'LING I	N'NATE		GASTRULA H	IPPO H'LING N'NA	ATE
DAY1		1 2		DAY1	10 12 8		
DAY4		9		Day4	· ·	2	
DAY5	•	2				4 4 .	
DATS		ž		DAY5		2	
DAY6		9				4	
DAY7		9 2		DAY6		2 4	
DAYS		4	9	DAY7		4	_
			2	DAT 7			2 4 4
TREATMENT REPLICATE	:3.2% RP2	SAMPLE B					-
REPLICATE		DEVELOPMENTAL STAGE		TREATMENT :10 REPLICATE 1		MPLE B	
		LA HIPPO H'LING	N'NATE	KBI BIGKID I	DEVE	LOPMENTAL STAGE	
DAY1		10 11			GASTRULA H	IPPO H'LING N'N	ATE
DAY4		9 9		DAY1 DAY4	8	7	
DAY5		9		DAY5		4	
DAY6		9	9	DAY6		4	
DATO			9	DAY7		4	
				DAY8		4	
TREATMENT	:11 RP2			DAY9			4
REPLICATE	1 .	SAMPLE A					
	GASTRUL	DEVELOPMENTAL STAGE A HIPPO H'LING	N'NATE	TREATMENT :10%	, pp.		
DAY1	1	.2		REPLICATE 2		PLE A	
DAY4 DAY5		12		•	DEVEL GASTRULA HI	OPMENTAL STAGE PPO H'LING N'NAT	
DAY6		5 5		DAY1	12	. DING H NAI	1.5
DAY7		5		DAY4	12		
BYAO		5		Days		12 12	
DAY9			5	DAYS		12 12	
TREATMENT				DAY6		1	. 2
REPLICATE	1	SAMPLE B				1.	2
•	GASTRUL	DEVELOPMENTAL STAGE A HIPPO H'LING I	4'NATE				
DAYI	. 1	4 5					
DAY4		12					
DAYS	•	15 12					
		15					
DAY6		12					

	TREATMENT :10% RP2	CLUDY S. D.	TREATME REPLICA	NT : 32% RP2 TE 2 SAM	PLE B
•	REPLICATE 2	SAMPLE B DEVELOPMENTAL STAGE		DEVELOP	MENTAL STAGE
	GASTRUÍ	A HIPPO H'LING N'NAT			H'LING N'HATE
	DAYI . I	1	DAY1 DAY4	7	,
	DAY4	11	DAY5		6
	••••	îî	DAY6		5
	DAYS	11 11	DAY7		4
	DAY6	11	DAYS		4
		11	DAY9		4
	DAY7	11			•
l	DAY8	11	TREATMENT REPLICATE	:100 % RP2 1 SAMPLE	
	DATE	. 11			ENTAL STAGE
	DAY9		11 11	GASTRULA HIPPO	H'LING N'NATE
			DAY1	10 12	
				10	
	TREATMENT :32% RP2 REPLICATE 1	SAMPLE A	DAY4		9 1
		DEVELOPMENTAL STAGE			7
	GASTR	JLA HIPPO H'LING N'NA	ATE DAYS		9 1
	DAY1	7 11			7
		11 13	DAY6		9 1
		14 12			7
I	DAY4	7	DAY7		9 1
		10 11			7
		13 7	DAY8		9 1
	DAY5	4			7
Control of the contro	J	6 2	DAY9		. 9 1
		9 4 2 ·	22.414		7
•		1	DAY10		1 7
	DAY6	6 2			
		9	TREATMENT REPLICATE	:100% RP2 1 SAMPL	2 B
•		2 1		DEVELOP	MENTAL STAGE
	DAY7	6	9		H'LING N'HATE
•	•	2 4	DAY1	10	_
		2 1	DAY4	1	
	DAY8		DAY5 6 2	1	
			DAY6		9
			DAY /		9
•	TREATMENT :32% RP2 REPLICATE 1	SAMPLE B	DAYS		9
1	-	DEVELOPMENTAL STAGE	DAY9		9
	GASTRU	LA HIPPO H'LING N'NAT	DAY10		ŕ
	DAY1	9			
		10	TREATMENT REPLICATE	:100 % RP2 SAMPLE	A
	DAY4	9 10		DEVELOPM	ENTAL STAGE
	DAYS	7	DAYI		H'LING N'NATE
,	DAY6	10		4 6	
	DATO		7 10	<b>4</b> 5	
			DAY4		1 5
	MOREMUNIA . 224 DD2				2
	TREATMENT :32% RP2 REPLICATE 2	SAMPLE A	DAY5	•	1
	GASTRUI	DEVELOPMENTAL STAGE A HIPPO H'LING N'NAT			3 2
l		0			3
	1	2 2	DAY6		1
	DAY4	5		•	2
		3 2	DAY7		1
	DAYS	5			3 2
		3 2	DAY8		3
	DAY6	5	UNIS		1 3
		3 2			2
	DAY7		5 DAY9		1 3
			2		2
			DAY10		3

TREATMENT : 100% RP2 REPLICATE 2

SAMPLE B

	DEVELOPMENTAL STAGE							
	GASTRULA	нгрро	H'LING	N'NATE				
DAY1	10 10							
DAY4		10 10	•					
OAY5			10 10					
DAY6			10 10					
DAY7			10 10					
DAY8			10 10					
DAY9			10 10					
DAY10				10 10				

## Appendix 4.b.1

PERCENT.

pendix 4.b.1.			
TRIAL #3 ENDPOINT: DEVELOPE SPECIES A. caris	COMMENCED 13/3/91 MENTAL EMBRYONIC MORT nata		
TREATMENT: CONTRO	L DEVELOPMEN GASTRULA TO HIPPO	TAL STAGE	DATA NATE
REP 1A			
REP 18			
REP 2A			
REP 2B			
	GASTRULA TO HIPPO		CENTILE 'NATE
REP 1A			
REP 1B	•		
REP 2A			
REP 2B			
TOTAL	0	0	0
PERCENT.	a	0	0
	•		
TREATMENT: 1% RP	2 DEVELOPME GASTRULA TO HIPPO	ENTAL STAGE	W DATA
REP 1A	1		
REP 18	1		
REP 2A			
REP 2B	1	4	
	GASTRULA TO HIPPO	PE	RCENTILE N'NATE
REP 1A	3.3	n Dino	
REP 1B	5		
REP 2A	-		
REP 2B	3.7	14.8	
TOTAL PERCENT.	3	4	0
PERCENT.	,	•	o
TREATMENT: 3.2% R	P2 DEVELOPMEN GASTRULA TO HIPPO	TAL STAGE	DATA
REP 1A			
REP 1B			
REP 2A			
REP 2B			
	GASTRULA TO HIPPO	PER H'LING N	CENTILE 'NATE
REP 1A			
REP 18			
REP 2A			
REP 2B			
TOTAL .	O	o	0
PERCENT.	0	o	0
		•	•
TREATMENT:10% RP	2 DEVELOPME GASTRULA TO HIPPO	NTAL STAGE	DATA
REP 1A	GASTROLA TO HIPPO	H. FING N	'NATE
REP 1B			
REP 2A			
REP 28	2		
	-	PER	CENTILE
	GASTRULA TO HIPPO	H'LING N	NATE
REP 1A			
REP 1B			
REP 2A			
REP 2B	8.3		
TOTAL	2	o	O

TREATMENT: 32% R	P2 GASTRULA	DEVELOPMEN TO HIPPO	TAL STAC	RAW DATA E N'NATE
REP 1A			11	
REP 1B			•	
REP 2A				
REP 2B				
	GASTRULA	то нірро	H'LING	PERCENTILE N'NATE
REP 1A			45.8	
REP 1B				
REP 2A				
REP 2B				
TOTAL	. 0		11	o
PERCENT.	0		10.7	0
TREATMENT: 100%	RP2 GASTRULA	DEVELOPMENTO HIPPO	TAL STAC	RAW DATA SE N'NATE
TREATMENT: 100%	RP2 GASTRULA 1	DEVELOPMEN TO HIPPO	TAL STAC	E
	GASTRULA	DEVELOPMENTO HIPPO	TAL STAC	E
REP 1A	GASTRULA	TO HIPPO	TAL STAC H'LING	E
REP 1A REP 1B	GASTRULA 1	то нірро	TAL STAC H'LING	E
REP 1A REP 1B REP 2A	GASTRULA  1  1  2	то нірро	TAL STAG H'LING 1	E N'NATE
REP 1A REP 1B REP 2A	GASTRULA  1  1  2	то нірро	TAL STAG H'LING 1	E N'NATE
REP 1A REP 1B REP 2A REP 2B	GASTRULA  1  1  2  GASTRULA	то нірро	TAL STAG H'LING 1	PERCENTILE
REP 1A REP 1B REP 2A REP 2B	GASTRULA  1  1  2  GASTRULA 5	то нірро	H'LING  1  2  H'LING	PERCENTILE
REP 1A REP 1B REP 2A REP 2B REP 1A REP 1B	GASTRULA  1  1  2  GASTRULA 5	то нірро	H'LING  1  2  H'LING	SE N'NATE N'NATE PERCENTILE N'NATE
REP 1A REP 1B REP 2A REP 2B REP 1A REP 1B REP 2A	GASTRULA  1  1  2  GASTRULA  5	то нірро	iTAL STAG H'LING 1 2 H'LING 3.1	E N'NATE  PERCENTILE N'NATE
REP 1A REP 2A REP 2B REP 1A REP 1B REP 2A REP 2B	GASTRULA  1  2  GASTRULA  5  4.2	то нірро	TAL STACHY LING  1  2  H'LING  J.1  6.7	SE N'NATE  PERCENTILE N'NATE

	COMMENCED DEVELOPMENTAL EMBR	) 13/3/91 PAGE RYONIC MORTALITY	1 RAW DATA
TREATMENT	: CONTROL GASTRULA	DEVELOPMENTAL STAC	E N'NATE
REP 1A	1		
REP 18		2	
REP 2A			
REP 28			
			PERCENTILE DATA
	GASTRULA	TO HIPPO H'LING	
REP 1A	3.6		
REP 18		9.5	
REP 2A			
REP 2B			
TOTAL	1	2	0
PERCENT.	1	2	0
	COMMENCE DEVELOPMENTAL EMB A. cummingii	D 13/3/91 PAGE RYONIC MORTALITY	2 RAW DATA
TREATMENT	:1% RP2 GASTRULA	DEVELOPMENTAL STAC	JE N'NATE
REP 1A	1	,	
REP 18	1		
	•		
REP 2A	_		
REP 2B	5		
	GASTRULA	TO HIPPO H'LING	PERCENTILE DATA N'NATE
REP 1A	3.5		
REP 19	5		
REP 2A			
REP 2B	18.5		
REP 20	10.5		
TOTAL	7	0	0
PERCENT.	7.1	0	0
TÖPATMENT	':3.2% RP2	. DOUBLOOMENMAL COM	an
INDAINENI		DEVELOPMENTAL STATE TO HIPPO H'LING	GE N'NATE
REP 1A	2	2	
REP 1B	1		
REP 2A	1		
REP 2B	, -		
	•		DECORUMENT DAMA
	GASTRULA	TO HIPPO H'LING	PERCENTILE DATA N'NATE
REP 1A	6.9	6.9	
REP 1B	. 5		
REP 2A	4.4		
REP 2B	11.1		
TOTAL	7	2	0
PERCENT.	7	2	0
TREATMENT	:10% RP2	DEVELOPMENTAL STA	
REP 1A	GASTRULA	TO HIPPO H'LING	N'NATE
REP 18			
REP 2A		1	
REP 28			
	GASTRIII.A	TO HIPPO H'LING	PERCENTILE DATA
REP 1A			A. NATE
REP 18		•	
REP 2A			
REP 2B		4	
nur 48			
TOTAL	o	1	o
PERCENT.	0	1	0
		•	ŭ

Appendix 4.b.2.

4a	COMMENCED 13/3/91	PAGE 5				D.	AW DATA
TRIAL #3 ENDPOINT: DEVELOPM	ENTAL EMBRYONIC MORT		RAW DATA	TREATMENT:3.2%	RP2 DEVELOPMENT BLASTULA TO HIPPO	ENTAL STAGE	
SPECIES A. cummi	ngii			· ·	BLASIOLA TO HIPPO	n bins	o oate.
TREATMENT : 32% RP2	DEVELOPMEN GASTRULA TO HIPPO	TAL STAGE	NATE	REP 1A	3		
	1	11 521.9		REP 1B		6	
PEP 1A				REP 2A	11	1	
REP 1B	1			REP 2B	4		ERCENTIL
REP 2A	3				BLASTULA TO HIPP		N'NATE
REP 2B		202	CENTILE DATA	REP 1A	15.4		
	GASTRULA TO HIPPO	H'LING N		REP 1B	14.3		
REP 1A	5			REP 2A	35.5	19.4	
REP 1B	4.2			REP 2B	40	10	
REP 2A	12.5						
REP 2B				TOTAL	20	7	0
REF 25				PERCENT.	26.7	9.3	0
TOTAL	5	0	0				
PERCENT.	5.4	0	0				AW DATA
				TREATMENT: 10%	RP2 DEVELOPE BLASTULA TO HIPP	MENTAL STAGE D H'LING	N'NATE
				REP 1A	20		
TREATMENT : 100% RE	P2 DEVELOPMEN GASTRULA TO HIPPO		NATE		4		
REP 1A		1		REP 1B	•		
REP 1B	1			REP 2A			
	•			REP 28		τ	PERCENTIL
REP 2A		4			BLASTULA TO HIPE		N'NATE
REP 2B		•	CENTILE DATA	REP 1A	66.7		
	GASTRULA TO HIPPO		'NATE	REP 1B	50		
REP 1A		3.4					
REP 1B	5			REP 2A			
REP 2A	-			REP 2B			
		16.7		TOTAL	24	0	0
REP 28		2001		PERCENT.	28 6	0	0
TOTAL	1	5	0				
PERCENT.	<u>.</u> 1	5	<b>0</b> .				
				TREATMENT: 32% R	P2 DEVELORM	RA ENTAL STAGE	W DATA
					BLASTULA TO HIPPO		N'NATE
Appendix 4.b.3.				REP 1A		2	
				REP 1B	25		2
TRIAL #3 ENDPOINT: DEVELOP	COMMENCED 13/3/91 MENTAL EMBRYONIC MOR	PAGE 1 RTALITY		REP 2A	24		
SPECIES GLYPTOP				REP 2B	1	2	
TREATMENT: CONTRO	L DEVELOPME	RA' ENTAL STAGE	W DATA			PE	RCENTILE
	BLASTULA TO HIPPO	H'LING	N'NATE		BLASTULA TO HIPPO	H'LING	N'NATE
REP 1A	1			REP 1A	•	10.5	
REP 18	1	2		REP 1B	36.8		2.9
REP 2A	9			REP 2A	70.6		
REP 2B		1		REP 2B	14.3	28.6	
•			RCENTILE DATA	mam. r	_		
	BLASTULA TO HIPPO	H'LING	N'NATE	TOTAL	50	4	2
REP 1A	3.2			PERCENT.	39.7	3.2	1.6
REP 18	3.2	6.5					
REP 2A	31						
REP 28		7.1					
5001 F		_					
TOTAL	11	3	0	TREATMENT: 100% RP	2 DEVELOPMENT	RAW I	DATA
PERCENT.	10.5	2.9	0		BLASTULA TO HIPPO	H'LING N	'NATE
				REP 1A	15		
TREATMENT:1% RP2	DEVELOPME	RAW	DATA	REP 18	1		
	BLASTULA TO HIPPO	H'LING	N'NATE	REP 2A	8	2	
REP 1A				REP 2B		-	
REP 18	2 .					Bener	ENTITE DIE
REP 2A	4				BLASTULA TO HIPPO	H'LING N'	ENTILE DAT 'NATE
REP 28	9			REP 1A	46.9		
		PER	CENTILE DATA	REP 1B	10		
	BLASTULA TO HIPPO	H'LING	N'NATE	REP 2A	42.1	10.5	
REP 1A				REP 2B			
REP 18	6.9						
REP 2A	18.2			TOTAL	24	2	0
REP 2B	81.1			PERCENT.	29.6	2.5	0
				•			
TOTAL	15	0	0				•

PERCENT.

19.7

TRIAL 3 COMMENCED 13/3/91 PAGE 1
ENDPOINT: JUVENILE HORTALITY EXPECTED: FROM NUMBERS OF
SPECIES A. cummingil NEGNATES HATCHED

REPLICATE 1	LIVING	SAMPLE A DEAD	♦ MORT	LIVING	SAMPLE B DEAD	• MORT
TREATHENT			40.7	17	2	10.5
CONTROL	16	11			ž	10.5
18 RP2	20	9	31	17		
3.2% RP2	15	10	40	17	2	10.5
10. RP2	22	9	29	20	9	0
321 RP2	19	0	0	21		30
100 RP2	2	26	92.9	2	17	89.5
REPLICATE 2					SAMPLE B	
		SAMPLE A			DEAD	• MORT
	LIVING	DEAD	<ul><li>MORT</li></ul>	LIVING	DEAD	1 HOR1
TREATHENT						
CONTROL	18	10	35.7	19	2	9.5
IN RPZ	18	4	18.2	20	2	9.1
3.24 RP2	22	O	0	21	3	12.5
10 RP2	23	2	8	21	3	12.5
329 RP2	10	11	52.4	11	12	52.2
1001 RP2						

TRIAL #3	COMMENCED	PAGE 1	
ENDPOINT : JUVENILE	MORTALITY		M NUMBERS OF
SPECIES A. carin	BTA	NEO	NATES HATCHED

REPLICATE !	ι					
		SAMPLE A			SAMPLE B	
	LIVING	DEAD	* HORT	LIVING	DEAD	• HORT
TREATMENT						
CONTROL	19	5	20.8	28	4	14.3
1	20	ā	69	17	2	10.5
1.24 RP2	29	i	9.4	i	19	95
10% RP2	18	í	14.3	26	- 3	10.3
320 RP2	27	į	6.9	8	Š	38.5
100 × RP2	Š	14	73.7	2	29	93.5
	_					
REPLICATE :	2				SAMPLE B	
		SAMPLE A				
	LIVING	DEAD	HORT	LIVING	DEAD	* MORT
TREATMENT						
CONTROL	21	. 5	19.2	21	3	12.5
19 RP2	18	4	18.2	20	2	9.1
3.2% RP2	17	9	34.6	15	9	37.5
LOS RP2	26	3	10.3	20	2	9.1
32 RP2	16	10	38.5	10	14	58.3
1004 002		24	100	0	26	100

# Appendix 4.d.

TRIAL #3 COMMENCED 15/3/91 PHYSICO-CHEMICAL DATA

0122004	D OXYGEN	ng/L			TREATMENT							
	CON	COM	12892	12892	3.2%RP2		10XRP2	10%RP2	354865	32XRP2	100%RP2	100%RP2
DAY1	7.5	7.5	7.5	7.5	7.3	7.6	7.3	7.5	7.5	7.2	7.3	7.5
DAYZ	7.4	7.5	7.7	7.5	7.5	7.7	7.5	7.7	7.7	7.5	7.5	7.5
DAYS	7.1	7.3	7.4	6.8	7.2	7.5	7.4	7.6	7.6	7.4	7.3	7.2
DAY4	7.1	7,1	7.2	7	7.1	7.1	7.2	7.1	7.1	7.1	7.1	7
DAYS	7.1	6.8	7.2	7.4	77.4	7	6.7	7.1	7.1	7.1	7.1	7
DAY6	7.5	7.6	7.4	7.7	7.6	7.6	7.6	7.6	7.6	7.3	7.5	7.1
DAY7	7.1	7.1	7.2	7.5	7.5	7.5	7.2	7.5	7.5	7.1	7.3	7.2
DAYS	7.4	7.3	7.2	7.5	7.5	7.5	7.2	7.6	7.6	7.6	7.7	7.5
DAY9	7.3	7.3	7.5	7.5	7.5	7.6	7.3	7.3	7.3	7.4	7.3	7.4
DAY10	7.4	7.3	7.4	7.2	7.2	7.2	7.5	7.2	7.2	7.2	7.1	7
DAY11	7.4	7.1	7.1	7.3	7.5	7.3	7.5	7.5	7.1	7.2	7.2	7.2
Яq												
DAY1	6.24	6.54	6.65	6.67	6.7	6.73	6.76	6.85	6.96	7.09	7.25	7.34
DAY2	6.44	6.73	6.82	6.96	6.92		7.06					7.54
DAY3	6.81	6.89	7.01		6.81	7.01 7.0 <b>7</b>		7.18	7.18	7.31 7.39	7.48 7.51	
	6.57	6.61	6.84	7.14 6.89	6.86	6.95	7.17 6.9	7.27	7.39			7.56
DAY4 Day5	6.5	6.79	6.66				6.85	6.98	6.86	7.04	7.13	7.31
	6.21	6.53	6.71	6.87	6.72	6.71 6.72		6.91	6.92	7.03 7	7.02	7.2 7.33
DAY6	6.18		6.7	6.75	6.75		6.81	6.83	6.9		7.11	
DAY7	6.14	6.61	7.61	6.7	6.69	6.71	6.81	6.93	6.87	6.96	7.18	7.4
DAY8		6.52		7.15	6.77	6.89	6.93	6.93	6.99	7.04	7.17	7.43
DAY9	6.48	6.67	6.78	6.78	6.66	6.74	6.7	6.84	6.83	6.97	7.05	7.2
DAY1G Day11	6.31 6.66	6.7 6.79	6.69 6.83	6.71 6.76	6.61 6.73	8.41 7.21	7.7 7.18	6.72 7.15	7.15 7	7.18 7.08	7.31 7.11	7.4 7.4
CONDUCT	VITY USem/	/cm										
DAY1	19.7	21.2	35	34	68.9	71.8	179	177	462	461	1170	1170
SYAG	19	23.4	. 39	37.3	73.4	75.2	188	183	469	476	1190	1500
DAY3	21.9	23.4	34.6	35.2	73,8	70.4	174	174	445	449	1150	1180
DAY4	55	53	35.8	38.4	76.1	73.7	179	177	454	463	1190	1200
DAYS	. 29	24.9	35.4	37.9	75	72.2	178	181	450	456	1170	1200
DAY6	19.8	26.6	36.7	38.1	73	72.6	181	179	461	462	1190	1190
DAY7	22.5	23.5	354.2	37.3	71.3	73.4	182	171	462	460	1190	1190
DAY8	23.1	25.6	106.5	39.5	71.8	72.3	182	176	465	458	1170	1180
DAY9	24.3	35.2	38.9	42.5	77.1	76.4	180	180	460	463	1180	1180
DAY10	24	25	38	39.6	74.6	255	189	183	468	467	1190	1200
DAY11	22.9	24.3	36.6	37.7	72.6	112	179	178	450	453	1160	1170

REPLICATE 1	ιT
	ιT
SAMPLE A SAMPLE B	t T
TREATHENT LIVING DEAD & HORT LIVING DEAD & HO	
CONTROL	
14 000	į.
	ı
	1
10% RP2 8 2 20 3 1 2 32% RP2 8 9 52.9 16 6 27	,
100% RP2 6 11 64.7 7 2 22.5	
REPLICATE 2	
SAMPLE A SAMPLE B	
LIVING DEAD A MARK	_
TREATHENT DEAD & HORT LIVING DEAD & HOR	r
CONTROL 14 6 30 6 7 53 5	
15 007 17	
1 29 892 10	
106 882 26 0	
329 992	
100 RP2 1 7 87 5 8 12	

DAY7

DAYS

DAY9

DAY10

COMMENCED 17/3/91 CONDUCTED AT 25deg.C
DEVELOPMENTAL CHARACTERISTICS PAGE 1
EGG NUMBERS RAW DATA

# Appendix 5.a.

TRIAL #4 ENDPOINT SPECIES	D.	EVELOPMEN	TAL CHARA	CTERISTIC		J DATA
TREATMENT	CONTROL	32% RP2	42% RP2	56% RP2	754 RP2 10	00% RP2
EGG MASS						
A	10	10	9	9	9	11
В	9	9	10	10	10	13
Ç	10	10	9	10	9	14
D E	10	10	9	10	10 14	9 10
E F	10 10	9 10	11 8	14	14	14
ć	10	9	9	10	10	14
н	10	12	10	10		
TRIAL #4 ENDPOINT SPECIES	D 0	EVELOPHEN	ITAL CHARA	CTERISTIC		# DATA
TREATMENT	CONTROL	324 RP2	424 RP2	564 RP2	75% RP2 10	00% RP2
EGG MASS						
A	9	12	10	9	14	12
В	9	9	11	10	12	12
Ç	10	. 8	9	10	12	11
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endpoint			ITAL CHARA G CAPSULE	CTERISTIC RUPTURE	S PAGE 1 RAV	J DATA
SPECIES		LYPTOPHYS				
TREATHENT	CONTROL	324 RP2	42% RP2	56% RP2	751 RP2 10	00% RP2
EGG MASS						
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SPECIES		Α.	carinata				
TREATMEN	T:CONTROL		REP	LICATE 1			
	GASTRULA		DEV TROCH	ELOPMENT	AL STAGE		
DAYI	9		rkoch	VEL	HIPPO	H'LING	N'NATE
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DAY3			-	9			
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TREATMENT	r: control		REPL	ICATE 2			
	GASTRULA		DEVE TROCH	LOPMENT. VEL	AL STAGE	H'LING	N'NATE
DAY1	7						
DAY2	5		7 5				
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TREATMENT	r: CONTROL			ICATE 3			
	GASTRULA		TROCH	LOPMENT.	AL STAGE HIPPO		
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TREATM	ent : control		LICATE 4	AL STAGE			ikrain	ENT:32% RP2		PLICATE 3 VELOPMENT			
	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE	DAY1	GASTRULA	TROCH	AEL	HIPPO	H, FING	H'NAT
DAY1	24 15						DAII	8 9					
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DAY10						24	DAY10						9
TREATM	ENT: CONTROL	REI	LICATE S	5			TREATM	ENT: 32% RP2	RE	PLICATE 4			
	GASTRULA	DE\ TROCH	VELOPMENT	TAL STAGE	H'LING	N'NATE							
DAY1	4							GASTRULA	DEV TROCH	elopmenta Vel	L STAGE	H'LING	N'NATE
DAY2		2					DAY1	10					
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DAS 7					0		DAYS				16	10	
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TREATM	ENT:32% RP2	REF	LICATE 1	L			DAY7				10	10	
	as contract			AL STAGE			DAIT					16	
DAY1	GASTRULA 8	TROCH	VEL	HIPPO	H'LING	N'NATE	DAYS					10 16	
DAY2		. 7					DAY9					16	10
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BYAG					6		TREATME	NT:42% RP2		LICATE 1			
DAY9					6			GASTRULA	TROCH	VELOPMENT.	AL STAGE HIPPO	H'LING	N'NATE
DAY10						6	DAY1	9 10					
TREATM	ENT:32% RP2	REF	LICATE 2	:			DAY2		9				
	GASTRULA-	DEV TROCH	elopment Vel	AL STAGE	H'LING	N'NATE	DAY3			10 9			
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DAY7					8	•			DEV	ELOPMENT			
JAL!					13 9 8		DAY1	GASTRULA 7	TROCH	VEL	нірро	H'LING	N'NATE
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TREATMENT	:42% RP2	REPLICATE 3									
		DEVELOPMENTAL STAGE			TREATHEN	T:56% RP2	REPL	ICATE 2			
	GASTRULA	TROCH VEL HIPPO	H'LING	M'NATE		GASTRULA	DEVE TROCH	LOPHENTA VEL	L STAGE HIPPO	H'LING	N'NATE
DAY1	9					GASTROLA	troca	725			
DAY2 DAY3		9			DAY1	15 10					
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TREATMENT	· 473 DD7	· REPLICATE 4			DAY6		•			15 10	
		DEVELOPMENTAL STAGE			DAY7					15 10	
	GASTRULA	TROCH VEL HIPPO	H'LING	N'NATE						15	
DAY1	20				DAY8					8	
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DAY7			. 20		TREATME	NT:56% RP2	REP	LICATE 3			
BYAG			20			GASTRULA	DEV TROCH	ELOPMENT	AL STAGE HIPPO	11/1 THE	W4W4 @P
DAY9			20			ONSTRULA	TROCK	VEL	HIPPO	H'LING	N'NATE
DAYLO		•	20		DAYL	7					
DAY11				20	DAY2		7				
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TREATMEN'	T:42% RP2	REPLICATE 5			DAY4			1	6		
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	· 5				DAY7				4	3	
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			8			GASTRULA	TROCH DEV		AL STAGE HIPPO	H'LING	N'NATE
DAY7	•		4 5								
			8		DAY1	14 14					
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TO FATME	NT:56% RP2	REPLICATE 1			DAYS					13 14	
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TUCUTUE	ENT:75% RP2		PLICATE 1					DAY7						11	
	GASTRULA	TROCH	VELOPMENT VEL	AL STAGE HIPPO	H'LING	H'NATE		BYAG						11	
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DAY3		8	11					#D.D.) #W#		222	nen				
			8					TREATME	NT:100%	RP2		LICATE 1 ELOPMENT	AL STAGE		
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reatne.	NT:75% RP2		PLICATE 2					DAY11						• •	15
	GASTRULA	TROCH	VELOPMENT	AL STAGE HIPPO		N'NATE									
DAY1	8							TREATME	NT:100%	RP2		PLICATE 2	AL STAGE		
	11								GASTR	ULA	TROCH	VEL	HIPPO	H'LING	N'NATE
DAY2		8	11					DAYl	•	7 4					
CYAC			8	11				21.112		7	7				
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TREATME	NT:75% RP2	REI	PLICATE 3					DAY11						2 7	
	GASTRULA	DE\ TROCH	velopment Vel	AL STAGE	H'LING	N'NATE		DAY12						2	
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DAY3 ,			10 2					TREATM	ENT: 100	1 RP2	PI	EPLICATE	1		
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TREATHF	NT:75% RP2	RP	PLICATE 4		÷			DAY9							13
		DET	VELOPMENT	AL STAGE											
D. V.	GASTRULA	TROCH	VEL	HIPPO	H'LING	N'NATE								-	
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							TREATMENT: CO	ONTROL	REPI	LICATE 3			
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	TREATMENT: 100 C RP.		EVELOPMENTA	L STAGE				BLAST	TROCH	VEL	HIPPO	H, TING	и,и:
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	DATIO				3	12							
	DAY11				3		TREATMENT: C	ONTROL		LICATE 4			
	DAY12				3			BLAST	DEV'	elopmenta Vel	L STAGE HIPPO	H'LING	ran'n
	DAY13				3		DAY1	21					
	DAY14			TE	C HOITAHIMS	ı		26	21				
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ΑĮ	opendix 5.b.2.	COMMENCED	17/3/91 CON	IDIICTED A	T 15deg (	_	DAY6					21	
	ENDPOINT	DEVELOPMEN	TAL CHARACT	ERISTICS	PAGE 1	~ A₩ DATA	OREG					25 21	
	SPECIES	A. cummino	gil				DAY7					25	
	TREATMENT: CONTROL	, F	REPLICATE 1				DAYS					21 25	
	BLAS		DEVELOPMENTA VEL	L STAGE HIPPO	H'LING	N'NAT	DAY9					25	21
	DAY1 20						DAY10						25
	· 13						TREATMENT:	CONTROL	RE	PLICATE 5			
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	TREATMENT: CONTR	or.	REPLICATE	,			DAY10						23
			DEVELOPMEN	TAL STAG	E								
		AST TROC	H VEL	HIPPO	H'LING	TAN'N							
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TREATMENT	:32% RP2		PLICATE				16.	CAIGGG.	324 RF2			L STAGE		
	BLAST	TROCH	VELOPMEN	TAL STAGE HIPPO	H'LING	N'NAT			BLAST	TROCH	ELOPMENTA VEL	HIPPO	H'LING	N' MAC
DAY1	29 24						DA	Y1	28 11					
DAY2	24	26 .					DA	¥2		28				
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DAYS					22		DA	.Y8					27 11	•
DAY9					22		DA	.¥9j					27 9	
DAY10					22	21	DA	Y10					9	27
DAY11					22								,	9
DAY12						22	DA	Y11						,
TREATMENT	128 002	250	I I CAMP 1											
INDATRENT	. J2 6 RP2		LICATE 2	AL STAGE			TR	REATMENT	:32% RP2	RE	PLICATE 5	i		
	BLAST	TROCH	VEL	HIPPO	H'LING	N'NAT			BLAST		VELOPMENT VEL	AL STAGE		N'NA
DAY1	16 20						DA	Y1	10 24					
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TREATMENT	. 128 002	950	LICATE :	1										
IREAINEAI		DEV	ELOPMENT	TAL STAGE	H'LING	N'NAT	TRE	ATMENT:	32% RP2	REP	LICATE 6			
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DAY11

TREATMENT: 4	21 RP2	REPI	JICATE 1			TREATMENT	:42% RP2	PPD	LICATE 4			
			LOPMENTAL STAGE						ELOPMENTAL	STAGE		
	BLAST	TROCH	VEL HIPPO	H'LING	N'NAT		BLAST	TROCH		HIPPO	H'LING	•
DAY1	22 29					DAY1	24 17 22					
DAY2		22 29				DAY2	24	24 16				
DAY3			21 26					22				
DAY4			21 28			DAY3			24 15 22			
DAY5				21 28		DAY4				24 15		
DAY6				20 28		DAYS				22	24	
DAY7				20 28		DAY6					15	
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DAY9				20 28 20	28	DAY7					2 4 1 5 2 2	
DAY10					20	DAYS					24	
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TREATMENT:	42 <b>\$</b> 222	777									15 22	
TREATMENT:	428 KP2		PLICATE 2 /ELOPMENTAL STAGE			DAY10					15 22	
DAY1	BLAST 12	TROCH	VEL HIPPO	H'LING	N'NAT	DAY11						
	34 16											
DAY2	30	12	•		. •	TREATMENT:	:56% RP2		LICATE 1			
OR C		34 16					BLAST	TROCH	VEL H		H'LING	N′
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	·		34 16 30			DAY3			34 25 28			
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				34 16 30					15	25 10		
DAY6				12		DAY5				2 8	32 17	
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DAY7				30 12		DAY6			•	8 8	34 17 11	
				34 16 30		DAY7					33	
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				34 16 30		DAY8				6	33 19 13	
DAY9				12		DAY9				•	31	
				30	34 16	DAY10			·		25 16	
DAY10			•		. 12	DATIO						
					30	TREATMENT:	56% RP2	REP	LICATE 2			
TREATMENT: 4	2% RP2		LICATE 3 ELOPMENTAL STAGE				BLAST	DEVI TROCH	VEL H	STAGE IIPPO	H'LING	N′
	BLAST	TROCH	AEF HIBBO	H'LING	ТАИ'И	DAY1	19 27					
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DAY5				12 26		DAY6			4	18 6 22	11	
DAY6				12 26		DAY7				2 18	11	
DAY7				12 26		DAY8				18	11 4	
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DAY10	•			20	11	DAY11					11	
DAY11					20						20	

DAY13

TREAT	MENT:56% RP2	RE	PLICATE :	)			TREATMENT:	:75% RP2	RÉP	LICATE 2			
	BLAST	TROCH	VELOPMENT VEL	TAL STAGE HIPPO	H'LING	N'NAT				ELOPMENTA			
DAY1	14							BLAST	TROCH	VEL	HIPPO	H'LING	н,
	. 17						DAY1	23	••				
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				27			DAY6			8		15	
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~					27		DAY9					16	
DAY7					14 27		DAY10					16	
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					27		DAY14					16	
DAY10						14 27					TE	RMIHATION	
TREAT	MENT:56% RP2	REI	PLICATE 4				TREATMENT:	:75% RP2	REP	LICATE 3			
	BLAST	DE7 TROCH	VELOPMENT VEL	AL STAGE	H'LING	N'NAT			DEV	ELOPMENT!			
DAY1	9						DAY1	BLAST 27	TROCH	VEL	HIPPO	H'LING	N':
	35 27						DAIL	21					
DAY2		9 34					DAY2		27 20				
		27					DAY3			27			
CYAC			9 34							20			
DAY4			27 9				DAY4			4	23 20		
UNIT			8 15	26 7			DAYS			1	5 19	22	
DAY5			5	4			DAY6				5	22 20	
			•	7 15	26 7		DAY7					22	
DAY6				2 7	7 26				•			20	
		•		4	16		DAY8					22 20	٠
DAY7		•			8 25		DAY9					22 20	
2142					18 8		DAY10					22	
DAYS					25 18							20	
DAY9					8		DAY11						:
					25 18								
DAY10					7	25	TREATMENT	:75% RP2		PLICATE 4			
					18			BLAST	TROCH	VELOPMENT VEL	AL STAGE HIPPO	H'LING	א'י
DAY11						7 18	DAY1	20					
TREAT	MENT:75% RP2	RE	PLICATE 1	٠ .			22.42	22					
	, BLAST	DE'		PAL STAGE HIPPO	H'LING	N'NAT	DAY2		20 22	•			
DAY1							DAY3			20 22			
	12 23 25						DAY4				20		
DAY2		12 23					22.45				21		
		25					DAY5				2 11	18 10	
DAYS			12 23				DAY6				2 11	18 10	
			25				DAY7					18	
DAY4				12 23			****				6	15	
				25			DAY8					17 17	
DAY5				12 23 25			DAY9					17 17	
DAVE				25	12		DAY10					17	
DAY6					23 25							17	
DAY7					11		DAY11						
5					22 24								
DAYS					11	•							
					22 24								
DAY9					11 22								
	•				24								
DAY1	0				11 22								
_					24 11								
DAY1	1				22 24								
DAY1	.2				11	22							
DAYI					11	24							

							TREATHENT:	1001 RP2	REP	LICATE 4			
TREATMENT	:100% RP2	RE	PLICATE 1					BLAST	DEV TROCH	ELOPMENT.	AL STAGE		
	BLAST	TROCH	VELOPMENT	AL STAGE HIPPO	H'LING	n'nat	DAY1	21	IROCH	AEL	нірро	H. LING	N'NAT
DAY1	31		•					23 21	•				
DAY2	24	30			•		DAY2		21 23				
EYAG		24	29				DAY3		21	21 23			
DAY4			24 13	16			<b>5.</b>			21			
DAY5			11	13 16			DAY4			8 2 3	13 21 18		
DAY6			10	13	9		DAYS			7	9 16	<b>5</b> 7	
DAY7				13 15	10		DAY6				13	16	
DAYB					9 18						8 2	15 19	
DAY9					9 18		DAY7				10 8 2	5 12 19	
DAY10					9 18		DAYB				•	5 12	
DAY11					9 18		DAY9					19	
DAY12					9 18							12 16	
DAY13					9 18		DAY10					4 12 16	
DAY14					9 18		DAY11					4	12 16
DATIA					9 TERMINATI	ON	DAY12					4	
TREATMENT:	100% RP2	RE	LICATE 2				DAY13					4	
		nev	ELOPMENTAL	STAGE			DAY14				T	4 ERMINATIO	N
	BLAST	TROCH			H'LING	N'NAT					•		
DAY1	7 13 15						TREATMENT	::100% RP2		REPLI	CATE 5		
DAY2		7 13			•		DAY1	BLAST	TRO	CH DEVEL	OPMENTA: VEL	L STAGE HIPPO	H'LING
2172		. 15	7					12 16					
DAYJ			12 15		•		DAY2		11		1		
DAY4		,	12 15	7			DAY3		2	!	9 · 16		
DAY5			4	7 7			DAY4		2		9 16		
DAY6				15	7		DAY5				4 8	7 7	
			2	2	9 15		DAY6					7 13	4 2
DAY7			1	1	7 9 15		DAY7					4	6 3
DAYS					7 9		DAYS						7 2
DAY9					15 7		DAY9						5 2
UNIT					9 15		DAY10						5 2
DAY10					7 9 15		DAY11						2
DAY11					7 9		DAY12 DAY13						2
						15 7	DAY14						2 IINATION
DAY12 TREATMENT:	100% RP2		LICATE 3			9						TER	NOITANI
	BLAST	TROCH	ELOPMENTAI VEL	L STAGE HIPPO	H'LING	N'NAT							
DAY1	18 26												
DAY2		18 26											
DAY3.			18 26										
DAY4			1 5	17									
DAY5			2	1 24	17								
DAY6			2	1 1	17 23								
DAY7			2	1	17								
DAY8				-	17 25								
DAY9					16								

25

DAY10

								TREATMENT:	1001 RP2	REPL.	ICATE 4			
TREATMENT	:100% RP2	RE	PLICATE 1	•					BLAST	DEVE TROCH	LOPHENTA VEL	L STAGE HIPPO	H'I INC	N'NAT
	BLAST	DE TROCH	VELOPMENT VEL	AL STAGE HIPPO	H'LING	N'NAT		DAY1	21 23					
DAY1	31 24								21					
DAY2		30 24						DAY2		21 23 21				
DAY3	•		29 24					DAY3			21 23			
DAY4			13 11	16 13				DAY4			21 8	13		
DAY5			13	16				2			2	21 18		
DAY6			10	13 18	9			DAY5			7	9 16	5 7	
DAY7				13 15	10 12			DAY6				5 13	16 8	
					9 18							8 2	15 19	
DAYS					9			DAY7				10 8 2	5 12 19	
DAY9					9			DAY8				•	5	
DAY10					18 9								12 19	
DAY11					18 9			DAY9					5 12 16	
DAY12					18 9			DAY10					4	
DAY13					18 9								16	
DAY14					18 9			DAY11	•				4	12 16
TREATMENT: 1	00% RP2	REP	LICATE 2	7	ERMINATIO	ON		DAY12 DAY13					4	
		2011	nr o numuma i					DAY14				***	4	
	BLAST	TROCH	ELOPMENTAI VEL		H'LING	N'NAT						TE	RHINATIO	N
DAY1	7 13 .15							TREATMENT	::100% RP2	!	REPLIC	ATE 5		
DAY2		7 13							BLAST	TROCE	DEVELO	PMENTAI VEL	STAGE HIPPO	H'LING
		15	_					DAY1	12 16					
DAY3			7 12 15					DAY2		11 16		1		
DAY4			12	7				DAY3		2		9 16		
DAY5		•	15	7				DAY4		2		9		
DATS			4	7 15				DAYS				16 4 8	7	
DAY6			2	2	7 9			DAY6				8	7	4
DAY7					15 7			DAY7					13	2
•			1	1	9 15			DAYS					4	6 3
DAYS					7 9 15			DAY9						7 2
DAÝ9					7			DAY10						5 2
					9 15									5 2
DAY10					7 9 15			DAY11						2
DAY11					7 9			DAY12 DAY13						2
					•	15 7		DAY14						2
DAY12 TREATHENT: 1	.00% RP2		LICAȚE 3		~ -	ģ							TERM	INATION
	BLAST	TROCH	ELOPMENTA VEL	L STAGE HIPPO	H'LING	N'NAT								
DAY1	18 26													
DAY2		18 26												
DAYJ			18 26											
DAY4	,		1	17										
DAYS			5	21	17						•			
DAY6			2	24 1	17									
DAY7			2	1	23 17		•							
DAYS			2	1	23 17									
DAY9					25									

DAY9

DAY10

•

DAY6
DAY6
DAY7
DAY8
DAY9

TREATMENT: 56% RP2	REPLICATE 2		
	DEVELOPHENTAL STAGE TROCH VEL HIPPO	H'LING	N'NATE
GASTRULA DAY1 8	TROCH VEL HIPPO	H 51110	
9			
DAY2 8	9		
DAY3	8 1 8		
DAY4	7		
	1 8	7	
DAY5		8	
DAY6		7 8	
DAY7		7 8	
BYAG		7	
			8 .
DAY10		7	7
5			•
TREATMENT:75% RP2	REPLICATE 1		
CASTRULA	DEVELOPHENTAL STAGE TROCH VEL HIPPO	1111110	
DAY1 8	THOSE TEE	n LING	N NAIE
4 14			
DAYZ	6		
	14		
DAY3	6		
DAY4	13		
	1 12		
DAY5	3	2	
	1 11		
ĎAY6		5	
		10	
DAY7		5	
		10	
DAY8		5	
		10	
DAY9	•	. 4	
DAY10		10 5	
54110		10	
DAY11		5	
		10	
DAY12		4	5
		10	
DAY13		4	10
DAY14	т	4 ERMINATIO	4
TREATHENT: 75% RP2	REPLICATE 2		
GASTRULA	DEVELOPHENTAL STAGE TROCH VEL HIPPO	H. TING	N'NATE
DAY1 8			
DAY2	8		
DAY3 DAY4	8 7		
DAYS .	7		
DAY6		6	
DAY7		6	
DAY8		6	
DAY9		5 5	
DAYLO		5	
DAY11 DAY12		5	
DAYL3		5	
DAY14	1	S ERMINATIO	N
	'		

TREATHENT		REPLICATE 1		
	CASTRULA	DEVELOPMENTAL STAGE TROCH VEL HIPPO	H'LING	N'NATE
DAYL	9 7	1000 100 11110	11 21110	N NAIC
DAY2	,	8 7		
DAY3		7 8		
		6		
DAY4		7		
DAY5		7 6		
DAY6			4 6	
DAY7			4 6	
BYAG			4	
DAY9			6	
DAYLO			6	
			6	
DAYII			4 6	
DAY12			6 6	
DAY13			4 6	
DAY14			6	4
		T	ERMINATION	ı
TREATMEN	T:100   RP2	REPLICATE 2		
	CASTRIE A	DEVELOPMENTAL STAGE	H'LING	N'NATE
	GASTRULA		H'LING	N'NATE
	GASTRULA	DEVELOPMENTAL STAGE	H'LING	N'NATE
DAYI	·	DEVELOPMENTAL STAGE	H'LING	N'NATE
DAY1	GASTRULA	DEVELOPMENTAL STAGE	H'LING	N'NATE
DAY2	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO	H'LING	N'NATE
DAY2 DAY3	·	DEVELOPMENTAL STACE TROCH VEL HIPPO	H'LING	N'NATE
DAY2	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO  7	H'LING	N'NATE
DAY2 DAY3 DAY4	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO  7 7	H'LING	N'NATE
DAY2 DAY3 DAY4 DAY5	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO  7 7	H'LING	N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO  7 7	H'LING	N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO  7 7	l l	N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO  7 7	I I I	N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9	·	DEVELOPMENTAL STACE TROCH VEL HIPPO  7 7 4	I I I I I	N'NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9	·	DEVELOPMENTAL STAGE TROCH VEL HIPPO  7 7	1 1 1 1	N' NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 DAY10 DAY11	·	DEVELOPMENTAL STACE TROCH VEL HIPPO  7 7 4	1 1 1 1	N' NATE
DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 DAY10 DAY11 DAY12	·	DEVELOPMENTAL STACE TROCH VEL HIPPO  7 7 4	1 1 1 1 1	N' NATE

ENG	AL #4		COMMENCED NTAL EMBRY	13/3/91 ONIC MORT		
TRE	ATMEN	T:CONTROL GASTRULA	TROCH	PEVELOPMEN VEL		H'LING
REI	1					
RES	2					
REI	? 3					
REI	<b>4</b>		2			
REI	5	2		1		1
		GASTRULA	TROCH	VEL	P HIPPO	ERCENTILE H'LING
RES	<b>,</b> 1					
REI	2					
REI						
RE		•	5.1			
REI		50		25	25	
TO	TAL .	2	2	1	0	1
PER	RCENT.	2.1	2.1	1.1	0	1.1
					Đ	W DATA
TRI	ATMEN	T:J2% RP2 GASTRULA	TROCH	evelopment Vel	TAL STAGE HIPPO	H'LING
REI	1	1			1	•
REE	2				2	1
REE	, 3	1				
REE	4		1			
		GASTRULA	TROCH	VEL	PI HIPPO	RCENTILE H'LING
REE	, 1	12.5			12.5	
REE					6.1	3
RÉF		5.9			٧.٠	,
REF		3.7	3.7			
	•		3.,			
TOT	AL	2	1	. 0	3	1
PEF	CENT.	2.4	1.2	0	3.5	1.2
		•	•		F	AW DATA
TR.	EATMEN	T:42% RP2	TROCH	Developmen Vel	TAL STAGE HIPPO	H'LING
RE:	P 1					1
RE	P 2					
RE	P 3					
RE	P 4					
RE	P 5			1		1
						ERCENTILE
		GASTRULA	TROCH	VEL	HIPPO	
	P 1					5.3
	P 2					
	P 3					
	P 4					
RE	P 5			5		5
TO	FAL	0	o	1	0 .	2 ·
PE	RCENT.	. 0	0	1.3	0	2.7
			_			AW DATA
TRI	EATMEN	T:56% RP2 GASTRULA	TROCH	evelopmen Vel	HIPPO	H'LING
REI	? 1					
RE	P 2					2
RE	P 3	•			4	1
RE	P 4		1			
		GASTRULA	TROCH	VEL		ERCENTILE H'LING
RE	P 1					
	P 2					
	P 3				57.1	14.3
	P 4		3.6			

1.5

0

PERCENT.

					₩ DATA
TREATMEN'	T:75% RP2 GASTRULA	TROCH	LOPMENTA VEL	L STAGE HIPPO	H'LING
REP 1					
REP 2					8
REP 3					2
REP 4					
	GASTRULA	TROCH	VEL	рЕ НІРРО	RCENTILE H'LING
REP 1					
REP 2					42.1
REP 3					16.7
REP 4					
TOTAL	0	o	0	0	10
PERCENT.	0	. 0	0	a	16.4
TREATME	NT:100% RP2 GASTRULA	DE <sup>r</sup> Troch	VELOPMENT VEL	R AL STAGE HIPPO	AW DATA H'LING
REP 2				5	9
REP 3					•
REP 4					3
	GASTRULA .	TROCH	VEL	HIPPO	RCENTILE H'LING
REP 1					
REP 2				27.8	50
REP 3					
REP 4					20
TOTAL	o	0	0	5	12
PERCENT.	0	0	o	8.2	19.7

pendix 5.c.		MENCEO 13/	1/91	PAGE 1	
TRIAL #4 ENDPOINT: DE SPECIES A	COM EVELOPMENTA . cummingii	MENCED 13/ L EMBRYONI	C MORTAL	TY	DATA
REATMENT:	CONTROL		LOPMENTA	STAGE	DATA 'LING
( Carling of the carl	GASTRULA	TROCH			3
REP I	2	1	2	4	,
REP 2		1			1
REP 3		1			ı
REP 4		1			
REP 5	1				
	GASTRULA	TROCH	VEL		CENTILE DATA H'LING
•	3.3	1.7	3.3	6.7	5
REP 1 REP 2		4			
		2	•		2
REP 3		2.1			
REP 4	1.3				
REP 5	1.3				
TOTAL	3	4	2	4	4
PERCENT.	1.1	1.5	0.8	1.5	1.5
TREATMEN	T:32% RP2			TAL STAGE	
	GASTRULA	TROCH	VEL	HIPPO	H'LING
REP 1	11	3	2		1
REP 2	4				,
REP 3	_		1	1	1
REP 4	2				3
REP 5	1	2	1		
REP 6				_	
	GASTRULA	TROCH	VEL	нірро	ERCENTILE DATA H'LING
REP 1	11.7	6.7	3.3		1.7
REP 2	10				
REP 3		•	1.2	1.2	1.2
REP 4	4.9				7.3
REP 5	2.9	5.7	2.9		
REP 6					
					•
TOTAL	18	5	4	1	5
PERCENT.	, 6.2	1.7	1.4	0.3	1.7
				R	AW DATA
TREATMEN	T:42% RP2 GASTRULA	TROCH	EVELOPMEN VEL	TAL STAGE HIPPO	
REP 1	1	2			1
REP 2					•
REP 3					7
REP 4	2	1			,
		_		b	ERCENTILE DATA
	GASTRULA	TROCH	VEL	HIPPO	H'LING
REP 1	1.9	3.8			1.9
REP 2					
REP 3					15.8
REP 4	1.6	3.1			
TOTAL	3	3	0	0	•
PERCENT.		1.2	0	0	8
			Ū	U	3.3
				RA	W DATA
TREATMENT	:56% RP2 GASTRULA	DE TROCH	velopment vel	AL STAGE	
REP 1		1	3	6	6
REP 2	ı	2	-	10	-
REP 3	•	-			
REP 4	•		6	16	2
nur 4	1		•		RCENTILE DATA
	GASTRULA	TROCH	VEL	HIPPO	H'LING
REP 1		1.1	3.4	6.8	6.8
REP 2	1.6	3.2		15.6	
REP 3					
REP 4	1.4		8.4	22.5	2.8
TOTAL	2	3	9	32	8
PERCENT	Λ α	1 1	1 8	17 6	3.4

				R.A	W DATA
TREATMENT	:75% RP2 GASTRULA	DEV TROCH	ELOPMENT VEL	AL STAGE HIPPO	H'LING
REP 1	2			1	2
REP 2			ı	6	
REP 3	4			5	
REP 4	1			4	1
	GASTRULA	TROCH	VEL	PE HIPPO	RCENTILE DATA H'LING
REP 1	3.2			1.6	3.2
REP 2			4.3	26.1	
REP 3	7.8			9.8	
REP 4	2.3			9.3	2.3
TOTAL	7	. 0	ı	16	3
PERCENT.	3.9	0	0.6	8.9	1.7
				R.A	AW DATA
TREATMENT	S:100% RP2 GASTRULA	TROCH	VELOPMENT VEL	AL STAGE HIPPO	H'LING
REP 1	1	1	3	22	1
REP 2	6	. 1	3	2	6
REP 3			ı	1	1
REP 4				19	14
REP 5		1	ı	17	2
	GASTRULA	TROCH	VEL	HIPPO	ERCENTILE DATA H'LING
REP 1	1.8	1.8	5.5	0.4	1.8
REP 2	14.6	2.4	7.3	4.9	14.6
REP 3			2.4	2.4	2.4
REP 4				29.2	21.5
REP 5		3.6	3.6	60.7	7.1
TOTAL	7	3	8	61	24
PERCENT.	3	1.3	3.4	26.3	10.3

TRIAL #4 COMMENCED 13/3/91 PAGE 1 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES GLYPTOPHYSA SP.

TREATMEN	T: CONTROL	DE	VELOPHENT		NU DATA
	CASTRULA	TROCH	VEL	HIPPO	H'LING
REP 1	8	15	1	1	
REP 2		2	2		
REP 3	2		1		1
	GASTRULA	TROCH	AEL	PI	RCENTILE H'LING
REP 1	29.6	55.6	3.7	3.7	
REP 2		25	25		
REP 3	50		25		25
TOTAL	10	17	4	ı	1
PERCENT.	25.6	43.6	10.3	2.6	2.6

TO 0 4 TW F1F	T:32% RP2	ne:	ELOPHENT	AI STACE	
IKEAINEN	CASTRULA	TROCH	AET	HIPPO	H. TING
REP 1					
REP 2	4	6	1		
	GASTRULA	TROCH	VEL	HIPPO P	ERCENTILE H'LING
REP 1					
REP 2	28.6	42.9	7.1		
TOTAL	4	6	1	0	0
PERCENT.	11.4	17.1	2.9	0	0

TREATMENT		DE	VELOPMENT	AL STAGE	
	CASTRULA	TROCH	VEL	HIPPO	H, TING
REP 1	5	ı	1		
REP 2		Ĺ	4	ı	
				PI	ERCENTILE
	GASTRULA	TROCH	VEL	HIPPO	H' LING
REP 1	17.9	3.6	3.6		
REP 2		16.7	66.7	16.7	
TOTAL	5	2	5	1	0
PERCENT.	14.7	5.9	14.7	2.9	0

					AW DATA
TREATMENT	:56% RP2 GASTRULA	TROCH	VELOPMENT JBV	HIPPO	H'LING
REP 1	2	3	3	2	1
REP 2		2			
	CASTRULA	TROCH	VEL	PE HTPPO	RCENTILE H'LING
REP 1	4.5	6.8	6.8	4.5	2.3
REP 2		11.8			
TOTAL	ż	5	3	2	1
PERCENT,	3.3	8.2	4.9	3.3	1.6

1 KEVIII	541:/38 KF2	y e	VELOPHEN	TAL STACE	
	GASTRULA	TROCH	VEL	HIPPO	H, TING
REP 1	2	1	2	2	4
REP 2		1		ı	6
				P	ercentile
	CASTRULA	TROCH	AEF	HIPPO	H. FING
REP 1	7.7	3.8	7.7	7.7	15.4
REP 2		12.5		12.5	75
TOTAL	2	2 .	2	3	10
PERCENT,	5.9	5.9	5.9	8.8	29.4

				R.A	W DATA
TREATHENT	:100% RP2 GASTRULA	DEV Troch	elopment. Vel	AL STAGE HIPPO	H'LING
REP 1	1	2		3	6
REP Z	6	3		3	1
•	GASTRULA	TROCH	VEL	HIPPO	ERCENTILE H'LINC
REP 1	6.3	12.5		18.8	37.5
REP 2	46.2	23.1		23.1	7.7
TOTAL	,7	5	0	6	7
PERCENT		17.2	0	20.7	24.1

pendix o.	COMMENCED 3	1/3/91	PACE 1	RAW	DATA									
ENDPOINT:	DAILY EGGMA	SS NUMBER	PAGE 1	r.n.w	UNIA			TREATHENT :	10% RP2	REP 1			1	
TREATMENT	: CONTROL							SAMPLE	A	B B	C	A	REP 2 B	С
SAMPLE	A	REP 1	с	A	REP 2	С		DAY1 DAY2	0	0 17	9	31	15	0
DAYL	1	3	2	ı	o	0		DAY3 DAY4	15	12	19	10 41	0	0 27
DAY2 DAY3	2 3	2	0 3	1 2	1 2	4		DAY5	13	0	8	21	15 23	11 23
DAY4 DAY5	1 4	0	3 2	1 4	1 .	2 2		DAY5 DAY7	3 0	12 0	5 8	0 12	16 13	10 18
DAY6 DAY7	2 2	2 1	2 4	1 2	2	3		TREATHENT :	329 RP2					
TREATMENT	:10 RP2							SAMPLE	٨	REP 1 B	С	A	REP 2 B	С
SAMPLE	A	REP 1 B	c	A	REP 2	c		DAY1	a a	Q	0	0	a	a
DAYL	٥	0	0	0	0	1		DAY2	0	0	0	0	0	2
DAY2 DAY3	1 4	2 0	1 2	o l	1	o l		DAY3 DAY4	0	0	0 0	0	0	0 7
DAY4 DAY5	0 6	0 2	l 3	0	1	1		DAYS DAY6	0	0	0	13	7	0 5
DAY6 DAY7	3 1	. 2	1 2	0	. 0	0 3		DAY7	0	4	0	0	8	a
	:3.29 RP2							TREATHENT :	100% RP2	REP 1			REP 2	
SAMPLE	Α.	REP 1	С	A	REP 2	С		SAMPLE	A	В	c	A	8	c
DAYL	0	0	2	2	1	ı		DAYL	0	0	0	0	0	0
DAY2 DAY3	1 2	i	0 3	0	0	0 3		DAY2 DAY3	0	0	0	0	0	0
DAY4 DAY5	o o	ì	1	9	0 2	9		DAY4 DAY5	0	0	0	0	0	0
DAY6 DAY7	i	3 2	2 2	1 1	2 1	1		DAY6 DAY7	0	0	0	ŏ	0	0
ent!	•	٠	•	•	-	-		wei\$2	U	U	U	U	0	0
TREATMENT	:10% RP2						Α	ppendix 6.a.2	2.					
SAMPLE	٨	REP 1 B	c	A	REP 2	c		TRIAL #5 CC	MMENCED	31/3/91	PAGE L	R	ATAC WA	
DAY1	0	o	1	3	1	0		ENDPOINT: DA SPECIES: A.	cumming	MSS NUMBER 11				
DAY2 DAY3	0	2	0	1	0	. 3		TREATMENT :	יטאדפי.					
DAY4 DAY5	0 2	0 1	1 0	0	2	1 2		SAMPLE		REP 1	_		REP 2	
DAY6 DAY7	1 0	1 0	0	0 1	0	1 2		DAYI	۸ ,	8	c	٨	8	С
TREATMENT	: 32% RP2							DAY2 DAY3	2	3	2 4	I L	1	2 1
SAMPLE	A	REP 1 B	С	A	REP 2 B	c		DAY4 DAY5	0	1	1	3	3 l	3
DAYL	0	0	0	0	0	0		DAY6 DAY7	0	1 2	2	3 1	3 1	2
DAY2 DAY3	0	0	0	0	0	1 0			1	3	3	3	2	2
DAY4 DAY5	0	0	0	0 1	0 1	0		TREATHENT : 1		REP 1			REP 2	
DAY6 DAY7	ŏ ·	o 1	o o	o o	o 1	0		SAMPLE	۸ .	8	С	٨	В	c
	:100% RP2	•	•	•				DAY1 DAY2	1 2	1 1	2 2	1 2	2	1
SAMPLE	A	REP 1 B	c	A	REP 2 B	c		DAY3 DAY4	. 2	3 1	2	1 2	1 2	i
DAYL	0	0	0	0	0	0		DAYS DAY6	1	2 0	2 2	2	4 2	2 3
DAY2 DAY3	0	. ŏ	ŏ	0	1 2	0		DAY7	2	2	ō	ĩ	ž	í
DAY4 DAY5	0	ŏ	ŏ	ō	i	0 1		TREATMENT :3.	.20 RP2	REP 1			REP 2	
DAY6	, 0	1 0	ŏ	0	ŏ	ō o		SAMPLE	٨	8	С	A-	8	С
DAY7	U	<b>J</b>	·	·	•	<del>.</del>		DAY1 DAY2	0 2	1 2	0	2	1 5	0
								DAY3 DAY4	2 2	1 3	4	3	1	2
								DAY5 DAY6	3 2	1 2	3 2	3	0	1
TRIAL 45	COMMENCED	31/3/91	PAGE 1	9417	DATA			DAY7	ī	2.	2	2 2	1 2	2
ENDPOINT:	DAILY TOTAL	L EGG PROD		KAW	DALA									
TREATMENT	:CONTROL													
SAMPLE		REP 1 B	c		REP 2	•		TREATMENT : 10	RP2	REP 1				
	٨			Α	8	С		SAMPLE	A	8	С	A	REP 2 B	c
DAY1 DAY2	12 17	25 18	45 13	13 13	0 3	0 53		DAY1 DAY2	0	0	0	1	o o	0
DAY3	0	28 0	36 22	32 20	20 8	40 28		DAY3 DAY4	1	1 3	0	2	0	1
DAY5 DAY6	0	10 16	23 18	58 17	14	24		DAYS	0	1	0	2	0	0
DAY7	ŏ	0	36	27	13 24	16 35		DAY6 DAY7	3	l 2	0	2	2 2	1 2
TREATMENT	:18 RP2							TREATMENT :32	RP2					
SAMPLE	A	REP 1 8	С	٨	REP 2 B	С		SAMPLE	A	REP 1 B	С	A	REP 2 B	c
DAY1	o	0	0	0	0	8		DAY1	1	0	0	0	2	0
DAY2 DAY3	11 44	5	11 22	0	7	14		DAY2	. 0	0 1	0 1	0	0	0
DAY4	0	0	15	5	7 11	6 7		DAYS	0	0	0	0	o o	ŏ
DAY5 DAY6	63 31	8 18	37 20	0 4	3 10	1 0		DAY6 DAY7	0 1	0 1	1	i	i	Ö
DAY7	9	23	24	0	0	15		TREATMENT : 100	01 RP2			-	-	•
TREATMENT	:3.2% RP2	REP 1			REP 2			SAMPLE	٨	REP 1 B	С	٨	REP 2 B	С
SAMPLE	A	B B	c	A	B B	c		DAY1	0	0	0	0	1	0
DAYL	.0	0	13	9	13	0		DAY2 DAY3	0 1	o 1	1 0	0	0	0
DAY2 DAY3 .	10 21	5 0	0 22	0 25	0 23	9 31		DAY4 Days	ō o	ò	0	0	ŏ	0
DAY4 DAY5	11 0	9 8	4	0 42	0 15	0 32		DAY6 DAY7	Ö	ŏ	0	0	0	0
DAY6	L3	14	18	13	24	9			·	J	•	v	U	U
DAY7	5	5	13	11	11	9								

	DAILY TOTA		PAGE 1 DUCTION	R.	AW DATA		TREATHENT	104 RP2	REP 1			REP 2	
	A. cummin						SAMPLE	٨	В	C	A	В	c
							DAY1 DAY2	0 1	0 3	1	0	0	0
TREATMENT	':CONTROL	REP 1			REP 2		DAY3	1	2	3	2	0	0
SAMPLE	A	В	c	A	8	c	DAYA DAYS	i O	ì	i S	0	0	0 2
DAY1	16	54	40	29	25	34	DAY6 DAY7	1 2	1	2 2	0	2 2	0 1
DAY2 DAY3	28 28	56 66	75 61	20 51	15 71	17 49	TREATHENT:	32% RP2			-	-	-
DAY4	0	26	22	0	16	29			REP 1			REP 2	
DAY5 DAY6	0 34	20 56	47 30	83 28	13	49 27	SAMPLE	A	8	c	٨	8	С
DAY7	24	10	26	37	36	16	DAY1 DAY2	0 1	2 0	1	1	0	0
TREATMENT	:1% RP2						DAY3 DAY4	0	o o	0	0	0	0
SAMPLE	A	REP 1	С	A	REP 2 B	С	DAYS	0	2	0	0	0	1
							DAY6 DAY7	1	1	0	1	0	0 1
DAY1 DAY2	18 40	17 15	39 45	22 46	62 51	15 36	TREATMENT:	1001 892				•	-
DAY3	34	41	79	24	65	16			REP 1	_		REP 2	
DAY4 DAY5	38 63	18 46	. 35 41	35 49	54 81	0 36	SAMPLE	Α.	В	С	^	8	С
DAY6 DAY7	2 34	0	21 27	30	39	48	DAY1 DAY2	0	0	0	0	0	0
DAT	34	35	27	14	50	15	DAY3 DAY4	o	0	0	0	0	0
TREATMENT	:3.2% RP2	REP 1			REP 2		DAYS	0	0	0	0	0	0
SAMPLE	A	8	c	A	8	c	DAY6 DAY7	0	0	0	0	0	0
DAY1	0	27	0	53	19	0			-	-	•	•	·
DAY2	60	44	0	38	77	53							
DAY3 DAY4	83 52	19 44	59 0	63 0	24	36 0							
DAY5	78	18	63	68	24	18							
DAY6 DAY7	53 18	35 27	31 35	10 22	7 7	28 38	TRIAL #5	COMMENCED	31/3/91	PAGE 1	R.	AU DATA	
							ENDPOINT: SPECIES:	DAILY TOTA GLYPTOPHYS	L EGG PROD A SP.	UCTION			
TREATMENT	:10% RP2						TREATMENT	: CONTROL	•				
SAMPLE	A	REP 1 B	с	A	REP 2 B	С	SAMPLE	A	REP 1 B	С	A	REP 2	С
DAY1	0						DAY1	0	0	49	0	29	54
DAY2	18	0 16	0 25	24 22	0	0 · 31	DAY2	0	26	20	0	0	30
DAYI	15	54	0	46	18	30	DAY3 DAY4	0	16 0	55 0	0 8	0	30 7
DAY4 Days	25	25 14	0	0 48	0	0 33	DAYS DAY6	0	5 0	39 10	25	27	39
DAY6	40	14	0	29	33	14	DAY7	ő	ŏ	15	26 5	10 12	16 9
DAY7	35	24	0	24	42	25	TREATMENT	: 18 RP2					
TREATMENT	:32% RP2	REP 1					SAMPLE	A	REP 1	С	A	REP 2	с
SAMPLE	A	8	c	A	REP 2	С	DAYL						
DAY1	16	0	0	o	62		DAY2	24 3	23 12	19 36	24 24	0	18 16
DAY2	0	o	ŏ	Ö	62 0	0	DAY3 DAY4	35 8	26 24	3 25	16 6	0	18
DAY3 DAY4	0	21	14	0	0	0	DAY5	32	24	14	4	0	15 39
DAYS	Ö	21 0	0	0	0	0	DAY6 DAY7	5 22	19 10	0 15	. 5 13	0	6 16
DAY6 DAY7	. 0	0	10	10	19	0					••	•	
DAIT	14	13	0	13	0	o	TREATHENT	3.2% KP2	REP 1			REP 2	
TREATMENT	:100% RP2	REP 1					SAMPLE	٨	В	С	A	В	c
SAMPLE	A	B B	c	A	REP 2 B	с	DAY1 DAY2	0 14	0	29	0	4	0
DAY1	. 0	0	.0	0	22	0	DAY3	4	19 16	27 31	0	0 45	15 7
DAY2	ď	ŏ	22	ŏ	20	ō	DAY4 DAY5	8 9	9	0	3	0 27	9 19
DAY3 DAY4	28 0	18 0	0	0	0	0	DAY6 Day7	0	7	15	0	12	14
DAY5	0	Q	0	Q	0	0	UR ( )	v	,	U	U	15	27
DAY6 DAY7	0	0	0	0	0	0							
			•		•	·							
							TREATMENT :	10					
							SAMPLE		REP 1			REP 2	
Appendix 6.a	a.3.							A .	В	c	٨	8	С
• •	OMMENCED 31/3	/01 PAC	E L RA	W DATA			DAYI DAY2	0 6	0 10	13 17	0 18	0	0
ENDPOINT: DA	ALLY EGGHASS	NUMBER	e i	W UNIA			DAY3 DAY4	5 7	12	33	69	0	0
SPECIES: G	LYPTOPHYSA SP	<b>'</b> •					DAYS	ó	6 0	9 51	0	0	0 7
TREATHENT:	CONTRAL						DAY6 DAY7	6 11	6 17	28 16	0 21	12 11	0
	R	EP_L		REP 2	_		TREATMENT :		••	•-			•
SAMPLE	<b>A</b>	В	C A	В	С			324 KF2	REP L			REP 2	
DAY1 DAY2	0		2 0	3	6. 3		SAMPLE	A	В	С	٨	8	С
DAY3	Ŏ	. 5	6 0	ŏ	3		DAY1 DAY2	.0	21	7	13	0	0
DAY4 DAY5	0	1	0 1 4	0 3	1 4		DAY3	11	ā	0	9	0	0
DAY6 DAY7	0		1 3 2	1 2	2 1		DAY4 Days	. 0	0 13	0	0	0	6 0
TREATHENT:		•	-	•	-		DAY6 Day7	10 12	3	0	10	0	ŏ
	R	EP 1	_	REP 2					•	J	,	v	,
SAMPLE	٨	В	C A	8	С		TREATHENT :	TOOA KES	REP 1			REP 2	
DAYL DAY2	3 1		2 3	0	4 2		SAMPLE	<b>A</b>	8	c	A	8	c
DAY3	4	2	2 3	ō	1		DAY1 DAY2	0	0	0	0	0	0
DAYS	2	2	3 1 2 1	0	2 4		DAY3	0	0	0	0	0	0
DAY6 DAY7	2 2		0 1 2	0	1 2		DAY4 DAY5	0	0	0	0	0	Ö
		•		v	4		DAY6 DAY7	ŏ	ŏ	ŏ	ō	ō	0
TREATHENT:		EP 1		REP 2			UAI/	ď	0		0	0	0
SAMPLE	٨		C A	В	С					•			
DAY1 DAY2	0 3		3 0	l O	0								
DAY3	ı	2	3 0	6	1								
DAY4 DAY5	1 1		0 1	1 3	1 2								
DAY6 DAY7	Ö	ı	2 0	1 2	2 3								
DUI.	v			4	,								

# Appendix 6.b.

TRIAL #5 COMMENCE 31/3/91 PHYSICO-CHEMICAL DATA

DISSOLVE	D OXYGEN m	g/L										
					TREATMENT	•						
	CON	CON	12RP2	1782	3.2%RP2	3.2%RP2	10%RP2	10%RP2	32%RP2	32%RP2	100%RP2	100%RP2
DAY1	7.5	7.2	7.5	7.4	7.4	7.5	7.4	7.2	7.5	7.3	7.3	7.4
DAYZ	7.7	7.5	7.7	7.4	7.5	7.5	7.5	7.5	7.5	7.6	7.6	7.4
DAY3	7.4	7.4	7.5	7.4	7.3	7.3	7.4	7.4	7.4	7.4	7.3	7.4
DAY4	7.5	7.5	7.4	7.3	7.3	7.6	7.3	7.3	7.5	7.4	7.1	7.4
DAY5	7.2	7.3	7.4	7.3	7.2	7.4	7.4	7.5	7.5	7.3	7.4	7.6
DAY6	7.9	7.2	7.8	7.5	7.8	7.9	7.7	7.9	7.8	7.8	7.5	7.9
Ма												
	6.3	6.35	6.45	6.75	6.65	6.78	6.74	6.84	6.76	6.81	6.9	7.4
DAY1	6.28	6.75	6.66	6.88	6.75	6.81	6.71	6.92	6.81	7.05	7.13	7.43
SYAG	6.35	6.72	6.66	6.63	6.48	6.65	6.67	6.72	6,79	6.99	6,97	6.96
DAY3	6.48	6.84	6.64	6.64	6.57	6.68	6.7	6.96	6.9	7.03	7.04	7.3
DAY4	6.51	6.61	6.59	6.7	6.6	6.71	6.74	6.94	6.85	7.11	7.12	7.34
DAY5	6.25	6.48	6.49	6.76	6.64	6.86	6.57	7.09	6.93	7.15	7.28	7.48
CONDUCTI	VITY uSem/	'cm			TREATMENT	r						
	CON	CON	12892	1%RP2	3.2XRP2	3.2%RP2	10%RP2	10%RP2	32XRP2	32%RP2	100%RPZ	100%RP2
DAYT	29.2	22,1	44.7	42.1	75.3	74.8	181	187	464	465	1180	1180
DAYZ	29.3	27.3	50.4	43	77.2	75.9	186	184	464	466	1190	1190
DAY3	32.6	26.6	39.7	40.1	77.4	77.3	189	183	460	472	1180	1180
DAY4	46.4	27.8	42	42	85	79.9	191	186	469	474	1190	1190
DAY5	38.5	26.2	44.1	44.1	82.8	80.6	183	180	458	462	1170	1170
DAY6	33.5	31.7	46.5	46.5	94.2	88.4	191	191	474	480	1190	1190

ppendix 7.a  TRIAL #5 COM ENDPOINT DAIL  SPECIES: A. CO	TENCED	12,4/9 ASS PRODUCT	PAGE L	RAS	DATA	
TREATMENT: CON		REP I			REP 2	
SAMPLE	A	8	С	A	5	
DAY1 DAY2 DAY3 DAY4 DAY5	1 0 2 0	2 0 1 2	0 0 0 2 0	0 2 1 2 2	1 1 3 1	
TREATMENT: 1 %	RP2					
SAMPLE	A	REP 1	С		REP 2 B	
DAYL DAY2	0 2	0	0 2	0 2	0	
DAY3 DAY4	5	2	o l	1 2	2 2	
DAY5	0	1	1	2	1	
TREATMENT: 3.2		REP 1			REP_2	
SAMPLE	Α	8.	c	A .	3	
DAY1 DAY2 DAY3	0	0 1 0	0 0 2	0 1 0	0 1 0	
DAY4 DAY5	ì	2	0 2	2	2	
				•	L	
TREATHENT: 10	RP2	REP 1			REP 2	
SAMPLE	٨	8	С	A	8	
DAY1 DAY2	0	0 2	0	0	0	
DAY3 DAY4	1	0 1	0	0 1	0	
DAY5	1	0	1	0	ι	
TREATMENT: 32	RP2	REP 1 B	С	A	REP 2 B	
SAMPLE	0	0	0	0	0	
DAY1 DAY2 DAY3	0	ŏ	ŏ	ŏ	0	
DAY4 DAY5	0	0	1 0	0	0	
TREATMENT: 10			•	-		
SAMPLE	A	REP 1 8	с	A	REP 2 B	
DAY1	0	0	0	. 0	0	
DAY2 DAY3	0	0	0	0 1 0	0 0 0	
DAY4 DAY5	0	<b>0</b> 1	0	ŏ	ŏ	
ENDPOINT: DAI SPECIES: A.	cumming		PAGE 1 UCTION	R	AW DATA	
TREATMENT : CO	NTRGL A	REP 1	С	A	REP 2	
DAYL	17	37	0	0	25	
DAY2 DAY3	0	0 21	0	45 24	29 58	
DAY4 DAY5	30 0	46	29 0	38 38	18 17	
TREATHENT : 14	RP2	REP 1			950 -	
SAMPLE	A	8 B	c	A	REP 2 B	
DAY1 DAY2	0 48	0	0 52	0 40	0 2 <b>5</b>	
DAY3 DAY4	48 0	55 28	0 25	17 35	51 36	
DAYS	0	28	15	37	22	
TREATMENT : 3.		REP L	_		REP 2	
DAY1	0	В О	с 0	Α .	8	
DAY2 DAY3	0	19 0	0 38	0 23 0	0 21 0	
DAY4 DAY5	11	44 26	0 29	35 19	37 19	
TREATHENT : 10	RP2	REP 1			רפקק	
SAMPLE	A	8	С	<b>A</b>	REP 2 B	
DAYI DAY2	0	0 40	0	Ö O	0	
DAY3 DAY4	14 0	0 15	0	0 14	ŏ	
DAYS	7	o	21	ō	14	
TREATHENT : 321 SAMPLE		REP 1		_	REP 2	
DAYL	A 0	в 0	с 0	A 0	8 0	
DAY2 DAY3	. 0	0	0	0	0	
DAY4	13	ŏ	3	Ö	ŏ	

TREATMENT : 100% RP2

: TRIOPORS	COMMENCED DAILY EGG P A. carinata		PAGE 1	R.	W DATA	
TREATMENT	CONTROL	REP 1			REP 2	
SAMPLE	٨	3	c	٨	5	С
DAY1 DAY2	0	3 1	0	2 0	0	l 2
DAY3 DAY4	0 1	0 1	5 0	1 2	5	2 1
DAY5	i	i	i	2	2	2
TREATMENT	11 RP2				REP 2	
SAMPLE	A	REP 1 B	С	A	3	С
DAYI	1	0	ı	o	o o	0
DAY2 DAY3	0 1	0	i U	0	o l	0
DAY4 DAY5	1 2	0	1 2	0	l o	1 3
	3.2% RP2					
	A	REP L B	c	A	REP 2	c
SAMPLE				5	0	ı
DAY1 DAY2	l O	2 1	0	ó	0	0
DAY3 DAY4	1 2	0	0 1	0 2	0	0
DAY5	2	i	ō	ō	ō	ō
TREATMENT	:10% RP2	REP L			REP 2	
SAMPLE	A	8	С	A	8	С
DAY1	0	2	0	1	1	0
DAY2 DAY3	0	1 0	0 1	0	0	0
DAY4 DAY5	0	1 0	0	0	1	1
TREATMENT	:32% RP2					
SAMPLE	Α	REP 1 B	c	٨	REP 2 B	с
					_	
DAY1 DAY2	0	0	0	0	0	0
DAY3 DAY4	0	0	0	0 1	0	0
DAYS	0	0	0	0	0	0
TREATMENT	:100% RP2	REP L			REP 2	
SAMPLE	A		c	A	3	C
DAYI	0	0	0	0	0	0
DAY2 DAY3	0	0	0	0	0	0
DAY4 DAY5	0.	0	0	0	0	2
(RIAL =6	COMMENCED	12/4/91	PAGE 1	a	TALL DATA	
ENDPOINT: SPECIES:	COMMENCED DAILY TOTA A. carinac	L EGG PROD	PAGE 1 UCTION	я	MAW DATA	
: TRIOPORE	DAILY TOTA A. carinac	L EGG PROD	HC1TOU		REP_2	
ENDPOINT: SPECIES: TREATMENT SAMPLE	DAILY TOTA A. carinac :CONTROL A	L ECG PROD a REP 1 B	C	A	REP 2 B	c
ENDPOINT: SPECIES: TREATMENT SAMPLE DAYL DAYL	DAILY TOTA A. carinac :CONTROL A 0 0	L EGG PROD REP 1 B 46 17	C C O	A 12 0	REP 2 B 41 0	7 16
ENDPOINT: SPECIES: TREATHENT SAMPLE DAYL DAYL DAYZ DAYA	DAILY TOTA A. carinac :CONTROL A 0 0 0 0	E EGG PROD REP 1 B 46 17 0 8	C 0 0 47 0	A 12 0 6 12	REP 2 B 41 0 24 0	7 16 13 9
EMDPOINT: SPECIES: TREATHENT SAMPLE DAY1 DAY2 DAY3 DAY4 DAY5	DAILY TOTA A. carinac :CONTROL A 0 0 0 2	E EGG PROD  REP 1  8  46 17	C 0 0 47	A 12 0 6	REF 2 B 41 0 24	7 16 13
ENDPOINT: SPECIES: TREATMENT SAMPLE DAYI DAY2 DAY3 DAY3 DAY6 DAY5 TREATMENT	DAILY TOTA A. carinac :CONTROL A 0 0 0 0 2 :L% RP2	REP 1  8  46 17 0 817	C 9 0 47 0 11	A 12 0 6 12 11	REP 2 B 41 0 24 0 21	7 16 13 9 16
EMPPOINT: SPECIES: TREATMENT SAMPLE DAY1 DAY2 DAY3 DAY3 DAY5 TREATMENT SAMPLE	DAILY TOTA A. carinac :CONTROL A 0 0 0 2 :L% RP2 A	REP 1 8 46 17 0 8 17 REP 1 3	C 9 0 47 0 11	A 12 0 6 12 11	REP 2 8 41 0 24 0 21 REP 2 8	7 16 13 9
ENPOINT: SPECIES: TREATMENT SAMPLE DAY1 DAY2 DAY3 DAY3 DAY5 TREATMENT SAMPLE DAY1 DAY2	DAILY TOTA A. carinac  :CONTROL  A  0  0  0  2  :L% RP2  A  2  0	REP 1 8 46 17 0 8 17	C 0 0 47 0 11	A 12 0 6 12 11	REP 2 8 41 0 24 0 21 REP 2 8	7 16 13 9 16
ENPOINT: SPECIES: TREATMENT SAMPLE DAY1 DAY2 DAY3 DAY6 TREATMENT SAMPLE DAY2 DAY3 DAY4	DAILY TOTA A. carinae :CONTROL A 0 0 0 2 :L% RP2 A 2 0 7 9	REP 1 8 46 17 0 8 17 REF 1 3	C 0 0 0 11 C	A 12 0 6 12 11 A 0 6 6 0	REP 2 8 41 0 24 0 21 REP 2 8	7 16 13 9 16
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Appendix 7	.a.3.						Appendix	7.b.1.				
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		iO 8		TREATHENT : 3.2% RP2 REPLICATE LA	
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		10 8		DAYL 11	
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DAYS				DEVELOPMENTAL STAGE	
UATO		. 10		CASTRULA TROCH VEL HIPPO H'LING M'NATE	
DAY6		LO		DAY1 8 10	
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TREATME	NT :1% RP2			DAYS	
	CASTRULA	DEVELOPMENTAL STAGE TROCH VEL HIPPO H'LING	N'NATE	,	
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DAY2	11			<b>y</b>	
				DAY7 8	
DAY3		11 .		DAY8 8	
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DAY6		11		TREATMENT : 3.2% RP2 REPLICATE 2A	
DAY7		11		DEVELOPMENTAL STAGE GASTRULA TROCH VEL HIPPO H'LING N'NATE	
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TREATHE	NT :1% RP2	REPLICATE 2A		·	
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DAY?		6		TREATMENT :1.2% RP2 REPLICATE 2B	
DAYS			6	DEVELOPMENTAL STACE	
-			-	GASTRULA TROCH VEL HIPPO H'LING N'NAT	É
TREATME	NT :18 RP2	REPLICATE 2B		DAYL 10	
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TREATME	NT :104 RP2	Ri	EPLICATE 1A				Λр	pendix 7		COMMENCED	12/6/21			
		DI	EVELOPHENTAL	STAGE				TRIAL #6	VALIDATION DEV	ELOPMENTAL	HALACI	ERISTICS DATA	PAGE !	
DAYI	CASTRULA	TROCH	AET HI	PPO H'L	ING N	MATE		SPECIES		cummingii		2		
ONTI	8 10							TOPATMENT	T: CONTROL	REP	ICATE LA			
DAY2		8 10						TREATHE.			I OPMENTA	1. STAGE		
DAY3		8							CASTRULA	TROCH	VEL	HIPPO	H'LING	NAME
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TREATMEN	T :101 RP2	RE	PLICATE 18					DATE						
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5.44	GASTRULA	TROCH	VEL HIP	bo H. TI	NG N.	NATE								
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DAY7 DAY8 DAY9	: :100% RP2	Rep	LICATE 1A	1	4	14		DAYL	GASTRULA 17	DEV	ELOPHENTA	L STAGE	H. FINC	N'NATE
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DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN DAY1 DAY2 DAY3 DAY4	GASTRULA  17  17  17: CONTROL  GASTRULA  24  21	TROCH  17  REP DEV	ELOPMENTA VEL  17  LIGATE 2A ELOPMENTA VEL	L STAGE HIPPO	17 17 17 H'LING	17
DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN DAY1 OAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA  17  17  17: CONTROL  GASTRULA  24  21	TROCH  17  REP DEV	ELOPMENTA VEL  17  LIGATE 2A ELOPMENTA VEL	L STAGE HIPPO	17 17 17 H'LING	17 N'NATE
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DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN DAY1 OAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA  17  17  17: CONTROL  GASTRULA  24  21  24	TROCH  17  REPTOCH  21	ELOPMENTA VEL  17  LICATE 2A ELOPMENTA VEL  20 21	L STAGE HIPPO	17 17 17 H'LING	17 N'NATE
DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN DAY1 DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	GASTRULA  17  17  17: CONTROL  GASTRULA  24  21  24	TROCH  17  REPTOCH  21	LIGATE 2A  LIGATE 2A  LIGATE 2A  LIGATE 2B  LIGATE 2B  LIGATE 2B	L STAGE HIPPO  17  17  17  19	17 17 17 H'LING	17 N'NATE 17 19
DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN DAY1 DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	GASTRULA  17  17  17: CONTROL  GASTRULA  24  21  24	DEVITED OF TROCH	LIGATE 2A  LIGATE 2A  LIGATE 2A  LIGATE 2B  LIGATE 2B  LIGATE 2B	L STAGE HIPPO  17  17  17  19	17 17 17 H'LING	17 N'NATE 17 19
DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAYL DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN  DAY1 DAY2 DAY3 DAY4 DAY5 DAY4 TREATHEN  TREATHEN  TREATHEN  TREATHEN  TREATHEN  TREATHEN  TREATHEN  TREATHEN	GASTRULA  17  17  17:CONTROL  GASTRULA  24  21  24  C:CONTROL  GASTRULA	DEVITED OF TROCH	LIGATE 2A  LIGATE 2A  LIGATE 2A  LIGATE 2B  LIGATE 2B  LIGATE 2B	L STAGE HIPPO  17  17  17  19	17 17 17 H'LING	17 N'NATE 17 19
DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN  DAY1 DAY2 DAY3 DAY4 DAY5 DAY4 DAY5 TAY5 DAY6 DAY7 DAY1 DAY1 DAY1 DAY1 DAY1 DAY1 DAY1	GASTRULA  17  17  17:CONTROL  GASTRULA  24  21  24  C:CONTROL  GASTRULA  25	DEVITED OF TROCH	LIGATE 2A  LIGATE 2A  LIGATE 2A  LIGATE 2B  LIGATE 2B  LIGATE 2B	L STAGE HIPPO  17  17  17  19	17 17 17 H'LING	17 N'NATE 17 19
DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN  DAY1 OAY2 DAY3 DAY4 DAY5 DAY6 TREATHEN  DAY1 DAY4 DAY5 DAY6 DAY7 TREATHEN  DAY1 DAY2	GASTRULA  17  17  17:CONTROL  GASTRULA  24  21  24  C:CONTROL  GASTRULA  25	DEVITED OF TROCH	LIGATE 2A  LIGATE 2A  LIGATE 2A  LIGATE 2B  LIGATE 2B  LIGATE 2B	L STAGE HIPPO  17  17  17  19	17 17 17 H'LING	17 N'NATE 17 19
DAY7 DAY8 DAY9 TREATHENT DAY1 DAY2 DAY3 DAY4 DAY5 DAY6	GASTRULA 4 4	DEV TROCH	ELOPHENTAL ST	AGE O H'LIN	<b>4</b>			DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 DAY9 TREATHEN  DAY1 OAY2 DAY3 DAY4 DAY5 DAY6 TREATHEN  DAY1 DAY1 DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	GASTRULA  17  17  17:CONTROL  GASTRULA  24  21  24  C:CONTROL  GASTRULA  25	DEVITED OF TROCH	LIGATE 2A ELOPHENTA VEL  20 21  LIGATE 28 ELOPHENTA VEL	L STAGE HIPPO  17  17  17  19	17 17 17 H'LING	17 N'NATE 17 19

DAY7

TREATHEN	T : CONTROL	REPLICATE 2C	_		TREATHEN	T:18 RP2		ICATE 2B		
	GASTRULA	DEVELOPMENTAL STAGE TROCH VEL HIPPO	H. I'INC	BYBATE		GASTRULA	TROCH	LOPMENTAL STAGE VEL HIPPO	H, TIMC	N'NATE
DAYI	12 16				DAYl	27 24				
DAY2	12 15				DAY2		27 24			
CYAG		12 16			EYAG			26 26		
DAY4		12 16			OAY4				21 23	
DAY5		12 16			DAYS				21 23	
DAY6			12 16		DAY5				21	
DAY7			12		DAY7				23 21 23	
			16 12		DA'8			*	23	21
DAY8			16	12						23
DAY9				15						
TREATHE	NT:19 RP2	REPLICATE 1A			TREATHENT	:11 RP2		CATE 2C OPHENTAL STAGE		
	GASTRULA	DEVELOPMENTAL STAC TROCH VEL HIPPO	H'LING	N'NATE		GASTRULA	TROCH	VEL HIPPO	H'LING :	NATE
DAYL	23 24				DAY1	19 15				
DAY2	23 24				DAY2	15	19			
DAY3		23 24			DAY3		19 15			•.
DAY4		23 24			DAY4			19 15		
DAY5			23 23		DAYS				19 15	
DAY6			23		DAY6				19 15	
DAY7			23	23 23	DAY7				19	
				23	DAY8		•		15 19	
TREATM	ENT:18 RP2	REPLICATE 18 DEVELOPMENTAL STA	.GF						15	
	CASTRULA	TROCH VEL HIPP		STAILS	DAY9			FOR	19 15 CED HATCH	
JAYL	30 25				01YA0					19 15
DAY2	30 25				TOFATHE	T:3.24 RP2	959	LICATE LA		
DAY3	-	29 25			TREATRE		DEVI	LOPMENTAL STAGE		
DAY4		25	29		DAY1	GASTRULA 13	TROCH	VEL HIPPO	H'LING	N'NATE
DAY5			29		DAY2	13				
DAY6			23 29 23		DAY3		13			
			23	29	DAY4 DAY5			12		
DAY7	ENT: 1 RF2	REPLICATE 1G		29 21	DAY6				12	
IKEAIN	ENI: IA KLY	DEVELOPMENTAL STA	AGE		DAY7				12	
DAYL	GASTRULA	TROCH VEL HIPS	SO H. FING	N'NATE	DAY8		•			12
	28 23				TREATMEN	T:3.21 RP2		LICATE IB		
DAY2	28 23					GASTRULA	TROCH	CLOPMENTAL STAGE VEL HIPPO	H'LING	N' NATE
DAY3		27 22		*	DAY1 DAY2	25 19 25				
DAY4		22	7			19				
QAY5			27 22		EYAD			24 19		
DAY6			27 22		DAY4			19	24	
DAY7			26 22		DAYS				24 19	
BYAG				26 22	DAY6				24 19	
					DAY7				24 19	
TREATH	ENT:1% RP2	REPLICATE ZA			DAY8				24 19	
	GASTRULA	DEVELOPMENTAL STATE	GE O H'LING	N'NATE	DAY9					24 19
DAYL	20									••
DAY2	20									
CYAD	20	20 19								
DAY4										
DAYS		20 18	20							
			18							
DAY6			20 18							
DAY7			20 18							
0.473				20						

DAY7 DAYA

TREATHENT:	3.28 RP2	REPLICATE 1G				TREATHE	NT: 101 RP2	R E	PLICATE 18		
		DEVELOPMENTAL STAGE TROCH VEL HIPPO	uri ING	N'NATE		i Niaring			VELOPMENTAL STAGE		
DAY1	GASTRULA 27 24	TROCH VEL HITTS	., 5			DAY1	GASTRULA 23 17	TROCH	VEL HIPPO	H'LING	HIMATE
DAY2		27 24				DAY2	23 17				
DAY3		24 24				DAY3		23 17			
DAY4			21 23			DAY4			23 16		
DAY5			21 23			DAYS			23		
QAY6			21 23			DAY6				23 16	
DAY7			21 23			DAY7				23	
DAYS				21 23		DAYS				16 23 16	
T084T46117	F:3.24 RP2	REPLICATE 2A				DAY9				23 16	
(NEA (III)		DEVELOPMENTAL STAGE		MANATE		DAY10					23 16
	GAS TRULA	TROCH VEL HIPPO	H-CING	NUMBER							
DAYI	23					TREATME	NT:10% RP2	RFI	PLICATE 1C		
DAY2	21	21							ELOPHENTAL STAGE		
DAY3 DAY4		28					GASTRULA	TROCH	VEL HIPPO	H' LING	B'BATE
DAY5		••	18			DAYL	21				
DAY6			18			DAY2	20				
DAY7			18			DAY3		20			
DAY8			18			DAY4			20		
DAY9				18		DAYS				20	
DAYLO						DAY6				20	
DALLO						DAY7				20	
TREATMEN	T:3.2% RP2	REPLICATE 2B				DAY8					20
	GASTRULA	DEVELOPHENTAL STAGE TROCH VEL HIPPO	uri tuc	WINATE		TREATHEN	T:10% RP2	REP	LICATE 2A		
DAYL	21	troon 120 attro	H LING	2186 0					ELOPMENTAL STACE		
DAY2	20						CASTRULA	TROCH	VEL HIPPO	H, FINC	N'MATE
DAY3		19				DAY1	14				
DAY4		19				DAY2	14				
DAYS		19	19			DAY3		14			
DAY6			19			DAY4			14		
DAY7			19			DAYS			13		
DAY8			19	19		DAY6				IJ	
51110				1,7		DAY7				13	
TREATMEN	NT:3.2% RP2	REPLICATE 2C				DAYB				13	
		DEVELOPMENTAL STAGE	E			DAY9					13
	GASTRULA	TROCH VEL HIPPO	H'LINC	H'NATE		TREATME	NT:10	oci	PLICATE AN		
DAYL	17								PLICATE 2B		
DAY2	1.7						GASTRULA	TROCH	VEL HIPPO	H'LING	N'DATE
DAY3		16				DAY1	14				
DAY4		15				DAY2	14				
DAY5			15			DAY3	•	14			
DAY6			15			DAY4			14		
DAY7			15			DAY5			13		
BYAG			15			DAY6				13	
DAY9				15		DAY7				13	
						DAYS				13	
•						DAY9				13	
TREATH	ENT:10% RP2	REPLICATE 1A				DAYLO					13
	GASTRULA	DEVELOPMENTAL STAC TROCH VEL HIPPO	H.TIN	IG N'NATE		TREATMEN	T:32% RP2	REPI	LICATE LA		
DAYL	14							DEVE	LOPMENTAL STAGE		
DAY2	14					04.44	GASTRULA	TROCH	VEL HIPPO	H'LING	N'NATE
DAY3		13				DAY1	13				
DAY4		ıı				DAY2 DAY3	13				
DAYS		11							11		
DAY6			11	l		DAY4			11		
DAY7			17		•	DAYS				11	
DAY8			11			DAY6				11	
DAY9			11			DAY7				11	
DAYLO				11		DAYS		*		11	
04110		•		**		DAY9				11	
						DAY10					11

TREATMENT	: 374 RF2	REPT	LICATE 28	3		
			ELOPHENTA	L STAGE		
	CASTRULA	TROCH	VEL	HIPPO	H, TING	N'NATE
DAYI	18					
DAY2	18					
DAY3		18				
DAY4			17			
DAY5				1.7		
DAY6				17		
DAY7				17		
DAY8				17		
DAY9					17	
TREATMENT	: 32% RP2	REP	LICATE 2/	`		
	GASTRULA	DEVI TROCH	ELOPMENTA "El	AL STAGE	H. FINC	N'NATE
DAYL	9					
DAY2	7					
DAY3		9				
DAY4				9		
DAY5				9		
DAY6					9	
DAY7					9	
DAYS					9	
DAY9					9	
DAYLO						9
	`					
TREATMENT	:100% RP?		LICATE 1			
	GASTRULA	DEV TROCH	VEL VEL	AL STACE HIPPO	H'LING	N'NATE
DAYL	15					
DAY2	15					
DAY3		15				
DAY4			1.5			
DAY5					15	
DAY6					15	
DAY7					15	
DAY8		•			15	
DAY9					15	
DAY10						15

L.							
:3	RIAL =6 VAL NOPOINT PEGIES	D E	COMMENCED EVELOPMENTAI GG : NUMBERS LYPTOPHYSA :	. CHARACT RAY	TERISTIC J DATA	S PAGE	ι.
т	REATHENT: CO	NTROL	REPI	JICATE 14			
	G <sub>A</sub>	STRULA	DEVI	ELOPHENTA VEL		H'LING	N'NATE
D	AY1	6	r no an				
0	AY2	7 6					
	AY3	5	,				
			3				
D.	AY4				3		
D.	AY5					2	
D.	AY6						2
							,
-	REATHENT: CO	WTDO!	250	10.75 \			
·			DEVI	LICATE 11 ELOPMENTA	AL STAG	E	
	GA AYl	STRULA 10	TROCH	VEL	HIPPO	H. FING	N' HATE
		8					
D	AY2	8 8					
D	AY3			8 7		•	•
D	AY4					8 7	
٥	AYS					, 1 7	
n	AY6					7	7
	A I G						7
ŤR	eathent : con	TROL	REPL	ICATE LC			
	CAS	TRULA	DEVE TROCH	LOPHENTAI VEL	L STAGE HIPPO	H, LINC	N'NATE
DA		9					n maid
		11 10					
DA	Y2	8					
DA	n	6	4				
			4 6				
DAY	(4				3		
DAY	<b>/</b> 5				6	_	
O.A.						2 3 6	
DAY	16					2	
						2	
DAY	17						2 2 5
							ń
TRE	ATMENT : CONT	ROL	REPLI	CATE ZA			
	CAST	RULA	DEVELO TROCH	PHENTAL VEL 1	STAGE	H. TING	11111
DAY	ı	13 14				n LING	B'NATE
DAY	,	14					
• • • • • • • • • • • • • • • • • • • •	•		12 14 11				
DAY3			••		10		
					12 11		
DAY4						10 11	
DAYS						8	
						10 11 8	
DAY6							10
DAY7						11 8	
							11 8

Appendix 7.b.3.

TREATHENT	: CONTROL	REPLICATE 2B				
	GASTRULA	DEVELOPMENTAL TROCH VEL	HIPPO	H, FINC	N' NATE	
DAYL	11					
DAY2	11 11					
DAY3		11				
DAY4			11			
DAYS			,	11		
DAY6				9 11		
DAY?				8	11	
	COUTOO				8	
TREATMENT		REPLICATE 2C DEVELOPMENTAL	STAGE			
DAYL	8	TROCH VEL	HIPPO	H, FING	N'NATE	
	5 9					
DAY2	8 5 9					
DAY3		9 4 9				
DAY4		5				
UN14		4	4			
DAY5				5 4 4		
DAY6				5 3 4		
DAY7				5 3 2		
8YAC					. 5 3 2	
TREATH	ENT: L% RP2	REPLICATE	1A			
	GASTRULA	DEVELOPMEN TROCH VEL	TAL STA HIPP	GE H'LIN	G N'NATE	•
DAY1	13 13 12					
DAY2	7 13 12					
DAY3	12	5 11 9				
DAY4		,	10	)		
DAY5				10	,	
DAY6				•		
				10	)	
DAYI					2 10 3	
TREAT	MENT: 1% RP2	REPLICATE	18			
	GASTRULA	DEVELOPHE TROCH VEL	NTAL STA	AGE	G N'NATE	
DAYL	10 11 13					
DAY2	10 11 13					
DAY3		3 11 11				
DAY4			1 1	3 1 1		
DAYS			•	1, 1	0	
DAY6				10		
DAY7				•	3 10 11	

TREATMEN	T:1% RP2	REP	LICATE 2A		
	GASTRULA	TROCH	ELOPMENTAL STACE VEL. HIPPO	H, FING	NIMATE
DAYL	10				
n. va	13				
DAY2	10 13				
DAY3	13	10			
DAY4			10		
DAYS			13	10	
				13	
DAY6				9 13	
DAY7				9 13	
DAYB					9
					10
FREATHE	NT:18 RP2	REI	PLICATE 28		
	CASTRULA	DE\ TROCH	VELOPMENTAL STAGE	H'LING	MINATE
DAYL	8	1110011			
	9 10				
DAY2	8 9				
	ıó				
DAY3		3 9			
DAY4	10		1		
UA14			3 9 10		
DAY5				3	
				10	
DAY6				3	
				10	
DAY7					3
					10
IKEAIMEN	T:3.2 * RP2		LICATE LA ELOPMENTAL STAGE		
	CASTRULA	TROCH	VEL HIPPO	H. TING	N' NATE
DAY1	10 10				
DAY2	10 10				
DAY3	•	10			
DAY4		3			
DA14			10 3		
DAY5				10 2	
DAY6					10
					2
TREATMENT	1:3.2 % RP2		ICATE 18		
	GASTRULA	тпосн	LOPMENTAL STAGE VEL HIPPO	H'LING	NUNATE
DAY1 DAY2	11 11				
DAY3	(1	10			
DAY4		••	10		
DAY5			•	10	
DAY6				10	
DAY7					10
TREATMENT	:3.2 % RP2	REPL	ICATE 1C		
	GASTRULA	DEVE TROCH	LOPMENTAL STAGE VEL HIPPO	H, FINC	N'NATE
DAYl	11				
DAY2		2			
DAY3		DEAD			
TREATMENT	:3.2 % RP2	REPL	ICATE ZA		
	CASTRULA	DEVE TROCH	LOPMENTAL STAGE VEL HIPPO	H'LING	N'NATE
DAYL	8			21,10	
DAY2	8				
DAY3		8			
DAY4			8	_	
DAY5				8	

TD 5 4 TM 5 W	T. 3 2 5 882	REPLICATE 2B			TREATH	ENT: LON RPZ	REI	PLICATE	2 B		
IKEAIMEN	1:3.2 ¶ KPZ					CASTRULA	DE'	VELOPMEN VEL	TAL STAGE	H.Tibo	. BIMALE
	GASTRULA	DEVELOPMENTAL STAGE TROCH VEL HIPPO H'LING	N'NATE		DAY1	11 12					
DAY1	14 14 13	·			DAY2	11 11 12					
DAY2	14 14 13				DAY3	11		11			
DAY3		13 14 8			DAY4			11	11		
DAY4		. 13 14 8			DAY5				12	11	
DAY5		13 14								12	
DAY6		8 13 14									
9AY7		8	13 14		DAY6					11	
		•	3							io	11
trea imen	T:3.2 % RP2	REPLICATE 2C			DAY7 ·						12
	GASTRULA	DEVELOPMENTAL STAGE TROCH VEL HIPPO H'LIN	G N'NATE		TREATM	ENT: 32% RP2	RE	PLICATE	la		
DAYL	8 7					GASTRULA	DE'	VELOPHEN VEL	TAL STAGE	H. FING	N'NATE
DAY2		<b>8</b> 7			DAYL	13 14					
DAY3		8 7			DAY2	12 13					
DAY4		8 7			DAY3		12				
DAY5		8 7			DAY4				12 13		
DAY6			8 7		DAY5					12	
				٠.	DAY6					11	
TREATME	INT: 10	REPLICATE 1A			DAY7					11	
	GASTRULA	DEVELOPHENTAL STAGE TROCH VEL HIPPO H'LI	G N'NATE		8YAD						11
DAY1	14										**
DAY2 DAY3		14			TREATMEN	T:100% RP2	DEVI	LICATE l ELOPMENT	AL STAGE		
DAY4		14			DAY1	GASTRULA 7	TROCH	VEL	HIPPO	H. FING	N' NATE
DAYS DAY6		10			DAY2		7				
DAY7		14	14		DAY3 DAY4				7	;	
TREATME	NT:10+ RP2	REPLICATE 18			DAY5					,	
	GASTRULA	DEVELOPMENTAL STAGE TROCH VEL HIPPO H'LIN	IC WHITE		DAY6					7	
DAYI	. 3	TROCK VEL HIPPO H. C.I.	C SUMIE		DAY7 DAY8					7	;
DAY2	6 3				54.10						,
DAY3	6 3				TREATHEN	T:100% RP2	DEV	LICATE L ELOPMENT	AL STAGE		
DAY4		6 3			DAYL	GASTRULA 13	TROCH	VEL	HIPPO	H'LING	N'NATE
DAY5		6 2			DAY2	13					
DAY6			s 2		DAY3	13		19			
DAY7		i	2		DAY4			12 13	11		
	ENT:10% RP2	REPLICATE 2A	6		DAY5				13		
IKEAINI		DEVELOPMENTAL STAGE	NO NINATE		DAY6					11	
DAYI	GASTRULA 12	TROCH VEL HIPPO H'L'	.no n naiz	•					•	11	
DAY2	5 10 10				DAY7					11	11 13
	10										13
DAY3	10	3 10									
DAY4		8 3									
DAY5		8	8 2								
DAY6			8								
			2								

### Appendix 7.c.1.

TREATHENT	CONTROL					
		MARK	ED		UNMARK	ED
	BEFORE	AFTER	NOSS	BEFORE	AFTER	*LOSS
REP 1A	256	250	2.3	131	116	11.5
REP 18	231	213	7.8	144	162	12.5
REP IC	125		-2.4	111	112	0.9
	237	128 243 139	2.5	121	121	.,,,
REP ZA	191	110	-2.3	127	121	-11
REP 28		139	· 2 . 5 27 . 2	127	141	
REP 2C	100	114	- 14	113	114	-0.5
TREATMENT	:1% RP2	MARK	ED		UNMARK	FD
	BEFORE		NLOSS	BEFORE	AFTER	
REP 1A	141	145	-2.3	172	117	4.1
REP 18	113	197	. 66 9	130	162	-16.5
REP IC	106	ioi		101 112 125 91	98	3
REP 2A		259	4.7 -5.5 0	101	,70	
REF ZA	243 151		.7.3	112	114 123 84	-1.8
REP 28		151	. 0	125	123	1.5
REP 2C	110	107	7.3	91	84	7.7
TO 5 . THE NT	. 1 21 002					
TREVISENT	:3.2% RP2	MARK	ED		UNMARK	£D.
	BEFORE	AFTER	11055	BEFORE	AFTER	
REP 1A	226	221	2.2	109	103	5.5
REP 18	148	149	-0.7	130	103 109 109 115 136	16.2
REP LC	204	191	6 4	116	100	6
REP 2A	191	158	1.6 0.8 14.9	118	115	2.5
REP 2B	132	131	0.8	122	115 136	-11.5
REF 2C	114	97	1/ 0	93	88	
KEF 2C	114	97	14.9	93	38	5.4
TREATHENT	:10% RP2					
		MARK	ED		UNHARK	ED .
	BEFORE	AFTER	LOSS	BEFORE	AFTER	1 LOSS
REP LA	187	167	10.7	175	130	4
REP 18	139	116	16.5	153	201	-31.4
REP 1C	106	149	-40.6	101	158 95	-56.4
DCD 24	144	148	-2.8	96	95	1
DED 38	123		. 6 5	127	131	3. Ĭ
REP 2A REP 28 REP 2G	108	122	·6.5	153 101 96 127 97	131 102	-5.2
TREATHENT	: 324 RP2					
		HAR			UNMARK	
	BEFORE	AFTER	*LOSS	BEFORE		*LOSS
REP LA	179	203	-13.4	99 121 122 115 152	171	-77.2
REP LB	175	190	-8.6	121	116	4.1
REP 1C	124	119		122	125	-3.3
REP ZA	124 258	286 164	-10.9	115	111	3.5
REP 2B	166	164	1 2	152	145	4.6
REP 2C	130	129	-10.9 1.2 0.8	117	DEAD	
KEF 2G	130	,	0.0	•••	0.01.0	
TREATMENT	:1004 RP2					
200000000000000000000000000000000000000		MARI	KED		UNMARI	CED
	BEFORE	AFTER	LOSS	BEFORE		\$LOSS
REP LA	182	183	0.5		130	.4.8
REP 18	168	167	0.5	139		-11.5
REP 1C	90	106	.17.8	141	155 149	-5.7
REP 2A	198	106 205	-17.8 -3.5	ioi	114	-12.9
REP 2B	104	126	-21.2	124	135	8.9
REP 2G	113	DEAD	- 2 2 . 2	93	109	-17.2

Appendix 7.c.3.

TRIAL =6 VALIDATION CONHENCED 12/4/91 PAGE 1 ENDOONNY: VEICHT LOSS IN EXPOSED ADULTS IN MILLIGRAMS SPECIES GLYPTOPHYSA SP.

	CONTROL	MARK	E.D		UNMARKE	ED 0.3
	BEFORE	AFTER	LOSS	BEFORE 375 364	AFTER	\$LOSS
REP LA	353	314	11	375	331	11.3
REP 18	316	297	6	364	329	9.6
REP LC	333	305 350	8.4	357	315	11.8
REP ZA	383	350	8.6	421	402	4.5
REP 2B REP 2C	294	284 298	3.4	342	310	9.4
REP 2C	333 383 294 316	298	5.7	364 357 421 342 254	253	3.9
TREATHENT	:14 RP2					
		MARK	ED		UNHARKI	
	BEFORE	AFTER	LOSS	BEFORE	AFTER	LOSS
REP LA	386	377	2.3	337	314	6.8
REP 18	340 330 424 313 296	377 321 319 397 308 297	5.6	337 368 318 273 392 286	314 341 296 297 388	7.3
REP 1C REP 2A REP 2B	330	319	3.5	318	296	6.9
REP ZA	424	397	6.4	273	297	-8.8
REP ZB	31.3	108	1.6	392	388	1
REP 2C	296	297	-0.3	286	258	9.8
TREATHENT	:3.2% RP2	MARK	rn.			
	REFORE	AFTER	41000	REFORE	UNMARK	ED
REP IA	327	302	7 6	120	AFTER	10055
REP LB	410	403	1.7	154	308 349.	3.8
REP 1C	319	292	a ś	307	100	2
REP 1B REP 1C REP 2A	344	321	6.7	181	369	0.7 3.7
REP 28 REP 2C	367	367	0.,	426	421	1.2
REP 2C	298	315	-5.7	BEFORE 320 356 307 383 426 283	283	
TREATMENT		HAR	ED		UNMARK	
	BEFORE	HAR) AFTER	ED LOSS	BEFORE	AFTER	*LOSS
REP 1A	BEFORE 388	HARI AFTER 192	VLOSS	BEFORE 334	AFTER 320	*LOSS
REP 1A REP 1B	BEFORE 388	AFTER 392	·Loss	BEFORE 334 378	AFTER 320	*LOSS 4.2 0.5
REP 1A REP 1B REP 1C	BEFORE 388	AFTER 392	·Loss	BEFORE 334 378 296	AFTER 320	*LOSS 4.2 0.5 0.7
REP 1A REP 1B REP 1C REP 2A	BEFORE 388	AFTER 392	·Loss	BEFORE 334 378 296	AFTER 320	*LOSS 4.2 0.5 0.7 -5.1
REP 1A REP 1B REP 1G REP 2A REP 2B	BEFORE 388	AFTER 392	·Loss	BEFORE 334 378 296 350 417	AFTER 320	*LOSS 4.2 0.5 0.7 -5.1 4.3
REP 1A REP 1B REP 1C REP 2A REP 2B	BEFORE 388	AFTER 392	·Loss	BEFORE 334 378 296 350 417 296	AFTER 320	*LOSS 4.2 0.5 0.7 -5.1
TREATMENT REP 1A REP 1C REP 2A REP 2B REP 2C TREATMENT	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	BEFORE 334 378 296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8
REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8
REP 1A REP 1B REP 1G REP 2A REP 2B REP 2C	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8
REP 1A REP 1B REP 1C REP 2A REP 2A REP 2C TREATHENT	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8
REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C TREATHENT REP 1A REP 1B	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 **ED
REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C TREATHENT REP 1A REP 1B	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 *LOSS 5 1.6 0.9
REP 1A REP 1B REP 1G REP 2A REP 2B REP 2C TREATHENT REP 1A REP 1A REP 1B REP 1C REP 1C	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 *ED *LOSS 5 1.6 0.9 6.8
REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C  TREATHENT REP 1A REP 1B REP 1C REP 2A REP 2B	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	296 350 417 296	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ***********************************
REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C	BEFORE 388 385 305 391 408 346	AFTER 392 373 295 382 402 343	1LOSS -1 3.1 3.3 2.3 1.2 0.9	BEFORE 334 378 296 350 417 296 BEFORE 334 379 350 368 374 279	AFTER 320 376 286 368 400 276	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 *ED *LOSS 5 1.6 0.9 6.8
REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C TREATHENT REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C	BEFORE 388 385 305 391 408 346	AFTER 192 171 295 382 402 343 HARL AFTER 1346 1320 283	*LOSS -1 3.3 2.3 1.2 0.9 *LOSS 1.3 -0.6 2.4 -1.7 -6.7 -1.8	296 350 417 296	AFTER 320 176 286 368 400 276 UNMARK AFTER 317 373 347 343 370 269	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ** **LOSS 5 1.6 0.9 9 6.8 1.1 3.7
REP 1A REP 1B REP 1C REP 2A REP 2B REP 2C TREATHENT REP 1A REP 1A REP 1C REP 2A REP 2A REP 2B REP 2C	BEFORE 388 385 305 391 408 346 ::32% RP2 BEFORE 307 344 317 401 343 278	AFTER 392 373 382 402 343 HARJ AFTER 303 346 329 408 320 283	*LOSS -1 3.1 3.3 2.3 1.2 0.9 *LOSS 1.3 -0.6 2.4 -1.7 6.7 -1.8	350 417 296 BEFORE 334 379 350 368 374 279	AFTER 320 376 286 400 276 UNMARW AFTER 317 373 343 370 269	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ** **LOSS 5 1.6 6.8 1.1 1.3 7.7
REP 1A REP 1B REP 1C REP 2A REP 2C  TREATHENT REP 1B REP 1B REP 1C REP 1C REP 2B REP 2C  TREATHENT	BEFORE 388 385 305 391 408 346 ::32% RP2 BEFORE 307 344 317 401 343 278	AFTER 392 373 382 402 343 HARJ AFTER 303 346 329 408 320 283	*LOSS -1 3.1 3.3 2.3 1.2 0.9 *LOSS 1.3 -0.6 2.4 -1.7 6.7 -1.8	350 417 296 BEFORE 334 379 350 368 374 279	AFTER 320 376 286 400 276 UNMARW AFTER 317 373 343 370 269	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ** **LOSS 5 1.6 6.8 1.1 1.3 7.7
REP 1A REP 1A REP 1C REP 2A REP 2C  TREATHENT REP 1A REP 1B REP 1C REP 2A REP 1B REP 2C  TREATHENT	BEFORE 388 385 305 391 408 346 ::32% RP2 BEFORE 307 344 317 401 343 278	AFTER 392 373 382 402 343 HARJ AFTER 303 346 329 408 320 283	*LOSS -1 3.1 3.3 2.3 1.2 0.9 *LOSS 1.3 -0.6 2.4 -1.7 6.7 -1.8	350 417 296 BEFORE 334 379 350 368 374 279	AFTER 320 376 286 400 276 UNMARW AFTER 317 373 343 370 269	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ** **LOSS 5 1.6 6.8 1.1 1.3 7.7
REP 1A REP 1B REP 1C REP 2A REP 2A REP 2C TREATHENT REP 1A REP 1B REP 1C REP 1C REP 2C TREATHENT REP 2C TREATHENT	BEFORE 388 385 305 391 408 346 ::32% RP2 BEFORE 307 344 317 401 343 278	AFTER 392 373 382 402 343 HARJ AFTER 303 346 329 408 320 283	*LOSS -1 3.1 3.3 2.3 1.2 0.9 *LOSS 1.3 -0.6 2.4 -1.7 6.7 -1.8	350 417 296 BEFORE 334 379 350 368 374 279	AFTER 320 376 286 400 276 UNMARW AFTER 317 373 343 370 269	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ** **LOSS 5 1.6 6.8 1.1 1.3 7.7
REP 1A REP 1A REP 1C REP 2A REP 2C  TREATHENT REP 1A REP 1B REP 2C  TREATHENT REP 2A REP 2C  TREATHENT REP 2A REP 2C  TREATHENT	BEFORE 388 385 305 391 408 346 ::32% RP2 BEFORE 307 344 317 401 343 278	AFTER 392 373 382 402 343 HARJ AFTER 303 346 329 408 320 283	*LOSS -1 3.1 3.3 2.3 1.2 0.9 *LOSS 1.3 -0.6 2.4 -1.7 6.7 -1.8	350 417 296 BEFORE 334 379 350 368 374 279	AFTER 320 376 286 400 276 UNMARW AFTER 317 373 343 370 269	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ** **LOSS 5 1.6 6.8 1.1 1.3 7.7
REP 1A REP 1B REP 1C REP 2A REP 2A REP 2C TREATHENT REP 1A REP 1B REP 1C REP 1C REP 2C TREATHENT REP 2C TREATHENT	BEFORE 388 385 305 391 408 346 ::32% RP2 BEFORE 307 344 317 401 343 278	AFTER 392 373 382 402 343 HARJ AFTER 303 346 329 408 320 283	*LOSS -1 3.1 3.3 2.3 1.2 0.9 *LOSS 1.3 -0.6 2.4 -1.7 6.7 -1.8	296 350 417 296	AFTER 320 376 286 400 276 UNMARW AFTER 317 373 343 370 269	*LOSS 4.2 0.5 0.7 -5.1 4.3 6.8 ** **LOSS 5 1.6 6.8 1.1 1.3 7.7

### Appendix 7.c.2.

TRIAL #6 VALIDATION COMMENCED 12/4/91 PAGE 1 ENDPOINT: FEIGHT LOSS IN EXPOSED ADULTS IN HILLIGRAMS SPECIES A. cummingii

TREATMENT	:CONTROL					
	0.5505.5	MARI			UNMAR.	
	BEFORE				AFTER	*LOSS
REP 1A	292	261	10.6		271	7.3
REP 1B	221	230	-4.1	264	231	12.5
REP 1C	253	240	13 24 10	233	204	12.4
REP 2A	252	228	24	218	194	12.4
REP 7B	255	245	10	285	275	3.5
REP 2C	252 255 177	228 245 191	-14	200	200	3.3
TREATHENT	11 RP2					
		MAR!	ED		UNMARI	/Fn
	BEFORE	AFTER	LOSS	BEFORE		*LOSS
REP 1A	263	247	6.1	284	292	-2.3
REP 1B	284	277	2.5	247	248	
REP 1C	162	186	-14.3			-0.4
REP 2A	239	237	- 14.5	259	230	11.2
REP 2B			0.8	214	221	- 3 . 2
	238	234	1.7	265	263	0.3
REP 2C	201	189	6	223	214	4
TREATMENT:	3.2% RP2					
		MARK	FD		UNMARK	
	BEFORE	AFTER	22014	BEFORE		
REP LA	198	186	6.1	242	AFTER	
REP 18	229	200	12.7	242	230	5
REP LC	232	195		258	265	-2.7
REP 2A		742	15.9	188 208	212	-12.3
	240	253	-5.4	208	268	-28.8
REP 2B	241	221	8.3	248	247	0.4
REP 2C	199	210	8.3 -5.5	248 222	240	-8.1
TREATHENT :	LON RP2					
		MARKI			UNMARK	
	BEFORE		NLOSS	BEFORE	AFTER	
REP 1A	251	258	-2.8	212	221	-4.2
REP 1B	274	256	6.6	256	268	-4.7
REP 1C	229	241	-5.2	201	203	0
REP 2A	277	278	-0.4	203 234	236	-0.9
REP 2B	234	237	-1.3	227	220	3.1
REP 2C	188	185	1.6	186	199	- 7
TREATHENT:	323 RP2					
		MARK	FD		UNMARK	ED
	BEFORE	AFTER		BEFORE	AFTER	
REP 1A	224	210				
		219	2.2	239	217	9.2
REP 1B	254 197	235	7.5 17.3 6.3	217	174	19.8
REP 1C	197	163 207	17.3	214	198	7.5
REP 2A	221	207	6.3	215	208	3.2
REP 2B	259	251	3.1	253	241	9.4
REP 2C	208	251 212	3.1	237	241 223	5.9
TREATMENT:	1009 892				•	
		MARK	ED		UNMARK	FD
	BEFORE		*LOSS	BEFORE	AFTER	
	DEFURE	AFICK	2.3		255	
				273		6.5
REP 1A	252	245	2.3	111		
REP 1B	252 264	245	7.2	272	235	13.6
REP 1B REP 1C	252 264 192	245 180	7.2 6.3	272 205	235 193	13.6
REP 1B REP 1C	252 264	245	7.2 6.3 3.4	272 205 222	235	13.6 6.3 4.5
	252 264 192	245 180	7.2 6.3	272 205	235 193	13.6

ENDPOINT:	CALIDATION	COMMENCE	D 12/4/9	L PAGE I		
SPECIES	A. carinat	TAL EMBRYO	NIC MORT	ALITY		
treathent	:CONTROL GASTRULA	DE'	VELOPMEN VEL	TAL STAGE HIPPO H	RAW ('LING :	DATA
REP IA						
REP 1B				PE	RCENTILE (	DATA
REP LA						
REP 1B						
TOTAL	0	0	0	0	0	0
PERCENT.	0	0	0	0	0	0
TREATMENT	:CONTROL CASTRULA	TROCH	VELOPMEN VEL	TAL STAGE HIPPO		DATA
REP 2A						_
REP 2B REP 2G						2
= *				PE	RCENTILE I	
REP JA						
REP 28 REP 20						5 5.3
TOTAL	. 0	0	0	- 0	0	3.3
PERCENT.	0	0	0	. 0	0	3.9
PO C 1 THE ST.	.14 200	<b>5</b>	iei oruz		9.41	DeT:
REATMENT	GASTRULA	TROCH	VELOPMENT	TAL STAGE HIPPO H		DATA STAN'
REP LA						
<del>-</del>				PER	CENTILE D	ATA
EP 1A						
REP 18	•	•		•	2	_
OTAL PERCENT.	0	0	0	. 0	0	0
REATMENT				AL STAGE		DATA
REP ZA	CASTRULA	TROCH	VEL	HI PPO H	'LING N	'NATE
EP 2B						
EP 2C						
PED 74				PER	CENTILE O.	ATA
EP 2A			٠			
EP 2C	•					
OTAL	0	o	0	0	0	0
PERCENT.	0	0	0	0	0	0
TREATMENT	:3.2% RP2 GASTRULA	TROCH	VELOPHENT VEL	TAL STAGE HIPPO H	I. TING V	DATA
REP LA REP LB	1					
	1			PER	CENTILE C	ATA
REP LA						
REP IB	1.8					
POTAL	1	ů o	0	0	0	9
ercent.	3.6		0	0	0	ο
OCITHENT	:3.2% RP2 GASTRULA	TROCH	VELOPHENT VEL	TAL STAGE HIPPO H	RAU I'LING N	/ DATA /'NATE
. REALINEOL						
REP ZA						
				PFR	CENTILE C	ATA
REP ZA				PEF	CENTILE C	ATA
REP 2A REP 28				PEF	CENTILE C	ATA
REP 2A REP 2B		o	0	PEF O	O SJITMBO	

TREATMENT	104 RP2	DI	VELOPHEN:	TAL STAGE		
REP IA	SASTRULA	TROCH	7EL	HIPPO	H. FING KA	N'DATA
REP 18						
REP 1A				28	RCENTILE	DATA
REP LB						
TOTAL	ō	0	ij	0	ı)	,
PERCENT.	0	0	ŋ	0	0	.) a
TREATMENT :1					-	.,
	STRULA	TROCH	ELOPMENTA VEL	L STAGE HIPPO H	RAU I'LING N	ATAC STAC'
REP 2A						
				PER	CENTILE D	ATA
REP ZA						
TOTAL	0	0	o	0	o	0
PERCENT.	0	0	0	0	o	0
TREATMENT :1		DEV	ELOPMENTA	J. STACE	941	DATA
	STRULA	TROCH	VEL	HIPPO F	I'LING N	NATE
REP 1A				4		
REP LA					CENTILE D	ATA
WELL IN				100		
TOTAL				4		
PERCENT.				100		
Appendix 7.	d.2.					
TRIAL #6 3	ALIDATION SEVELOPMENT	COMMENCE	D 12/4/91	l KLITY	PAGE 1	
	t. cumming					
TREATMENT	CONTROL		VELOPHENT			W DATA
	CONTROL GASTRULA	DE TROCH	VELOPHENT VEL	TAL STAGE HIPPO		W DATA N'NATE
REP LA	GASTRULA		VEL			
	CONTROL GASTRULA		VELOPMENT VEL 1			
REP LA	GASTRULA		VEL			
REP LA	GASTRULA		VEL	HIPPO		N'NATE
REP LA	GASTRULA		VEL	HIPPO	H'LING	N'NATE
REP LA REP LB REP LG	GASTRULA 1		VEL	HIPPO	H'LING	N'NATE
REP LA REP LG REP LG	GASTRULA 1		VEL	HIPPO	H'LING	N'NATE
REP LB REP LG REP LA REP LB	GASTRULA 1		VEL	HIPPO PE	RCENTILE	N'HATE
REP LA REP LG REP LA REP LB REP LB	S.9	TROCH	VEL 1 5.9	HIPPO PE	H'LING	N'NATE
REP LB REP LG REP LA REP LB REP LC TOTAL	S.9	TROCH	VEL 1 5.9	HIPPO PE	H'LING REENTILE	N'NATE  DATA
REP 1A REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.	S.9	TROCH  0 0	5.9 1 1.4	PE 0 0	H'LING  CROENTILE	DATA  O O
REP 1A REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.	1 5.9 1 1.4	TROCH  0 0	5.9 1 1.4	PE 0 0	H'LING  RGENTILE	DATA  O O
REP LA REP LG REP LA REP LB REP LG TOTAL PERCENT.	S.9	TROCH  0 0	5.9 1 1.4	PE 0 0	H'LING  CROENTILE	DATA  O O
REP 1A REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT. TREATMENT: REP 2A	S.9	TROCH  0 0	S.9  1 1.4  VELOPMENT VEL	HIPPO  PE  O  O  AL STACE HIPPO	H'LING  CROENTILE	DATA  O O
REP 1A REP 1G REP 1A REP 1B REP 1C TOTAL PERGENT. TREATMENT: REP 2A REP 2B	S.9	TROCH 0	S.9  1 1.4  VELOPMENT VEL	PE O O AL STACE HIPPO	H'LING  CROENTILE	DATA  DATA  DATA  DATA  DATA  N' NATE
REP 1A REP 1G REP 1A REP 1B REP 1C TOTAL PERGENT. TREATMENT: REP 2A REP 2B	S.9	TROCH 0	S.9  1 1.4  VELOPMENT VEL	PE O O AL STACE HIPPO	H'LING CREENTILE O O O H'LING	DATA  DATA  DATA  DATA  DATA  N' NATE
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT. TREATMENT: REP 2A REP 2B REP 2C	S.9	TROCH 0	S.9  1 1.4  VELOPMENT VEL	PE O O AL STACE HIPPO	H'LING CREENTILE O O O H'LING	DATA  DATA  DATA  DATA  DATA  N' NATE
REP LA REP LG REP LG REP LA REP LB REP LC TOTAL PERCENT. TREATMENT: REP 2A REP 2B REP 2C	S.9	TROCH 0	VEL  S.9  1 1.4  VELOPHENT VEL  4	PE O O AL STAGE HIPPO 5	H'LING CREENTILE O O O H'LING	DATA  DATA  DATA  DATA  DATA  N' NATE
REP LA REP LG  REP LA REP LA REP LC  TOTAL PERCENT.  TREATMENT: REP 2A REP 2B REP 2C  REP 2A REP 2A	S.9	TROCH 0	S.9  1 1.4  VELOPHENT VEL 4	PE  O  O  AL STAGE HIPPO  5  P	H'LING O O H'LING RA'	DATA  O  DATA  DATA  DATA
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT. TREATMENT: REP 2A REP 2B REP 2C REP 2A REP 2C	1  5.9  1 1.4  CONTROL GASTRULA	O O DE	VEL  S.9  1 1.4  VELOPHENT VEL  4	PE O O AL STAGE HIPPO 5	H'LING CREENTILE O O O H'LING	DATA  DATA  DATA  DATA  DATA  N' NATE
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT. TREATMENT: REP 2A REP 2B REP 2C REP 2B REP 2C TOTAL	S.9  1 1.4  CONTROL GASTRULA	O O DE'TROCH	S.9  1 1.4  VELOPHENT VEL 4	PE  O O O AL STACE HIPPO  S P 11.1	H'LING O H'LING RA' H'LING O	DATA  O  DATA  O  DATA  O  DATA
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT. TREATMENT: REP 2A REP 2B REP 2C REP 2B REP 2C TOTAL	GASTRULA  1  5.9  1 1.4  CONTROL GASTRULA	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O  O  AL STACE HIPPO  5  P  11.1	H'LING CREENTILE  O O O O	DATA  DATA  DATA  DATA  DATA  O O
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.  TREATMENT: REP 2A REP 2B REP 2C REP 2A REP 2B REP 2C TOTAL PERCENT.	S.9  1 1.4  CONTROL GASTRULA	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O  O  AL STACE HIPPO  5  P  11.1	H'LING O H'LING RAM ERCENTILE O O H'LING RAM H'LING	DATA  DATA  DATA  DATA  DATA  O O
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.  TREATMENT: REP 2A REP 2B REP 2C TOTAL PERCENT.  TREATMENT: TREATMENT	S.9  1 1.4  CONTROL GASTRULA  0 0 0	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O  O  AL STACE HIPPO  5  P  11.1	H'LING  RACENTILE  O  O  H'LING  A'LING  1	DATA  DATA  DATA  DATA  DATA  O O
REP 1A REP 1B REP 1G REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT. TREATMENT: REP 2A REP 2B REP 2C TOTAL PERCENT. TREATMENT TREATMENT TREATMENT	GASTRULA  1  5.9  1 1.4  CONTROL GASTRULA	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O  O  AL STACE HIPPO  5  P  11.1	H'LING  RACENTILE  O  O  H'LING  1  2	DATA  DATA  DATA  DATA  DATA  O O
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.  TREATMENT: REP 2A REP 2B REP 2C TOTAL PERCENT.  TREATMENT: TREATMENT	S.9  1 1.4  CONTROL GASTRULA  0 0 0	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O  O  AL STACE HIPPO  5  P  11.1	H'LING  RACENTILE  O  O  H'LING  A'LING  1	DATA  DATA  DATA  DATA  DATA  O O
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.  TREATMENT: REP 2A REP 2B REP 2C TOTAL PERCENT.  TREATMENT TREATMENT TREATMENT REP 1A REP 1A REP 1B REP 1C	S.9  1 1.4  CONTROL GASTRULA  0 0 0	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O O AL STACE HIPPO  S P 11.1  TAL STACE HIPPO	H'LING  RACENTILE  O  O  H'LING  1  2	DATA  O O O O O O O O O O O O O O O O O O O
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.  TREATMENT: REP 2A REP 2B REP 2C TOTAL PERCENT.  TREATMENT TREATMENT REP 1A REP 1A REP 1B REP 1C	1 5.9 1.4 CONTROL GASTRULA 0 0 0 1.14 RP2 GASTRULA 1	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O O AL STACE HIPPO  S P 11.1  TAL STACE HIPPO	H'LING  O  RA H'LING  RY H'LING  1  2  1	DATA  O O O O O O O O O O O O O O O O O O O
REP 1A REP 1B REP 1G REP 1A REP 1B REP 1C TOTAL PERCENT.  TREATMENT: REP 2A REP 2B REP 2C TOTAL PERCENT.  TREATMENT TREATMENT TREATMENT REP 1A REP 1A REP 1B REP 1C	S.9  1 1.4  CONTROL GASTRULA  0 0 0	O O DE TROCH	VEL  1  5.9  1 1.4  VELOPMENT  VEL  4  9.3	PE  O O AL STACE HIPPO  S P 11.1  TAL STACE HIPPO	H'LING  O O H'LING  I CREENTILE  O O O RA H'LING I CREENTILE	DATA  O O O O O O O O O O O O O O O O O O O

TOTAL PERCENT.

1,3

TREATMENT: 1 G	N RP2 ASTRULA	DEV TROCH	VELOPHENTA VEL	AL STAGE HIPPO	PA H1LING	DATA N'NATE
REP CA			1	1		
REP 18			3	2	1	
REP 2C				PE	RCENTILE	DATA
REP 2A			2.5	2.5		
REP 28			5.9	3.9	2	
			•			
REP 2C						
TOTAL	0	o	4	3	1	0
PERCENT.	9	0	3.2	2.4	0.8	o
TREATHENT:	3.2% RP2 CASTRULA	DE TROCH	VELOPMENT VEL	AL STACE HIPPO	H, L'INC L'	ATAD WATA
REP IA			ı			
REP 18			1			
REP 1C		1		2		
				PE	RCENTILE	DATA
REP IA			7.7			
REP 18			2.3			
REP 10		2.6		5.3		
TOTAL	0	ı	2	2	0	9
PERCENT.	0	1.1	2.1	2.1	0	0
	•					
TREATMENT : 3	ASTRULA	DE'	VELOPMENT	AL STACE	R.A	₩ DATA
		IROCH		HIPPO	H, FING	N. NATE
REP 2A	2 ·		3			
REP 2B	1	1				
REP 2C			1	1		
				PE	RCENTILE	DATA
REP 2A	8.7		1.3			
REP 2B	4.8	4.8				
REP 2C			5.9	5.9		
TOTAL	3	1	4	1	0	0
PERCENT.	4.9	1.6	6.6	1.6	0	0 .
TREATMENT:		DE	VELOPMENT	AL STAGE	R.	ATA WATA
	CASTRULA	TROCH		HIPPO	H, FINC	N'NATE
REP 1A		1	2			
REP 1B			1	1		
REP 1C	1					
				99	ERCENTILE	DATA
REP 1A		7.1	1.4			
REP 18			2.5	2.5		
REP 1C	4.8					
				_	_	_
TOTAL	1	1	3	1	0	0
PERCENT.	1.3	1.3	4	1.3	0	0
T0 64 TUTOT .	0.000		121 0 0 0 0 0 0 0 0	A1 CT.OF	-	
TREATHENT:	CASTRULA	TROCH	VELOPHENT VEL	HIPPO	H, LINC	N'NATE
REP ZA				1		
REP 28				ı		
					DCCNTII C	0474
	•				RCENTILE	AUTA
REP 2A				7.1		
REP 2B				7.1		
TOTAL	o	0	o	2	0	0
PERCENT.	9					
· caveni.	u	.0	0	7.1	0	0
TREATMENT:	32% RP2	DE	VELOPMENT	AL STAGE		AW DATA
	CASTRULA	TROCH	VEL	HIPPO	H'LING	
REP 1A	ı		ı			
REP 1B				ı		
				PI	ERCENTILE	DATA
REP 1A	7.7		7.7			
REP 18				5.6		
			-			•
TOTAL	1	0	1	1	0	0
DEDCENT	2 1	•	1 2	1 2	9	0

PERCENT.

3.2

TREATMENT	32% RP2 GASTRULA	DEVI	ELOPMENTAI VEL	STAGE HIPFO	RAS H'LING	J DATA BUNATE
REP 2A						
				PE	RCENTILE	DATA
REP 2A						
TOTAL	0	0	0	0	0	0
PERCENT.	0	0	0	0	0	0
TREATMENT	T:100% RP2 GASTRULA		VELOPMENTA VEL	AL STAGE HIPPO	RA H'LING	W DATA
REP IA						
,				P	ERCENTILE	DATA
REP 1A						
JATOT	o	0	0	0	0	0
PERCENT.	0	0	0	0	0	0

PERCENT.

TRIAL #6 VALIDATION COMMENCED 12/4/91 PAGE 1 ENDPOINT: DEVELOPMENTAL EMBRYONIC MORTALITY SPECIES CLYPTOPHYSA SP.

SPECIES C	EVELOPMENT LYPTOPHYSA	TAL EMBRYO A SP.	HIC MORTA	LITY		
	ASTRULA	TROCH	VELOPMENT VEL	HIPPO	H'LING RAG	J DATA N'NATE
REP LA	2	4		2		
REP IC	2	7	1	i i	3	
NET TO	,	•			RCENTILE	DATA
REP LA	15.3	30.8		15.3	ROGIVIES	2010
REP 18	22.2		11.1	11.1		
REP LC	30	23.3		3.3	10	
						_
TOTAL PERCENT.	13 21.3	11 18	1 1.6	6.6	4.9	0
PERCENT.	21.3	10	1.0	0.0	4.7	v
TREATMENT:	CONTROL	TROCH 4	VELOPMENT VEL	AL STAGE HIPPO		J DATA N'NATE
REP 2B		4	2	1	,	
REP 2C		1	8	•	3	
				. PE	RCENTILE I	DATA
REP 2A		9.8		9.8	7.3	
REP 28			9.1	4.5		
REP 2C		4.5	36.4		13.6	
TOTAL	0		10		,	
PERCENT.	. 0	5	10	4.2	6	0
PERCENT.	U	5.3	10.5	4.2	6.3	0
TREATMENT: 1			ELOPMENTA VEL	L STAGE HIPPO 1	RAW I'LING N	DATA 'NATE
REP IA	STRULA 6	TROCH 7	4	4	1 11.10	inte
REP 1B	٠	9	-		ı	
KSF 15				PER	CENTILE DA	.TA
REP 1A	15.8	18.4	10.5			
REP 1B		26.5			2.9	
			_			2
TOTAL PERCENT.	6 8.3	16 22.2	4 5.6	.i. 5.6	1.4	ر. ن
PERCENT.	0.3	22.2	3.5	3.6		Ü
TREATMENT:	ASTRULA	DE <sup>1</sup> TROCH	VELOPMENT/ VEL	AL STAGE HIPPO	RAW H' LING 1	DATA UMBATE
REP 28		5			•	
				PER	CENTILE D	ATA
REP 2A					4.3	
REP 28		17.9				
	_	_				
TOTAL	0	5	0	0	1	0
PERCENT	0	9.3	0	0	2	ij
TREATMENT	3.2% RP2 CASTRULA	TROCH	EVELOPMENT VEL	TAL STAGE HIPPO	RA H'LINC	W DATA N'NATE
REP 1A		7			ι	
REP 18		1				3
REP 1C		t <b>L</b>				
REP 1A		35		PE	RCENTILE 5	DATA
REP 18		9.1			•	27.3
REP LC		100				
TOTAL	0	19	0	. 0	ı	3
PERCENT.	0	45.2	0	0	2.4	7.1
TREATMENT	;3.21 RP2 CASTRULA	· TROCH	EVELOPMENT VEI.	TAL STAGE HIPPO	RA H'LING	U DATA N'NATE
REP 2B		6				
REP 2C					********	Da Ta
REP 2A				PE	RCENTILE	DAIA
REP 2B		14.6				
REP 2C						
TOTAL	0	6	0	0	0	0
			_	_	_	_

•	:10% RP2 GASTRULA	DE TROCH	VEL VELOTMENT	TAI. STAGE HIPPO	H. FING	NY DATA N'NATE
PEP 1A						
REP 1B				1		
				PE	RCENTILE	DATA
REF LA				11.1		
REP 1B						
TOTAL.	0	0	ŋ	1	:)	*1
PERCENT.	0	9	4)	4.3	0	J
TREATMENT	:10% RP2 CASTRULA	TROCH	EVELOPMEN VEL	TAL STAGE HIPPO	H, FINC	AV DATA DIDATE
REP 2A		2	2	2		
REP 2B				1		
					ERGENTILE	DATA
REP 2A		7.4	7.4	7.4	SKGS.V(1LE	UNIX
REP 2B		/. <del>-</del>	7.4	2.9		
KEI 23				2.9		
TOTAL	0	2	2	3	1)	ŋ
PERCENT.	0	3.3	3.3	4.9	.)	•)
TREATMENT		_			_	
IREAIMENT	GASTRULA	TROCH	VET.	TAL STAGE HIPPO	H, LINC S	ATAD WA ATARI'R
REP 1A	1				ı	
				Р	ERCENT I LE	DATA
REP 1A	3.7				3.7	
TOTAL	1	0	0	0	1	υ
TOTAL PERCENT.	1 3.7	0	0	0	1 3.7	ů
PERCENT.	3.7 100% RP2	O DE	0 VELOPMENT	O AL STAGE	3.7	u W DATA
PERCENT.  TREATHENT:	3.7	0	O VELOPMENT VEL	O AL STAGE HIPPO	3.7 RA	Ų
PERCENT.	3.7 100% RP2	O DE	0 VELOPMENT	O AL STAGE HIPPO I	3.7 RA H'LING	O W DATA N'NATE
PERCENT.  TREATMENT:  G  REP la	3.7 100% RP2	O DE	O VELOPMENT VEL 1	O AL STAGE HIPPO 1 PE:	3.7	O W DATA N'NATE
PERCENT.  TREATHENT:	3.7 100% RP2	O DE	O VELOPMENT VEL	O AL STAGE HIPPO I	3.7 RA H'LING	O W DATA N'NATE
PERCENT.  TREATMENT:  G  REP la	3.7 100% RP2	O DE	O VELOPMENT VEL	O AL STAGE HIPPO 1 PE: 14.3	3.7 RA H'LING RCENTILE	U DATA N'SATE
PERCENT.  TREATMENT: G REP LA  REP LA	3.7 100% RP2 ASTRULA	O DE TROCH	O VELOPMENT VEL 1	O AL STAGE HIPPO 1 PE: 14.3	3.7 RA H'LING RCENTILE	U DATA N'SATE DATA O
PERCENT.  TREATHENT: G REP LA	3.7 100% RP2 ASTRULA	DE TROCH	O VELOPMENT VEL	O AL STAGE HIPPO 1 PE: 14.3	3.7 RA H'LING RCENTILE	U DATA N'SATE
PERCENT.  TREATMENT: G REP LA  REP LA	3.7 100% RP2 ASTRULA 0	O DE TROCH	O VELOPMENT VEL 1	0  AL STAGE HIPPO  1  PE: 14.3  1 14.3	3.7  RA H'LING  RCENTILE  0	U DATA N'SATE DATA O
PERCENT.  TREATMENT: G REP LA  REP LA  TOTAL PERCENT.  TREATMENT:	3.7 100% RP2 ASTRULA 0	O DE TROCH	O VELOPMENT VEL 1	0  AL STAGE HIPPO  1  PE: 14.3  1 14.3	3.7  RA H'LING  RCENTILE  0	W DATA NY NATE DATA 0
PERCENT.  TREATMENT: G REP LA  REP LA  TOTAL PERCENT.  TREATMENT:	3.7 100% RP2 ASTRULA 0 0	O DE	O VELOPMENT VEL 1 14.3 14.3 VELOPMENT.	O AL STAGE HIPPO 1 PE: 14.3 1 14.3 AL STAGE	3.7  RA H'LING  RCENTILE  0  0  RA	W DATA WY NATE DATA O O
PERCENT.  TREATMENT: G REP LA  REP LA  TOTAL PERCENT.  TREATMENT:	3.7 100% RP2 ASTRULA 0 0	O DE	O VELOPMENT VEL 1 14.3 14.3 VELOPMENT.	O  AL STAGE HIPPO  1 PE: 14.3  1 14.3  AL STAGE HIPPO	3.7  RA H'LING  RCENTILE  0  0  RA	W DATA N'NATE DATA O O O W DATA
PERCENT.  TREATMENT: G REP LA  REP LA  TOTAL PERCENT.  TREATMENT:	3.7 100% RP2 ASTRULA 0 0	O DE	O VELOPMENT VEL 1 14.3 14.3 VELOPMENT.	O  AL STAGE HIPPO  1 PE: 14.3  1 14.3  AL STAGE HIPPO	3.7  RA H'LING  RCENTILE  O  O  RA H'LING	W DATA N'NATE DATA O O O W DATA
PERGENT.  TREATMENT: G REP 1A  TOTAL PERCENT.  TREATMENT: C REP 2A  REP 2A	3.7 100% RP2 ASTRULA 0 0	O DE	O VELOPMENT VEL 1 14.3 14.3 VELOPMENT.	O  AL STAGE HIPPO  1 PE: 14.3  1 14.3  AL STAGE HIPPO	3.7  RA H'LING  RCENTILE  O  O  RA H'LING	W DATA N'NATE DATA O O O W DATA
PERCENT.  TREATMENT: G REP 1A  TOTAL PERCENT.  TREATMENT: C REP 2A	3.7 100% RP2 ASTRULA 0 0	O DE	O VELOPMENT VEL 1 14.3 14.3 VELOPMENT.	O  AL STAGE HIPPO  1 PE: 14.3  1 14.3  AL STAGE HIPPO	3.7  RA H'LING  RCENTILE  O  O  RA H'LING	W DATA N'NATE DATA O O O W DATA
PERGENT.  TREATMENT: G REP 1A  TOTAL PERCENT.  TREATMENT: C REP 2A  REP 2A	3.7 LOON RP2 ASTRULA  O O LOON RP2 CASTRULA	O DE TROCH	O  VELOPMENT VEL  1  14.3  1  14.3  velopment.	O AL STAGE HIPPO  1 PE: 14.3 1 14.3 AL STAGE HIPPO	3.7  RA H'LING  O  O  RA' H'LING	W DATA NUNATE  DATA  O O W DATA SUBATE  DATA
PERGENT.  TREATMENT: G REP 1A  TOTAL PERCENT.  TREATMENT: G REP 2A  TOTAL	3.7 LOON RF2 ASTRULA  O O LOON RF2 ZASTRULA	O DE TROCH	O VELOPMENT VEL 1 14.3 1 14.3 VELOPMENT. VEL 0	O  AL STAGE HIPPO  1 PE: 14.3 1 14.3 AL STAGE HIPPO PE	3.7  RA H'LING  RCENTILE  O  RA H'LING  RECENTILE	W DATA MINATE  DATA  O  O  W DATA  SINATE  DATA  O  O

Α	ppendix	7.e.1.				
	TRIAL #6 ENOPOINT SPECIES	VALIDAT: JUVENILE A. carina		ED 12/4/		PAGE 1 FROM NUMBERS OF NEONATES HATCHED
	TREATMEN	T : CONTROL				
	REP 1A	NOT SUIT		DEAD		
	REP 18 REP 10		29 31 21	5 10 0	14.7 24.4	
	REP 2A REP 2B REP 3C		25 15	14	0 35.9 6.3	
				•	*	
	TREATMEN	T :15 RF2	LIVING	DEAG	MORT	
	REP 1A REP 18	HONE LAIL	11	6	35.3	
	REP 1C REP 2A		8 6	3	27.3	
	REP 2B REP 2G		10	0	9	
	TREATMEN	T :3,2% RP	2			
	PEP LA		LIVING	DEAD 3	13.6	
	REP 18 REP 10 REP 2A		13 20 7	4 3 0	23.5 13 0	
	REP 28 REP 2C	HOT SULT.		2	20	
	TDC . THEN					
	:KEATHEN:	T :10% RP2	LIVING	DEAD	MORT.	
	REP 1A REP 1B REP 1C	NONE LATE	14	4	22.2	
	REP 1C REP 2A REP 2B	NOT SUIT.	9	4	30.8	
	REP 26	NOT SUIT.	13	ι	7.1	
	TREATMENT	:32% RP2				
			LIVING	DEAD	MORT.	
	REP 1A REP 1B REP 1C	NONE LAID NONE LAID NONE LAID				
	REP 2A REP 28	NOT SUIT.				
	REP 2G	NONE LAID				
	TREATMENT	:1004 RP2				
	REP LA REP 1B	NONE LAID	LIVING	DEAD	MORT.	
	REP 1C REP 2A	NONE LAID				
	REP 2B REP 2C	NONE LAID NOT SUIT.				
\pp	oendix 7.	e.2.				
		VALIDATION JUVENILE MO A.cummingi			PECTED: F	PAGE 1 ROM NUMBERS OF ONATES HATCHED
	TREATMENT	:CONTROL				
			LIVING	DEAD	MORT.	
	REP 1A REP 1B REP 1C		13 30 17	4 5 0	23.5 14.3 0	
	REP 2A REP 2B		35 25	1	2.8	
	REP 2G		27	t	3.6	
	TREATMENT	:14 RP7				
	REP 1A		LIVING 42	DEAD	3MORT. 8.7	
	REP 1B REP 1C REP 2A		52 42 32	0 6 6	0 12.5 15.8	
	REP 28 REP 2C		36 33	8 1	18.2	•
	TPEATMENT	. 3 26 002				
			LIVING	DEAD	MORT.	
	REP 1A REP 1B		10 41	2 2	4.7	
	REP 1C REP 2A		33 16	2	5.7 11.1	
	REP 28 REP 2C		16 13	3	15.8	
	TREATMENT:	10 RP2				
	REP LA		LIVING 11	DEAD 0	NORT.	
	REP 18 REP 1C		36 21	3	7.7	
	REP ZA REP ZB REP ZC N	ONE LAID	13	0	7.7	
	TREATHENT:	321 RP2	LIVING	DEAD	MORT.	
	REP IA REP IB		11	0	17.6	
	REP 1C S	ONE LAID				
	REP 2B :	IONE LAID	8 ·	1	11.1	
	TREATMENT	:1004 RP2				
	250 14	MONE 1 4 7 P	FIATHC	DEAD	MORT.	
	REP 1B	NONE LAID	12	3	20	
	REP ZA		9	6	40	
	200 28	SONE LAID				

### Appendix 7.e.3.

TRIAL #6 VALIDATION COMMENCED	12/4/91	PAGE 1
ENDPOINT: JUVENILE MORTALITY	EXPECTED:	FROM NUMBERS OF
SPECIES GLYPTOPHYSA SP.		NEONATES HATCHED

	CLYPTOPHYSA		EX	PECTED: 1	
TREATHE	NT: CONTROL				
		LIVING	DEAD	MORT.	
REP 1A		5	0	0	
REP LB		6	4	40	
REP 1C		13	ı	7.1	
REP 2A		23	6	20.7	
REP 2B		19	0	0	
REP 2C		8	2	20	
TREATHE	NT:19 RP2				
		LIVING	DEAD	MORT.	
REP 1A		18	0	0	
REP 1B		18	3	14.3	
REP 1C		22	2	8.3	
REP 2A REP 2B	NONE LAID	22	1	4.3	
REP 2C	NORE LATE	19	3	13.6	
TREATME	NT:3.21 RP2	•			
		LIVING	DEAD	MORT.	
REP 1A REP 1B		11 6	0 1	0 14.3	
REP 1C	NOT SUIT.		1	14.3	
REP ZA	3011.	10	0	0	
REP 2B		12	š	20	
REP 2C		35	4	10.3	
TREATME	NT:10% RP2				
		LIVING	DEAD	MORT.	
REP LA		14	0	*nok1.	
REP IB	NOT SUIT.		•	•	
REP 1C		8	0	0	
REP 2A	NOT SUIT.				
REP 25		17	1	5.6	
REP 2C		26	.7	21.2	
TREATME	NT:32% RP2				
		LIVING	DEAD	MORT.	
REP 1A	NONE LAID	3	J		
REP 1B	NONE LAID				
REP 1C		21	3	12.5	
REP 2A	NONE LAID				
REP 2B	NONE LAID				
REP 2C	NONE LAID				
TREATME	NT:100% RP2				
		LIVING	DEAD	MORT.	
REP 1A		10	3	30	
REP 18	NONE LAID		-		
REP 1C	NONE LAID				
REP 2A	NONE LAID				

REP 2B REP 2C NONE LAID TRIAL #6 "ALIDATION CONHENCED 12/4/91 EMPROINT:MORTALITY OF CONTROL REARED JUVENILES SPECIES A. cummingli

PAGE 1

TREATMENT : CONTROL			
	LIVING	DEAD	MORT.
REP IA	FIATO	4	40
REP 18	ž	1	10
REP 1C	10	0	0
REP 2A	5	5	50
REP 28	10	0 2	0 2
REP 2C	8	2	2
TREATMENT: 14 RP2			
	LIVING	DEAD	MORT.
REP 1A	9	1	10
REP 18	9	l l	10 10
REP 1C REP 2A	6	4	40
REP 2B	ğ	ī	10
REP 2C	3	7	70
TREATMENT: 3.2% RP2			
	LIVING	DEAD	MORT.
REP \A	8	2	20
REP 18	8	2	20
REP 1C	10	0	0
REP 2A	4	6	60
REP 2B	9	1	10 10
REP 2C	7	٠	10
TREATMENT: 10% RP2			
	LIVING	DEAD	MORT.
REP IA	10	0	0 30
REP 1B REP 1C	7 8	3 2	20
REP 2A	9	i	10
REP 2B	í	3	30
REP 2C	8	2	20
TREATMENT: 32% RP2			
i	LIVING	DEAD	MORT.
REP IA	10	0	0
REP 1B REP 1C	9 8	l 2	10 20
REP 1C REP 2A	5	5	50
REP 28	6	4	40
REP 2C .	8	2	20
•			
TREATMENT: 100% RP2			
	LIVING	DEAD	MCRT.
REP LA	9	1	10
REP 1B	10	0	0
REP 1C	10	0,	0
REP 2A REP 3B	10 10	0	0
REP 2C	8	2	2
	-	-	-

### Appendix 7.g.

INTAL #6 VALIDATION COMMENCED 12/4/21
PMYSIGO-CHEMICAL DATA

	P4151CD-CH	IEMICAL 34	14									
01550LV	ED DYYGEN +	<b>4</b> /(										
	COM	COM	12002	110772	TREATMENT 3. 204P2		102892	101292	12002	:2902	:00%#2	1002
DATI	7.6	7.6	7.8	7,6	7.8	7.8	7.7	7.7	7.7	7.9	3	•
CAYZ	7.5	7.5	7.5	7.2	7.5	7.6	7.5	7.5	7.5	7.4	7.5	;
SATS	7.6	7.5	7.5	7.5	7.6	7.5	7,6	7.3	7.2	7.4	7,5	•
DATE	INSTRUMENT	. LAILURE										
DAYS												
DATS												
DAY												
DATE	7.5	7.8	7.8	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.7	•
CATO	7.8	7.9	7.8	7.8	7.8	7.7	7.8	7.7	7.8	7.7	7.7	
CATIO	7.7	7.8	7.8	7,5	7.6	7,5	7.8	7.5	7,7	7.7	7.7	• •
3A111	7.8	7.7	7.7	7.5	7.4	7.7	7.7	7.7	7.7	7.7	7.4	•
STYAC	7.8	7.6	7.6	7.6	7.8	7.8	7.5	7.7	7.7	7.7	7.5	;
24113	7.7	7.7	7.8	7.5	7.8	7.8	7.5	7.8	7.5	7.5	7.7	٠.
34116	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.5	7,8	7.7
DATIS	7.7	7.8	7.8	7.7	7.7	7.8	7.8	7.8	7.5	7.5	7.8	7
24716	7.5	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.5	
CATIF	7.7	7.7	7.8	7.8	7.8	7.7	7.7	7.7	7,7		7.1	
94718	7.8	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.5	7.5	3	
PH												
DAYS		6.18	6.26	5.29	6.3	5.6	5.43	5.63	5.79	5.57	5.7	٠, , .
2412	6.26	6.34	6.46	5.71	6.33	5.26	5.58	6.67	6.73	5.8	2.55	
DAY3	6.32	6.54	6.52	6.81	6.72	5.76	5.49	6.38	7.9	7.03	7.2	
DAT4	INSTRUMENT		5.12	0.01	9.72	3.70	3.69	9.35		7.03	2	
DATS	1491KOMEN	PATEGRE										
0476												
DAY?												
BYAC	6	5.67	5.95	5.71	6.02	5.76	4.14	6.25	5.45	5.25	6.71	5.27
DATE	6.41	6.14	6.44	6.62	5.85	5.73	5.93	7,17	7,2	7.25	7,57	3
04710	6.36	6.61	6.72	5.72	7.04	7,12	7,14	7.32	7.33	7.46	7.5	2.0
DATIS	5.25	6.63	5.85	5.72	5.94	7.02	7.1	7.34	7.42	7.5	7.55	1,11
DATIZ	5.89	6.45	5.7	5.81	7.02	7,15	7.07	7,47	7.64	7.67	7,78	÷,:
DATIS	6.22	6.2	6.16	5.3	6.84	7.2	7.01	7,15	7.45	7.5	7.67	2.27
DATIS	6.38	6.45	6.51	6.74	6.65	6.78	6.85	7.07	7.1	7.43	7.35	7.5
DAY15	6.32	6.45	6.62	6.78	6.7	6.8	6.77	6.9	6.97	7.12	7.43	7.5-
DAY 16	6.51	6.4	6.29	6.42	6.43	6,54	6.64	5.72	6.87	7.03	7,33	7,5-
DATIF	6.71	6.54	6.62	6.68	6.64	6.78	5.76	7.01	6.95	7.1	7.28	7.5*
DAT 18	6.48	6.72	6.82	6.79	6.76	6.82	6.82	3,99	7.13	7.13	7.33	, ,
			0.02	9.79	0.75	9.56	9.04	9,77	7.13	*.13		, -
	IVIIY USemy											
DAT1	25.7	56	38.6	39.3	71.9	72.2	157	166	420	423	1030	1050
STAG	34.4	29.6	46.3	44.1	76.5	75.6	177	174	421	433	1100	1100
DATS	33.8	24.2	43.6	41.2	70.8	74.7	171	168	421	+20	1070	10.11
DATÉ	INSTRUMENT	FAILURE										
0415												
DATA												
DAT7												
0418	52.2	43.6	56.1	53.2	82.2	79.4	176	179	457	434	1110	1112
PYAG	21.9	20.1	34.9	36.2	73.7	71.2	171	172	461	438	1120	1122
CATIS	20.4	21.6	38.1	40.8	72.7	72.6	177	171	448	141	1140	1140
DATII	21.7	24.7	37	37.5	70.2	75.7	:70	175	448	442	1140	1150
DAYSZ	22.4	28.5	35.8	37.1	70.4	79.1	176	178	449	441	1140	1140
DAY 13	25.8	31	39.9	41.5	70.7	83.7	170	176	430	423	1080	1080
DAT14	24.5	25.1	38.1	37.3	70.5	76.4	172	173	430	425	1030	1090
DAY15	22.7	22.5	35.6	25.7	70.7	59.9	172	173	441	-34	1120	1120
								167	+38	-29	1110	1150
DAT16	20.7	21.9	35.6	55.3	68.4	68	:66		- 26	-47	1090	1130
DAT17	21.1	24	34.7	34.1		55.2	177	175				
DAT15	19,7	21.9	35.1	34.4	67.2	\$7,2	:62	171	:30	428	1090	1100

TRIAL =1	COMMENCED 2/5/91 RP2-URANIUM COMPARISON
ENDPOINT	DAILY EGG MASS PRODUCTION PAW DATA
SPECIES:	A. carinata

TREATMENT :	IN RP2	REP 1			REP 2	
SAMPLE	A	8	¢	A	3	C
DAYL	2	2	1	1	ı	2
DAY2	0	9	1	2	o	1
DAY3	ŏ	i	ō	ò	ì	ā
DAYA	ì	ī	ĭ	2	ī	2
DAYS	1)	0	ì.	ı	Ü	1
TREATHENT	la U	REP 1			REP 2	
SAMPLE	A	3	с	A	3	C
DAY1	4	2	2	3	3	4
DAY2	1	ĭ	ĩ	ő	ő	ō
DAY3	ì	ò	ō	ŏ		ő
DAY4	ō	2	ì	2	2 2	
DATS	2	2	ņ			1
UNIO	2	''	ני	ı	ı	0
TREATMENT :	LOT RES	SEP 1			REP 2	
SAMPLE	A	3	С	A	В	С
J. L. I. D. L.			•	^	5	·
DAYL	0	0	0	0	9	2
DAY2	9	0	Ó	Ŏ	ŏ	0
DAY3	o	ò	Ö	ŏ	ŏ	ŏ
DAY4	á	ā	ā	ŏ	ŏ	ō
DAYS	ò	ŏ	ŏ	ŏ	ŏ	ŏ
	v	J	v	.,	•	U
TREATMENT :	101 U					
		REP 1			REP 2	
SAMP1.E	A	3	C	۸	8	c
DAYL	,			_	_	_
	3	l.	1	2	3	2 0
DAY2	0	õ	Q	0	Q	0
DAY3	0	0	0	0	1	o
DAY4	0	1	1	0	0	0
DAY5	0	0	l l	0	0	0
TREATMENT :	135 997					
		REP 1			REP 2	
SAMPLE	A	В	С		8	C
			•	-	ь	·
DAYL	0	1	1	0	1	0
DAY2	0	0	ō	ō	ō	
DAY3	0	0	0	Ō	ō	0
DAYA	1	1	ō	ŏ	ŏ	ň
DAY5	ō	ī	ō	ŏ	ŏ	ő
TREATMENT :	32¶ U					
		REP 1			REP 2	
SAMPLE	A	3	С	A	В	c
DAYL	0	0	0	1	ı	2
DAY2	0	0	0	0	0	0
DAY3	Ö	. 0	0	0	0	0
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UM 12	•	•	•	•		,

TRIAL =7 COMMENCED 2/5/91 RP2-URANIUM COMPARISON EMPROUNT: DAILY TOTAL EGG PRODUCTION RAW DATA SPECIES: A. carinaca

TREATMENT	:14 RP2	KEP 1			4	
SAMPLE	A	3	С	A	REP 2 B	_
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DAY3	ŏ	10	ó	ő		
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	18	5	12	27	11	22
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TREATMENT	:14 U					
		REP 1			REP 2	
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		10				34
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DAY2	12	0	υ	o o	.0	Q.
DAY3	26	0	0	0	39	0
DAY4	0	13	0	8	3	11
DAY5	14	0	0	7	0	0
	104 000					
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SAMPLE	A	3	C	A	В	С
SAMPLE	^	5	·	^		C
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# Appendix 8.a.2.

TRIAL #7 - COMMERCED 2/5/91 RP2-URANTUM COMPAPISOR ENOPOLIT: DAILY ECC MASS PRODUCTION RAW DATA SPECIES: A. cummingii

TREATMENT	:14 RP2					
SAMPLE	A	REP 1 3	С	A	REP .	c
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DAY3	0	2	3	1	2	2
DAY4	3	ī	2	4		
DAY5	í	ž	ì	2	2 2	2 2 1 7
TREATMENT	· 13 U					
		REP 1			REP 2	
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DAY2	0	0	1	2		2
DAY3	2	Ō	2	ō	õ	1
DAY4	ì	,	ì	ž	ĭ	,
DAY5	ž	2	ž	ì	3	0 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
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SAMPLE			-			
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DAY2	ī	ō	ō	Ž	ō	
DAY3	ō	ō	ō	ō	ó	ñ
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DAY5	ă	ò	ò	2	;	'n
DATE	3	,	v	-	-	''
TREATMENT	:101 0					
TREATHENT	:10% U	REP I			REP J	
		REP I	c	А	REP 2	12
TREATHENT SAMPLE	:10% U	REP L B	С	A	REP J B	r:
SAMPLE	A	3			Ŗ	
SAMPLE DAY1	A 1	3 2	4	2	R 2	2
SAMPLE DAY1 DAY2	A 1	3 2 2	4	2	8 2 0	2
SAMPLE DAY1 DAY2 DAY3	A 1 1 0	2 2 0	4 1 1	2 3 0	2 0 1	2 9
SAMPLE DAYL DAY2 DAY3 DAY4	A 1 1 0 2	3 2 2 0 1	4 1 1 0	2 3 0	2 0 1 0	2 9 0 1
SAMPLE DAY1 DAY2 DAY3	A 1 1 0	2 2 0	4 1 1	2 3 0	2 0 1	2 9
SAMPLE DAY1 DAY2 DAY3 DAY4 OAY5	A 1 1 0 2	2 2 0 1 1	4 1 1 0	2 3 0	2 0 1 0	2 9 0 1
SAMPLE DAY1 DAY2 DAY3 DAY4 OAY5 TREATMENT	A 1 1 0 2 1	3 2 2 0 1 1	4 1 0 0	2 3 0 0	R 2 0 1 0 0 0 0 REF 2	2 9 0 1 1
SAMPLE DAYL DAYL DAY2 DAY3 DAY4 OAY5	1 1 0 2	2 2 0 1 1	4 1 1 0	2 3 0	2 0 1 0	2 9 0 1
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TRIAL #7 COMMENCED 2/5/91 RP2-URANTUM COMPARISON ENDPOINT: DAILY TOTAL EGG PRODUCTION RAW DATA SPECIES: A. cummingii

TREATMENT	:10 RF2					
SAMPLE	A	REP 1	С	A	REP 2	
0.011.00	^	•	·	^	5	C
DAYl	31	53	36	20	16	31
DAY2	33	38	23	22	18	28
DAY3	ō	44	38	23	31	25
DAY4	59	22	28	56	26	14
DAYS	25	30	11	31	29	31
TREATMENT	:19 U					
		REP 1			REP 2	
SAMPLE	A	В	С	A	8	c
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DAY2	ő	70	15	28	19	35
DAY3	35	ŏ	30			
DAY4	30	33		0	.0	12
DAY5	20		20	34	77	25
UNIO	20	36	38	33	57	50
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		REP L			REP 2	
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DAY3	ő	ŏ	Ö	30	ŏ	0
DAY4	ŏ	18	6	ŏ		0
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JA(1)	•	v	v	23	35	0
TREATMENT	:10% U					
· · · · · · · · · · · · · · · · · · ·	.104 0	REP 1			REP 2	
SAMPLE	A	В	C	A	В	¢
D. 1/1						
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DAY2	24	26	0	33	0	0
DAY3	0	0	9	0	18	Q
DAY4	37	13	0	0	0	18
DAY5	13	9	0	16	o	18
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TREATMENT	: 324 U					
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TRIAL #	7 COMMENCED 1/5/91 R F:DEVELOPMENTAL CHARACT	P2-URANIUM COMP	ARISON PAGE 1			DAYL	GASTRULA 8	TROCH	VE(.	HIPPO	H, FIRE	BYDATE
	: A. carinata	ERISTICS	PAGE				8					
TREATME	T:1% RP2 REPLICATE IA					DAYS					_	
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UN L				14		TREATMEN	T:1% U RI GASTRULA	TROCH	VEL	нгрро	H. FINC	BINATE
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DAY6			10				T:10% RP2 RI GASTRULA		2 VEL	HIPPO		NYMATE
DAY7			10			DAYL	10					
DAY8				10		DAY5	18				10	•
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DAY5			11			DAY7					10 18	
DAY6			11			DAY8					10	10
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9AY9				.,		DAY5	12				12	
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TREATE	ENT:14 RP2 REPLICATE : GASTRULA TROCH	2B VEL HIPP	O H'LING	N'NATE	·	TREATMENT		PLICATE 2C				
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DAY5			11			DAY6					12	
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						DAYI	GASTRULA	TROCH	VEL	HIPPO	H, TIMC	N'UATE
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DAY8				13		G,	32% RP2 REPL ASTRULA T	ROCH	VEL	HIPPO	H'LING	N' NATE
	MENT:1% U REPLICATE			14		DAY1	14					
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				••		<b></b>						14
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DA'(4				13		DAY4					19 24	
DAYS				13		DAY5					10	
DAY6				13							18	
DAY8				13		DAY6					9	
DAY9				13							24	
DAYI	n			13		DAY7						18

13

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REATHENT: 324 RF2 REPLICATE 2A GASTRULA TROCH VEL	нгрро	H'LING	N'NATE
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9			
AY4			
AYS		13 9	
A76		13	
'A'(7			13
			9
REATMENT: 329 RP2 REPLICATE 28 GASTRULA TROCH VEL	HIPPO	H. L'INC	N'NATE
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7		7	
DAY5		20 7	
PAY6		7	
		2 <b>0</b> 7	
DAY7			7 20
			7
TREATHENT: 32% RP2 REPLICATE 2C GASTRULA TROCH VE	L HIPPO	H. FING	N'HATE
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DAY3	15		
DAY4	18	14	
		18 14	
DAYS		18	
DAY6		12 18	
DAY7			12
TREATHENT: 32% U REPLICATE 1A			18
GASTRULA TROCH VE	L HIPPO	H. TINC	N'NATE
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TREATMENT: 324 U REPLICATE 1C GASTRULA TROCH VE			
GASTRULA TROCH VE	L HIPPO	H, FING	N'NATE
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TREATHENT: 32% U REPLICATE 2A			
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TREATHE	NT:32% U GASTRULA	REPLICATE TROCH		VEL.	нірро	H, FING	N'MATE
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TREATM	ENT: 32% U	REPLICATE	20				
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Аp	pendix 8.b.2.						
	TRIAL #7 COMMENCENDPOINT: DEVELOPS SPECIES: A. cummi	ED 1/5/91 ENTAL CHAR ngii	RP2 - ACTERI	URANI STICS	UM COMPA	RISON PAGE 1	
	TREATMENT: 11 RP2 GASTRULA			EL	нірро	H. FINC	N'MATE
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	DAY5			12			
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٠.	GASTRU			7EL.	ОЧЧІН	H'LING	STRATE
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•	TREATMENT: 1% RF GASTRU	LA TROC	H ZC	VEL	HIPPO	H, LING	и.ичте
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DAY7

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TREATHENT	: I N U RE CASTRULA	PLICATE TROCH	۱۸ ۱	EL.	HIPPO	H' 1,135G	DINATE
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TREATHENT	:1% RP2 RE GASTRULA	PLICATE TROCH	18	/EL	нігро	и, глас	NINATE
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DAY5						13	
DAY6						18	
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TREATMENT	:1% RP2 R GASTRULA	EPLICATE TROCH	lC	VEL	HIPPO	H'LING	N'NATE
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	:1% U R	PDI 1CATE	74				
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DAY8 TREATH	ENT: 10  U 2	REPLICATE LE	3			
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		EPLICATE 2A TROCH	VEL	нірро	H'LING	N'NATE
AY1	21 15					
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TREATHE						
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DAYS				15	DAY6	23
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0.471	16				TREATMENT: 32% RP2 REPLICATE	
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DAY3	1:				DAY1 21	
DAYG		13			DAY2 20	
DAY5			4		DAY3 20	
DAY6			DEAD		DAY4 20	
TREATME	NT: 100 U REPLICA	TE 2E	CONTROL LAID			
	GASTRULA TROCI	4 VEL		N'NATE	DAY5	20
DAYL	33				DAY6	5 14
DAY3	1	5			DAY7	19
CAY4	t				DAY8	19
	Ţ	•			DAY9	19
DAYS			13		TREATMENT: 32% RP2 REPLICATE	2E CONTROL LAID
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TREATHE	NT:10% U REPLICAT		CONTROL LAID HIPPO H'LING	N'MATE	DAY4	28
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DAYL	26				DAY6	19
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DAY6			23		TREATMENT: 32% RP2 REPLICATE	2F CONTROL LAID
DAY7	•		23		GASTRULA TROCH	VEL HIPPO H'LING N'NATE
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			23		DAY2 10	
DAY9		•		23	DAY3 10	
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			13		DAY8	3
BYAG	*				DAY9	3
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DAY10			13		TREATMENT: 32% U REPLICATE	TA.
DAY11				13	GASTRULA TROCH	VEL HIPPO H'LING N'NATE
TREATME	ENT: 32% RP2 REPLICAT	LE IC			DAYL 19	
	GASTRULA TROCI	13V F	. HIPPO H'LING	N'NATE	DAY4	18
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	ENT: 32% RPZ REPUTCA	, ,,,,,,	HIPPO H'I.ING		DAYS	
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	GASTRULA INCC	er ver	HIPPO H'LING		DAY5	
DAYL	19 19	H VEI	HIPPO H'LING		DAY5	
DAY1 DAY2 DAY3	19 19		HIPPO H'LING		TREATHENT: 32% U REPLICATE	16
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DAYL DAY2 DAY3 DAY4 DAY5 DAY6 DAY7	19 19 19 19	9	19 19 19	9 9 9 · 19	TREATHENT: 32% U REPLICATE GASTRULA TROCH DAYL 18 L1	lC VEL HIPPO H'LING N'NATE
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DAYI DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATN DAY1 DAY2 DAY2 DAY3 DAY4	19 19 19 19 19 1 MENT: 32% RP2 REPLIC GASTRULA TRO	9 ATE LE CH VI	L HIPPO H'LING  19  15  15  CONTROL LAID EL HIPPO H'LIN	9 9 · L9 G N'NATE	TREATHENT: 32% U REPLICATE GASTRULA TROCH  DAY1 18 11  DAY4  DAY5  DAY6  DAY7  DAY8  DAY9	1C VEL HIPPO H'LING N'NATE  4 18 4 10 4 6 4 6 4 6 4 6 6 4 6 6 4 6 6
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DAYI DAY2 DAY3 DAY4 DAY5 DAY6 DAY7 DAY8 TREATN DAY1 DAY2 DAY2 DAY3 DAY4	19 19 19 19 10 HENT: 32% RP2 REPLICE GASTRULA TRO	9 ATE LE CH VI	L HIPPO H'LING  19  15  16  CONTROL LAID EL HIPPO H'LIN	9 · 19 G N'NATE	TREATHENT: 32% U REPLICATE GASTRULA TROCH  DAY1 18 11  DAY4  DAY5  DAY6  DAY7  DAY8  DAY9	1G VEL HIPPO H'LING N'NATE  4 18 4 10 4 6 6 4 6 6 4 6 6 4 6 6 4 6 6 4 6 6 4 6 6 6 4 6 6 6 6 4 6

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TREATMENT: 124 U REPLICATE 1D CONTROL LAID
GASTRULA TROCH VEL HIPPO HILING NIMATE
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                  10
 DAY2
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 DAY3
 DAY4
 DAY5
 DAY6
                                                   BREAKDOWN
 DAY7
                                                   DEAD
                                    CONTROL LAID
VEL HIPPO H'LING N'NATE
 TREATMENT: 32% U
GASTRULA
                    REPLICATE 1E
TROCH
                18
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 TREATMENT: 32% U REPLICATE 1F
GASTRULA TROCH
                                    VEL HIPPO R'LING N'NATE
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TREATHENT: 32% U REPLICATE 2D CONTROL LAID GASTRULA TROCH VEL HIPPO H'LING N'NATE
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DAYS
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TREATMENT: 321 U REPLICATE 2E GASTRULA TROCH
                                   VEL HIPPO H'LING N'NATE
DAY1
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DAY2
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DAY4
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DAY8
TREATHENT: 32% U REPLICATE 2F GASTRULA TROCH
                                   CONTROL LAID
VEL HIPPO H'LING
DAYI
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DAYS
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# Appendix 8.c.1.

		S PER SAMPLE	The second secon
TREATHENT: 18 RP2	2 DAY EXPOSURE 3MORT	4 DAY EXPOSURE NHORT	TRIAL #7 COMMENCED 1/5/91 RP2 URANIUM COMPARISC ENDPOINT: JUVENILE MORTALITY EXPOSED EGG MASS SPECIES: A. CALINATA
REP1A REP1B	100	70 70	TREATHENT: LV RP2 LIVING DEAD *MORT
REPZA REP2B	80 100	80 70	REPLA 19 0 0 REPLB 10 0 0 REPLC 6 5 45.5
TREATHENT: 1 U	2 DAY EXPOSURE	4 DAY EXPOSURE MORT	REP2A 15 0 0 REP2B INFECTED REP2C 17 10 37
REP1A REP18	100 90	100 100	TREATMENT: 1% U
REPZA REP2B	100 100	100	LIVING DEAD WHORT REPLA 9 2 18.2
TREATMENT: 10% RP2	2 DAY EXPOSURE	4 DAY EXPOSURE	REPLB     11     1     91.7       REPLC     NOT SULT.       REP2A     IMFECTED       REP2B     NOT SULT.       REP2C     0     7     100
REPIA REPIB	100 100	40 100	TREATMENT: 10% RP2
REPZA REPZB	70 40	80 80	LIVING DEAD MORT REPLA NONE LAID
TREATHENT: 10% U	2 DAY EXPOSURE	4 DAY EXPOSURE	REPLB NONE LAID REPIC NONE LAID REP2A NONE LAID REP2B NONE LAID
REPLA	NORT 100	MORT 100	REP2C 14 14 50
REPLB	100	100	TREATMENT: 10% U LIVING DEAD *MORT
REP2A REP2B	90 100	100	REPLA NOT SULT REPLB 10 2 16.7 REPLC 3 9 75
TREATMENT:32% RP2		4 DAY EXPOSURE	REPZA NOT SUIT. REPZB NOT SUIT. REPZC 5 7 58.3
REPLA	NORT	100 90	TREATMENT: 32% RP2
REP1B	80 20 · 40	60 60	LIVING DEAD WHORT REPLA NONE LAID
REP2B	40		REPIB 14 1 6.7 REPIC NOT SUIT. REP2A NONE LAID
	2 DAY EXPOSURE WHORT	4 DAY EXPOSURE	REP2B NOT SUIT. REP2C NONE LAID
REPIA REPIB	100	100	TREATMENT: 32% U LIVING DEAD MMORT
REP2A REP2B	100 100	100	REPLA NONE LAID REPLB NONE LAID
ndix 8.c.2.			REPIC NONE LAID REP2A NOT SUIT. REP2B NOT SUIT.
RIAL #7 COMMENCED	1/5/91 RP2-URANTUM ARED JUVENILE MORTALIT II 10 INDIVIDUAL	COMPARISON Y PAGE 1 S PER SAMPLE	REPZC NOT SUIT.  TREATHENT: 32% RP2
PECIES: A. cumming	11 10 11011110	4 DAY EXPOSURE	LIVING DEAD MORT
REATHENT: LE RP2	2 DAY EXPOSURE		ייי חר תופשם
TREATMENT: 18 RP2	0	NHORT 40 30	REPID 20 1 4.8 REPIE 12 2 14.3 REPIF 35 16 31.4 REPIP 18 4 18.2
REPLA REPLA REPLA REPLA REPLA	0 0		REP1E 12 2 14.3
REATHENT: 1% RP2 REP1A REP1B REP2A REP2B	0 0 10	40 30 30 20 4 DAY EXPOSURE	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REPZE 34 0 0
REATHENT: 1% RP2 REPIA REPIB REP2A REP2B TREATHENT: 1% U	0 0 30 10 2 DAY EXPOSURE HORT	40 10 30 20	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT: 32% U LIVING DEAD WHONT REP1D 0 19 100 REP1E 0 12 100
REATHENT: 1% RP2 REPIA REPIB REP2A REP2B TREATHENT: 1% U	0 0 30 10 10 2 DAY EXPOSURE HORT 10 10	40 30 20 4 DAY EXPOSURE *MORT 10 30	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REPIA REPZA REPZA REPZA REPZB TREATHENT: LV REPIA	0 0 30 10 2 DAY EXPOSURE NORT	40 30 30 20 4 DAY EXPOSURE WHORT 30	REPLE 12 2 14.3 REPLF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATHENT: 32% U LIVING DEAD WHORT  REPLD 0 19 100 REPLE 0 12 100 REPLF 0 23 100 REPLF 0 21 100
REPIA	2 DAY EXPOSURE HORT 10 10 30 10	40 30 20 4 DAY EXPOSURE *HORT 30	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REATMENT: 1% RP2 REP1A REP2A REP2B TREATMENT: 1% U REP1A REP1A REP2B	0 0 30 10 2 DAY EXPOSURE HORT 10 10 0 30 30 2 DAY EXPOSURE	40 30 20 4 DAY EXPOSURE **MORT** 30 30 10 10 4 DAY EXPOSURE	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REPIA REPIA REPIB	0 0 30 10 2 DAY EXPOSURE WHORT 10 10 0 30 2 DAY EXPOSURE WHORT 30	40 30 30 20 4 DAY EXPOSURE WHORT 30 30 10 10 4 DAY EXPOSURE WHORT 20	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REPIA REPIA REPZA	2 DAY EXPOSURE HORT 10 10 0 30 10 2 DAY EXPOSURE HORT 30 2 DAY EXPOSURE HORT 30 10	40 30 20 4 DAY EXPOSURE **HORT 30 10 10 10 4 DAY EXPOSURE **HORT 20 20 10	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REPIA REPIA REPIB REP2A REP2B TREATHENT:1% U REPIA REP2B TREATHENT:10% RP2 REP1B REP2B REP2B REP2B REP2B REP2B	2 DAY EXPOSURE SHORT 10 10 0 30 2 DAY EXPOSURE SHORT 10 10 0 30 2 DAY EXPOSURE 10 0 2 DAY EXPOSURE	40 10 30 20 4 DAY EXPOSURE **MORT* 10 10 10 4 DAY EXPOSURE **MORT* 20 20 10 0	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REPIA REPIA REPIB REP2B TREATHENT:10 U REPIA REP2B TREATHENT:100 RP2 REP1B REP2B TREATHENT:100 U REPIA	2 DAY EXPOSURE NORT  10 10 0 30 2 DAY EXPOSURE NORT  2 DAY EXPOSURE NORT  30 20 10 0 2 DAY EXPOSURE NORT  20 20 2 DAY EXPOSURE NORT  20 20 2 DAY EXPOSURE NORT  20 2 DAY EXPOSURE NORT	40 10 20 4 DAY EXPOSURE WHORT 10 10 10 10 4 DAY EXPOSURE WHORT 20 20 10 0 4 DAY EXPOSURE WHORT 60	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REPIA REPIB	2 DAY EXPOSURE HORT  10 10 0 30 10 2 DAY EXPOSURE HORT  20 10 0 2 DAY EXPOSURE HORT  20 10 0 2 DAY EXPOSURE HORT  20 10 0	40 30 30 20 4 DAY EXPOSURE NORT 30 30 10 10 10 4 DAY EXPOSURE NORT 20 20 10 0 4 DAY EXPOSURE NORT 60 60	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
REPIA REPIB	2 DAY EXPOSURE HORT  10 10 0 30 2 DAY EXPOSURE HORT  30 20 10 0 2 DAY EXPOSURE HORT  20 20 2 DAY EXPOSURE 20 20 2 DAY EXPOSURE	40 10 30 20 4 DAY EXPOSURE *** *** *** *** *** *** ** ** ** ** **	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
TREATMENT: 1% RP2  REP1A REP1A REP1B REP1A REP1B REP2A REP2A REP2B TREATMENT: 10% RP2 REP1B REP2A REP1B REP1B REP2A REP2B	2 DAY EXPOSURE HORT  10 10 0 30 2 DAY EXPOSURE HORT  30 2 DAY EXPOSURE HORT  20 10 0 2 DAY EXPOSURE HORT  20 20 10 2 DAY EXPOSURE HORT  10 10 10 10 10 10 10 10 10 10 10 10 10	40 10 30 20 4 DAY EXPOSURE NORT 30 10 10 10 4 DAY EXPOSURE NORT 20 20 10 0 4 DAY EXPOSURE NORT 60 10 60 60 4 DAY EXPOSURE	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
TREATMENT: 1% RP2  REP1B REP2B REP2B TREATMENT: 1% U  REP1B REP2B TREATMENT: 10% RP2  REP2B TREATMENT: 10% RP2  REP1B REP2B TREATMENT: 10% U  REP1B REP2B TREATMENT: 10% U  REP1B REP2B TREATMENT: 32% RP2B TREATMENT: 32% RP2B TREATMENT: 32% RP2B REP1B REP2B REP2B REP2B REP2B REP2B	2 DAY EXPOSURE HORT  10 10 0 30 10  2 DAY EXPOSURE HORT  30 20 10 0  2 DAY EXPOSURE HORT  20 20 30 20 2 DAY EXPOSURE HORT  20 30 20 2 DAY EXPOSURE HORT  10 0 60	40 10 30 20 4 DAY EXPOSURE WHORT 10 30 10 10 10 4 DAY EXPOSURE WHORT 20 20 10 0 4 DAY EXPOSURE WHORT 60 60 60 4 DAY EXPOSURE WHORT 20 10 60 60 50	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100
TREATMENT: 1% RP2  REP1B REP2B REP2B TREATMENT: 1% U  REP1B REP2B TREATMENT: 10% RP2 REP2B TREATMENT: 10% RP2 REP1B REP2B TREATMENT: 10% U  REP1B REP2B TREATMENT: 10% U  REP1B REP2B TREATMENT: 32% RP2B TREATMENT: 32% RP2B REP2B	2 DAY EXPOSURE  **HORT  10  10  2 DAY EXPOSURE  **HORT  30  2 DAY EXPOSURE  **HORT  30  20  2 DAY EXPOSURE  **HORT  20  20  2 DAY EXPOSURE  **HORT  10  0  2 DAY EXPOSURE  **HORT  20  20  2 DAY EXPOSURE  **HORT  10  0  60  50  2 DAY EXPOSURE	40 10 30 20 4 DAY EXPOSURE **MORT 30 10 10 10 4 DAY EXPOSURE **MORT 20 20 10 0 4 DAY EXPOSURE **MORT 60 10 60 60 4 DAY EXPOSURE **MORT 20 50 50 80	REPIE 12 2 14.3 REPIF 35 16 31.4 REP2D 18 4 18.2 REP2E 34 0 0 REP2F 26 4 13.3  TREATMENT:32% U LIVING DEAD *MORT  REP1D 0 19 100 REP1E 0 12 100 REP1F 0 23 100 REP1F 0 19 100 REP1E 0 19 100 REP1E 0 19 100 REP2E 0 19 100

## Appendix 8.d.2.

TRIAL #/ COMMENCED 1/5/91 RF2-URANIUM COMPARISON ENDPOINT: JUVENILE HORTALITY EXPOSED EGG MASS SPECIES: A commingit PAGE L TREATMENT: 14 KP2 LIVING • MÜKT Appendix 8.f. 11.3 10.3 4.5 13.9 11.1 13.3 REPLA REPLO REPLO REPLO REPLO REPLO 26 26 21 29 16 IRIAL #7 COMMENCED 2/5/91 RP2-URANIUM COMPARISON PHYSICO-CHEMICAL DATA DISSOLVED GXYGEN mg/L INSTRUMENT OVERHAUL TREATMENT: LA U LIVING DEAD MORT REPLA REPLB REPLC REP2A TREATMENT 13892 1XRP2 10XRP2 10%892 32XRP2 10% 32% REP2B REP2C DAY 1 6.63 6.25 7.09 6.91 6.74 ó. : 6.62 90.6 6.41 6.02 6.62 6.27 6.73 6.87 6.55 6.81 6.85 6.38 7.17 6.8 7.59 DAY2 6.12 7.07 DAY3 6.05 5.£ 6.66 TREATMENT: 10 \* RP2 DAY4 5.92 5.94 6.16 6.54 6.5 6.64 6.38 7.05 6.37 6.73 6.5 DEAD THUMA 6.41 6.38 6.28 4.25 6.28 7.33 12.5 40 31 41.7 6.28 6.37 6.55 6.68 6.78 6.83 DAYS 6.15 6.28 6.18 6.27 6.3 6.48 6.37 6.38 6.3 6.37 6.45 6.62 6.14 6.47 7.11 7.6 20 6.96 7.2 DAY8 6.11 6.24 6.07 6.16 6.51 6.75 6.07 6.38 6.26 6.26 6.2 6.91 6.53 REP2B REP2C 6.5 5.8 6.54 7.¢ DAY 10 6.59 7.07 6.8 7.03 6.35 6.6 5.9 6.29 6.42 6.51 6.66 6.45 7.08 6.21 6.5 6.4 6.48 6.48 6.62 6.55 7.07 6.7 TREATMENT: 10% U LIVING DAY12 6.28 6.28 6.29 6.22 6.57 4.69 6.51 6.45 6.39 6.31 DEAD MURT 6.19 6.37 6.81 4.75 6 86 6.75 6.75 6.4 6.19 6.16 6 41 6.35 REPIA REPIB REPIC REPIA REPIB REPIC 100 55.2 35.7 50 DAY14 6.25 6.38 6.5 6.54 6.75 6.89 6.52 6.54 7.01 22 16 10 14 16 15 DAY 15 6.04 6.36 6.37 6 6.61 6.71 7.01 6.72 6.95 6.65 6.94 6.5 TRIAL #7 COMMENCED 2/5/91 RP2-URANIUM COMPARISON PHYSICO-CHEMICAL DATA COMPUCITALIA r usem/cm 1%RP2 TREATMENT: 32% RP2 LIVING 1XRP2 10%8P2 10%RP2 32%RP2 10% 32% DEAD THOME 32x892 120 120 1020 32XU ٥ 0 DAY1 170 176 453 23.9 23.8 34 7 450 26.7 25.8 32 2 HONE LAID
HONE LAID
HONE LAID 49.2 39.7 174 171 458 460 DAY2 47.8 455 34.1 22.5 14.3 31 29.5 30.4 DAYS 24.7 47.8 185 458 34 20.7 23.7 22.6 23.€ 44.4 169 172 177 461 461 21.6 DAY4 39.6 457 23.9 23.2 DAY5 42.1 457 23.7 23.9 22.1 26.3 28.9 24.7 41.7 DAYA 41 171 177 460 TREATMENT: 32% U LIVING DAY7 40.9 43.1 175 177 454 23.1 467 27.2 20.6 23.5 20.7 20.1 DEAD MORT DAYS 41.0 41.7 181 174 176 465 461 24.4 20.6 19.7 22.6 19.6 19.4 76.9 100 12.5 10 9 8 DAY9 41.1 REPLA REPLB REPLC 181 466 19.6 19.7 20.6 24.8 19.9 41.2 DAY 10 39.4 175 177 472 474 23.7 19.5 DAT 11 40.3 39.9 173 186 468 464 24 4 18.7 18 9 29.6 19.2 20.7 18.9 179 461 DAY 12 72.3 70.7 174 460 22.9 18.8 DAY 13 42.4 42 171 474 21 19.3 19.9 19.7 21.5 19.8 DAY 14 40.2 40.7 20.5 DAY 15 36.2 35.5 23.4 20.6 18.1 19.3 Appendix 8.e.1.

TRIAL #7 COMMENCED 1/5/91 RP2-UMANIUM COMPARISON ENOPOINT: UNVENTLE MORTALITY CONTROL ECG MASS PAGE 2 SPECIES: A, cummingii

TOPATHENT: 10s ap2

IREALME	LIVING	DEAD	MORT
REPLO	13	5	27.8
REPLE	9	5 8 3	47.1
REPLF	13	3	18.8
KEP2D	BREAKDOUN		
REPZE	BREAKDOUN		
REP2F	BREAKDOWN		
TREATME	NT:104 U		
	LIVING	DEAD	TROM
REPID	3	0	0
REPLE	16		23.8
REPIF	2	26	92.9
REP2D	INFECTED		
REP2E	10	j.	9.1
REP2F	19	4	17.4
TREATME	NT:32% RP2 LIVING	DEAD	MORT
	211110	500	******
REPLO	16	3	15.8
REPLE	13	4	23.5
REPLF	20	3	13
REP2D	NOT SUIT.		
REPZE	20	9	31
REPZF	3	3	0
TREATHE	NT:32% U		
***********	LIVING	DEAD	MURT
KELLD	BREAKDOWN		
REPLE	BREAKDOWN		
REPLF	ģ	7	100
REP2D	o o	7	100
REP2E	BREAKDOUN	_	
REP2F	0	9	100

	ENDPOINT SPECIES	GENE :EMBRYONIC AND A. carinaca	TIC VARI JUVENII SAH	ATION E MORT IPLES FROM	PACE 1 KNOWN			
	REP 1	DEV. TIME (DAYS)	EGG Nos.	Nos. Hatch	Nos. SURV.	*HATCH /LAID	SURV. /HATCH	SURV.
	SAMPLE 1	. 8	20 10 9	7 10 9	4 8 9	35 100 100	57.1 80 100	16 80 100
	REP 2 SAMPLE 1 2 3	8 8	14 8 9 15	14 8 8 15	5 8 6 9	100 100 88.9 100	35.7 100 75 60	35.7 100 66.7 60
	REP 3 SAMPLE 1 2 3	7	22 9 25	22 9 25	17 4 22	100 100 100	77.3 44.4 88	77.3 44.4 88
	REP 4 SAMPLE 1 2 3	7 7	15 9 8 4	6 9 8 4	5 5 6 4	40 100 100 100	83.3 77.8 75 100	33.3 77.8 75 100
Appe	ndix 9.	a.2						
	SPECIES	A. cummingii						
	REP 1	DEV. TIME (DAYS)	EGG Nos.	Nos. HATCH	Nos. SURV.	VHATCH /LAID	SURV. /HATCH	SURV. /LAID
	SAMPLE 1	! 8 ! 8	22 22 37 17	17 15 12 5	11 11 7 5	77.3 68.2 30.1 29.4	64.7 73.3 58.3 100	50 50 18.9 29.4
	REP 2 Sample 1	? 7	48 28 32	22 28 22	20 21 19	45.8 100 68.8	90.9 75 86.4	41.7 75 59.4
	REP 3 SAMPLE 1		21 19	11 12	8 12	52.4 63.2	72.7 100	38.1 63.2
	REP 4 SAMPLE 1 2	. 7	25 16 22	11 16 18	9 13 17	44 100 81.8	81.8 43.3 94.4	36 43.3 77.3
	REP 5 SAMPLE 1	8 9	9 15 33 • 65	8 14 23 65	6 6 20 36	100 93.3 69.7 100	66.7 50 87 55.4	66.7 46.7 60.6 55.4
Appe	endix 9.	b.1						

TRIAL CONTAINER/ALGAE TRIAL COMMENCED 2/5/91 ENDPOINT:JUVENILE MORTALITY PAGE 1 SPECIES A. carinata

TREATMENT: CONTROL WATER 20 NEONATES PER TREATMENT :LARGE/SMALL (STANDARD) VIALS :WITH/WITHOUT ALGAE

### LARGE VIALS

	+ALGAE LIVING	DEAD	*MORT	LIVING	-algae Dead	*MORT
REP1	5	15	75	8	12	60
REP2	7	13	65	7	13 .	65
REP3	11	9	45	12	8	40
REP4	2	18	90	3	17	85

#### SMALL VIALS

	+ALGAE LIVING	DEAD	*MORT	FIVING	-ALGAE DEAD	MORT
REP1	12	8	40	15	5	25
REP2	13	7	35	15	5	25
REP3	15	5	25	11	9	45
REP4	19	1	5	16	4	20

Appendix 9.b.2

SPECIES A. cummingii

TREATMENT:CONTROL WATER 20 NEONATES PER TREATMENT :LARGE/SMALL (STANDARD) VIALS :WITH/WITHOUT ALGAE

#### LARGE VIALS

	+algae			-algae			
	LIVING	DEAD	*MORT	LIVING	DEAD	*MORT	
REP1	2	18	90	4	16	80	
REP2	9	11	55	7	13	65	
REP3	4	16	80	0	20	100	
REP4	LOST			11	9	45	

### SMALL VIALS

+ALGAE				-ALGAE	
LIVING	DEAD	*MORT	LIVING	DEAD	MORT
1	19	95	7	13	65
11	9	45	20	0	. 0
17	3	15	15	5	25
	LIVING 1 11	LIVING DEAD  1 19 11 9	LIVING DEAD *MORT  1 19 95 11 9 45 17 3 15	LIVING DEAD &MORT LIVING  1 19 95 7 11 9 45 20	LIVING DEAD *MORT LIVING DEAD  1 19 95 7 13 11 9 45 20 0 17 3 15 15 5

#### Appendix 10.a.

TRIAL #1 RESULTS OF URANIUM AND MANGANESE ANALYSIS DATE SUBMITTED 19/2/91

SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
MAGELA CK WATER	1	6.5
0.3% RP2	6.1	12
1% RP2	16	18
3.2% RP2	53	37
3.2% RP2	48	38
10% RP2	170	90
32% RP2	520	180
BLANK	< 0.1	< 0.1

All samples were analysed using Scintrex Time Decay Flourimetric technique for the determination of uranium, and Graphite Furnace Atomic Absorbtion Spectrometric technique for the determination of manganese.

The 3.2% RP2 samples were randomly chosen replicates.

Appendix 10.b.

BLANK

TRIAL #2 RESULTS OF URANIUM AND MANGANESE ANALYSIS DATE SUBMITTED COMMENCEMENT TRIAL#2 28/2/91 SAMPLE URANIUM MANGANESE ug/L U ug/L Mn MAGELA CK WATER 5.7 13 1% RP2 21 22 3.2% RP2 62 41 10% RP2 180 90 32% RP2 510 170 32% RP2 550 170 100% RP2 1700 380

All samples were analysed using Scintrex Time Decay Flourimetric technique for the determination of uranium, and Graphite Furnace Atomic Absorbtion Spectrometric technique for the determination of manganese.

< 0.1

< 0.1

The 32% RP2 samples were randomly chosen replicates.

DATE SUBMITTED	28/2/91	TERMINATION	TRIAL#2
SAMPLE	URANI ug/l		MANGANESE ug/L Mn
MAGELA CK WATER		5	1.2
1% RP2		15	2.7
3.2% RP2		55	. 24
10% RP2		160	50
10% RP2		160	60
32% RP2		380	100
100% RP2	1	400	440
BLANK	<	0.1	< 0.1

All samples were analysed using Scintrex Time Decay Flourimetric technique for the determination of uranium, and Graphite Furnace Atomic Absorbtion Spectrometric technique for the determination of manganese.

The 10% RP2 samples were randomly chosen replicates.

Appendix 10.c.

TRIAL #3	RESULTS	OF	URANIUM	AND	MANGANESE	Αľ	NALYSIS	i
DATE SUBMI	TTED	19	/3/91	(	COMMENCEMEN	ΙT	TRIAL	#3

SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
MAGELA CK WATER	1.3	6.6
1% RP2	17	15
3.2% RP2	60	36
3.2% RP2	60	36
10% RP2	110	60
32% RP2	560	200
100% RP2	1600	460
BLANK	< 0.1	< 0.1

All samples were analysed using Scintrex Time Decay Flourimetric technique for the determination of uranium, and Graphite Furnace Atomic Absorbtion Spectrometric technique for the determination of manganese.

The 3.2% RP2 samples were randomly selected replicates.

### Appendix 10.d.

TRIAL #5	RESULTS	OF URANIUM	AND MANGANESE	ANALYSIS
DATE SUBMIT	TTED 3	28/3/91	COMMENCEMENT	TRIAL #5

SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
MAGELA CK WATER	0.2	1.4
1% RP2	11	2.3
3.2% RP2	37	3
10% RP2	160	56
10% RP2	180	46
32% RP2	420	310
100% RP2	1600	750
BLANK	< 0.1	< 0.1

All samples were analysed using Scintrex Time Decay Flourimetric technique for the determination of uranium, and Graphite Furnace Atomic Absorbtion Spectrometric technique for the determination of manganese.

The 10% RP2 samples were randomly selected replicates.

### Appendix 10.d.

TRIAL #6 RESULTS DATE SUBMITTED COMMENCEMENT	OF URANIUM AND MANGANESE 1/4/91 FIRST WATER LOAD	ANALYSIS TRIAL #6
SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
MAGELA CK WATER	0.3	10
1% RP2	17	17
1% RP2	16	19
3.2% RP2	53	36
10% RP2	150	96
32% RP2	540	280
100% RP2	1700	860
BLANK	0.6	0.5

The 1% RP2 samples were randomly selected replicates.

DATE SUBMITTED TERMINATION	1/4/91 FIRST WATER LOAD	TRIAL #6
SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
MAGELA CK WATER	2.7	110
1% RP2	32	110
1% RP2	140	640
10% RP2	670	890
32% RP2	1300	660
100% RP2	1800	600
BLANK	0.3	0.3
1% RP2 1% RP2 10% RP2 32% RP2 100% RP2	32 140 670 1300 1800	110 640 890 660

TRIAL #6 RESULTS DATE SUBMITTED COMMENCEMENT	OF URANIUM AND MANGANESE 20/4/91 SECOND WATER LOAD	ANALYSIS TRIAL #6	TRIAL #6 RESULTS DATE SUBMITTED Communications	OF URANIUM AND MANGANESE 25/4/91 THIRD WATER LOAD	TRIAL #6
SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn	SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
MAGELA CK WATER	1.6	15	MAGELA CK WATER	< 0.1	2.9
1% RP2	19	24	1% RP2	19	9.6
3.2% RP2	52	34	3.2% RP2	55	22
3.2% RP2	52	30	10% RP2	200	54
10% RP2	180	79	32% RP2	670	190
32% RP2	510	210	32% RP2	640	190
100% RP2	1600	920	100% RP2	1900	690
BLANK	0.2	0.2	BLANK	< .1	< .1

The 3.2% RP2 samples were randomly selected replicates.

The	32%	RP2	samples	were	randomly	selected	replicates.

DATE SUBMITTED TERMINATION	1/4/91 SECOND WATER LOAD	TRIAL #6	DATE SUBMITTED TERMINATION	10/5/91 THIRD WATER LOAD	TRIAL #6
SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn	SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
MAGELA CK WATER	0.9	1.6	MAGELA CK WATER	1.4	3.5
1% RP2	16	8.4	1% RP2	37	56
3.2% RP2	50	19	3.2% RP2	72	42
10% RP2	170	57	3.2% RP2	70	33
10% RP2	180	58	10% RP2	220	84
32% RP2	540	180	32% RP2	730	230
100% RP2	1700	610	100% RP2	2000	480
BLANK	0.1	0.1	BLANK	0.2	< .1

All samples were analysed using Scintrex Time Decay Flourimetric technique for the determination of uranium, and Graphite Furnace Atomic Absorbtion Spectrometric technique for the determination of manganese.

The 10% RP2 samples were randomly selected replicates.

NOTE: SEDIMENTATION OBSERVED IN PERLICATE TOWN

# Appendix 10.e.

TRIAL #7 RESULTS OF URANIUM AND MANGANESE ANALYSIS
DATE SUBMITTED 3/5/91 TRIAL #7
COMMENCEMENT

COMMENCEMENT		
SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
1% RP2	29	12
1% RP2	19	8.2
1% U	17	8.6
10% RP2	130	59
10% U	170	7.5
32% RP2	500	170
32% U	550	8
100% RP2	1300	540
100% U	1800	7.5
BLANK	< 0.1	< 0.1

The 1% RP2 samples were randomly selected replicates.

DATE SUBMITTED TERMINATION	31/5/91	TRIAL #7
SAMPLE	URANIUM ug/L U	MANGANESE ug/L Mn
1% RP2	20	6.4
1% U	39	1.5
10% RP2	220	47
10% U	170	1.8
32% RP2	740	150
32% U	470	2
32% U	500	2.2
BLANK	12	< 0.1

All samples were analysed using Scintrex Time Decay Flourimetric technique for the determination of uranium, and Graphite Furnace Atomic Absorbtion Spectrometric technique for the determination of manganese.

The 32% U samples were randomly selected replicates.

#### Appendix 11.a.1.

#### STATISTICAL TESTING

#1

TEST:

ANALYSIS OF VARIANCE

ENDPOINT: JUVENILE MORTALITY

SE	EC	ΉF	S

A. carinata

Source	dF	s <b>s</b>	MSS	F	P > F
Treatment	5	153.233	30.6466	0.29	0.9122
Error	18	1900.78	105.598		
221		2054.01			

RESULT: NO SIGNIFICANT DIFFERENCE

A. cummingii

Source	dF	SS	MSS	F	P > F
Treatment	5	1299.85	259.970	1.12	0.3855
Error	18	4182.62	232.368		
Total	23	5482.47			

RESULT: NO SIGNIFICANT DIFFERENCE

GLYPTOPHYSA SP.

₫ <b>F</b>	SS	MSS	F*	P > F
5	521.602	106.230	0.78	0.5757
18	2447.16	135.953		
23	2978.76			
	5	5 521.602 18 2447.16	5 521.602 106.230 18 2447.16 135.953	5 521.602 106.230 0.78 18 2447.16 135.953

RESULT: NO SIGNIFICANT DIFFERENCE

## Appendix 11.b.1

### STATISTICAL TESTING

TEST:

ANALYSIS OF VARIANCE

TRIAL:

#2

ENDPOINT: DAYS TO HATCHING - DEVELOPMENTAL RETARDATION

### SPECIES: A. cummingii

Source	dF	SS	MSS	F	P>F
Treatment	5	6.8750	1.3750	3.19	0.308
Error	18	7.750	0.430556		
Total	23	14.6250			

RESULT: NO SIGNIFICANT DIFFERENCE

#### SPECIES: GYRAULUS SP.

Source	dF	SS	MSS	F	P>F
Treatment	5	42.8565	8.57197	31.67	0.0001
Error	18	4.87256	0.270203		
Total	23	47.7291			

RESULT: SIGNIFICANTLY DIFFERENT MEANS: 5.4 / 5.81 / 5.2 / 5.5 / 5.54 / 9.05

#### SPECIES: LYMNAEA SP.

Source	dF	SS	MSS	F	P>F
Treatment	5	118.708	23.7147	100.55	0.0001
Error	18	4.250	0.236111		
Total	23	122,958			

RESULT: SIGNIFICANTLY DIFFERENT MEANS: 7.5 / 7,5 / 7 / 7.25 / 7.25 / 13.25

### Appendix 11.a.2.

#### STATISTICAL TESTING

TEST:

ANALYSIS OF VARIANCE

TRIAL:

ENDPOINT: DAYS TO HATCHING

#1

SPECIES:

A. carinata

Source	dF	SS	MSS	F	P > F
Treatment	5	1.7143	0.34286	1.87	0.1491
Error	18	2.2923	0.182091	0.32	
Total	23	5.0066	6.2852		

#### RESULT: NO SIGNIFICANT DIFFERENCE

### SPECIES: A. cummingii

Source	dF	SS	MSS	F'	P > F
Treatment	5	0.95613	0.191228	0.73	0.6071
Error	18	4.68603	0.260335		
Total	23	5.64216			

#### RESULT: NO SIGNIFICANT DIFFERENCE

#### SPECIES: GLYPTOPHYSA SP.

Source	dF	SS	MSS	F'	P > F
Treatment	5	1.0804	0.21608	0.45	0.8058
Error	18	3.5886	0.47714		
Total	23	9.6690			

#### RESULT: NO SIGNIFICANT DIFFERENCE

### Appendix 11.b.2

#### STATISTICAL TESTING

ANALYSIS OF VARIANCE

TRIAL:

ENDPOINT: EMBRYONIC MORTALITY

#### SPECIES: A. cummingii

Source	dF	SS	MSS	F	P>F
Treatment	5	627.383	125.476	0.67	0.6490
Error	18	3354.75	186.375		
Total	23	3982.13			

#### RESULT: NO SIGNIFICANT DIFFERENCE

#### SPECIES: GYRAULUS SP.

Source	dF	SS	MSS	F	P>F
Treatment	5	4060.98	812.197	2.38	0.082
Error	18	6150.32	341.685		
Total	23	10211 21			

## RESULT: SIGNIFICANTLY DIFFERENT AT 10%

#### SPECIES: LYMNAEA SP.

Source	dF	. SS	MSS	F	P > F
Treatment	5	469.194	93.8388	0.72	0.6196
Error	18	2358.75	131.042		
Total	23	2827.05			

#### RESULT: NO SIGNIFICANT DIFFERENCE

### Appendix 11.b.3

#### STATISTICAL TESTING

TEST:

DUNNETT'S COMPARISON TO CONTROL MEAN.

ENDPOINT: DEVELOPMENTAL RETARDATION.

SPECIES:

Gyrandus so.

MEANS CONT.L 1% RP2 3.2% RP2 10% RP2 32% RP2 100% RP2 5.4 5.81 5.54 9.05

5.2 5.5

100%

100%

RANK 3.2% CONT. 10%

ANOVA EMSS = 0.2703 a = 7

CONTRAST	DIFF.	S.E.	[q]	Р	q'	CONCLUSION
10%	0.1	0.280	0.36	2	2.02	Do not reject.
32%	0.14	0.280	0.50	3	2.44	Do not reject.
1%	0.41	0.280	1.48	4	2.68	Do not reject.
100%	3.65	0.280	13.1	5	2.85	Reject.

NOEC 32% RP2 LOEC 100% RP2.

SPECIES: Lymnaea sp.

MEANS CONT. 1% RP2 3.2% RP2 10% RP2 32% RP2 100% RP2

7.25 7.25 7.5 7.5

RANK 3.2% 10%/32% CONT./1% ANOVA EMSS = 0.2361 Smallest n = 4

CONTRAST DIFF. S.E. q' CONCLUSION iqi р /100% 5.75 16.7 2.02 Reject.

NOEC 32% RP2 LOEC 100% RP2.

### Appendix 11.c.2

#### STATISTICAL TESTING

TEST:

TWO WAY ANALYSIS OF VARIANCE

TRIAL:

#3

STAGE \* TREATMENT 8

ENDPOINT: EMBRYONIC MORTALITY - mortality to hatchling stage, as hatchling and as neonate.

SPECIES: A. cummingii zero values excluded

Source dF SS MSS P > F Treatment 480.047 96.0094 0.2682 1226.82 Total 16 355.119 STAGE 3.62416 3.62416 0.21

RESULT: NO SIGNIFICANT DIFFERENCE BETWEEN TREATMENTS OR INTERACTION BETWEEN TREATMENTS AND STAGES

72.0697 9.00871 0.23

0.9734

SPECIES: A. cummingii zero values excluded

Source dF SS MSS DEV.STAGE 2 331.339 165.670 5.6 0.0153 Error 15 444,136 29,6090

Total 17 775,475

RESULT: SIGNIFICANT DIFFERENCE IN MORTALITY BETWEEN STAGES MEANS: 3.1% / 1.7% / 0.0%

SPECIES: A. carinata

Source SS MSS P>F Treatment 364,453 72.8909 STAGE 208.276 104.138 2.55 0.0872 INTERRACTION 10 0.3582 460.357 46.0357 1.13

RESULT: NO SIGNIFICANT DIFFERENCE BETWEEN TREATMENTS OR STAGES, AND NO SIGNIFICANT INTERACTION BETWEEN TREATMENTS AND STAGES

#### Appendix 11.c.1

#### STATISTICAL TESTING

TEST:

ANALYSIS OF VARIANCE

TRIAL:

ENDPOINT: DAYS TO HATCHING - DEVELOPMENTAL RETARDATION

#### SPECIES: A. carinata

P>F MSS dF SS Source 3.36667 6.73 0.0011 Treatment 5 16.8333 Error 18 9.0 0.50

23 25.8333

RESULT: SIGNIFICANTLY DIFFERENT MEANS: 7.25 / 7.50 / 7.75 / 7.75 / 7.50 / 9.75

#### SPECIES: A. cummingii

P > F SS Source .027 6.20833 1.24167 5 Treatment 0.3750 18 6.75 Error 12,9583 Total 23

RESULT: SIGNIFICANTLY DIFFERENT MEANS: 8.0 / 8.0 / 7.0 / 7.0 / 8.0 / 8.25

#### SPECIES:

P>F dF SS MSS 0.0105 26.0893 5.21786 5.2 22.3539 1.24188 Error 23 48.4432 Total

RESULT: SIGNIFICANTLY DIFFERENT MEANS: 75/75/6.75/7.25/7.46/10.0

#### STATISTICAL TESTING

TEST:

TWO WAY ANALYSIS OF VARIANCE

TRIAL:

ENDPOINT: EMBRYONIC MORTALITY - mortality to hatchling stage, as hatchling and as neonate.

#### SPECIES: GLYPTOPHYSA SP.

TREATMENT AND STAGES.

Treatment 998.492 199.690 0.8022 7850.25 Error 18 436,125 Total 23 8848 70 STAGE 2 954,650 477.325 0.1252 INTERACTION 1017.37 203.474 0.84 RESULT: NO SIGNIFICANT DIFFERENCE BETWEEN TREATMENTS OR

LIFE STAGES AND NO SIGNIFICANT INTERACTION BETWEEN

### Appendix 11.c.3

#### STATISTICAL TESTING

TEST:

ANALYSIS OF VARIANCE

#1

ENDPOINT: JUVENILE MORTALITY

#### SPECIES: A, carinata

dF SS MSS 5 9140.92 1828.18 7.89 0.0004 Treatment 18 4170.17 231.676 Error

13311.1 23 Total

RESULT: SIGNIFICANTLY DIFFERENT

MEANS: 16.5% / 24.5% / 45.1% / 10.9% / 33.6% / 96.1%

#### SPECIES: A. cummingii

MSS Source dF SS 0.0001 2037.15 11.89 Treatment 10185.7 Error 18 5786.72 171,280 12205.4 Total

RESULT: SIGNIFICANTLY DIFFERENCE MEANS: 22.5% / 16.4% / 11.4% / 5.3% / 9.1% / 92.7%

#### SPECIES: GLYPTOPHYSA SP.

dF SS MSS Source 0.017 6218.70 1243.74 3.4 Treatment 5 Error 18 5786.72 332.595 23 Total

RESULT: SIGNIFICANTLY DIFFERENT

MEANS: 31.9% / 9.7% / 32.7% / 13.2% / 81.5% / 59.4%

#### Appendix 11.c.4

### STATISTICAL TESTING

TEST:

TRIAL .

DUNNETT'S COMPARISON TO CONTROL MEAN.

ENDPOINT: DEVELOPMENTAL RETARDATION - DAYS TO HATCH

SPECIES: A. carinata

MEANS CON 1% RP2 3.2% RP2 10% RP2 32% RP2 100% RP2 7.25 7.50 7.75 7.75 7.5 RANK CON 1% RP2 / 32% RP2 3.2% RP2 / 10% RP2 100% RP2 Smallest n=4 ANOVA EMSS = 0.50 Ho:Xcon> = Xa. H1:Xcon < Xa. CONTRAST DIFF. STD.ERR.igi p CONCLUSION CONTROL / 1% RP2 / 32% RP2 0.50 0.50 3 2.44 DO NOT REJECT Ho 3.2% RP2 / 10% RP2 0.50 0.50 1.0 5 2.85 DO NOT REJECT Ho

NOEC: 32% RP2 LOEC 100% RP2

100% RP2

SPECIES: A. cummingii

2.0

MEANS CON 1% RP2 3.2% RP2 10% RP2 32% RP2 100% RP2 8 7 8

RANK 3.2% RP2 / 10% RP2CON / 1% RP2 / 32% RP2 100% RP2

Smallest n=4 ANOVA EMSS = 0.375

0.50

One-sided Ho:Ucon > = Ua. H1:Ucon < Ua. (Denoted by "'"). Two-sided Ho:Ucon-Ua = 0. H1:Ucon-Ua < > 0. (Denoted by " " ")

CONTRAST DIFF. STD.ERR.[q] p q' CONCLUSION

CONTROL /

3.2% RP2 /

10% RP2 0.43 3 2.57" DO NOT REJECT Ho 100% RP2 0.25 0.433 0.57 2 2.44° DO NOT REJECT Ho

NOEC: 100% RP2

LOEC UNDEFINED

### STATISTICAL TESTING

DUNNETT'S COMPARISON TO CONTROL MEAN. TEST:

ENDPOINT: DEVELOPMENTAL RETARDATION - DAYS TO HATCH

GLYPTOPHYSA SP. SPECIES:

MEANS CON 1% RP2 32% RP2 10% RP2 32% RP2 100% RP2 10.0

7.5 7.5 6.75 7.25 7.46 RANK 3.2% RP2 10% RP2 32% RP2 CON / 1% RP2 100% RP2 Smallest n=4 ANOVA EMSS = 1.24188

Ho:Xcon > = Xa. H1:Xcon < Xa.

CONCLUSION CONTRAST DIFF. STD.ERR. | a| p a' CONTROL /

0.04 0.788 .05 2 2.57" DO NOT REJECT Ho 0.25 0.788 .32 3 3.03'' DO NOT REJECT Ho 0.75 0.788 .95 4 3.29'' DO NOT REJECT Ho 10% RP2

3.2% RP2 0.788 2.45 5 2.85' DO NOT REJECT Ho 100% RP2 2.50

NOEC: 100% RP2

LOEC UNDEFINED

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