Ranavirus Fact Sheet

The Pathogen

Ranavirus is a genus within the family Iridoviridae (other Genera currently include: Iridovus, Chloriridovirus, Megalocytivirus, and Lymphocystivirus). Ranaviruses are large (120-300 nm diameter) icosahedral with linear, dsDNA genomes. They are enveloped viruses; however, they maintain their infectivity without the envelope. Recent evidence suggests that the virus originated in fish and underwent multiple host-shifts. Environmental persistence outside of the host remains unknown and likely varies with ambient conditions; however, experimental evidence suggests that ranaviruses may be able to remain viable for over 1 month.

The Hosts

Ranaviruses infect amphibians, reptiles, and fish; however, susceptibility varies by species and across phylogenetic lineages. For amphibians, the orders Anura and Caudata are affected and, to date, natural infections have been documented in at least 72 species, representing 14 families with most cases reported from the family *Ranidae*. Currently, ranaviruses have been reported in several species of boney fish and FV3-like ranaviruses have caused die-offs in pallid sturgeon (*Scaphirhynchus albus*) and threespine stickleback (*Gasterostelus aculeatus*). Ranaviruses also have been associated with disease in snakes, lizards, and chelonians, and may best be known for die-offs in eastern box turtles (*Terrapene carolina carolina*). All age groups may be susceptible but this may vary by species. In general, hatchling and metamorphs are the most susceptible age groups in amphibians; however, adults are reported most often in die-offs of several European amphibian species. The egg appears to protect embryos from infection.

Distribution:

Ranaviruses are globally distributed; currently reported from 5 continents. Anthropogenic spread (e.g., infected animals used as live fishing bait, field and recreational equipment, boots, import/export of infected animals for food or pets) has resulted in exposure of na[illegible]ve populations and subsequent mortality events.

Transmission and Pathogenesis:

Transmission is horizontal via direct contact, ingestion of virus or infected animals and water exposure. Vertical transmission is suspected but remains unknown. Frequency-dependent transmission is possible. There is considerable evidence, in nature and from laboratory experiments, for interclass transmission among amphibians, reptiles and fish. The pathogenesis of ranaviral disease is under investigation but current research findings support viral entry through epithelial surfaces, with subsequent dissemination through the body. Studies have shown that infection can begin within seconds of contact. Disease (and deaths) may be established in as short as 3 days but also may take weeks, and likely is dependent on host susceptibility (species and age group) and pathogenicity and amount of the ranavirus. Although it is not always clear to determine how ranaviruses kill their host, in most cases, death results from severe cellular/organ necrosis. Clinical signs may include lethargy, buoyancy problems, erratic swimming, and gasping for air (chelonians). Gross lesions may include swelling (neck, appendages, body), hemorrhages (especially on ventrum and legs [amphibians]), tan friable organs, ulceration, and oral necrotic tan

plaques (chelonians). Microscopic lesions may include, hemorrhage, swelling (edema), cellular necrosis (e.g., hematopoietic tissue, hepatocytes, epithelial cells, endothelial cells), and inclusion bodies (intracytoplasmic; however, intranuclear have been reported but are rare). Subclinical infection has been detected in wild amphibians and in experimental challenges.

Significance:
Ranaviral diseases may be enzootic or epizootic with high mortality (100% in some species). Ranaviruses are not distributed uniformly across the landscape; infection hotspots exist. Therefore, these viruses may have negative impacts on conservation measures, especially in cases of repatriation of endangered species. Rare species that are highly susceptible (e.g., *Lithobates capito*) are at greatest risk. In general, translocation of animals into environments from where they did not originate, should be discouraged. Statistically valid sampling practices still need to be defined.

Treatment: Currently there is no reliable treatment. Quarantine of infected animals is recommended. Treatment of secondary invaders also may limit the severity of the disease. Disinfection: A minimum of 1 minute contact time with > 3% Bleach, > 1% Virkon or > 0.75% Nolvasan will inactivate the virus.

Prevention and Control:
Vaccination or chemotherapeutics are not currently available. Newly acquired animals should be isolated and tested prior to introducing them to captive colonies. Water in captive facilities should be disinfected to inactivate the virus prior to discarding it from tanks/enclosures housing infected animals. If possible, each tank/pond should have a separate water source. All equipment and surfaces of captive facilities should be disinfected after use. Similarly, equipment and boots used at a field site should be disinfected before proceeding to a new field site. Translocation of hosts, including those used for fishing bait, should be discouraged.

Zoonotic potential: None

Wildlife Impact: Susceptible species may experience population declines. Current (and on-going) research suggests that community composition may play a role in emergence within an ecosystem. Die-offs may begin and end in less than 2 weeks.

Status: Amphibian diseases caused by ranaviruses are listed as notifiable by the World Organization of Animal Health (OIE). Information regarding the OIE listing can be found within the *Aquatic Animal health Code*, with ranavirus specific information at http://www.oie.int/index.php?id=171&L=0&htmfile=chapitre_1.8.2.htm
The OIE approved diagnostic tests can be found within the *Manual of Diagnostic Tests for Aquatic Animals*, with ranavirus specific information found at: http://www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/2.01.02_RANAVIRUS.pdf