Fertility in Adverse Environments: Correlating sperm quality with fertility in barramundi.

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GAME Lab: About Us

• **Research Interest:**
  - Impact of *adverse conditions on fertility* (e.g. IVF, heat-stress, social-stress, disease)

• **Current Projects:**
  - IVF on horse embryos; season & social stress on African wild dog sperm; chytrid infection on frog embryos; **heat-stress on boar sperm**

• **Tools Used:**
  - highly sensitive cellular & molecular tools as ‘**barometer**’ to detect compromised survival in sperm & embryos:
  - CASA, TUNEL/FACS, IVF, sperm freezing, gene & protein expression.
Heat-stress & Summer Infertility in Pig

- pork is most consumed meat in the world (USDA 2008)
- costs industry ~$300 million annually in US (St. Pierre et al. 2003)
- in mice: heat-stress = sperm DNA damage = embryo failure (Paul et al. 2008; Perez-Crespo et al. 2008)
- **Aim:** determine if heat-stress causes DNA damage in boar sperm, that results in embryo loss in the sow → develop mitigation strategy

1. Heat-stress
2. DNA damage → Reduced fertilization → Arrested embryo development
3. Mitigation strategies
Results: Summer causes sperm DNA damage in boars

- **Sperm motility:** did not change across seasons *BUT*
- **Sperm DNA damage:** increased significantly in summer
- **Treatment:** 42-day antioxidant supplement *significantly decreases* sperm DNA damage in summer
- **Ongoing research:** IVF experiments to test if development arrested in pig embryos
Problems in the Barramundi Industry

- **Variable spawning success**: across months/years (fertilization & hatch rates, arrested embryo development)

- **Skewed paternity**: selected males sire 0-1% of progeny vs. 60% by other males

*Problem with male fertility?*

- **Sperm parameters important to fertility**:  
  - *motility*: how well they swim (analysed by CASA)  
  - *number*: how many produced (by sperm counts)  
  - *morphology*: normal shape (by microscopy)  
  - *DNA integrity*: developmental potential (by TUNEL)

Frost et al. 2006
Pilot Project: Assess male influence on barramundi spawning performance

Collaboration with Prof Dean Jerry, Jarrod Guppy, Adrien Marc & Santiago Pena

- Using state-of-the-art JCU Aquaculture/GAME Lab facilities
- Investigating *differences in sperm quality between males* prior to mass spawning events of commercially important broodstock
- If differences detected examine *downstream effect on development & paternity of embryos*

Semen Collection  Motility (CASA)  DNA integrity (TUNEL/FACS)
Our Expertise

- **Sperm quality analysis tools**: CASA, TUNEL/FACS, microscopy
- **Sperm cryopreservation**: develop sperm freezing techniques
- **Embryo viability & paternity testing**: DAPI, morphology, protein & gene expression, microsatellite analysis
- **Management strategies**: mitigation or broodstock selection

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