ICAIS

16TH INTERNATIONAL CONFERENCE ON AQUATIC INVASIVE SPECIES

NUMERICAL MODELLING FOR THE ECONOMIC COSTS OF BIOLOGICAL INVASION

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Situations of Interest

Theoretical Assumptions

- The environment is divided for:
  - native specie that is a natural resource commercially exploited, and
  - invasive specie that interacts resulting in a reduction in biomass of native species.

$$Max \int_0^{\infty} \pi(h) e^{-rt} dt,$$

Subject to:

$$\begin{cases} \dfrac{\partial n_1(d,t)}{\partial t} = D_1 \dfrac{\partial^2 n_1}{\partial d^2} - k_1 \dfrac{\partial^4 n_1}{\partial d^4} + F_1(n_1, n_2) - h(n_1, E) \\ \dfrac{\partial n_2(d,t)}{\partial t} = D_2 \dfrac{\partial^2 n_2}{\partial d^2} - k_2 \dfrac{\partial^4 n_2}{\partial d^4} + F_2(n_1, n_2) \end{cases}$$

with conditions,

$$F_1(n_1(d,0)) = h(n_1(d,0), E) \qquad \text{and} \qquad n_2(d,0) = 0.$$

Research

1. We presented the invasion problem.
   - Mathematically modeled by a non-linear advection-diffusion-reaction equation, which analytical solutions are restricted to rare cases
2. It was developed a bio-economic model for invasion considering the retention effects.
   - New terms of high order will be incorporated to take in account the contents retention in the redistribution process and the asymmetry of the distribution.
3. We are developing a methodology for solving the bio-economic model with the retention term.
   - We will use a stabilized finite element method, and
   - the continuous-time deterministic optimal control to solve the control problem.
4. We will analyze through numerical simulations the influence of retention in biological invasion.

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