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Abstract The text of your abstract. 150 – 250 words.

Keywords key · dictionary · word ·

Mathematics Subject Classification (2000) MSC code 1 · MSC code 2 ·

1 Introduction

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2 Background

In this section we first review two well-established techniques commonly used in sustainable fishery management. These are the maximum sustainable yield (MSY) and the constant escapement (CE) approaches. After this, deep reinforcement learning is briefly reviewed

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2.1 Fishery management

2.2 Deep reinforcement learning

3 Dynamical models used

In this section we present three models of increasing complexity which plausibly describe the population dynamics of a marine ecosystem. These models will form the test beds for the comparison between classical fishery management strategies and DRL.

A one-dimensional tipping point model. Consider a population V whose dynamics is given by

$$\frac{\mathrm{d}V}{\mathrm{d}t} = rV\left(1 - V/K\right) - \frac{\beta H V^2}{V_0^2 + V^2}. \tag{1}$$

This model has been used in [**?**] to study the possible dangers of driving a Here the only dynamic degree of freedom is V, while $r,\ K,\ \beta,\ V_0$, and $H > 0$ are fixed positive parameters.

In (1), a population V grows logistically with rate r up to carrying capacity K. This is expressed by the first term in the equation,

$$L(V \mid r,\ K) := rV\left(1 - V/K\right).$$

Moreover, V is predated on by a (constant) population H, as can be seen from the negative term

$$F(V,\ H \mid \beta,\ V_0) := \frac{\beta H V^2}{V_0^2 + V^2}$$

which saturates to $F \to \beta H$ as $V \to \infty$, and whose half maximum is V_0, i.e. $F(V = V_0,\ H; \beta,\ V_0) = \beta H/2$.

For fixed values of $r,\ K,\ V_0$ and β, varying H may produce a *catastrophe* (see Fig. **??**)—a sudden disappearance of a stable fixed point of the system which .

4 Results

5 Discussion

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$$a^2 + b^2 = c^2 \tag{2}$$

References

1. R. Mislevy, in *Educational Assessment*, ed. by R.L. Brennan (American Council on Education and Praeger Publishers, 2006), chap. 8