**An introduction TO** **Dynamical systemS applied to exploited populations**

**THE FIGURES IN THE ARTICLE**



**Figure 1**. corresponds to (2.2). The natural growth of the population, *dn/dt* is shown as a function of *n*. The growth of the population is positive whenever it is less than K (*dn/dt>0* if *0<n<K*). *K* is the environmental carrying capacity and r the intrinsic growth rate. The parabola reaches its maximum value, MSY when n=nmsy. MSY = *rK/4* and nmsy= *K/2.*



**Figure 2.** corresponds to (3.1.1). The net growth of the population, *dn/dt* is shown as a function of *n*. *K* is the environmental carrying capacity and *r* the intrinsic growth rate. The parabola reaches its maximum when n= *K/2.* The parabola is the natural growth of the population while the horizontal lines are the constant yields, *H* at three different predating levels. Where the line lies above the parabola; the net growth rate is negative. Where the line lies below the parabola, the net growth rate is positive. The points of intersection correspond to possible equilibria and the arrows indicate the stability of the equilibria.

logistic curve with Type I



Figure 3. corresponds to (3.2.2). The net growth of the population, *dn/dt* is shown as a function of *n*. *K* is the environmental carrying capacity, *r* is the intrinsic growth rate, *e* is the effort and *q* is the capturability. The parabola is the natural growth of the population while lines are loss due to predation using constant effort, *h=qe(t)n*. When *e(t)* is increased, *h1* moves to the left to *h2*. Where the line lies above the parabola; the net growth rate is negative. Where the line lies below the parabola, the net growth rate is positive. The points of intersection correspond to possible equilibria and the arrows indicate the stability of the equilibria.

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*K*

 **Figure 4.** corresponds to (3.3.2) and (3.3.3). The net growth of the population, *dn/dt* is shown as a function of *n.* *K* is the environmental carrying capacity and *H(n)* is Holling Type II functional response. The points of intersection correspond to the possible equilibria. Where the parabola is above the curve, the net growth rate is positive (the flow along the x-axis is to the right). Where the curve is above the parabola, the net growth rate is negative (the flow along the x-axis is to the left). *h(1),h(2),h(3),h(4),h(5)* are predation levels with *a* =0.12 and η =0.048, 0.136, 0.224, 0.312 and 0.48 respectively.



*K*

**Figure 5.** corresponds to (3.4.2) and (3.4.3). The net growth of the population, *dn/dt* is shown as a function of *n.* *K* is the environmental carrying capacity and *H(n)* is Holling Type III functional response. The points of intersection correspond to the possible equilibria. Where the parabola is above the curve, the net growth rate is positive (the flow along the x-axis is to the right). Where the curve is above the parabola, the net growth rate is negative (the flow along the x-axis is to the left). *H(1),H(2),H(3),H(4),H(5)* are predation levels with *a* =1.2 and η =0.12, 0.24 , 0.36, 0.48 and 0.64 respectively.



*K*

**Figure 6.** corresponds to (3.4.2) and (3.4.3). The net growth of the population, *dn/dt* is shown as a function of *n.* *K* is the environmental carrying capacity and *H(n)* is Holling Type III functional response. The points of intersection correspond to the possible equilibria. Where the parabola is above the curve, the net growth rate is positive (the flow along the x-axis is to the right). Where the curve is above the parabola, the net growth rate is negative (the flow along the x-axis is to the left). *h(1),h(2),h(3),h(4),h(5)* are predation levels with *a* =0.12 and η =0.048, 0.136, 0.224, 0.312 and 0.48 respectively.