New management issues within the reformed Common Fisheries Policy: implementation and socio-economic impacts

28th – 30th April 2015, University of Salerno, Italy

AN APPLICATION OF LIFE-CYCLE THEORY TO THE WEST OF SCOTLAND COD FISHERY

Dr PHILIP RODGERS
phil@erinecon.com
Gordon-Schaefer - stable bionomic equilibrium

Why should economic and biological equilibrium be achieved simultaneously?

A fish stock may be a harvestable resource even without reproduction and growth
\( \pi = \text{profit} \)
\( \bar{p} = \text{exogenous price} \)
\( q_e = \text{equilibrium output} \)
\( c = \text{costs (opportunity)} \)

The Economic Equilibrium Condition
\[
\pi(t) = \bar{p}q_e(t) - c(t) = 0 \tag{1}
\]

where
\[
c(t) = \gamma k(t) \tag{2}
\]

\( k = \text{index of capital employed} \)
\( \dot{B} = \text{change in the fish stock} \)

and a Production Function
\[
q(t) = \alpha_0 \dot{B}(t)^{\alpha_1} k(t)^{\alpha_2} \tag{5}
\]
\[ \pi(t) = \bar{p} q_e(t) - \gamma k(t) = 0 \]

\[ q(t) = \alpha_0 \dot{B}(t)^{\alpha_1} k(t)^{\alpha_2} \]

\[ \gamma = \frac{p(0)q_e(0)}{k(0)} \] \hspace{1cm} (3)

\[ k(t) = \frac{p(t)q(t)}{\gamma} \] \hspace{1cm} (4)
\[ \pi(t) = \bar{\rho} q_e(t) - \gamma k(t) = 0 \]
\[ q(t) = \alpha_0 \dot{B}(t)^{\alpha_1} k(t)^{\alpha_2} \]
\[ \dot{B}(t) = \gamma \left( \frac{q(t)}{\alpha_0 k(t)^{\alpha_2}} \right)^{\frac{1}{\alpha_1}} \]  
\[ (5a) \]
\[ B(t) = \int_{i=t}^{T} \dot{B}(t) \, dt \]  
\[ (6) \]
The Life-Cycle in Open-Access of the West of Scotland Cod Fishery

AN APPLICATION OF LIFE-CYCLE THEORY TO THE WEST OF SCOTLAND COD FISHERY
\[ \pi(t) = \bar{\rho} q_e(t) - \gamma k(t) = 0 \]

\[ q(t) = \alpha_0 \dot{B}(t)^{\alpha_1} k(t)^{\alpha_2} \]

\[ SW = \int_0^T (q(t)D(q(t)) - q(t)S(q(t)))e^{-rt}dt \]  \hspace{1cm} (7)

\[ D = \text{demand curve} \]

\[ S = \text{short run supply curve} \]
The Results

\[ \gamma = 5.06m \]
\[ \alpha_0 = 5.144 \]
\[ \alpha_1 = 0.91 \]
\[ \alpha_2 = 0.67 \]

€7,711m at 2011 prices

Correlation Coefficient = .9742
Mean Percentage Difference = 6.01%
Percentage Standard Deviation = 27.62%
AN APPLICATION OF LIFE-CYCLE THEORY TO THE WEST OF SCOTLAND COD FISHERY