

Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission



Videojuego de Evaluación de Estrategias de Ordenación
para atún patudo (Bigeye tuna)

1er TALLER EEO CIAT, San Diego, California (USA), 9-10 de Diciembre, 2019

Aprendizaje mediante prueba y error

Vida real:

Costoso, poca o ninguna repetición



Videojuego:

Casi sin costo, repito cuanto quiera

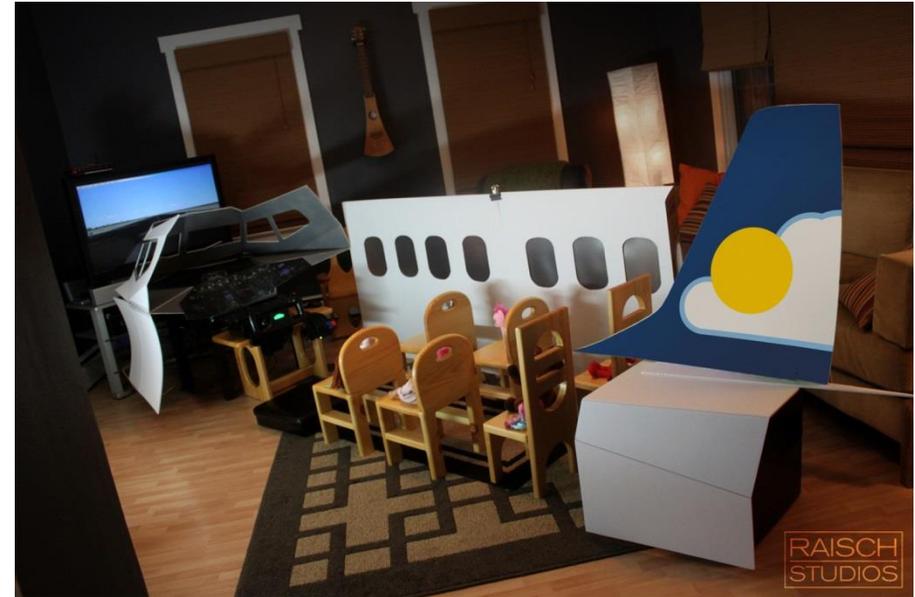


Juguemos con los conceptos simulando la ordenación

SIMULADOR DE VUELO



Este juego es mas simple que un simulador realista





**BREAKING
NEWS**



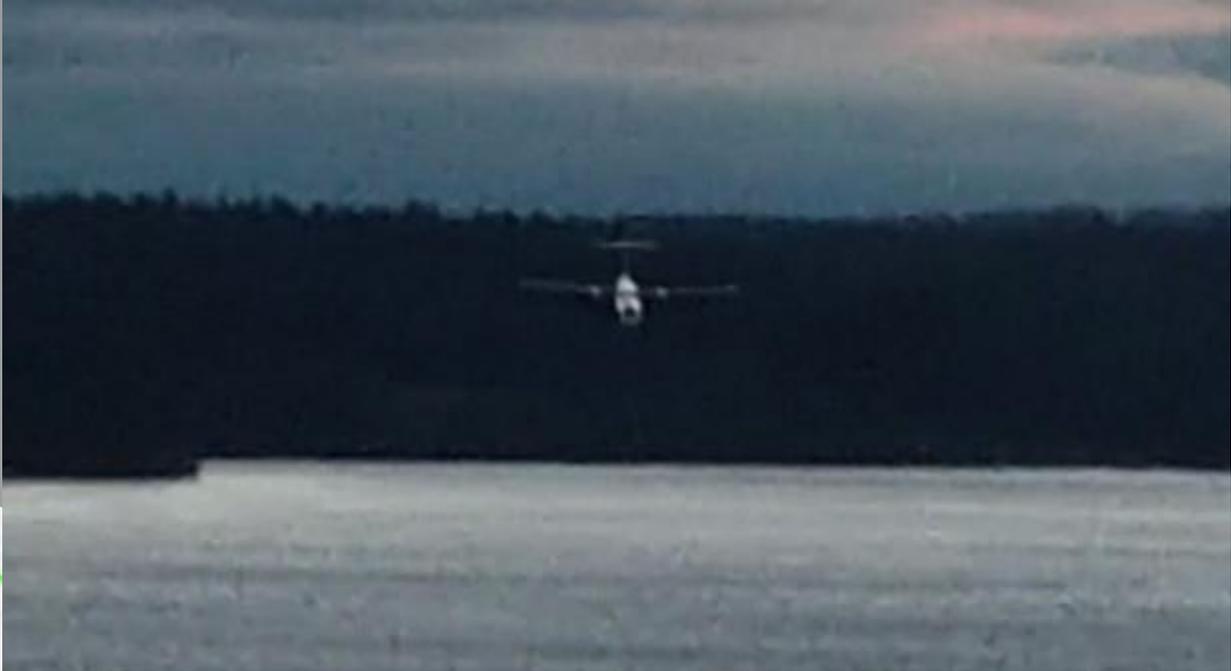
EL PAÍS



ESTADOS UNIDOS

[ACCIDENTES AÉREOS >](#)

El hombre que robó el avión en Seattle y lo estrelló: “No necesito ayuda, he jugado a algunos videojuegos”



University Place, Washington

10 de agosto, 2018



He jugado videojuegos antes, así que
creo que sé lo que hago.



**COROLARIO: Jugar videojuegos no es realizar el trabajo real...
Este juego NO ES UNA EVALUACION DE ESTRATEGIA DE ORDENACION**

En que consiste este juego

- Aspectos de evaluación de estrategias de ordenación
- TunaMSE, herramienta simple que ilustra interactivamente:
 - Proyección de modelo poblacional/pesquero
 - Elementos del proceso de evaluación de estrategias
 - Compara RCEs simples
 - Utiliza Interrogating performance measures to make comparisons between HCRs
 - Configurado para atún patudo en el OPO

Como usar este juego

https://valeromaspez.shinyapps.io/TunaMSE_OPO_SPN/



Juego de EEO de atun patudo x +

← → ↻ valeromaspez.shinyapps.io/tunamse_opo_spn/

Juego de EEO de atun patudo Información Ej 1. Manejo Manual Ej 2. Manejo con RCE Ej 3. Seleccion de RCE Configuracion

Introduccion



Ejemplo de Evaluación de Estrategias de Explotación (EEO)

Esta herramienta permite a los usuarios explorar el desempeño de opciones de reglas de control de explotación para la ordenación de especies de túnidos. Ha sido desarrollada como herramienta educativa para resaltar aspectos de la aproximación de **evaluación de estrategias de explotación (EEO)**.

Como interpretar resultados del juego



Biomasa

Manejo de la pesquería de manera 'manual' determinando el límite de captura en cada año

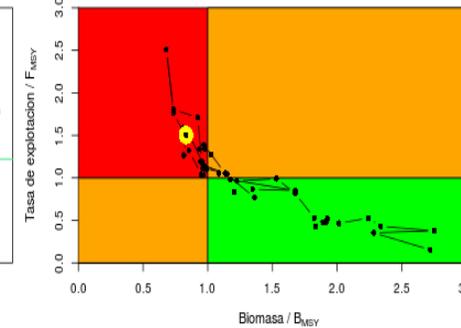
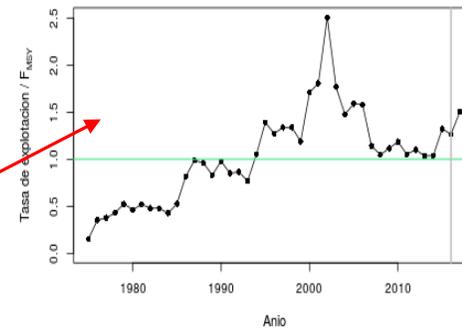
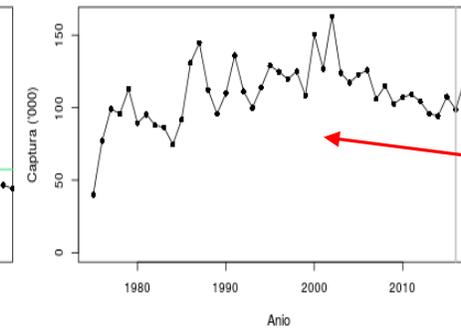
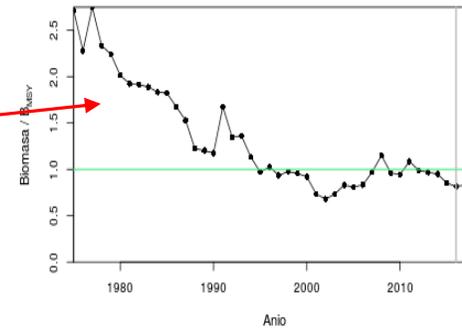
Cada vez que cambie el límite de captura, discuta en el grupo porque esta haciendo el cambio. Su objetivo es obtener la mayor captura y mantener el estado del stock, evitando sobre explotación y manteniendo baja variabilidad en capturas.

Límite de Captura ('000t)

Duración de límite de captura (años)

Aplicar manejo Reiniciar

Indicadores de desempeño: figuras



Captura

Tasa de explotación

Especificaciones del juego



Manejo de la pesquería de manera 'manual'
determinando el límite de captura en cada año

Cada vez que cambie el límite de captura, discuta en el grupo porque esta haciendo el cambio. Su objetivo es obtener la mayor captura y mantener el estado del stock, evitando sobre explotación y manteniendo baja variabilidad en capturas.

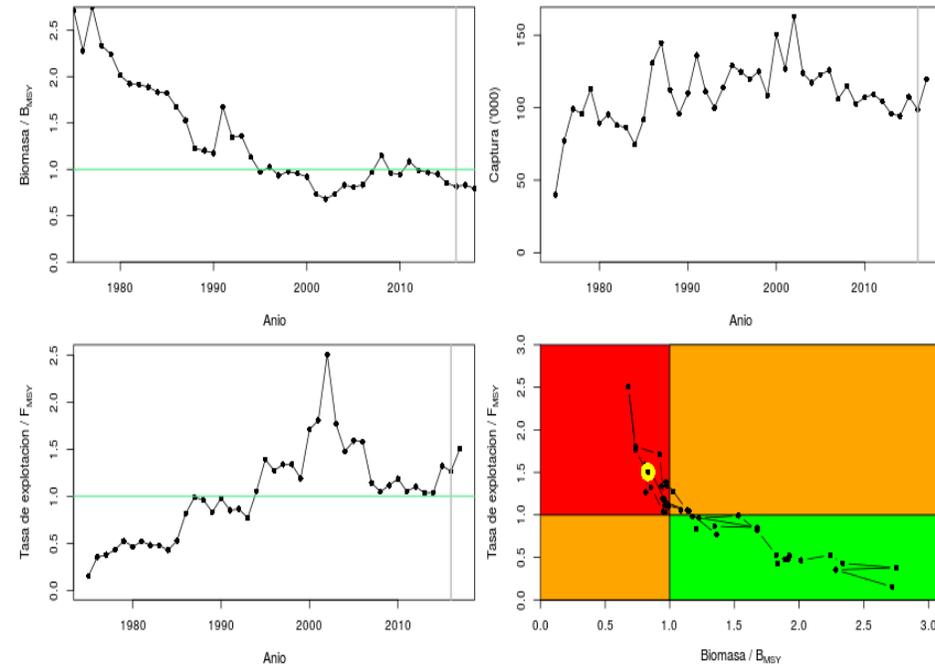
Límite de Captura ('000t)

Duración de límite de captura (años)

Aplicar manejo Reiniciar

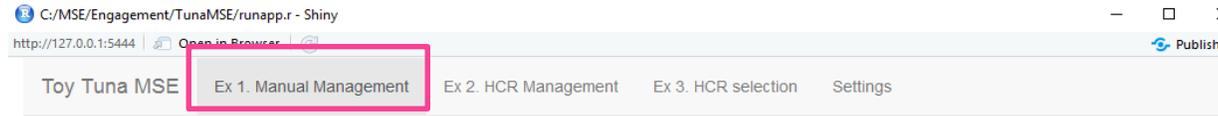
Captura a futuro
60,000 toneladas

Indicadores de desempeño: figuras



Periodo de manejo 1 año

Especificaciones del juego



Manage the fishery 'manually' by changing the catch limit each year.

Each time you change the catch limit, discuss amongst the group why you are making the change. Your aim is to get the highest overall catch while maintaining stock status, avoiding overfishing and keeping catch variation low.

Catch limit ('000t)

300

Catch limit duration (yrs)

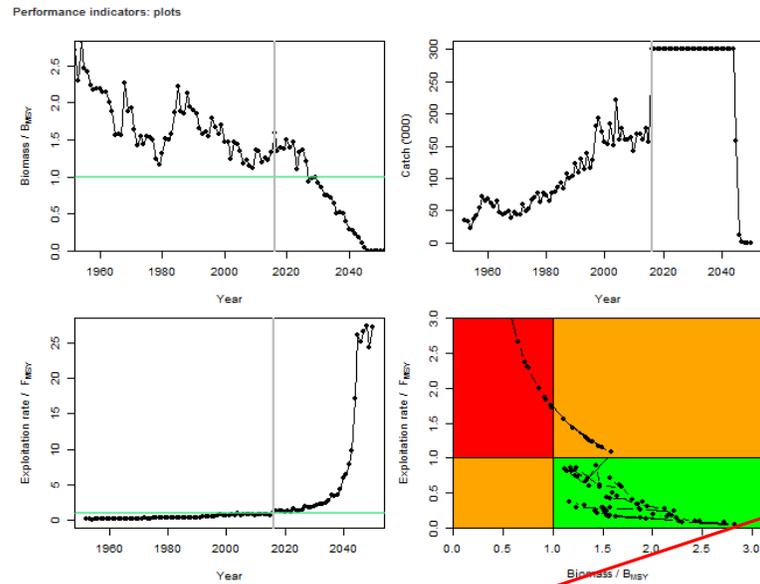
35

Apply management

Restart

Captura
300,000
toneladas

Periodo de manejo
35 años



Performance indicators: values

	Stock status (B/B _{MSY})	Fishing intensity (F/F _{MSY})	Prob. green	Catch (kt)	Catch variation (%)
Current (2051)	0.00	27.37	0.00	0.00	88.79
Overall (2016-2051)	0.85	5.74	0.00	253.49	3.48



Año final

Promedio años
de proyección

Métricas de desempeño

- Estado del stock - B/B_{MSY}
- Tasa de explotación - F/F_{MSY}
- Probabilidad de estar dentro de área Verde Kobe
- Captura
- Variabilidad en capturas

- Todos los indicadores son igualmente importantes?
- Cual es el periodo de tiempo de interés? Corto, largo plazo?

Panel de configuración

The screenshot shows a web browser window with the URL `http://127.0.0.1:5444` and a navigation bar with tabs: "Toy Tuna MSE", "Ex 1. Manual Management", "Ex 2. HCR Management", "Ex 3. HCR selection", and "Settings" (highlighted with a red box). The main content area is a configuration panel titled "Specifications for the runs" with the following fields:

- Type of scenario to consider:** Radio buttons for "Easy", "Moderate" (selected), and "Hard".
- Type of scenario to consider:** Radio buttons for "RUN1_USLL" (selected), "RUN2_JLL", and "RUN3_CHTAI".
- Number of simulations:** A spinner box containing the value "10".
- Last year of simulation:** A spinner box containing the value "100".
- Number of years to compute outputs over:** A spinner box containing the value "50".
- Random number seed:** A spinner box containing the value "42".
- Limit Reference point (proportion of BMSY) (Not used in this version):** A spinner box containing the value "0.4".
- Catch Reference ('000):** A spinner box containing the value "180".

At the bottom of the panel is a button labeled "Implement Updates".

Tipo de escenario

No usado ahora

N simulaciones

Sugerimos no usar por ahora

Ejercicio (1) – proyección manual

- Pruebe proyecciones con distintos niveles de captura y duración de manejo.
 - Use gráficos e indicadores de desempeño para ver como les va con el juego y cambie la captura para mantener al stock cerca de B_{msy}
 - Ej.
 - 3 años de proyección, captura = 60 kt
 - Seguido de:
 - 3 años de proyección, captura = 100 kt
 - Seguido de:
 - 3 años de proyección, captura = 120 kt

Ejercicio (2) – proyección con reglas de control

C:/MSE/Engagement/TunaMSE/runapp.r - Shiny
http://127.0.0.1:3980 Open in Browser Publish

Toy Tuna MSE Ex 1. Manual Management **Ex 2. HCR Management** Ex 3. HCR selection Settings

Use a harvest control rule (HCR) to manage the fishery.

Try different types of HCR. The 'Constant Catch' and 'Constant Exp. Rate' HCRs are 'static' - they fix catch or exploitation rate at a constant level. The 'Threshold Exp. Rate' HCR is 'adaptive' or 'dynamic', it adjusts the exploitation rate depending upon the status of the stock.

Each HCR has one or more control parameters. These are like tuning knobs on an autopilot - they allow you to alter how the HCR operates. Try changing each control parameter and see how it affects the biomass and catch trajectories. Your aim is to get a high average catch, without too much variability, while maintaining the stock status around the green line and away from the red line.

Note: The <simulation outcomes> graph is ONLY updated when the <Run Simulations> button is pressed.

Type of HCR:
Constant Catch

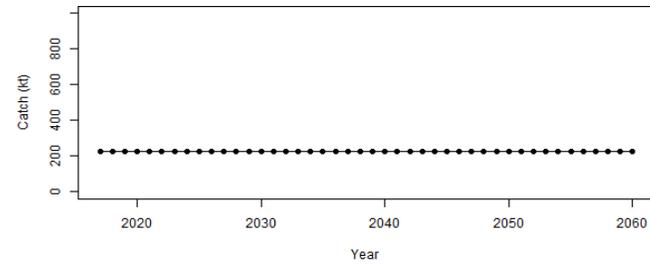
Catch ('000t)
0 225

The catch limit in every year

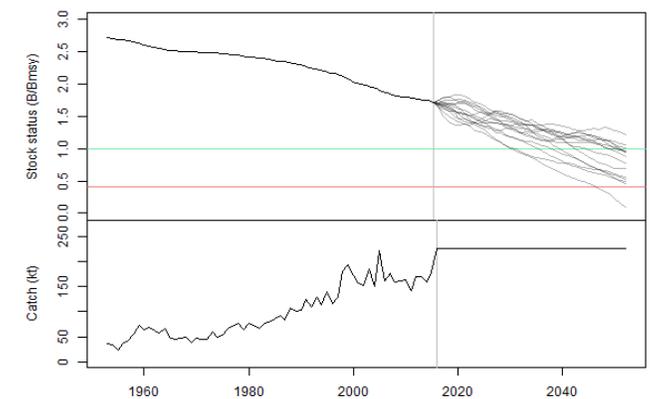
Number of simulations
15

Run simulations

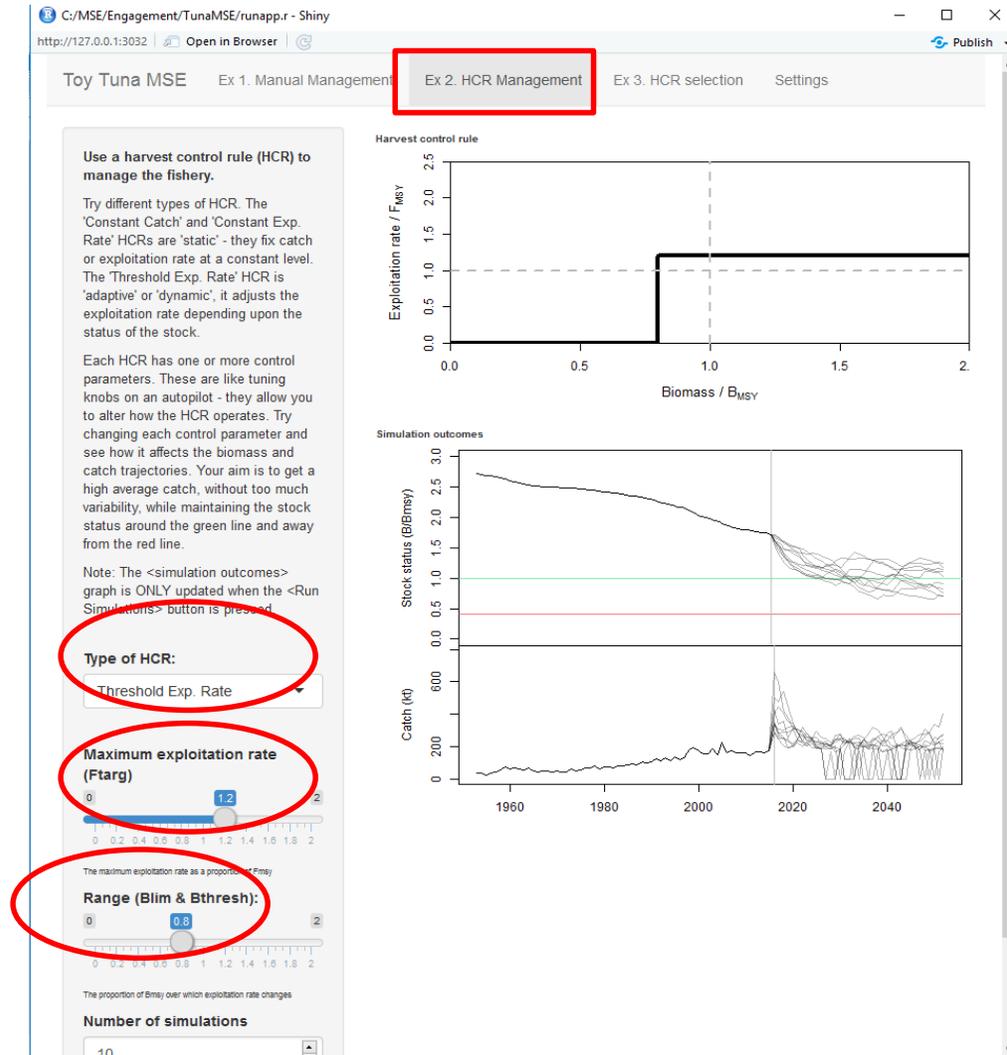
Harvest control rule



Simulation outcomes



Ejercicio (2) – proyección con reglas de control



Ejercicio (2) – proyección con reglas de control

C:/MSE/Engagement/TunaMSE/runapp.r - shiny
 http://127.0.0.1:3032 | Open in Browser | Publish

Toy Tuna MSE Ex 1. Manual Management **Ex 2. HCR Management** Ex 3. HCR selection Settings

Use a harvest control rule (HCR) to manage the fishery.

Try different types of HCR. The 'Constant Catch' and 'Constant Exp. Rate' HCRs are 'static' - they fix catch or exploitation rate at a constant level. The 'Threshold Exp. Rate' HCR is 'adaptive' or 'dynamic', it adjusts the exploitation rate depending upon the status of the stock.

Each HCR has one or more control parameters. These are like tuning knobs on an autopilot - they allow you to alter how the HCR operates. Try changing each control parameter and see how it affects the biomass and catch trajectories. Your aim is to get a high average catch, without too much variability, while maintaining the stock status around the green line and away from the red line.

Note: The <simulation outcomes> graph is ONLY updated when the <Run Simulations> button is pressed.

Type of HCR:
 Threshold Exp. Rate

Maximum exploitation rate (F_{targ})
 0 1.2 2

Range (B_{lim} & B_{thresh}):
 0 0.4 1 2

Number of simulations
 10

Harvest control rule

Simulation outcomes

Catch (kt)	HCR	Type	Catch	Exp. rate	F _{mult}	B _{lim}	B _{thresh}	Median Depletion (%)	*Prob. green	*Catch	*Catch var.
	1	Knife-edge	NA	NA	1.2	0.8	0.8	37.7	0.694	207.5	0.227
	2	Slope	NA	NA	1.2	0.4	1	37.9	0.675	209.2	0.172

Median Depletion (%)	*Prob. green	*Catch	*Catch var.
37.7	0.694	207.5	0.227
37.9	0.675	209.2	0.172

Ejercicio (2) – proyección con reglas de control

Toy Tuna MSE Ex 1. Manual Management Ex 2. HCR Management **Ex 3. HCR selection** Settings

Select the HCR that best achieves your management objectives.

The performance indicators have been recorded for each of the HCRs that you tested during Exercise 2. Select one HCR that you think has the best tradeoffs amongst the performance indicators. You can go back to Exercise 2 and evaluate more HCRs to try and find a HCR with even better performance.

Plot trajectories for which HCR?

3

Use this to choose which HCR to plot trajectories for.

Key

HCR control parameters

- Catch is the constant catch.
- Exp. rate is the constant exploitation rate.
- F_{flag}, B_{lim} and B_{thresh} define the threshold harvest control rule.

Performance indicators

- Median depletion (%): Median of B_{unfished} B.
- Prob. green: probability of being above B > B_{MSY} and F < F_{MSY}.
- Catch: median over sims of the catch.
- Catch var.: median over sims of the catch variation.

HCR	Type	Catch	Exp. rate	Fmult	Blim	Bthresh	Median Depletion (%)	*Prob. green	*Catch
1	Threshold	NA	NA	1.2	0.8	0.8	37.7	0.694	207.5
2	Threshold	NA	NA	1.2	0.4	1	37.9	0.675	209.2
3	Threshold	NA	NA	0.8	0.4	1.2	49.2	0.981	184.8

Toy Tuna MSE Ex 1. Manual Management Ex 2. HCR Management **Ex 3. HCR selection** Settings

Select the HCR that best achieves your management objectives.

The performance indicators have been recorded for each of the HCRs that you tested during Exercise 2. Select one HCR that you think has the best tradeoffs amongst the performance indicators. You can go back to Exercise 2 and evaluate more HCRs to try and find a HCR with even better performance.

Plot trajectories for which HCR?

3

Use this to choose which HCR to plot trajectories for.

Key

HCR control parameters

- Catch is the constant catch.
- Exp. rate is the constant exploitation rate.
- F_{flag}, B_{lim} and B_{thresh} define the threshold harvest control rule.

Performance indicators

- Median depletion (%): Median of B_{unfished} B.
- Prob. green: probability of being above B > B_{MSY} and F < F_{MSY}.
- Catch: median over sims of the catch.
- Catch var.: median over sims of the catch variation.

Candidate HCRs **Plots**

Catch (000) vs Biomass / B_{MSY}

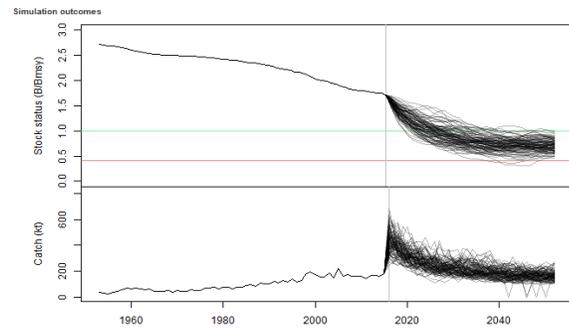
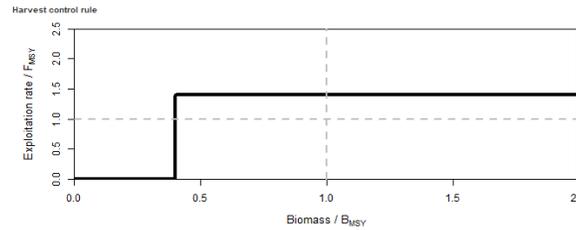
Exploitation rate / F_{MSY} vs Biomass / B_{MSY}

Biomass / B_{MSY} (%) vs Year

Catch (000) vs Year

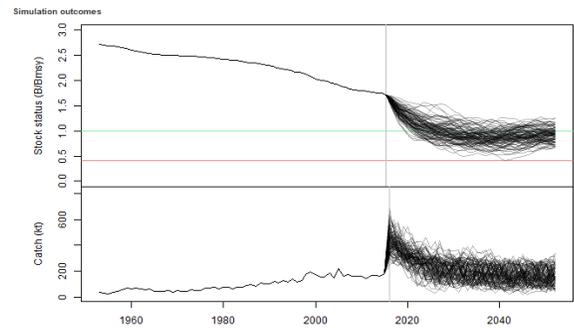
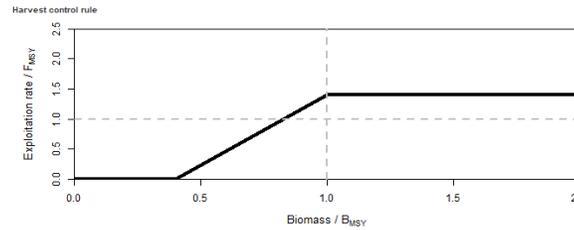
Ejemplos de resultados de juego

HCR 1



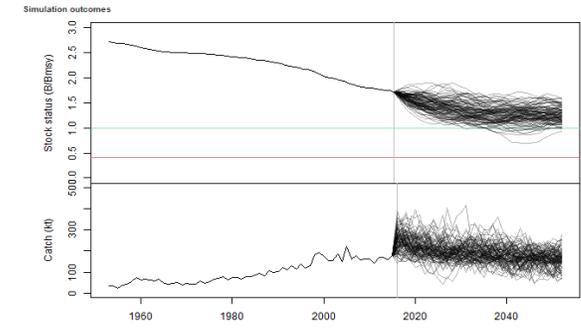
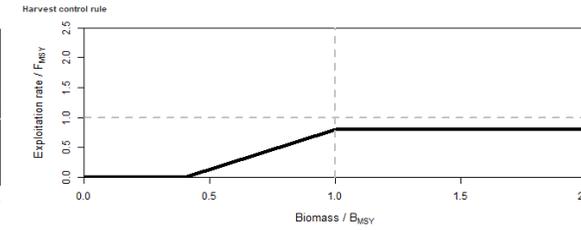
Agresiva

HCR 2



Moderada

HCR 3

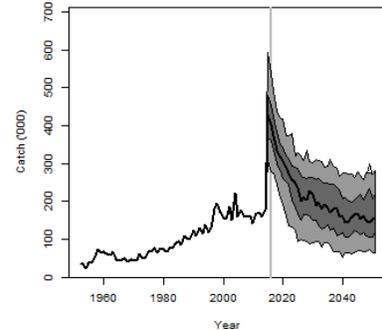
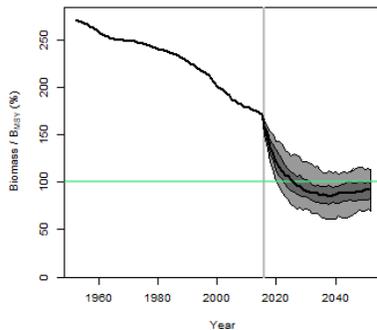
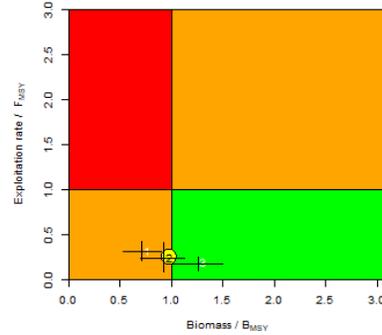
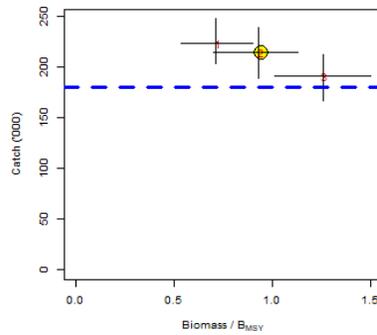


Conservativa

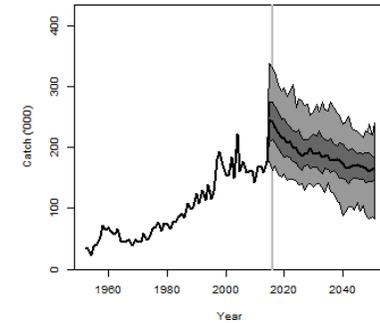
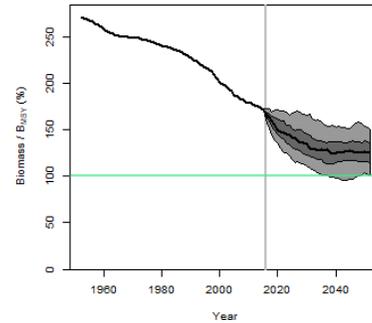
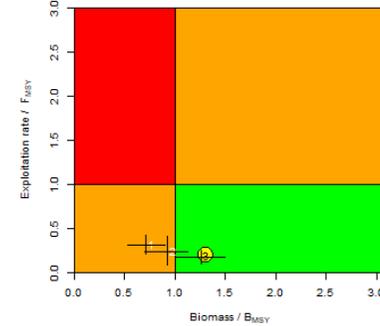
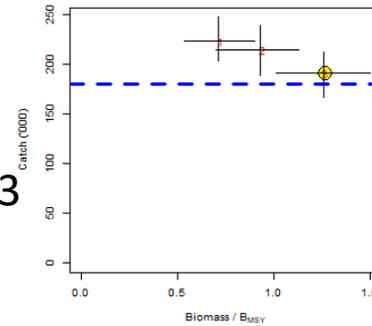
Ejemplos de resultados de juego

HCR	Type	Catch	Exp. rate	Fmult	Blim	Bthresh	Median Depletion (%)	*Prob. green	*Catch	*Catch var.
1	Threshold	NA	NA	1.4	0.4	0.4	26.3	0.306	223.3	0.11
2	Threshold	NA	NA	1.4	0.4	1	34	0.419	214	0.2
3	Threshold	NA	NA	0.8	0.4	1	46.3	0.972	191.5	0.113

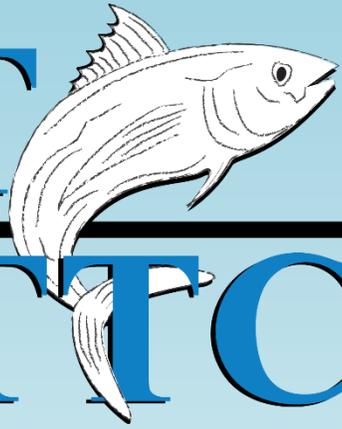
HCR 2



HCR 3



CIAT IATTC



¿Preguntas?