Management of New Zealand mixed fisheries: a bio-economic modeling approach

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EU-funded TRANZEF project

1. IFREMER (Boulogne s/mer, France)
2. Seafood Industry Council Ltd (Wellington, New Zealand)
3. NIWA (Wellington, New Zealand)
4. IFREMER (Nantes, France)
5. Agrocampus (Rennes, France)

TRANZEF project

- 18-month EU funded project
  - 12 month in Wellington (NZ) at SeaFIC
  - 6 month in Boulogne (FRA) at Ifremer

- Main objectives
  - Comparative review of the management in the EU and in NZ
  - Fleet dynamics of selected NZ fleets
  - Development of a bio-economic model applicable to the NZ fleets
  - Application of this model the EU Channel fisheries

NZ fisheries management

- Quota Management System (QMS), based on ITQ, implemented since 1986
- TAC is the main management tool, set mainly on the basis of MSY
- TAC split into
  - Commercial TACC (Total Allowable Commercial Catch)
  - Recreational quota
  - Other sources of mortality (e.g. illegal fishing)
- TACC split based on ITQ (%), generating an Annual Catch Entitlement (ACE)
  - ACE = TACC x ITQ
- Discarding prohibited
  - Fishers landing above quota are charged a fee per kg extra: the deemed value

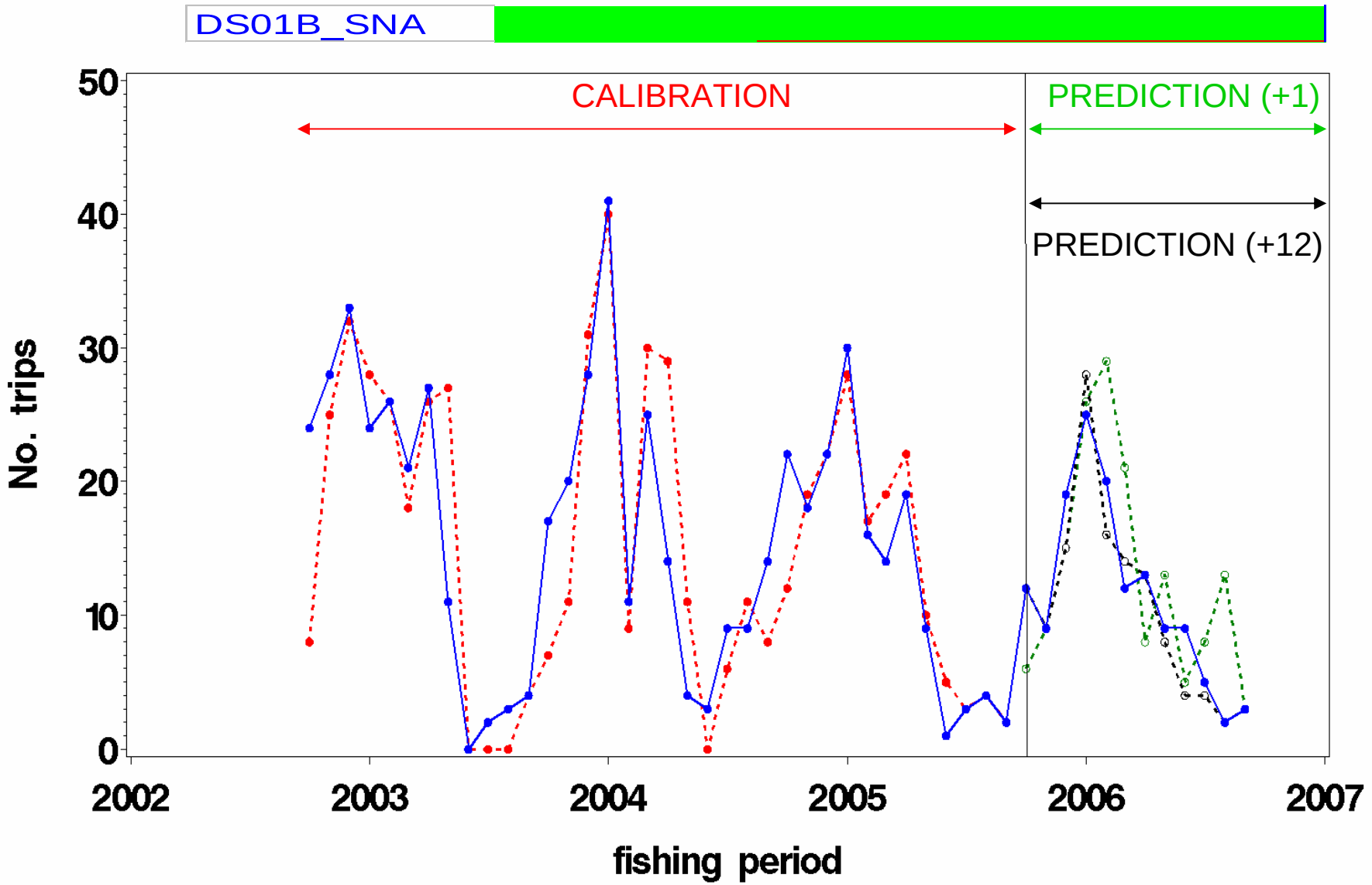
Fleet dynamics

- RUMs applied to model discrete choices (e.g. spatial allocation of fishing effort)
- Discrete choices determined by maximising an utility function, which measures the benefits of making a choice
- The utility function may include a combination of determinants:
  - Expected profit
  - Risk
  - Traditions, …
- Coefficients associated to each determinant estimated based on historical data, through « a sort of regression »
- RUMs applied in the context of MPA. What about ITQ?

Parameterisation of the RUM

Fishers' perception	Explanatory variable	Data sources
Economic return (includes stock density)	Value Per Unit Effort (t-1) Value Per Unit Effort (t-12)	Log-books Price surveys Quota register Deemed value
Attitude towards risk	Coeff. Variation of VPUE (t-1) Coeff. Variation of VPUE (t-12)	Log-books Price surveys
Traditions	Effort allocation(t-1) Effort allocation(t-12)	Log-books Price surveys
Consistency between: catch plan / catch composition Catch plan consist of : -an annual strategy (quota holder) -a tactic (ACE availability)	Penalty function (t-1) Penalty function (t-12)	Quota register Industry data

Results (Snapper seiners)



Model's ability to allocate effort

Fleet code	Métier	Calibration	Prediction 1 month ahead	Prediction 1 year ahead
Hoki trawlers	BT03_018			
	BT03_022			
	BT03_ZZZ			
	BT07_ZZZ			
	MW02_ZZZ			
	MW07_017			
	MW07_ZZZ			
	ZZZ_ZZZ			
Snapper long-liners <12 m	BLL01A_002			
	BLL01A_003			
	BLL01A_008			
	BLL01A_009			
	BLL01A_ZZZ			
	BLL01B_005			
	BLL01B_006			
	BLL01B_007			
	ZZZ_ZZZ			
Snapper long-liners 12-24 m	BLL01A_002			
	BLL01A_003			
	BLL01A_008			
	BLL01A_ZZZ			
	BLL01B_006			
	BLL01B_ZZZ			
	ZZZ_ZZZ			
Snapper trawlers 12-24 m	BT01A_003			
	BT01A_008			
	BT01A_009			
	BT01A_010			
	BT01A_ZZZ			
	BT01B_005			
	BT01B_ZZZ			
	ZZZ_ZZZ			
Snapper seiners <24 m	DS01A_008			
	DS01A_009			
	DS01A_010			
	DS01A_ZZZ			
	DS01B_005			
	DS01B_006			
	DS01B_007			
	ZZZ_ZZZ			

>66% correct effort allocation
33-66% correct effort allocati
<33% correct effort allocation

Determinants	Mc Fadden's LRI
Traditions only	33 – 79%
Penalties only	5 – 32%
All	34 – 81%

Bio-economic modeling

TAC

Catch

270000
260000
250000
240000
230000
220000
210000
200000
190000
180000
170000
160000
150000
140000
130000
120000
110000
100000

1987 1989 1991 1993 1995 1997 1999 2001 2003 2005

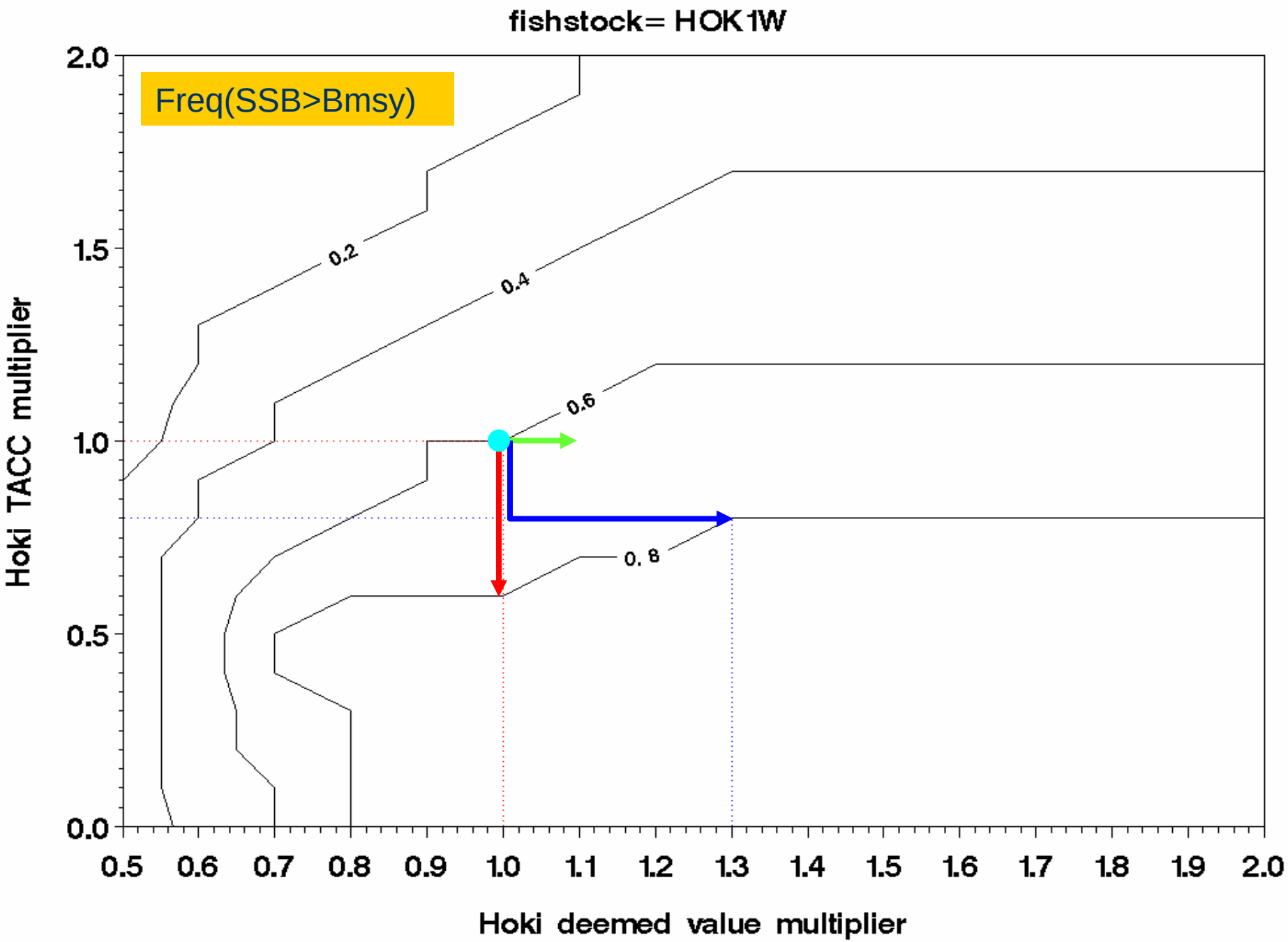
year

Bio-economic modeling

- Issue: to provide some scientific basis to support the setting of the deemed value in a mixed fisheries context
- The inclusion of the ITQ problematic is under way
- Application to the NZ hoki mixed-fishery
  - Hoki as target species
  - Hake as by-catch
  - No provision for other stocks

ISIS-Fish: fisheries modeling tool

- ISIS-Fish: spatial bio-economic model simulating the dynamics of regulated mixed fisheries (www.ifremer.fr/isis-fish)
  - Open source, spatially explicit
- Populations dynamics
  - Length/age, seasonal and spatial distribution, large scale migrations
- Fishing activities dynamics
  - Fleets, métiers (gear, areas, target species)
  - Dynamic allocation of fishing effort building on utility function
- Management dynamics
  - Combination of TAC, deemed value and effort limits


fishstock= HOK1W
Freq(SSB>Bmsy)
0.2
0.4
0.6
0.8
Hoki TACC multiplier
2.0
1.5
1.0
0.5
0.0
0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Hoki deemed value multiplier

Conclusions

- There are indications that economic management could efficiently support TAC implementation if set at appropriate levels
- In mixed fisheries, the deemed value may increase management options
- Increasing hoki deemed value does not have adverse effects on the hake and hoki stocks (but could have on other stocks (e.g. squids) not included here
- Future work will include:
  - Splitting TACC among the fleets and allowing quota exchanges
  - Refining assumptions on the other species dynamics
  - Further develop the economic part of the model