NZ sea lion TMP quantitative risk assessment
Threat scenarios

Jim Roberts & Ian Doonan NIWA
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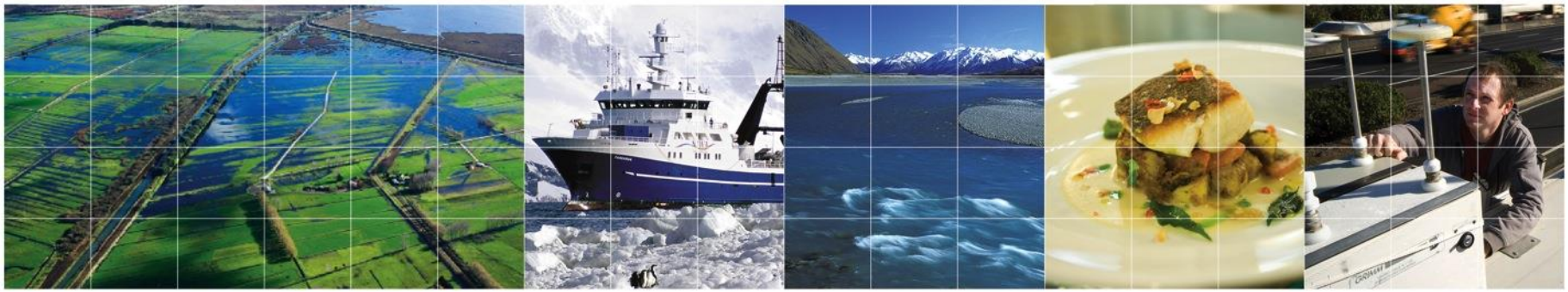
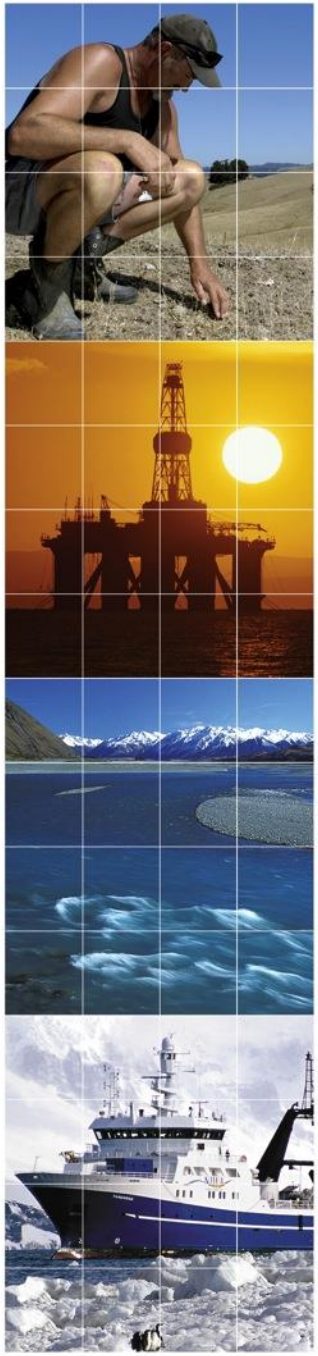




This presentation

- Summary of threats
- Investigative projections for selection of key threats (upper bound of threat - triage)
- MCMC projections for selection of key threats (best estimate of threats)

Summary of threats

All threats to be modelled
Auckland Islands

Threat Class	Threat	Description of threat
Disease	Klebsiella	Pup mortality
Disease	Hookworm	Compromised health (pups)
Disease	Hookworm	Pup mortality
Disease	TB	Adult mortality
Disease	TB	Indirect effect on pup
Disease	Novel agent	Pup mortality
Disease	Novel agent	Adult mortality
Environmental change	Pups drowning in holes	Pup mortality
Trophic effects	Prey availability	Direct & indirect effects of nutritional stress, competition for prey, & changes in prey and predator abundance
Fishing	Commercial trawl	Incidental capture
Fishing	Commercial trawl	Indirect effect on pup
Fishing	SLEDs	Cryptic mortality
Fishing	SLEDs	Indirect effect on pup from cryptic death (non-retained breeding female)
Natural behaviour	Male NZSL aggression	Female mortality
Natural behaviour	Male NZSL aggression	Indirect effect on pup
Natural behaviour	Male NZSL aggression	Pup mortality
Pollution	Plastics - entanglement	Adult mortality
Pollution	Plastics - entanglement	Indirect effect on pup
Pollution	Plastics - entanglement	Juvenile mortality
Predation	Sharks	Injury
Predation	Sharks	Indirect effect of shark bite injury on pup

All threats to be modelled
Otago Peninsula

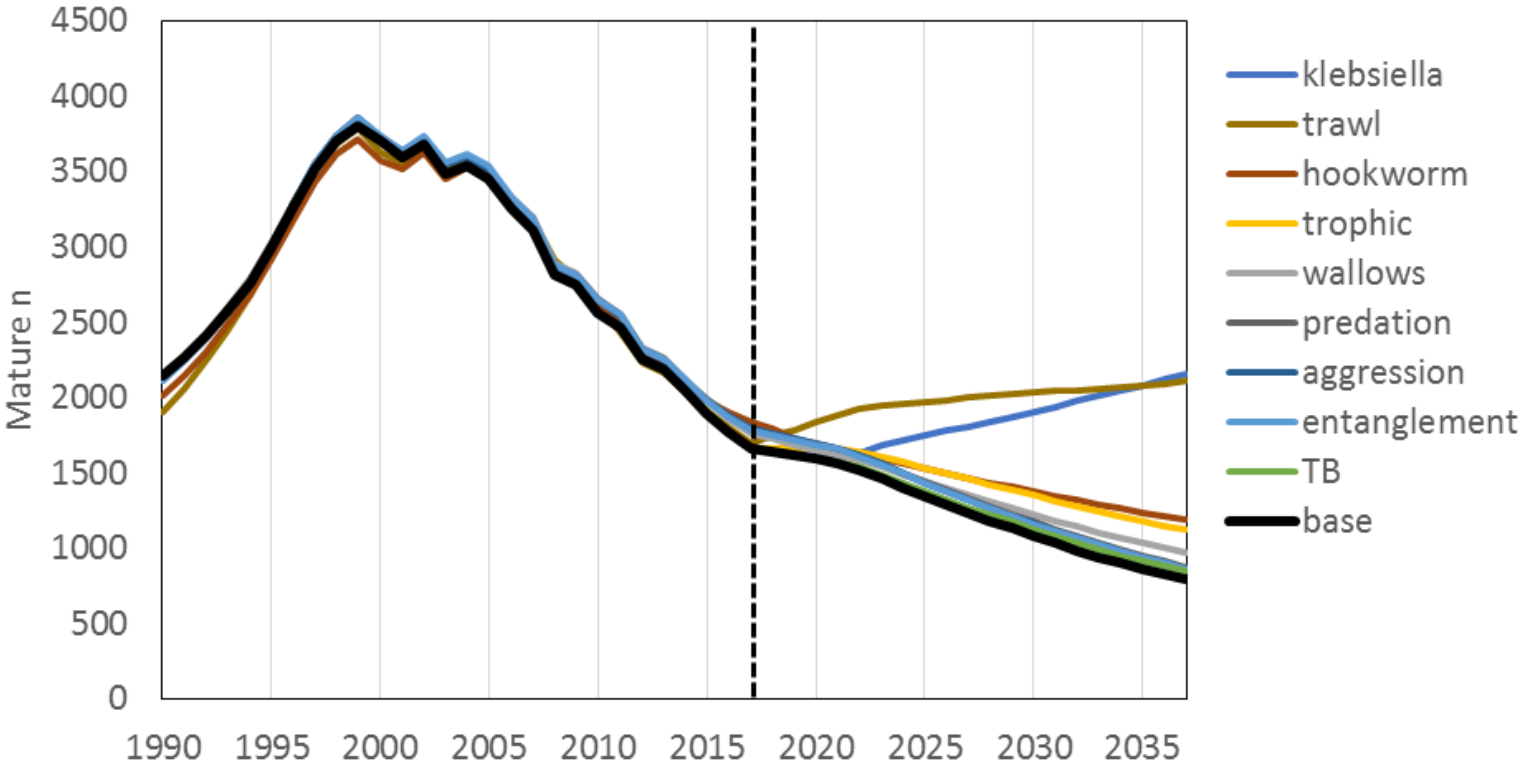
Threat Class	Threat	Description of threat
Disease	Novel agent	Adult mortality
Disease	Novel agent	Pup mortality
Disease	Klebsiella	Adult mortality
Disease	Klebsiella	Indirect effect on pup
Disease	Klebsiella	Direct pup mortality
Fishing	Commercial set net	Incidental capture
Fishing	Commercial set net	Indirect effect on pup
Fishing	Commercial set net	Entanglement/injury
Fishing	Commercial set net	Indirect effect on pup
Natural behaviour	Male NZSL aggression	Female mortality
Natural behaviour	Male NZSL aggression	Indirect effect on pup
Natural behaviour	Male NZSL aggression	Juveniles
Natural behaviour	Male NZSL aggression	Pup mortality
Other humans	Dogs	Pup mortality
Other humans	Deliberate mortality	Adult mortality
Other humans	Deliberate mortality	Indirect effect on pup
Pollution	Plastics - entanglement	Adult mortality
Pollution	Plastics - entanglement	Indirect effect on pup
Pollution	Plastics - entanglement	Juvenile mortality
Predation	Sharks	Juvenile/adult mortality
Predation	Sharks	pup direct
Predation	Sharks	pup indirect
Vehicles	Vehicle strike	Adult mortality
Vehicles	Vehicle strike	Indirect effect on pup

Triage projections

Projection method

- Projections from MPD estimates:
  - Alteration of demographic rates for some threats, e.g. trophic effects
  - MPD run includes mortality at age for remaining threats (will elevate survival estimates used in projections) – scaled to SB females
- Projections use mean of 2005-2014 for year-varying parameters
  - This will effect projected population *n* for threats that have uneven effect through time (e.g. commercial trawl captures)
- Estimate of mature females from 2017 to 2037
  - All age 8+
  - Relative pupping at age 4-7 used as proxy for mature *n*
- Performance criteria – we chose λ_{2037} & N_{2037} ($\%N_{2017}$)

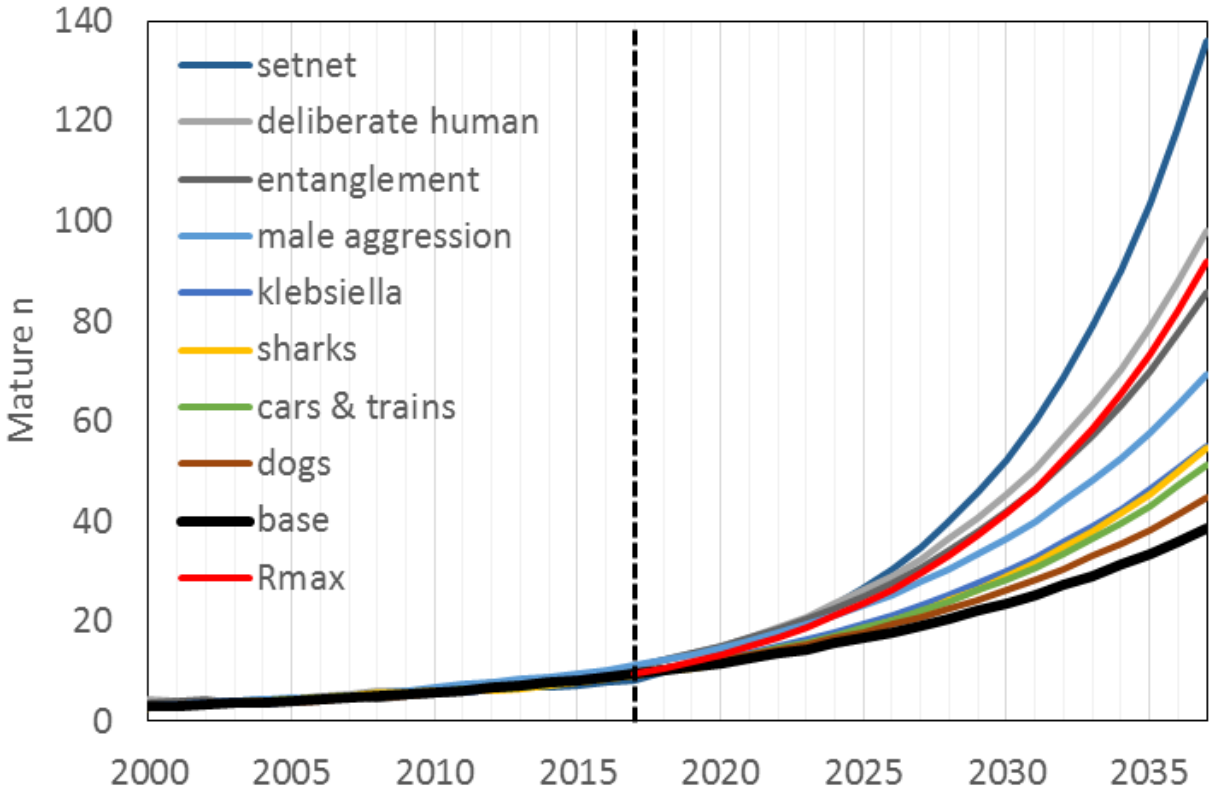
Triage projections – Auckland Islands



Triage projections – Auckland Islands

Threat	λ_{2037}	N_{2037} (% N_{2017})
Klebsiella infection	1.02	130
Commercial trawl	1.01	124
Trophic effects	0.97	67
Hookworm	0.98	65
Drowning in wallows	0.97	55
TB	0.96	51
Predation	0.96	49
Entanglement	0.96	48
Male aggression	0.96	48
Base	0.96	48

Triage projections – Otago Peninsula



Triage projections – Otago Peninsula

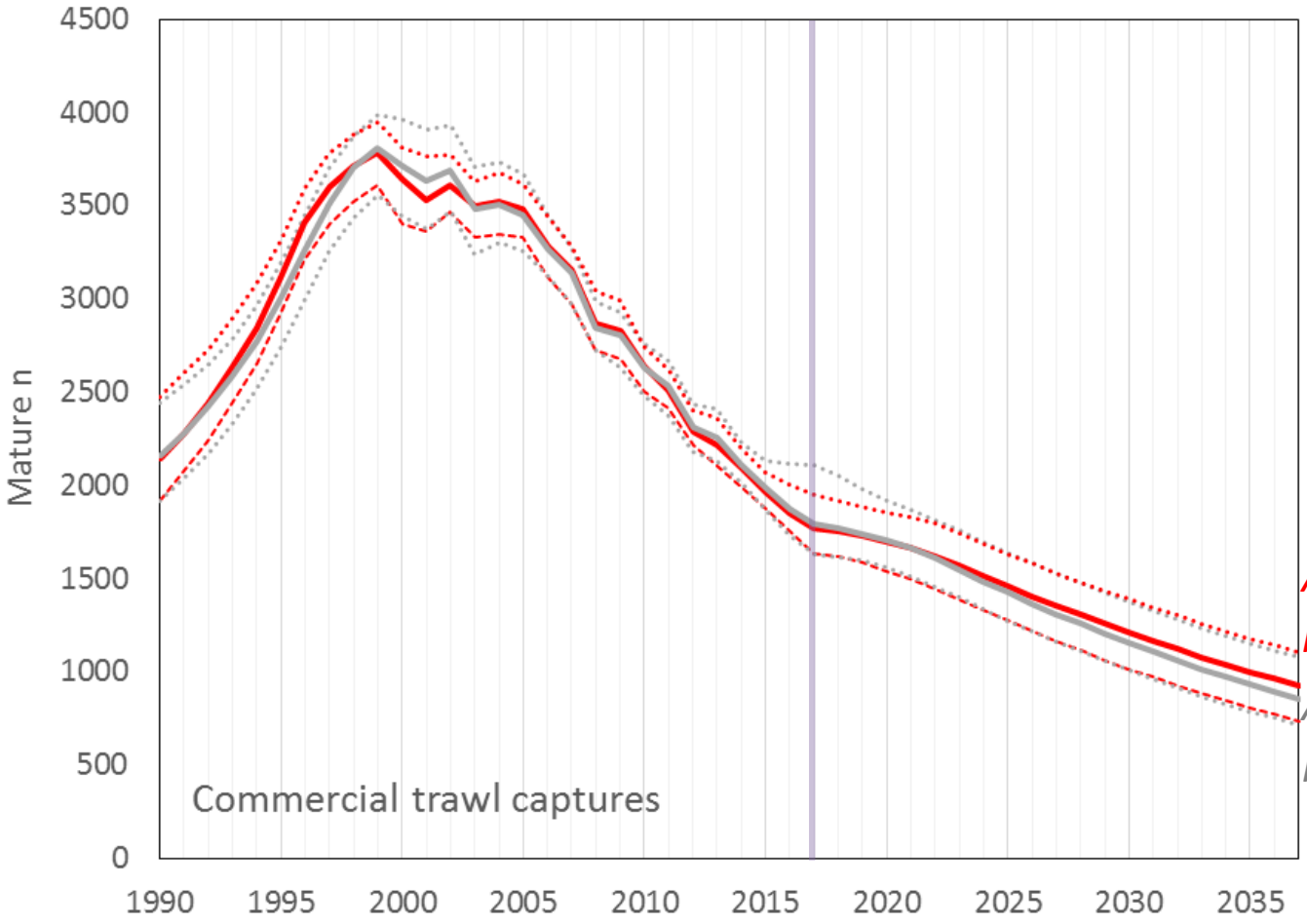
Threat	λ_{2037}	N_{2037} (% N_{2017})
Commercial set net	1.15	1630
Deliberate human	1.12	910
Entanglement	1.11	780
Male aggression	1.10	610
Sharks	1.10	590
Klebsiella infection	1.09	570
Cars & trains	1.09	530
Dogs	1.08	460
Base	1.07	410

MCMC projections

Two examples:

- Commercial trawl Auckland Islands
  - Median estimated captures (Thompson et al)/2
  - Pups = the above * 0.7 (pupping rate) * 0.5 (females)
- Male aggression mainland
  - Inputs as triage run (all female mortalities observed)
- Performance criteria still to be agreed on
  - we chose λ_{2037} & N_{2037} (%N_{2017})

MCMC projections
Commercial trawl captures Auckland Islands



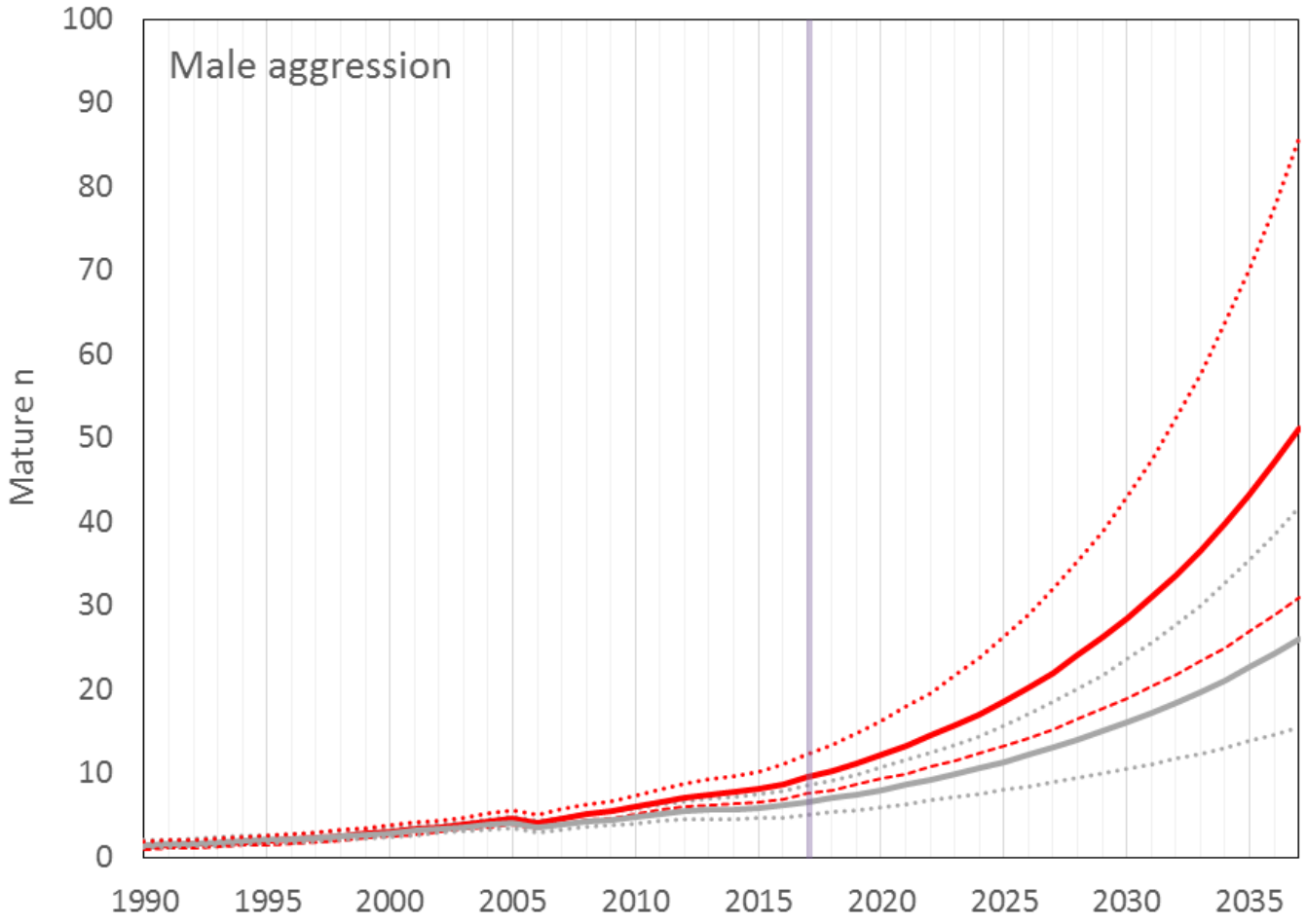
λ_{2037} = 0.963 (0.955–0.969)

N_{2037} = 52% (44–60)

λ_{2037} = 0.959 (0.952–0.968)

N_{2037} = 52% (41–60)

MCMC projections
Commercial trawl captures Auckland Islands



λ_{2037} = 1.09 (1.07–1.11)
N_{2037} = 540% (390–750)

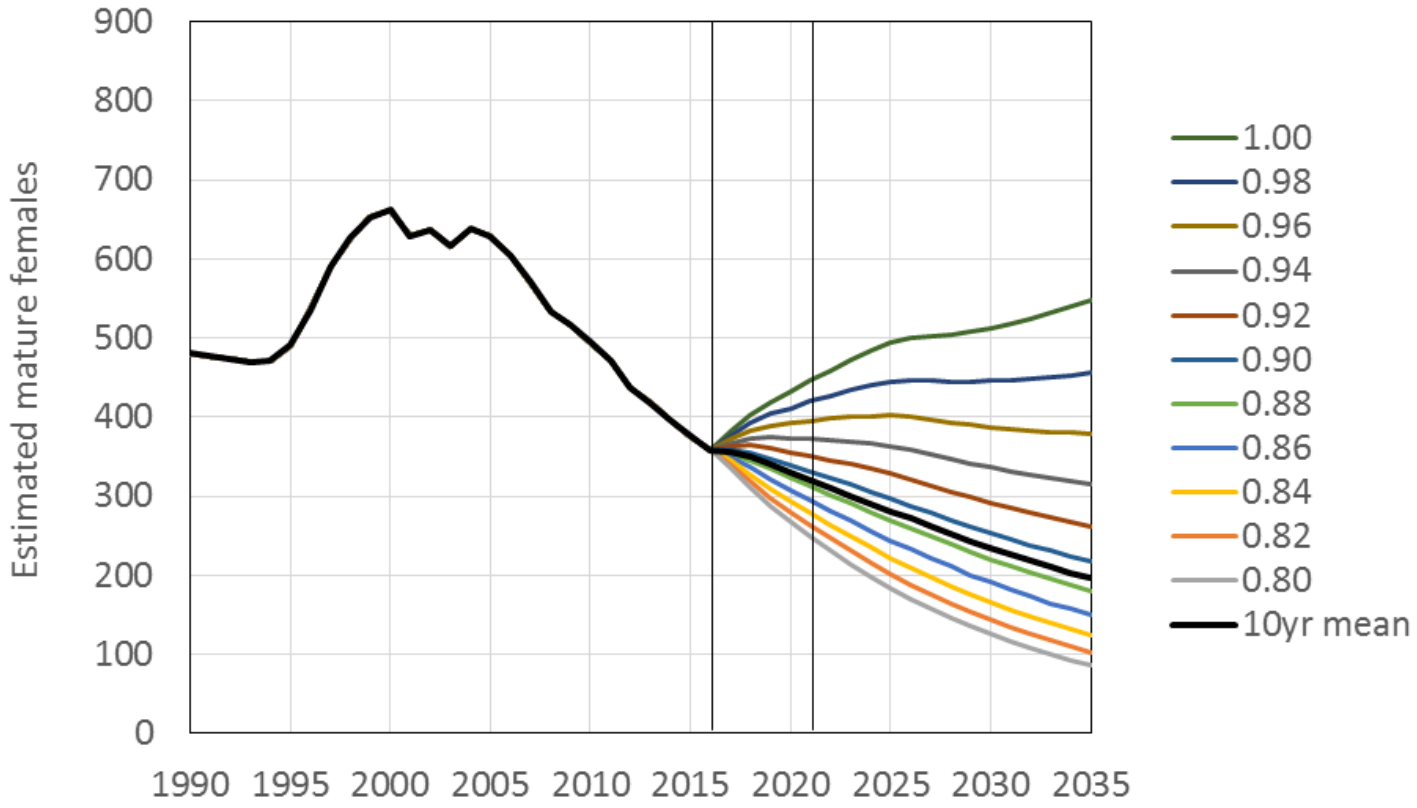
λ_{2037} = 1.07 (1.05–1.09)
N_{2037} = 390% (290–530)

To do

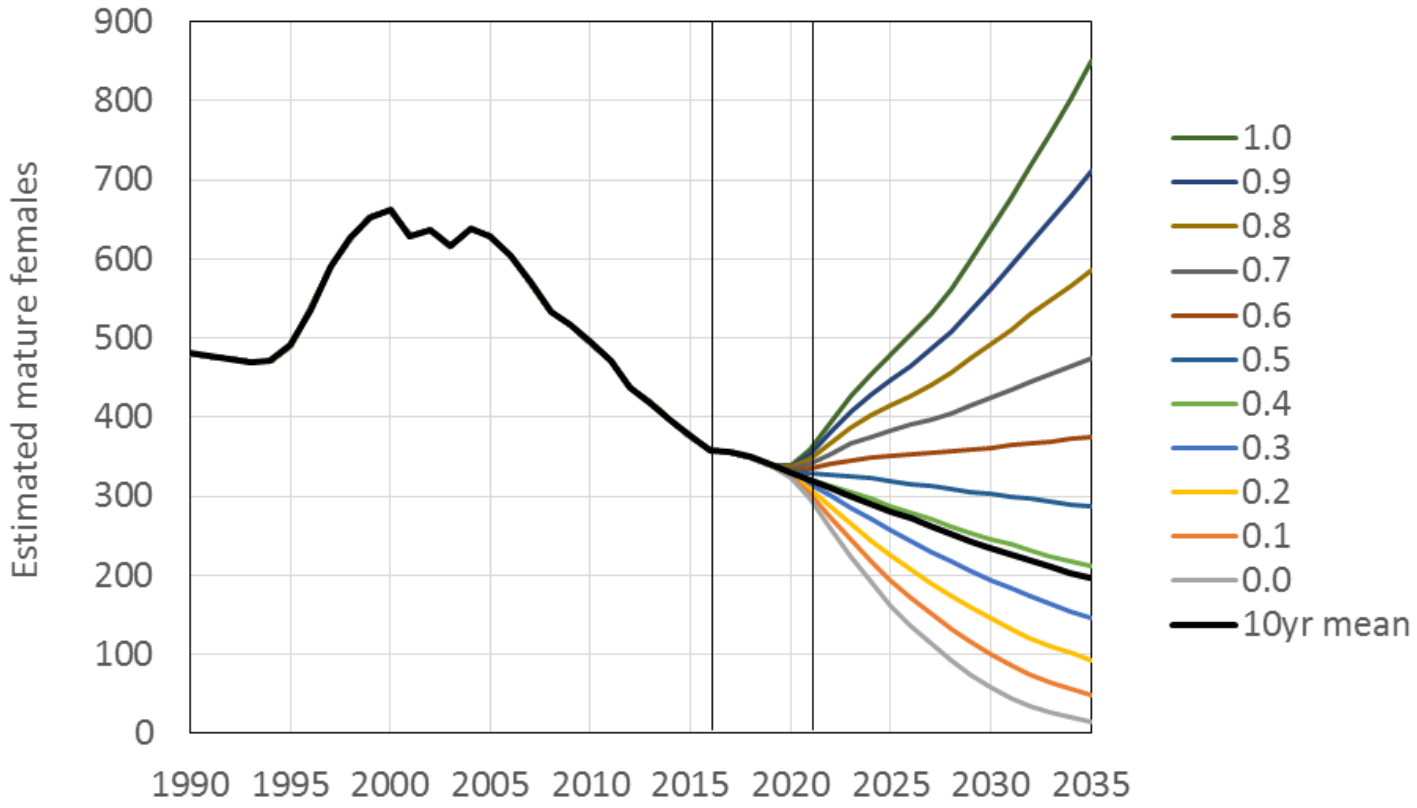
- Obtain agreed best estimates for key threats from Triage
- MCMC projections for all key threats
- Longer chain
- Method for sampling demographic rates – currently mean of 2005-2014 (does this represent uncertainty?)

End of threats presentation

Demographic rate scenarios
Adult survival (age 6-14)



Demographic rate scenarios
Pup survival (to age 1)



Demographic rate scenarios
Pupping rate