Powerpoint guide to Comprehensive Assessments

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INTERNATIONAL
WHALING COMMISSION

What on earth is a comprehensive assessment?

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…well 1982 in Brighton

- But I won't go into the history…….

The SC's 'Comprehensive Assessment'

- Traditionally, the SC's Comprehensive Assessment has initial caps, recognising that it feeds into the Commission's comprehensive assessment
- 'an in-depth evaluation of the status of all whale stocks in the light of management objectives and procedures'
- this will include:
  - the examination of current stock size,
  - recent population trends,
  - carrying capacity and productivity
- Will involve three major areas of work:

The SC's 'Comprehensive Assessment'

1) To review and revise current knowledge concerning methodology, stock identity and available data

2) To plan and conduct the collection of new data

3) To examine alternative management regimes

- Recognised that these are heavily inter-related

- Work on (3) led to the development of the RMP and the ongoing finalisation of the AWMP so not considered further

Where is the SC now up to?

- Traditionally the first time an ocean basis/species specific evaluation considered this is termed a 'Comprehensive Assessment'

- Follow ups to these are called 'in-depth' assessments

- …….. but this terminology has slipped a bit…

Species	Region	Assessment/Management Status	Sub- Group
Blue whale	North Pacific	Pre-In-Depth Assessment	NH
	North Atlantic	No assessment plans at present. Receive new information	NH
	Southern Hemisphere	Antarctic wide in-depth assessment completed. Investigation to see if smaller scale in-depth assessment feasible	SH
Sei whale	North Pacific	Ongoing In-Depth Assessment. Subject of Special Permit whaling	IA/SP
	North Atlantic	Request for RMP Implementation postponed. Receive new information	NH
	Southern Hemisphere	No assessment plans. Receive new information.	SH
Fin whale	North Pacific	No assessment plans. Receive new information.	NH
	North Atlantic	Implementation Review completed. Subject of whaling under reservation	RMP
	West Greenland hunt	SLA being developed. Subject of Aboriginal Subsistence Whaling	AWMP
	Southern Hemisphere	Examining feasibility of undertaking in-depth assessment. Receive new information.	SH
Omura's Whale	Indian Ocean, north and central west Pacific	No assessment plans. Receive new information.	NH
Gray whale	North Pacific	Rangewide review in progress	CMP
	western	Subject of Conservation Management Plan	CMP
	Chukotka, Makah hunts	SLA developed. Next Implementation/Review expected in 2019. Subject of Aboriginal Subsistence Whaling	AWMP
Common minke whale	North Pacific	Other than outlined below, no assessment plans. Receive new information.	NH
	Western	Next Implementation Review expected in 2019. Subject of special permit whaling	RMP/SP
	North Atlantic	Other than outlined below, no assessment plans. Receive new information.	NH
	central and eastern	Complete Implementation Review in 2017. Subject of whaling under objection	RMP
	East Greenland	SLA being developed. Subject of Aboriginal Subsistence Whaling	AWMP
	West Greenland	SLA being developed. Subject of Aboriginal Subsistence Whaling	AWMP
	Southern Hemisphere	No assessment plans for dwarf minke whales. Receive new information	SH
Antarctic minke whale	Southern Hemisphere	Assessment recently completed. Subject of Special Permit whaling	IA/SP

| Species	Region	Assessment/Management Status	Sub- Group
Bryde's whales	North Pacific	Other than outlined below, no assessment plans. Receive new information especially from IWC-POWER	NH
	Western	Implementation Review starting in 2017. Was subject of Special Permit whaling until 2016	RMP/SP
	North Atlantic	No assessment plans. Receive new information.	NH
	Southern Hemisphere	No assessment plans. Receive new information.	SH
Right whale	North Pacific	No assessment plans. Receive new information.	NH
	North Atlantic	Other than outlined below, no assessment plans. Receive new information.	NH
	Western	New assessment required.	IA
	Southern Hemisphere	Assessment recently completed. Receive new information	SH
	SE Pacific, South Atlantic	Two populations subject of Conservation Management Plans	CMP
Bowhead whale	North Atlantic	Other than outlined below, no assessment plans. Receive new information.	NH
	Greenland hunt (and Canada)	SLA developed. Subject of Aboriginal Subsistence Whaling (also by Canada - a non-member nation)	AWMP
	North Pacific		
	Bering-Chukchi-Beaufort Seas	Subject to Aboriginal Subsistence Whaling	AWMP
	Okhotsk Sea	SLA developed. Next Implementation Review expected in 2019. Subject of Aboriginal Subsistence Whaling	NH
Humpback whale	North Pacific	Subject to In-Depth Assessment (P-IA)	IA
	North Atlantic	Due a new assessment (last one completed in 2002). Receive new information.	NH
	West Greenland hunt	Subject of Aboriginal Subsistence Whaling	AWMP
	St. Vincent and The Grenadines	Subject of Aboriginal Subsistence Whaling	AWMP
	Southern Hemisphere	Assessment recently completed. Receive new information	SH
	Arabian Sea	Proposed for Conservation Management Plan	CMP
Sperm whale	Global	Reviewing assessment plans. Receive new information	

What do we need to do?

- Examine current knowledge with the aim of completing a review of status by 'stock' or 'stocks' in the region (usually but not always an ocean basin, it can be smaller if coherent)

- **Status**: where are the stocks now compared to where they were and where are they going?

What does it involve?

- Pre-assessment review
    - Reviewing information on:
        - Whales (stock structure, abundance etc.)
        - Threats (actual and potential)
    - Examine quantity, quality, availability
    - Decide whether sufficient information is available to go forward to the assessment
    - If no, identify work needed to say 'yes'

Review information and inputs

- Stock structure – fundamental to the cause:
  - Not necessarily only 'the best' but the plausible
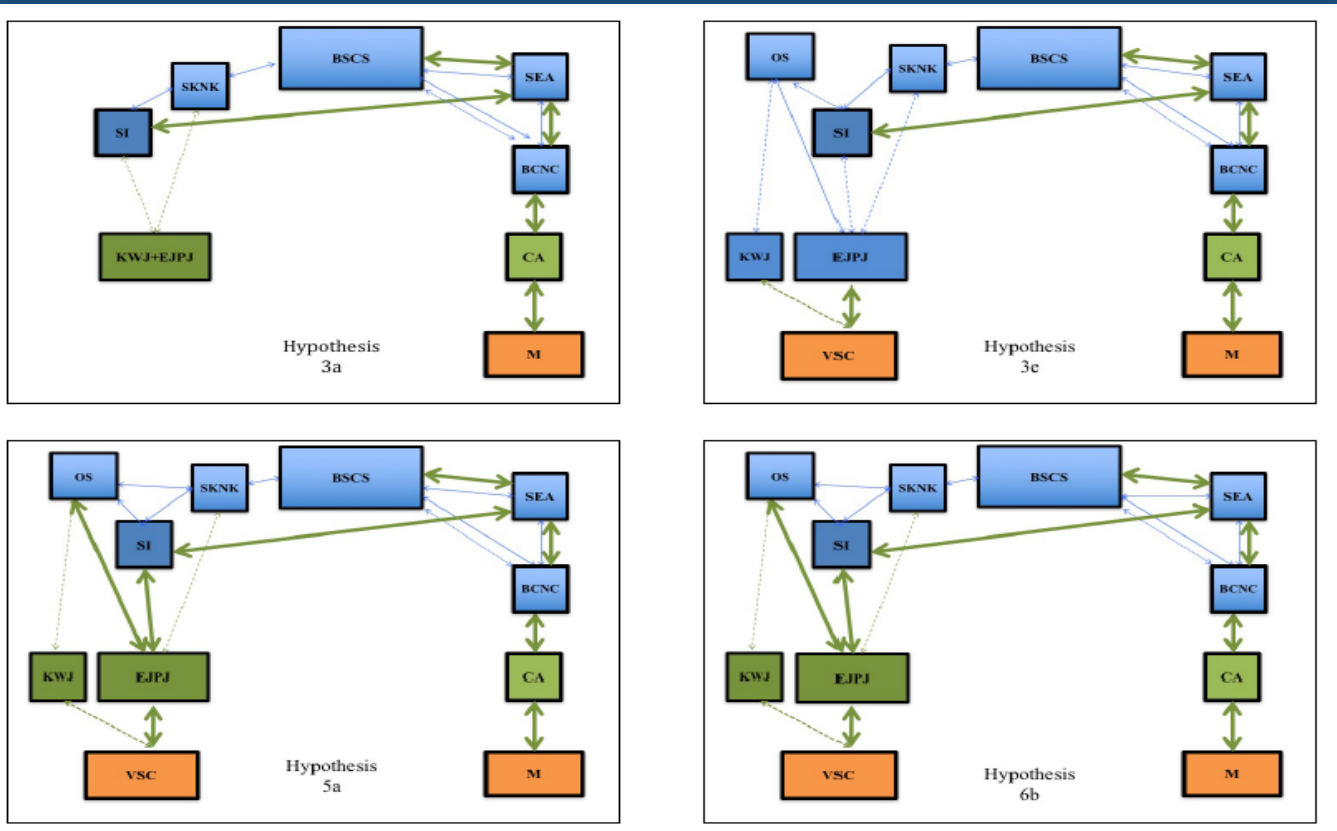
Review information and inputs

- Stock structure and movement info needed to *inter alia*:
    - Assign present (and past) abundance
    - Assign present and past removals
  - Use a suite of data: genetics, photo-ID, telemetry, catch and sightings distributions etc.
- Removals: catches and incidental takes (**HIM**)
- Abundance and trends
- Biological parameters
- Environmental factors

Integrate all this information with population modelling

35

Review of contemporary cetacean stock assessment models

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ABSTRACT

Model-based methods of analysis are widely used to conduct cetacean stock assessments, and to provide the operating models on which management strategy evaluation is based. This paper reviews recent assessments and management strategy evaluations for cetacean populations, with a view towards establishing 'best practice' guidelines for such analyses. The models on which these analyses are based range from simple exponential trend models that ignore density-dependence to complex multi-stock age-sex- and stage-structured models that form the basis for management strategy evaluation. Most analyses assume that density-dependence is on calf survival (which implicitly includes maturity and pregnancy rate), but it could also impact the survival rate of adults or the age-at-maturity. Cetaceans seldom have more than one calf per female each year, which limits the variation in calf numbers, and places an upper limit on the effects of density-dependent calf survival. The models differ in terms of whether the population projections start when substantial catches first occurred or whether allowance is made for time-varying carrying capacity by starting the model in a more recent year. Most of the models are deterministic, but account needs to be taken of variation in cohort strength for analyses that include age-composition data or for species that are relatively short-lived. A limited number of analyses include process variability using a state-space-like modelling framework. For some stocks, abundance is so low that ideally both demographic and environmental variability should be included in models. The primary source of data for parameter estimation is a time-series of estimates of absolute abundance, although some approaches considered used a variety of data types, including relative abundance indices, mark-recapture data and minimum abundance estimates based on haplotype counts. In general, at least one estimate of absolute abundance is needed for parameter estimation; this is because there is a lack of catch-induced declines in abundance captured by indices of relative abundance that could be used to provide information on absolute abundance. Similarly, information on abundance from age- and length- composition data is limited. Most of the analyses quantify uncertainty using Bayesian methods to allow information on biological parameters, particularly the intrinsic rate of growth and the relative population at which maximum production occurs, to be included in the analyses, along with sensitivity testing. The future for the models on which assessments and management strategy evaluations are based will often involve multi-stock models that include age-, sex- and spatial-structure and are fitted as state-space formulations, although at present such models are often too computationally intensive to be feasible for implementation or there is insufficient information in the data to estimate the parameters representing all the processes, leading to simplifications, with the result that the performance of some of the methods of assessment used for cetacean stocks needs to be better understood, including through simulation testing.

KEYWORDS: ASSESSMENT; BAYESIAN; CETACEAN; MANAGEMENT STRATEGY

Integrate all this information with population modelling

- Develop a set of **plausible** scenarios that **capture uncertainty**

- Stage 1 develop 'conceptual' models

- Stage 2 translate these into parameterised models (the dreaded mixing matrices)

Breeding stock								Sub-area								
Feeding aggregation	VSC	KWJ	EJPJ	OS	SI	EKK	BSCS	SEA (J-N)	SEA(D-M)	BCNC (J-N)	BCNC (D-M)	BCNC-3	CA (J-N)	CA (D-M)	CA-3	M
(a) Hypothesis 3a (no extant Western breeding stock)																
Eastern WFG	-	-	1	1	1	1	-	-	1	-	γ_4	-	-	1	1	1
North	-	-	γ_1	-	-	-	1	1	1	1	1	-	1	1	1	1
PCFG	-	-	-	-	-	-	χ_1	γ_2	1	γ_3	γ_5	1	γ_6	1	1	1
(b) Hypothesis 3e (extant Western breeding stock)																
Western	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Eastern WFG	-	-	γ_7	1	1	1	-	-	1	-	γ_4	-	-	1	1	1
North	-	-	-	-	-	-	1	1	1	1	1	-	1	1	1	1
PCFG	-	-	-	-	-	-	χ_1	γ_2	1	γ_3	γ_6	1	γ_6	1	1	1
(c) Hypothesis 5a (with Western breeding stock in SI)																
Western	1	1	1	1	γ_8	-	-	-	-	-	-	-	-	-	-	-
Eastern WFG	-	-	γ_7	1	1	1	-	-	1	-	γ_4	-	-	1	1	1
North	-	-	-	-	-	-	1	1	1	1	1	-	1	1	1	1
PCFG	-	-	-	-	-	-	χ_1	γ_2	1	γ_3	γ_5	1	γ_6	1	1	1
(d) Hypothesis 6b (no WFG feeding aggregation)																
Western	1	1	1	1	1	1	-	-	1	-	γ_4	-	-	1	1	1
Eastern North	-	-	-	-	-	-	1	1	1	1	1	-	1	1	1	1
PCFG	-	-	-	-	-	-	χ_1	γ_2	1	γ_3	γ_5	1	γ_6	1	1	1

'Trials'

- Use information on uncertainty to develop a set of scenarios to test – 'Trials'

Factors considered in the model scenarios. The bolded values are the base-levels.

Factor	Levels
Model fitting related	
Stock hypothesis	3a, 3e, 5a
Proportion of 'Western' stock in Sakhalin sub-area	0 (stock hypotheses 3a, 3e), 0.33 (stock hypothesis 5a), 0.70
$MSYR_{1+}$ (western)	As for WFG
$MSYR_{1+}$ (north)	4.5%, 5.5%, Estimated (common); estimate (separately)
$MSYR_{1+}$ (WFG)	4.5%, 5.5%, Estimated (common); estimate (separately)
$MSYR_{1+}$ (PCFG)	2%, 4.5%, Estimated (common); estimate (separately)
Matches	Definite; Definite+Likely (Table 2)
Immigration into the PCFG	0, 2, 4
Bycatches and ship strikes	Numbers dead, M/SI, numbers dead x 4; x numbers dead x 10
Pulse migrations into the PCFG	10, 20, 30
Bycatch off Sakhalin	1.5, 3
Projection-related	
Northern need in final year (from 150 in 2014)	340, 530
Struck and lost rate	25% 50%, 75%
Future effort	Constant, Increase by 100% over 100 years
Probability of mismatching a north whale, p_1	0.01
Probability of mismatching a PCFG, p_2	0.05 (trials)
PCFG harvest month	Migratory

Conditioning

- Must ensure models are behaving politely and consistent with the data – 'conditioning'
  - Abundance and trends, mark-recapture data etc
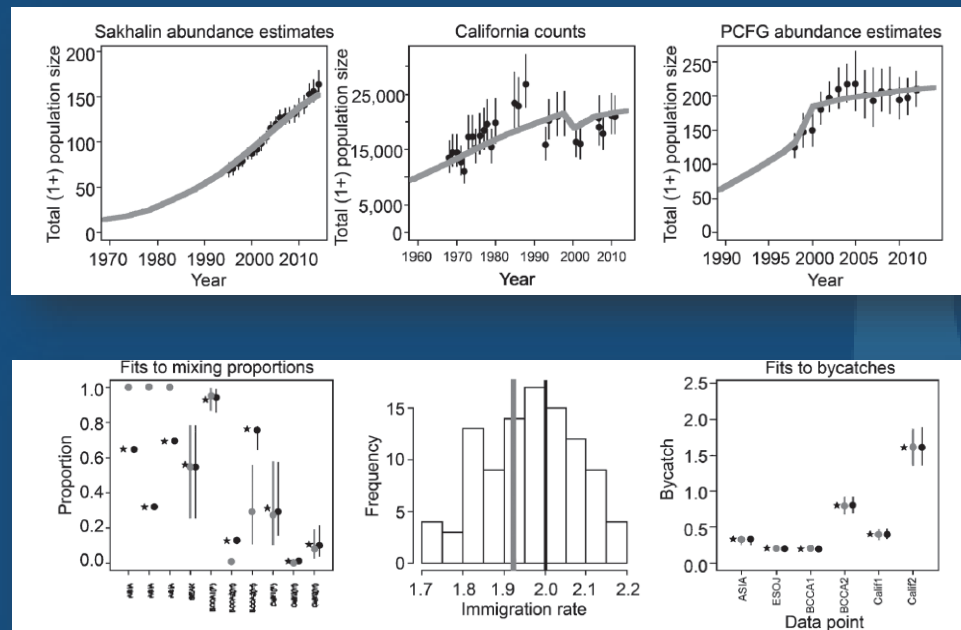
Process

- Objective: aim for a 2-3 year process, including workshops

- No more new data/analyses – save those for the next assessment

Output…..

- Provide Commission with information on present status
- Identify if populations are recovering, recovered or if there is cause for concern
- Identify factors that may affect status
- Identify information gaps to reduce uncertainty next time

SH Humpbacks

Table 9
Predicted abundance, recovery and population growth estimates for all Southern Hemisphere humpback populations projected to 2015, with 2015 recovery levels calculated relative to pre-exploitation abundance in 1900. Values rounded (precise values can be found in Annex H).

Breeding stock	Median K	Median N_{min}	Baseline year of estimate[2]	Projected abundance 2015	Recovery N_{2015}/K	Reference
BSA	24,600 (22,800-31,100)	500 (200-4,000)	2005[4]	11,700 (6,600-16,900)	0.47 (0.22-0.73)	IWC (2007b)
BSB1	18,300 (13,400-36,500)	1,500 (400-6,400)	2006[5]	13,000 (9,700-15,100)	0.74 (0.29-0.97)	IWC (2012c)
BSB2	4,400 (200-6,600)	70 (20-200)	2007[5]	500 (130-900)	0.13 (0.03-0.88)	IWC (2012c)
BSC1	8,400 (7,000-14,600)	700 (300-4,600)	2003[4]	8,000 (6,800-9,700)	0.97 (0.58-0.97)	IWC (2010b)
BSC3	8,900 (6,900-16,100)	1,900 (500-6,100)	2006[5]	8,000 (6,400-10,200)	0.96 (0.48-1.00)	IWC (2010b)
BSD	21,700 (19,000-29,400)	800 (500-4,000)	2008[3,4]	20,300 (18,400-25,000)	0.95 (0.80-0.99)	IWC (2015h)
BSE1	26,100 (21,600-29,000)	240 (200-300)	2010[4]	19,600 (17,600-21,500)	0.76 (0.69-0.84)	IWC (2015h)
BSO	14,100 (10,200-19,600)	130 (100-250)	2004[5]	6,400 (5,500-7,600)	0.47 (0.29-0.66)	IWC (2015h)
BSG	11,600 (10,600-14,900)	700 (240-3,000)	2006[4]	9,700 (8,500-10,200)	0.93 (0.74-0.98)	IWC (2007b)
Total[1]	138,000 (111,900-198,000)			97,000 (78,000-117,500)	0.70	

[1]Note: totals are the sums of medians and 95% probability intervals calculated for individual breeding stocks. [2]Model projections are based on abundance estimates summarised in Annex H, table 2 'Updated list of accepted abundance estimates'. [3]Tentative minimum bound on 2008 abundance imposed, this assessment will be updated at the 2016 Annual Meeting. [4]Abundance derived from sightings surveys. [5]Abundance derived from mark recapture data fitted into the population assessment model.
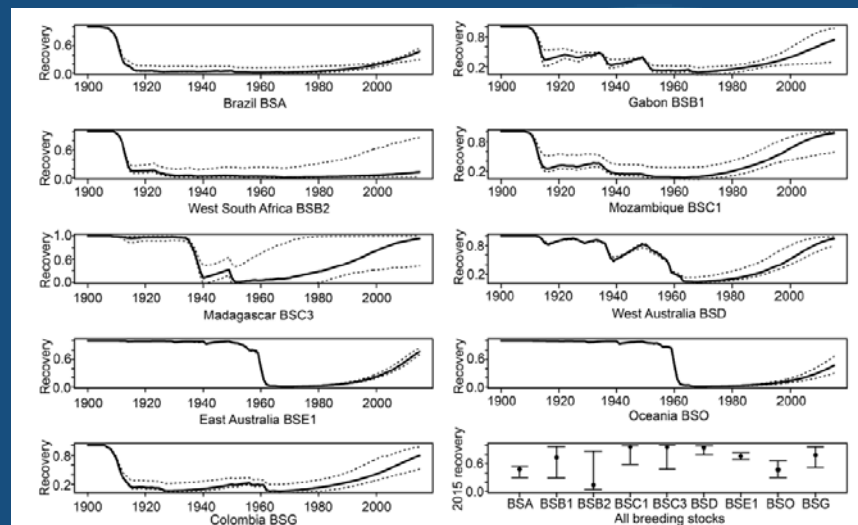

Fig. 4. A-C Southern Hemisphere humpback whale recovery levels (relative to 1900 abundance) plotted by Breeding Stock and year from 1900 to 2015.

NH/SH/SM/CMP

IA

Pre-assessment Annual Meeting(s)
Compile available information on whales and humans.
Review data quality and gaps.
Consider if feasible to conduct assessment.
If yes provide preliminary conceptual stock hypothesis/es

NO TIME FRAME

Assessment
e.g.Two Specialist Workshops and Two Annual Meetings
Review conceptual **stock hypotheses** and parameterise them for modelling

Finalise **abundance estimates**
Finalise **catch series**
Finalise **other removals**
Finalise **biological parameters**
Finalise **other issues (e.g. environment)**

CAPTURE UNCERTAINTY IN TRIALS
Condition trials
Review trial results
Finalise assessment and conclusions on status in accord with guidelines

AIM FOR TWO YEARS

SD/ASI/HIM