A note on the sensitivity of RMP outputs to the 'versions' of the programs used to implement *Catch Limit Algorithm*

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ABSTRACT
The sensitivity of catch limits to the level of accuracy when computing posterior distributions using the *CLA* is investigated. It is found that the catch limits for some combinations of species, region, and variant are very sensitive to the choice of the step sizes when applying the *CLA*. Furthermore, the choice of step sizes can have an impact on the selection among variants of the RMP. Four versions of programs used to implement the *CLA* are discussed. It is recommended that future implementations use the Norwegian "CatchLimit" program when conducting trials. There is occasionally a need to conduct trials during meetings (particularly the 2nd Intersessional Workshop) and we recommend that an "intermediate" version of the Cooke program that be used for this purpose with the results being confirmed using the Norwegian "CatchLimit" program after the meeting.

KEYWORDS: CATCH LIMITS, IMPLEMENTATION SIMULATION TRIALS; RMP

INTRODUCTION

The Revised Management Procedure or RMP (IWC, 1999) can be said to consist of two components: (a) the *Catch Limit Algorithm* (*CLA*), which determines catch limits when stock structure is known, and (b) other rules, primarily those to handle situations in which stock structure is uncertain (i.e., *Small Area* definitions, catch capping, and catch cascading). The aim of the *Implementation* process (IWC 2005, IWC 2007a), and the *Implementation Simulation Trials* which are a key part of an *Implementation*, is to evaluate the conservation and utilisation performance of different 'variants' of the RMP (e.g. ways to define *Small Areas* and whether and how to apply catch capping and catch cascading). As part of its Guidelines for undertaking the *Implementation* process, the IWC Scientific Committee has defined a set of rules to interpret the results of *Implementation Simulation Trials* (IWC, 2007b) in order to avoid a recurrence of the difficulties encountered during the first RMP *Implementation* for the North Pacific minke whales. These rules have been successfully applied during the *Implementations* for the Western North Pacific Bryde's whales and the North Atlantic fin whales (IWC 2008, IWC 2010).

The specifications for the *CLA* are given in IWC (1994). Two different computer implementations of the *CLA* have been developed: (a) the original implementation by Cooke; and (b) a subsequent implementation developed by the Norwegian Computing Center (the 'CatchLimit' program)[1]. Both versions include input parameters that determine the accuracy with which the *CLA* calculations are conducted; in particular, the accuracy with which the Bayesian-like calculations are undertaken, which depends on the step-sizes used when conducting the numerical integrations needed. The Norwegian program was compared with the Cooke program by the Scientific Committee (IWC 2001a,) and it was agreed that the generally faster but equally accurate Norwegian version should be used if the Scientific Committee was requested by the Commission to calculate catch limits (IWC2001b).

However, for *Implementation Simulation Trial* purposes, the Norwegian version of the *CLA* can be very slow (particularly when there are many abundance estimates as is the case when trials involving 100-year projections are undertaken). Consequently, the Committee has used a 'trials' version of the Cooke implementation of the *CLA* (i.e. one with coarse step-sizes which consequently runs much more quickly) when evaluating RMP variants during *Implementations* (see Table 1). It was assumed that the results from the Cooke 'trials' version would be sufficiently similar to those from the Norwegian version that the Scientific Committee could make robust decisions regarding which RMP variants satisfy the conservation criteria specified in IWC (2007b).

In practice, comparisons between the various versions of the *CLA* have been limited because the Commission has not requested the Scientific Committee to calculate catch limits using the RMP (in fact the RMP provides removal limits - bycatches and other anthropogenic mortality also need to be accounted for in determining catch limits). However, as part of the Commission's discussions on the Future of the IWC, the Chair of the Commission instructed the Secretariat to undertake such calculations and provide the results to the 'Scientific Assessment Group' or 'SAG' established as part of that process (IWC/M10/SWG6). As a result of that work, the Secretariat discovered that in some cases there can be substantial (and consequential) differences in catch limits when the catch limits are calculated using the Norwegian and the Cooke 'trials' versions for North Atlantic fin whales. A third Cooke version, denoted the 'intermediate' version, which is faster than the 'accurate' version and which might be appropriate for use during meetings (see Discussion) has also been tested as shown in Table 1.

[1] Hereafter referred to as the Cooke and Norwegian programs.

Table 1
The step sizes used in the three versions of the Cooke implementations of the *CLA*.

Version	MSYR steps	Bias Steps	K Steps	Depletion Steps
Accurate 600		500	0.002	0.0005
Trials 5		10	0.2	0.025
Intermediate 60		60	0.002	0.0005

The purpose of this note, is to explore the extent to which the results from the various versions differ and consider the consequences of this for how *Implementations* should be conducted in the future.

COMPARISONS OF REMOVAL LIMITS

Table 2 and Fig. 1 show the values for the removal limits calculated using the Norwegian, Cooke 'accurate', Cooke 'intermediate', and Cooke 'trials' versions.

Table 2

Removal limits for 2010 calculated using the Norwegian, Cooke 'accurate', Cooke 'intermediate', and Cooke 'trials' versions (using a value of 0.402 for the *CLA* tuning parameter)

Norwegian		Cooke 'accurate'	Cooke 'intermediate' Cooke	'trials'
North Atlantic fin				
WI	19.8	19.8 19.	8 20.	8
WI+EG	87.5	87.3 87.	3 80.	9
WI+EG+EI/F 142.	1	141.9	142.0	44.6
North Atlantic minke				
CIC	156.4	156.3 156.	3 164.	9
CM	142.3	142.3 142.	4 150.	1
CIC+CM	373.8	373.8 373.	9 419.	9
E	483.2	482.6 482.	9 405.	0
Western North Pacific Bryde's				
1E	6.7	6.7 6.	8 6.	8
1W	0.0	0.0 0.	0 0.	0
1W+1E	0.5	0.5 0.	6 0.	0
2	1.5	1.5 1.	5 1.	7
1W+1E+2	15.5	15.5 15.	7 18.	5

The catch limits for the Norwegian and the Cooke 'accurate' and 'intermediate' versions are within < 1 whale for all cases (Table 1; Fig. 1 left panels). However, this is not the case for the Cooke 'trials' version. The largest differences are for when sub-areas 1 and 2 for the Western North Pacific Bryde's whales are combined, and (particularly) for variant 3 for the North Atlantic fin whales (sub-areas WI+EG+EI/F treated as a *Small Area*).

OUTPUTS FROM TRIALS

It is important to note that the above differences between versions have the potential (and in one cases does) affect the choice of a variant during an *Implementation*. Tables 3 and 4 list the A / B tables (see IWC (2007b) for how these tables are constructed) for a subset of the trials for the North Atlantic fin whales while Tables 5 and 6 list the A / B tables for a subset of the trials for the North Pacific Bryde's whales. The results in Table 3 are based on the Cooke 'trials' version (and thus were the basis for the selection of variant 3 as 'acceptable without research' by the Scientific Committee in 2009); the equivalent results for the Cooke 'intermediate' version are given in Table 4. The results in Table 5 are based on the Cooke 'trials' version and thus were the basis for the selection of variants 1, 3 and 4 as 'acceptable without research' by the Scientific Committee (see IWC 2010); the equivalent results for the Norwegian version are given in Table 6.

The most striking result in Table 4 is that variant 3 is no longer 'acceptable' i.e. there are more Bs and a U in the final column of Table 4 in contrast to Table 3 when this variant only had a few Bs. This is perhaps not unexpected from the results in the upper right panel of Fig. 1. In contrast, the same selection of variants would have been made for the Bryde's whales irrespective of whether the Cooke 'trials' or Norwegian versions had been used when conducting the trials.

DISCUSSION

The results presented here confirm that the catch limits based on the Norwegian and Cooke 'accurate' and 'intermediate' versions do not differ by > 1 whale and that these three versions produce (essentially) the same results.

However, it is of concern that the results in Tables 3 and 4 indicate that the choice of version of the Cooke program when conducting *Implementation Simulation Trials* can affect which variants are considered 'acceptable' by the

Scientific Committee. Hence, we recommend that only the Norwegian version should be used when conducting future trials[2].

In making this recommendation, we recognise that both the Norwegian and Cooke 'accurate' versions take much longer to run than the Cooke 'trials' version. To take one of the most extreme examples encountered, the time to complete one trial of 100 simulations for variant 3 for the North Atlantic fin whales (there are typically dozens of trials and 4-6 variants during an *Implementation*), is 4 days (Norwegian), 2.5 hours (Cooke 'intermediate') and 1 minute (Cooke 'trials')[3], although the Norwegian version is much quicker for most other variants and trials. This may have some implications for the conduct of the *Implementation* process and in particular, scheduling. Final trial results are reviewed during the 2nd Intersessional Workshop (IWC, 2005) where the primary task is to make recommendations to the Scientific Committee regarding which variants are 'acceptable', 'acceptable with research', and 'unacceptable'. This 2nd Intersessional Workshop will need to be carefully scheduled to ensure that all trials can be run before it takes place (in recent *Implementations* not all results have been available at the start of this workshop and many became available during the workshop).

However, even with careful scheduling, in special circumstances it may be necessary to run *additional* trials during the course of the 2nd Intersessional Workshop. For practical reasons, we recommend that if this occurs, that the 'intermediate' version of the Cooke implementation that is more accurate than the "trials" version (but less accurate than the "accurate" or Norwegian version) be used for this purpose and the results confirmed using the Norwegian "CatchLimit" program after the meeting.

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[2] A full set of revised results for the North Atlantic fin whales, the Western North Pacific Bryde's whales, and the North Atlantic minke whales run using the Norwegian "CatchLimit" program are being conducted and will be put on the IWC website

[3] The equivalent time using the Cooke 'accurate' version is unknown, but it would be much more than 4 days.

Table 3. A / B tables for a subset of the trials for North Atlantic fin whales run using the 'trials' version of the Cooke implementation. An 'A' denotes 'acceptable' performance, a 'B' 'borderline' performance, and a 'U' 'unacceptable' performance. The process for combining results over output statistics and stocks is given in IWC (2007b). The final recommendation for a variant is given in the column "Overall".

Trial	Var	Catch over 1st 10 years				P final						P Low (scaled)						Combined						Over all Model	
		Catch Med	5%	Med	95%	Stk:1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6		
NF01-1	V1	9	24	24	24	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF01-1	V2	66	87	87	87	A	A	A	U		B	A	A	A	B	A	A	A	A	A	A	A		A	I
NF01-1	V3	23	42	42	42	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF01-1	V4	3	13	13	13	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF01-1	V5	23	32	32	32	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF01-1	V6	9	15	15	15	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF02-1	V1	11	24	24	24	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V2	84	87	87	87	A	A		B	A	U		A	A	A	B	A	A	A	A	B	A	A	B	II
NF02-1	V3	24	42	42	42	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V4	4	13	13	13	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V5	25	32	32	32	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V6	10	15	15	15	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF03-1	V1	8	24	24	24	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V2	62	87	87	87	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V3	22	42	42	42	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V4	2	13	13	13	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V5	23	32	32	32	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V6	9	15	15	15	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF04-1	V1	8	24	24	24	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	IV
NF04-1	V2	51	87	87	87	A	A	U	U	B	A	A	A	U	A	A	A	A	A	U	A	A	A	U	IV
NF04-1	V3	17	42	42	42	A	A		B	U		B	A	A	A	B	A	A	A	A	B	A	A	B	IV
NF04-1	V4	3	13	13	13	A	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	IV
NF04-1	V5	23	32	32	32	A	A	B	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	IV
NF04-1	V6	8	15	15	15	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	IV
NF05-1	V1	9	24	24	24	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V2	77	87	87	87	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V3	30	42	42	42	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V4	3	13	13	13	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V5	24	32	32	32	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V6	11	15	15	15	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF06-1	V1	9	24	24	24	A	A	A	B	A	x	A	A	A	A	A	x	A	A	A	A	A		A	VI
NF06-1	V2	69	87	87	87	A	A		B	B	A		x	A	A	B	A	A	x	A	A	B	A	A	B	VI
NF06-1	V3	23	42	42	42	A	A	A	B	A	x	A	A	A	A	A	x	A	A	A	A	A		A	VI
NF06-1	V4	3	13	13	13	A	A	A	B	A	x	A	A	A	A	A	x	A	A	A	A	A		A	VI
NF06-1	V5	24	32	32	32	A	A	A	B	A	x	A	A	A	A	A	x	A	A	A	A	A		A	VI
NF06-1	V6	10	15	15	15	A	A	A	B	A	x	A	A	A	A	A	x	A	A	A	A	A		A	VI
NF07-2	V1	52	24	24	24	A	A	A	A	x	x	A	A	A	A	x	x	A	A	A	A			A	VII
NF07-2	V2	117	87	87	87	A	B	A	A		x	x	A	B	A	A	x	x	A	B	A	A		B	VII
NF07-2	V3	71	42	42	42	A	A	A	A		x	x	A	B	A	A	x	x	A	A	A	A		A	VII
NF07-2	V4	35	13	13	13	A	A	A	A	x	x	A	A	A	A	x	x	A	A	A	A			A	VII
NF07-2	V5	38	32	32	32	A	A	A	A	x	x	A	A	A	A	x	x	A	A	A	A			A	VII
NF07-2	V6	22	15	15	15	A	A	A	A	x	x	A	A	A	A	x	x	A	A	A	A			A	VII

Table 4. A / B tables for a subset of the trials for North Atlantic fin whales run using the "intermediate" version of the Cooke implementation.

Trial	Var	Catch over 1st 10 years				P final						P Low (scaled)						Combined						Over all Model	
		Catch Med	5%	Med	95%	Stk:1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6		
NF01-1	V1	12	23	23	23	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF01-1	V2	79	87	87	87	A	A		B	U		B	A	A	A	B	A	A	A	A	B	A	A	B	I
NF01-1	V3	47	137	137	137	A	A	A	A	U		B	A	A	A	B	A	A	A	A	A	A	A	A	I
NF01-1	V4	5	12	12	12	A	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF01-1	V5	28	33	33	33	A	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF01-1	V6	19	47	47	47	A	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	I
NF02-1	V1	17	23	23	23	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V2	89	87	87	87	A	A		B	A	U		A	A	A	B	A	A	A	A	B	A	A	B	II
NF02-1	V3	51	137	137	137	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V4	7	12	12	12	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V5	32	33	33	33	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF02-1	V6	21	47	47	47	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	II
NF03-1	V1	12	23	23	23	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V2	74	87	87	87	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V3	47	137	137	137	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V4	4	12	12	12	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V5	27	33	33	33	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF03-1	V6	18	47	47	47	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	III
NF04-1	V1	13	23	23	23	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	IV
NF04-1	V2	61	87	87	87	A	A	U	U	B	A	A	A	U	A	A	A	A	A	U	A	A	A	U	IV
NF04-1	V3	32	137	137	137	A	A	U	U	B	A	A	A	U	A	A	A	A	A	U	A	A	A	U	IV

Trial	Var	Catch	Catch over 1st 10 years			P final						P Low (scaled)						Combined						Over all	Model
		Med	5%	Med	95%	Stk:1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6		
NF04-1	V4	5	12	12	12	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	IV
NF04-1	V5	27	33	33	33	A	A	B	U	B	A	A	A	B	A	A	A	A	A	B	A	A	A	B	IV
NF04-1	V6	15	47	47	47	A	A	A	U	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	IV
NF05-1	V1	14	23	23	23	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V2	84	87	87	87	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V3	61	137	137	137	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V4	5	12	12	12	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V5	30	33	33	33	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF05-1	V6	24	47	47	47	A	A	A	A	U	A	A	A	A	A	A	A	A	A	A	A	A	A	A	V
NF06-1	V1	13	23	23	23	A	A	A	B	A		A	A	A	A	A		A	A	A	A	A		A	VI
NF06-1	V2	81	87	87	87	A	A	B	B	A		A	A	B	A	A		A	A	B	A	A		B	VI
NF06-1	V3	50	137	137	137	A	A	B	B	A		A	A	B	A	A		A	A	B	A	A		B	VI
NF06-1	V4	5	12	12	12	A	A	A	B	A		A	A	A	A	A		A	A	A	A	A		A	VI
NF06-1	V5	29	33	33	33	A	A	A	B	A		A	A	A	A	A		A	A	A	A	A		A	VI
NF06-1	V6	20	47	47	47	A	A	A	B	A		A	A	A	A	A		A	A	A	A	A		A	VI
NF07-2	V1	51	23	23	23	A	A	A	A			A	A	A	A			A	A	A	A			A	VII
NF07-2	V2	119	87	87	87	A	B	A	A			A	B	A	A			A	B	A	A			B	VII
NF07-2	V3	135	137	137	137	A	B	A	A			A	B	A	A			A	B	A	A			B	VII
NF07-2	V4	38	12	12	12	A	A	A	A			A	A	A	A			A	A	A	A			A	VII
NF07-2	V5	56	33	33	33	A	A	A	A			A	A	A	A			A	A	A	A			A	VII
NF07-2	V6	55	47	47	47	A	A	A	A			A	A	A	A			A	A	A	A			A	VII

Table 5. A / B tables for a subset of the trials for North Pacific Bryde's whales run using the "trials" version of the Cooke implementation

Trial	Var	Median Catch			P final			P Low (scaled)			Combined			Over all
		Total	1w	1e 2	Stk:1	2	3	1	2	3	1 2		3	
Br01	C1	105	14	66 18	A			A			A			A
Br01	C2	98	78	0 18	A			A			A			A
Br01	C3	98	33	44 18	A			A			A			A
Br01	C4	103	38	48 14	A			A			A			A
Br03	C1	104	16	67 17	A	A		A	A		A	A		A
Br03	C2	98	80	0 17	A	A		A	A		A	A		A
Br03	C3	98	34	45 17	A	A		A	A		A	A		A
Br03	C4	101	38	47 13	A	A		A	A		A	A		A
Br05	C1	104	14	65 17	A	A		A	A		A	A		A
Br05	C2	97	78	0 17	A	A		A	A		A	A		A
Br05	C3	97	34	42 16	A	A		A	A		A	A		A
Br05	C4	104	37	48 13	A	A		A	A		A	A		A
Br07	C1	101	17	66 17	A	A	A	A	A	A	A	A	A	A
Br07	C2	98	81	0 17	A	A	A	A	A	A	A	A	A	A
Br07	C3	99	38	43 17	A	A	A	A	A	A	A	A	A	A
Br07	C4	102	40	45 13	A	A	A	A	A	A	A	A	A	A
Br09	C1	105	15	72 17	A	A		A	A		A	A		A
Br09	C2	98	83	0 17	A	A		A	A		A	A		A
Br09	C3	98	33	47 17	A	A		A	A		A	A		A
Br09	C4	103	35	50 12	A	A		A	A		A	A		A
Br13	C1	93	21	56 17	U	A	A	A	A	A	A	A	A	A
Br13	C2	90	74	0 17	U	A	A	U	A	A	U	A	A	U
Br13	C3	90	37	36 17	U	A	A	B	A	A	B	A	A	B
Br13	C4	93	39	39 13	U	A	A	B	A	A	B	A	A	B
Br15	C1	103	14	66 17	A	U	A	A	A	A	A	A	A	A
Br15	C2	97	79	0 17	U	U	A	B	U	A	B	U	A	U
Br15	C3	97	33	43 17	B	U	A	A	A	A	A	A	A	A
Br15	C4	102	36	46 13	B	U	A	A	A	A	A	A	A	A
Br17	C1	100	19	60 17	A	A	A	A	A	A	A	A	A	A
Br17	C2	91	75	0 17	A	U	A	A	U	A	A	U	A	U
Br17	C3	95	34	41 17	A	B	A	A	A	A	A	A	A	A
Br17	C4	99	39	45 13	A	B	A	A	A	A	A	A	A	A

Table 6. A / B tables for a subset of the trials for North Pacific Bryde's whales run using the Norwegian implementation

Trial	Var	Median Catch			P final			P Low (scaled)			Combined			Over all
		Total	1w	1e 2	Stk:1	2	3	1	2	3	1 2		3	
Br01	V1	106 17		65 18	A			A			A			A
Br01	V2	105 83		0 18	A			A			A			A
Br01	V3	105 35		47 18	A			A			A			A
Br01	V4	110 39		50 14	A			A			A			A
Br03	V1	106 18		66 17	A	A		A	A		A	A		A
Br03	V2	105 87		0 17	A	A		A	A		A	A		A
Br03	V3	104 37		49 17	A	A		A	A		A	A		A
Br03	V4	108 39		50 14	A	A		A	A		A	A		A
Br05	V1	106 18		65 16	A	A		A	A		A	A		A
Br05	V2	102 84		0 17	A	A		A	A		A	A		A
Br05	V3	102 37		45 17	A	A		A	A		A	A		A
Br05	V4	110 39		50 14	A	A		A	A		A	A		A
Br07	V1	105 20		65 17	A	A	A	A	A	A	A	A	A	A
Br07	V2	104 86		0 17	A	A	A	A	A	A	A	A	A	A
Br07	V3	104 40		44 17	A	A	A	A	A	A	A	A	A	A
Br07	V4	108 42		48 13	A	A	A	A	A	A	A	A	A	A
Br09	V1	107 18		71 17	A	A		A	A		A	A		A
Br09	V2	105 91		0 17	A	A		A	A		A	A		A
Br09	V3	105 36		51 17	A	A		A	A		A	A		A
Br09	V4	109 38		53 13	A	A		A	A		A	A		A
Br13	V1	96 24		55 17	U	A	A	A	A	A	A	A	A	A
Br13	V2	95 80		0 17	U	A	A	B	A	A	B	A	A	B
Br13	V3	96 40		39 17	U	A	A	A	A	A	A	A	A	A
Br13	V4	99 42		41 13	U	A	A	A	A	A	A	A	A	A
Br15	V1	106 17		65 17	B	U	A	A	A	A	A	A	A	A
Br15	V2	104 86		0 17	U	U	A	B	U	A	B	U	A	U
Br15	V3	104 36		45 17	B	U	A	A	A	A	A	A	A	A
Br15	V4	107 38		48 13	B	U	A	A	A	A	A	A	A	A
Br17	V1	102 23		60 17	A	A	A	A	A	A	A	A	A	A
Br17	V2	95 80		0 17	A	U	A	A	U	A	A	U	A	U
Br17	V3	100 37		44 17	A	A	A	A	A	A	A	A	A	A
Br17	V4	103 41		46 13	A	A	A	A	A	A	A	A	A	A

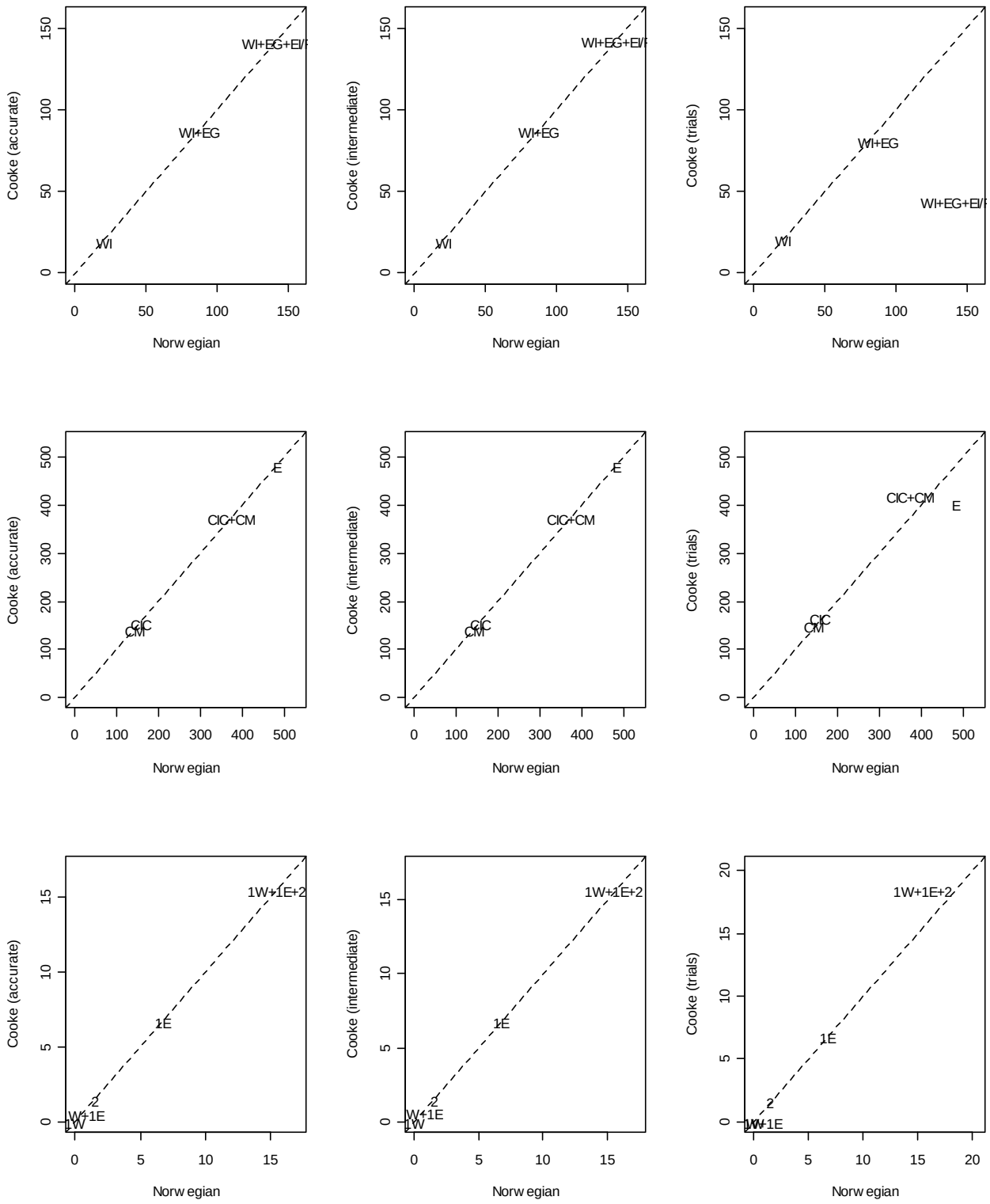

Fig. 1. Catch li mits for 2010 base d on two im plementations of the *CLA* (Nor wegian and Cooke) , and thr ee sets of step sizes for the Cooke implementation ('accurate', 'intermediate', and 'trials').