Gmacs update

The Gmacs team





Major updates

- Selectivity and retention
 - Much greater flexibility in specifying selectivity parameters, bounds and priors
 - Added parametric selectivity type as option (i.e. 1 parameter per sizeclass)
- Size-compositions
 - Allows any combination of size-compositions to be fitted simultaneously (e.g. males and females fitted together in the multinomial)
 - Added Dirichlet distribution
- Additional CV for surveys/CPUE
 - With bounds, priors, etc
- Adding prior specification for all parameters, working towards a proper Bayesian model
- Multiple model scripts
 - Example of application and plotting for SMBKC

Minor updates

- Simulation mode operational but incomplete
 - Needs work in size-composition simulation and unit testing
- Many fixes to gmr plotting functions, core model code and code structure, documentation, reference list, GitHub repository and support code (e.g. Makefiles), Wiki (i.e. user manual)
- Updated BBRKC input files to include 1 more year of data (thanks Jie)
 - BBRKC model still wierd
- Began application to SMBKC (thanks Jie)

- A major overhaul of the selectivity and retention code was done
- Improved prior and bound specification
 - Special case with uniform prior (this has been repeated throughout Gmacs)
 - Removed the mirror feature but may need to figure out how to put this back in
- Added parametric selectivity (i.e. 1 parameter per size-class)
- Unit testing to ensure that this additional flexibility did not slow down the code

sel type: 0 = parametric, 1 = coefficients, 2 = logistic, 3 = logistic, 9 4 = double normal (NY) gear index: use +ve for selectivity, -ve for retention sex dep: 0 for sex-independent, 1 for sex-dependent ivector for number of year periods or nodes fear-1 Gear-2 1 1 2 1 0 1 # sex specific selectivity 3 3 3 # male selectivity type 3 3 3 # male selectivity type 2 2 2 # female selectivity type 3 3 3 # male selectivity type 2 2 2 # male retention type 2 2 2 # female retention type 2 2 2 # female retention type 1 0 0 0 # female retention flag (0 = no, 1 0 0 0 0 # female retention 1 1 1 1 100 5 100 100 100 2 2 2 2 100 100 100 100 100 100 100	
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1 22 2 2 11 1 700 0 1 900 -3 1975 201 par-7	
2 23 1 0 595 1 700 0 1 900 3 1975 201	
2 24 2 0 10 1 700 0 1 900 -3 1975 201	
ear-3 3 25 1 A 50A 1 7AA A 1 0AA 3 1075 108	14 14
3 26 2 0 10 1 700 0 1 900 3 1982 201	14 14 81
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SELECTI	ITY CONTRO	DLS		
Each prio igno) gear must or is selec ored)	t have a se ted for a	electivity parameter	and a retention selectivity. If a uniform then the lb and ub are used (pl and p2 are
LEGEND				
f sel	type: 0 =	parametric	., 1 = coef	ficients, 2 = logistic, 3 = logistic95,
	4 =	double nor	mal	
e gear	index: us	se +ve for	selectivit	y, -ve for retention
sex	dep: 0 for	sex-indep	endent, 1	for sex-dependent
ivector	for number	of year p	eriods or	nodes
Gear-1	Gear-2	Gear-3	Gear-4	
1	1	2	1	<pre># selectivity periods</pre>
1	0	1	1	<pre># sex specific selectivity</pre>
3	3	3	3	<pre># male selectivity type</pre>
3	3	3	3	# female selectivity type
f Gear-1	Gear-2	Gear-3	Gear-4	
1	1	1	1	# retention periods
1	0	0	Θ	<pre># sex specific retention</pre>
3	2	2	2	<pre># male retention type</pre>
2	2	2	2	<pre># female retention type</pre>
1	0	0	Θ	<pre># male retention flag (0 = no, 1 = yes)</pre>
0	0	0	Θ	<pre># female retention flag (0 = no, 1 = yes)</pre>

Selectivity

##	-													— ##
##	gear	par	sel								phz	star	t end	##
##	index	index	par	sex	ival	lb	ub	prio	r pl	p2	mir	ror perio	od period	##
##														— ##
##	Select	tivity	P(c	aptur	e of a	ıll si	zes)							
# 0	iear-1													
	1	1	1	1	100	5	185	0	10	200	3	1975	2014	
	1	2	2	1	120	5	185	Θ	10	200	-1	1975	2014	
	1	1	1	2	80	60	150	0	10	200	3	1975	2014	
	1	2	2	2	95	60	150	0	10	200	-1	1975	2014	
# 0	iear-2													
	2	3	1	0	110	5	185	0	10	200	3	1975	2014	
	2	4	2	0	150	5	185	0	10	200	3	1975	2014	
# 0	iear-3													
	3	5	1	1	74	60	200	0	1	200	=3	1975	1981	
	3	6	2	1	95	60	200	0	1	200	- 3	1975	1981	
	3	7	1	1	95	60	200	0	1	200	- 3	1982	2014	
	3	8	2	1	140	60	200	0	1	200	- 3	1982	2014	
	3	5	1	2	90	60	200	0	1	200	=3	1975	1981	
	3	6	2	2	160	60	200	0	1	200	- 3	1975	1981	
	3	7	1	2	100	60	200	0	1	200	- 3	1982	2014	
	3	8	2	2	170	60	200	0	1	200	-3	1982	2014	
# 0	iear-4													
	4	9	1	1	70	1	200	0	1	200	4	1975	2014	
	4	10	2	1	90	1	200	0	1	200	-4	1975	2014	
	4	9	1	2	110	1	200	0	1	200	4	1975	2014	
	4	10	2	2	190	1	200	0	1	200	=4	1975	2014	
##														##

Selectivity

## ## gea ## inde ##	r par ex index	se pa	l r sex	ival	lb	ub	prio	or pl	p2	phz mir	star ror perio	t end od period	# # #
## Sele	ectivity	P (aptur	e of a	nll si	zes)							
# Gear	-1 1	1	1	100	5	185	Θ	10	200	3	1975	2014	
1	2	2	1	120	5	185	0	10	200	-1	1975	2014	
1	1	1	2	80	60	150	Θ	10	200	2	1975	2014	
1	2	2	2	95	60	150	0	10	200	-1	1975	2014	
# Gear	-2												
2	3	1	Θ	110	5	185	0	10	200	3	975	2014	
2	4	2	0	150	5	185	0	10	200	3	1.75	2014	

Single period of sexspecific selectivity for Gear-1, with selectivity type 3 (logistic95) for both sexes

-					
##					
##	SELECTI	VITY CONTRO	LS		
##	- Eac	h gear must	have a s	electivity	and a retention selectivity
##	LEGEND	sel type: 1	= coeffi	cien s. 2	= logistic. 3 = logistic95.4
##		gear index:	use +ve	for select	ivityve for retentio
##		sex dep: 0	for sex-i	nd pendent	. 1 for sex-dependent.
##					
##	ivector	for number	of vea	periods or	nodes
##	Gear-1	Gear-2	Gez 3	Gear-4	
	1	1		1	<pre># Selectivity periods</pre>
	1	0	1	1	<pre># sex specific selectivity</pre>
	3	3	3	3	# male selectivity type
	3				<pre># female selectivity type</pre>
~					

Selectivity

## ## gea ## ind ##	r par ex inde	se x pa	l r sex	: ival	lb	ub	prior	p1	р2	phz miru	star ror perio	t end od period	# # #
## Sel	ectivit	y P(captu	ire of	all si	zes)							
# Gear	1	1	1	100	5	185	0	10	200	3	1975	2014	
ī	2	2	1	120	5	185	0	10	200	-1	1975	2014	
1	1	1	2	80	60	150	Θ	10	200	3	1975	2014	
1	2	2	2	95	60	150	0	20	200	-1	1975	2014	
# Gear	-2												
2	3	1	0	110	5	185	0	10	200	3	1975	2014	
2	4	2	0	150	5	185	0	10	200	3	1975	2014	

- Uniform prior used so Ib and ub are used and p1 and p2 are ignored
- This feature has been extended throughout Gmacs

Retention

##	ŧ													##
##	Reta	ained												
#	Gear-													
	-1	11	1	1	133	50	200	Θ	1	900	-4	1975	2014	
	-1	12	2	1	137	50	200	Θ	1	900	-4	1975	2014	
	-1	13	1	2	591	1	700	0	1	900	- 3	1975	2014	
	-1	14	2	2	11	1	700	Θ	1	900	-3	1975	2014	
#	Gear-													
	-2	15	1	Θ	595	1	700	Θ	1	900	-3	1975	2014	
	-2	16	2	0	10	1	700	0	1	900	-3	1975	2014	
#	Gear-													
	-3	17	1	Θ	590	1	700	Θ	1	900	-3	1975	1981	
	-3	18	2	Θ	10	1	700	Θ	1	900	-3	1982	2014	
#	Gear-													
	-4	19	1	0	580	1	700	Θ	1	900	-3	1975	2014	
	-4	20	2	Θ	20	1	700	Θ	1	900	-3	1975	2014	
##	ŧ													##



Size-compositions

- Major overhaul of size-composition code
- Allows any combination of size-compositions to be fitted simultaneously (e.g. males and females fitted together in the multinomial)
 - The composition aggregator
- Added the Dirichlet distribution as an option

Size-compositions: aggregator

##										##
##	OPTIC	DNS F	OR	SIZE	COMP	POST	I NOI	DATA		##
##	(ne o	olu	mn fo	or ea	acdh	mat	rix		##
##	LIKEL	THO	D OI	PTIO	NS:					
##		Mul	tin	omial	l wit	th e	stim	ated	/fixed sample size	
##		Roh	ust	appi	roxi	natio	on to	n mu	ltinomial	
##		100	ist	ic no	ormal	(N	TY)			
##	- 4	mul	tiv	ariat	te-t	(NT)				
##		Dir	-ich	16+	ce e	(INT.				
##	AUTO	TATI	COL	MDDEC	CCTO					
##	AUTU	TAIL	i coi	the	55101	V - L - +		rana	stion used in tail compression	
##)III.T.LI		che d	cumu	Lati	ve p	opo	cion used in care compression.	##
2	2	2	2	2	2	2	2	2	# Type of likelihood	**
0	0	0	0	0	0	0	0	0	# Auto tail compression (pmin)	
1	1	1	1	1	1	1	1	1	<pre># Initial value for effective sample size multipli</pre>	er
-4	-4	-4	-4	-4	-4	-4	-4	-4	# Phz for estimating effective sample size (if app	
(i	2	2	3	3	4	4	4	5	# Composition and regator	
##										##

Size-compositions: Dirichlet

##				##
##	OPTIO	NS FO	DR SIZE COMPOSTION DATA (COLUMN FOR EACH MATRIX)	
##				##
##	LIKEL:	IHOOI	OPTIONS:	
##	-1)	Mul	tinomial with estimated/fixed sample size	
##	-2)	Rob	ust approximation to multinomial	
##	-3)	log	istic normal (NIY)	
##	-4)	mul	tivariate-t (NIY)	
##	-5)	Dir	ichlet	
##	AUTOT	ATL (COMPRESSION:	
##	- DI	min	is the cumulative proportion used in tail compression.	
##			ene camatactic proportion apea in care compression.	##
ſ	5 5	5	# Type of likelihood	1.00
	0 0	0	# Auto tail compression (pmin)	
Ć	1 1	1	<pre># Initial value for effective sample size multiplier</pre>	
	4 4	4	# Phz for estimating effective sample size (if appl.)	
	1 2	3	# Composition aggregator	
##				##

$$\lambda_{\ell,t} = N_{\ell,t} S_{\ell,t}$$
$$(Q_{\ell})_{t} = \frac{\lambda_{\ell,t}}{\sum_{\ell} \lambda_{\ell,t}} \text{ where } \sum_{\ell} (Q_{\ell})_{t} = 1 \forall t$$

$$(P_{\ell})_t \sim Dirichlet(\alpha_0 \alpha_t(Q_{\ell})_t)$$
 where $\sum_{\ell} (P_{\ell})_t = 1 \forall t$

Small values of α_0 will result in a "sloppy" (high variance) distribution, while a large α_0 will result in the expected value of $(P_\ell)_t$ strongly concentrated towards $(Q_\ell)_t$.

Additional CV for surveys/CPUE

Ifa	uniform pri	or is sel	ected fo	or a param	neter the	en the	lb and ub	are used (pl
and p	2 are ignor	ed). ival	must be	e > 0				
EGEND								
EGEND prior	type: 0 =	uniform,	1 = norm	nal, 2 = 1	Lognormal		beta, 4 =	gamma
EGEND prior	type: 0 =	uniform,	1 = norm	nal, 2 = 1	Lognormal		beta, 4 =	gamma
EGEND prior val	type: 0 =	uniform, ub	1 = norm phz	nal, 2 = 1 prior	lognormal pl	., 3 = 1 p2	beta, 4 =	gamma
EGEND prior val .0001	type: 0 =	uniform, ub 10.0	1 = norm 	nal, 2 = 1 prior 4	pl 1.0	p2	beta, 4 = 	gamma



Year

Multiple model scripts

- Makefile
 - Typing make -j N at the command line will run all models within independent directories and produce plots showing the different models using the R package gmr
- Example using SMBKC
 - In a different presentation



Simulation mode

- Use the command gmacs -ainp gmacs.par -sim 123 where gmacs.par contains the parameter values and 123 is the random number seed
- This part of the code is unfinished
 - Need to complete section that simulates size composition data and needs unit testing



Other stuff

- I want to remove analytic *q* and specify as a parameter?
- Do we want to use Francis iterative re-weighting?
- The continuous F argument
- I need to figure out Makefiles that work on windows
- What else do we want?
- Anything we don't want?