Introduction to Hierarchical Bayesian Analysis for Ecological Data using WinBUGS

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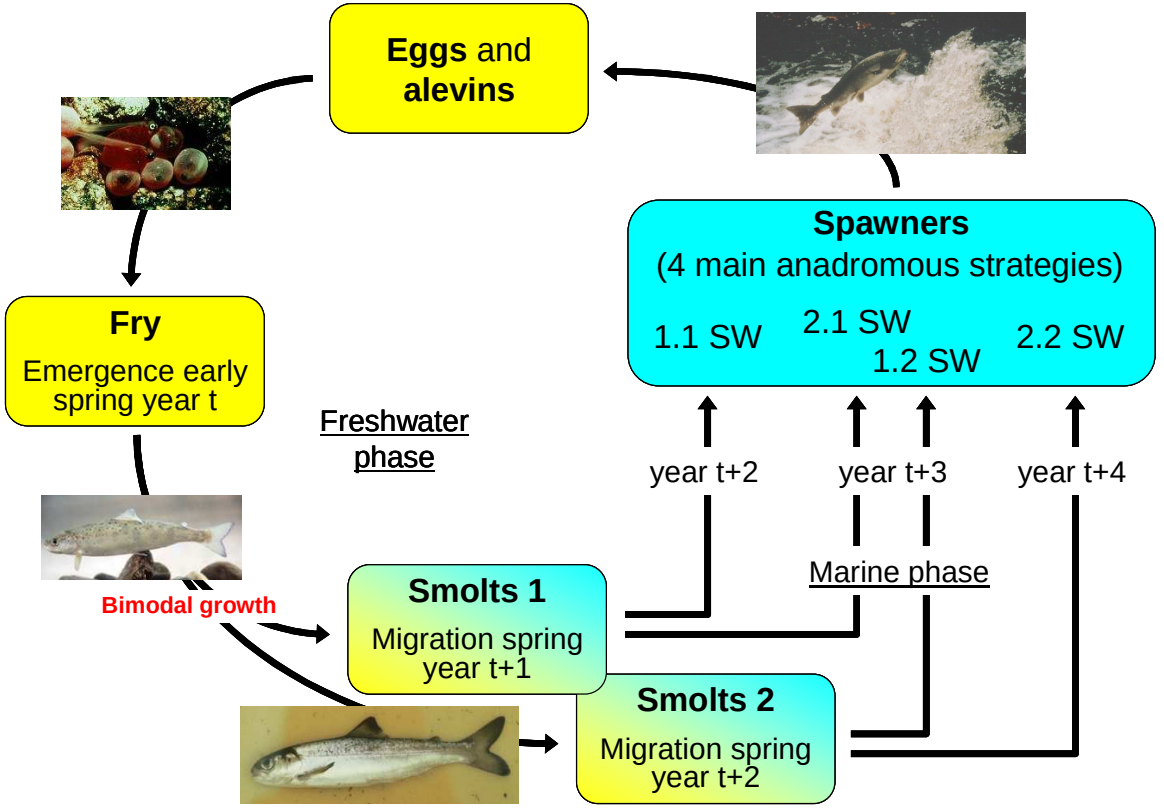
Bayesian modelling

of capture-mark-recapture experiments

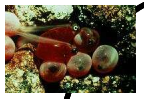
to estimate the smolts (and adults) runs

Atlantic salmon life cycle (In France)



Field surveys

Upstream migration of spawners



Eggs and **alevins**

Spawners
(4 main anadromous strategies)
1.1 SW 2.1 SW 1.2 SW 2.2 SW

year t+2 year t+3 year t+4

Marine phase

Fry
Emergence early spring year t

Freshwater phase

Bimodal growth

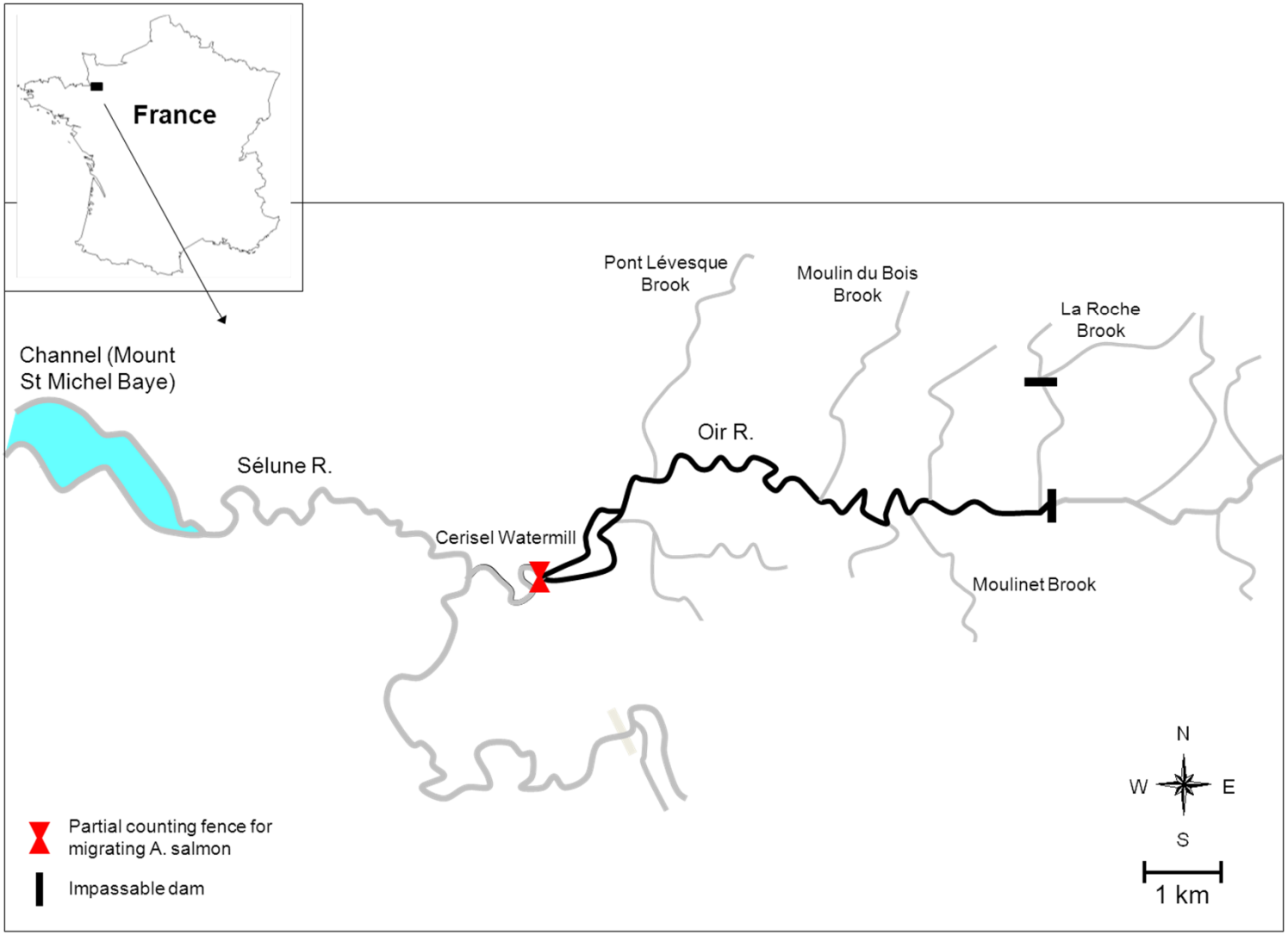
Smolts 1
Migration spring year t+1

Smolts 2
Migration spring year t+2

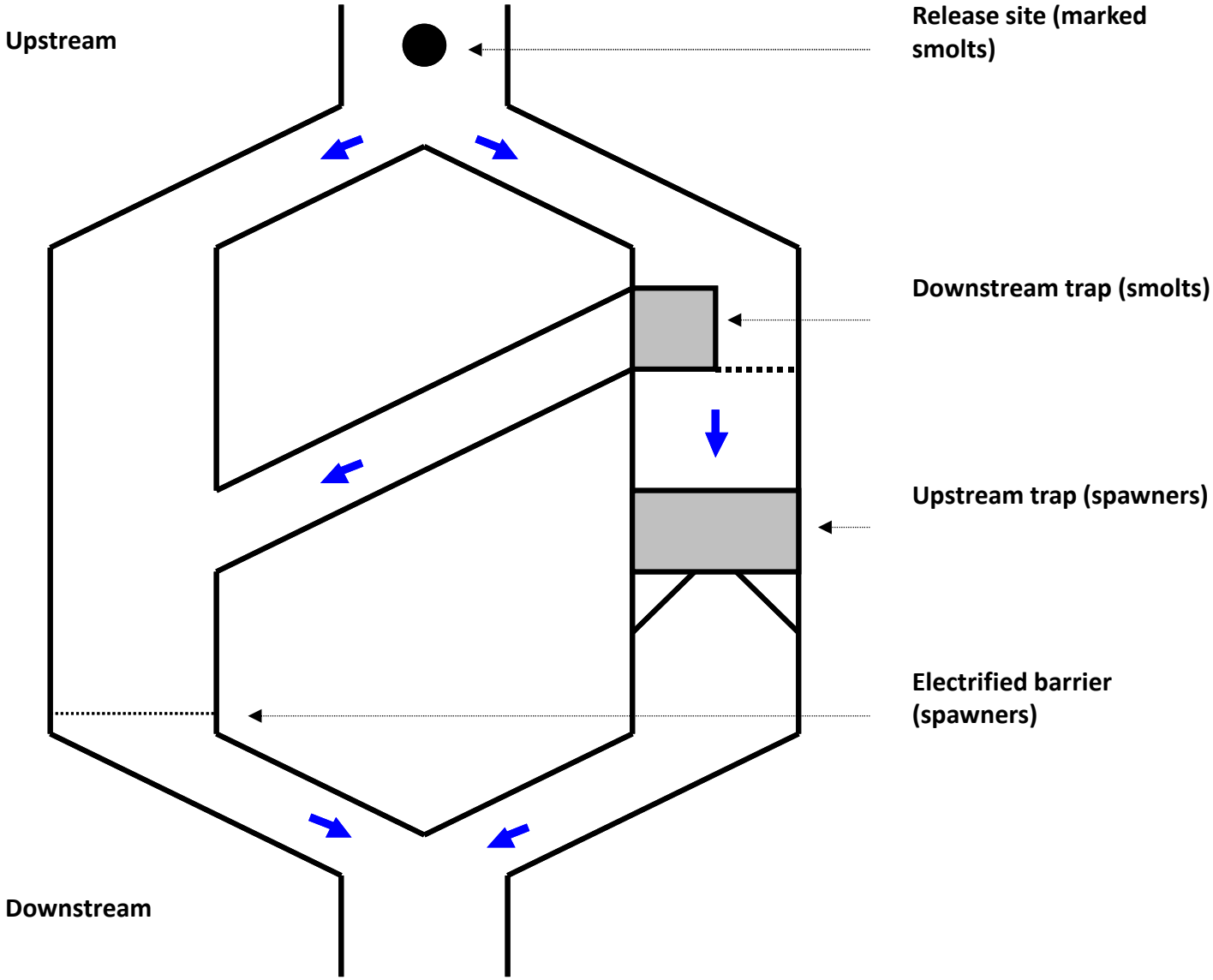
Juveniles

Downstream migration of smolts

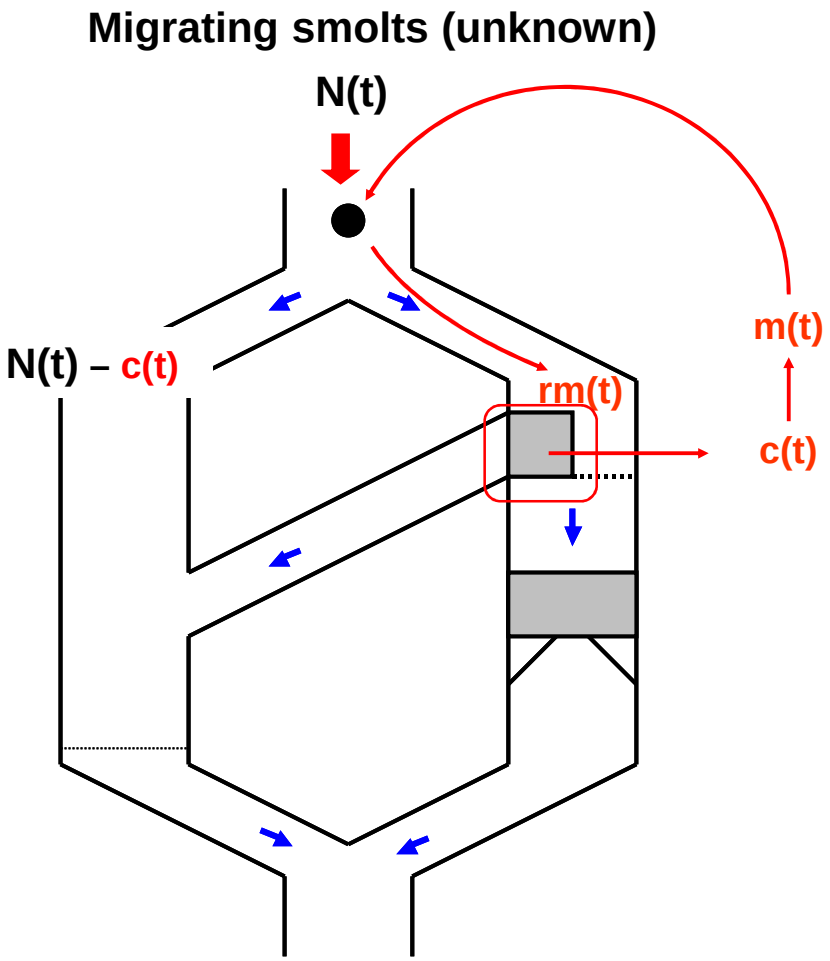
The Oir river



The trapping facility



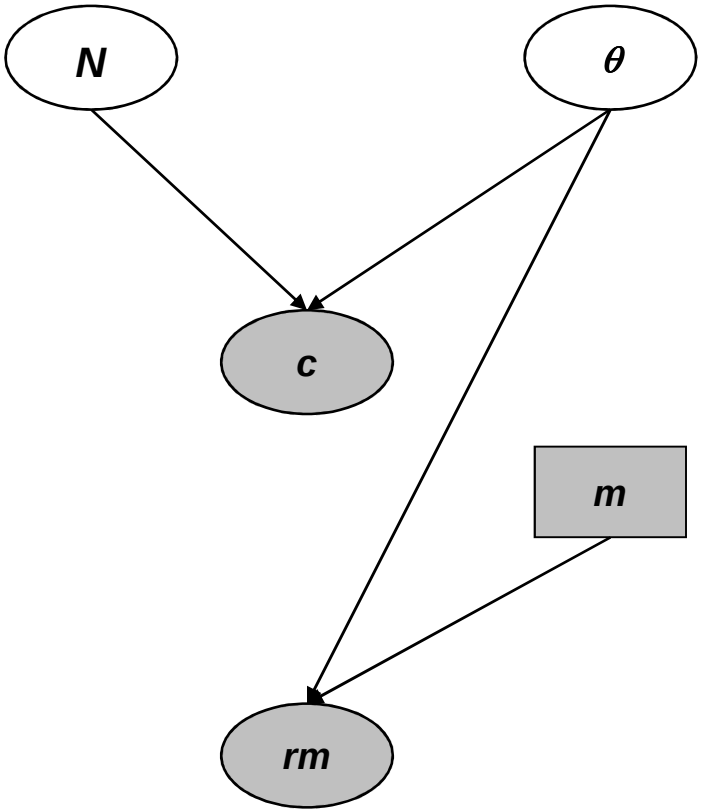
CMR for downstream migrating smolts



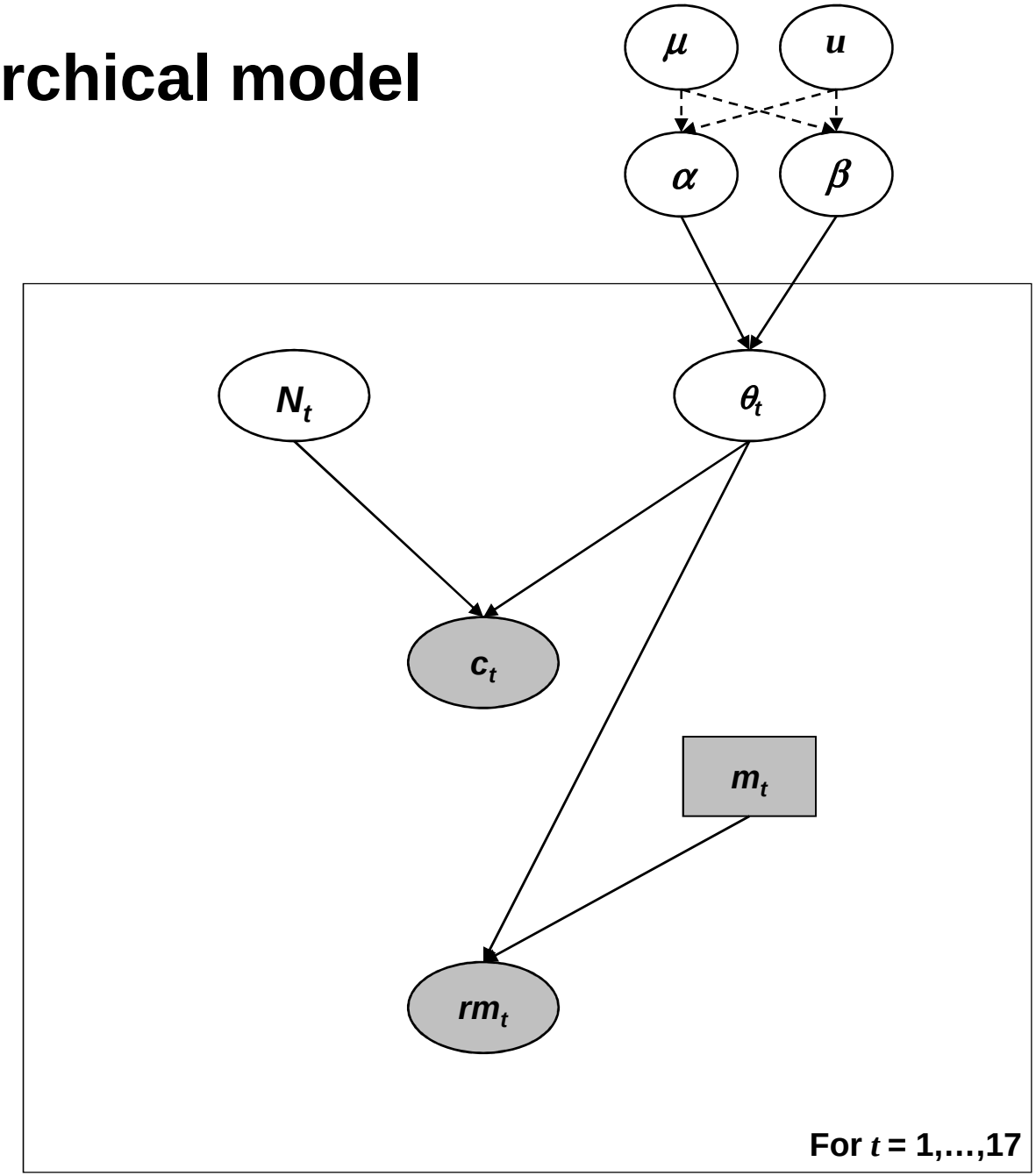
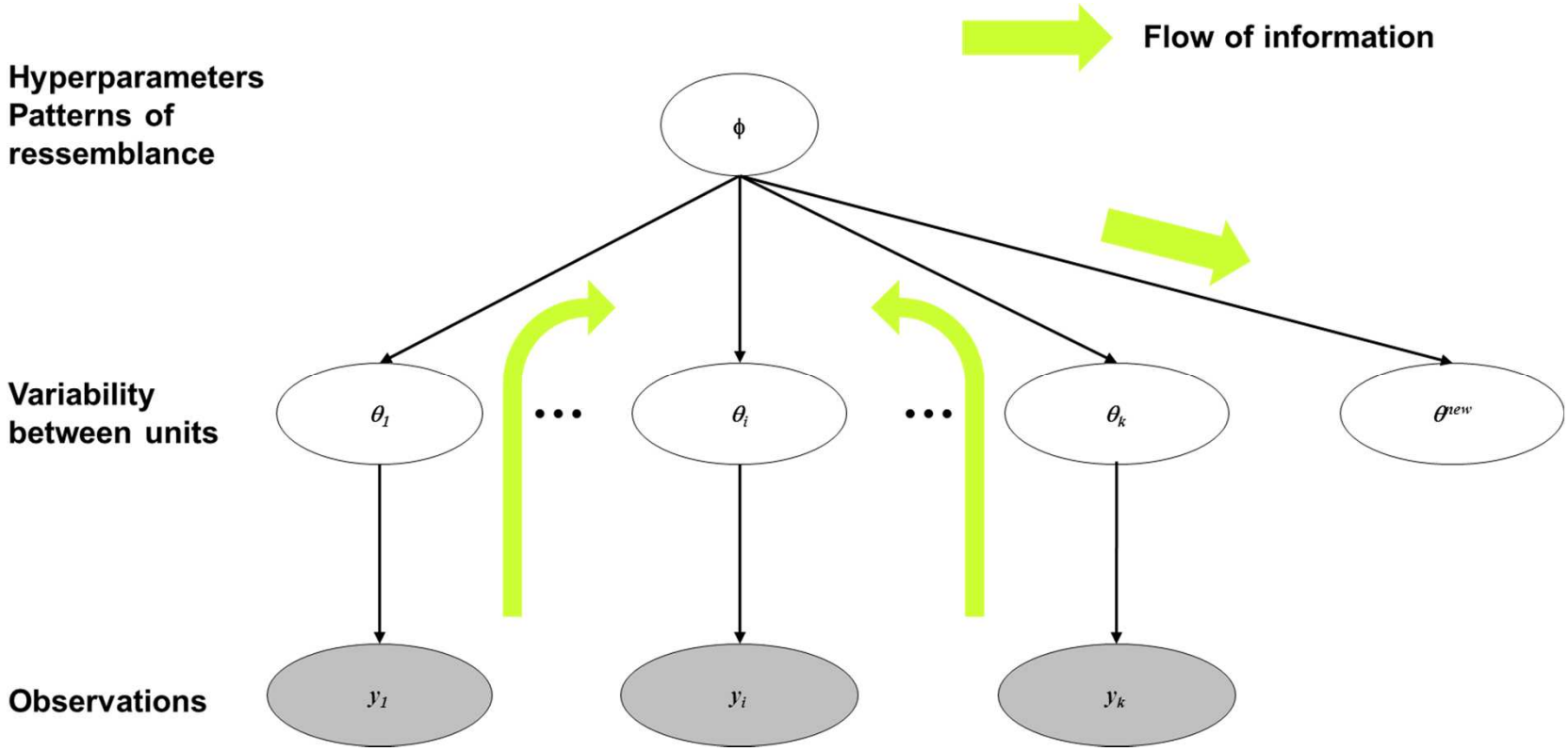
Data

Exp	Migration year	c	m	rm	p 1+	Q (m3 / sec)
1	1986	887	135	91	0.956	6.18
2	1987	283	31	24	0.516	4.19
3	1988	307	59	43	0.917	3.12
4	1989	553	65	43	0.895	4.13
5	1990	746	38	35	0.949	1.81
6	1991	151	35	27	0.669	5.45
7	1992	580	50	43	0.984	1.68
8	1993	209	26	24	0.818	3.25
9	1994	329	17	10	0.982	4.77
10	1995	618	63	NA	0.875	3.17
11	1996	767	76	NA	0.892	3.38
12	1997	205	63	31	0.907	5.29
13	1998	511	91	44	0.857	6.43
14	1999	195	59	45	0.221	3.40
15	2000	1849	300	232	0.992	5.04
16	2001	688	264	123	0.924	7.86
17	2002	1919	442	352	0.833	2.71
18	2003	844	326	222	0.581	4.42

Model



Hierarchical model



The flow of information