



4th CORE EXPERT MEETING
18-19 SEPTEMBER 2018, Melia Kuala Lumpur, Malaysia



Outputs based on Regional Synthesis

By Project Coordinator
of SEAFDEC/MFRDMD

19 September 2018



Objectives

1. Data screening for analysis using Allowable Biological Catch (ABC) Rule and Production Model.
2. Calculation of ABC using Rule 2-2 for selected areas and synthesized South China Sea and Andaman Sea.
3. Preliminary analysis using Equilibrium Production Model for selected areas.

Catch and effort data screening (provided from 8 MCs)

Annual catch of 8 MCs in SCS and AS

Year	LANDING (mt)												
	South China Sea							Andaman Sea					
	BRU	KH	IN	MY	PH	TH	VN	TOTAL SCS	IN	MY	MM	TH	TOTAL AS
1996	74		61,223	119,941		410,693		591,931	88,620	58,436		171,806	318,862
1997			59,055	140,077	34,400	388,009		621,541	88,345	58,152		164,701	311,198
1998			58,764	147,423	1,233	360,118		567,538	86,364	78,498		170,879	335,741
1999			63,888	189,314	39,954	363,236		656,392	86,042	81,075		168,971	336,088
2000			67,457	210,216	43,193	363,900	322,389	1,007,155	94,152	55,223		184,129	333,504
2001	124		57,916	205,768	44,965	352,789	330,435	991,997	96,570	54,861		173,533	324,964
2002	311		61,554	218,170		353,724	222,638	856,397	84,607	84,854		174,243	343,704
2003	326		62,558	178,751		397,276	278,622	917,533	95,056	91,276		155,265	341,597
2004	511		80,018	163,146		412,411	245,187	901,273	60,973	114,263		161,510	336,746
2005	1,186		73,764	167,560	2,400	407,296	101,532	753,738	61,049	128,180		181,798	371,027
2006	1,069		66,369	188,085	1,040	359,983	257,453	873,999	70,175	143,428	7,092	166,986	387,681
2007	1,113	592	75,940	169,754		328,305	149,100	724,804	68,237	175,522	7,707	149,105	400,571
2008	901	260	86,731	209,316		334,070	178,700	809,978	65,872	180,580	16,224	145,988	408,664
2009	895	270	106,280	181,952	22,400	333,466	191,300	836,563	65,690	176,884	137,887	153,467	533,928
2010	908		95,346	179,911		341,274	212,000	829,439	69,522	191,667	72,124	162,512	495,825
2011	986		53,897	184,190	39,400	353,161	237,000	868,633	91,279	149,271	51,978	148,771	441,299
2012	1,095		128,576	189,790	284,867	352,314	215,200	1,171,842	98,824	149,237	27,580	150,517	426,158
2013	1,049		47,991	208,005	445,811	369,431	226,900	1,299,186	101,136	135,471	16,132	133,017	385,756
2014	1,032		56,128	201,880	51,552	391,653	256,200	958,444	96,191	140,946	185,583	142,593	565,313
2015	949			279,218	13,367	347,960	434,200	1,075,695		140,735	10,892	134,203	285,830

Annual no. of vessels of 8 MCs in SCS and AS

NO OF VESSELS (unit)

Year	South China Sea								Andaman Sea				
	BRU	KH	IN	MY	PH	TH	VN	TOTAL SCS	IN	MY	MM	TH	TOTAL AS
1996	1	16	47	726		1,077		1,867	1,558	276		250	2,084
1997		15	58	689	18	1,157		1,937	1,811	270		345	2,426
1998		15	66	602	2	1,064		1,749	2,003	288		225	2,516
1999		8	64	736	17	1,134		1,959	1,918	309		420	2,647
2000		10	110	767	15	1,178		2,080	2,131	311		326	2,768
2001	2	14	110	734	24	1,039		1,923	2,198	306		410	2,914
2002	6	10	96	755		1,239		2,106	1,570	316		447	2,333
2003	6	12	81	747		1,295		2,141	2,942	312		342	3,596
2004	7	10	181	722		1,298		2,218	2,262	305		401	2,968
2005	8	10	222	734	1	1,210		2,185	1,519	320		335	2,174
2006	9	6	426	744	1	1,169		2,355	2,031	371	368	321	3,091
2007	9	4	421	766		1,162		2,362	1,936	374	367	279	2,956
2008	9	1	1,585	861		1,170	6,033	9,659	1,995	397	527	304	3,223
2009	10	1	1,543	834	6	1,120	7,155	10,669	2,314	413	532	364	3,623
2010	8	4	1,122	837		1,223	8,348	11,542	1,766	420	536	405	3,127
2011	13	1	1,312	795	4	1,135	5,261	8,521	1,611	440	545	363	2,959
2012	12	1	2,188	812	268	1,148	5,123	9,552	1,839	441	639	443	3,362
2013	14		2,383	801	930	1,175	4,726	10,029	1,763	443	640	373	3,219
2014	13		3,963	791	11	1,296	4,696	10,770	1,498	416	647	417	2,978
2015	9			800	23	1,297	4,992	7,121		394	580	431	1,405

Annual no. of trips of 4 MCs in SCS and AS

Year	TRIPS (trips)							
	South China Sea				Andaman Sea			
	BRU	IN	MY (ECPM)	TH	TOTAL SCS	MY	TH	TOTAL AS
1996	124		37,413	130,586	168,123	43,265	75,371	118,636
1997			39,572	139,059	178,631	45,441	79,472	124,913
1998			27,587	104,620	132,207	39,964	81,122	121,086
1999			39,083	96,342	135,425	33,491	74,982	108,473
2000			38,562	84,715	123,277	33,067	77,817	110,884
2001	169		38,983	84,067	123,219	37,706	76,773	114,479
2002	578		36,483	93,746	130,807	44,808	76,950	121,758
2003	857		34,876	119,399	155,132	42,054	81,268	123,322
2004	862		27,855	115,915	144,632	43,904	68,471	112,375
2005	1,071	9,384	28,028	119,676	158,159	45,918	90,423	136,341
2006	980	18,954	30,667	104,692	155,293	46,112	85,644	131,756
2007	964	19,524	25,868	94,549	140,905	50,653	66,704	117,357
2008	1,035	28,615	27,655	106,442	163,747	48,047	65,763	113,810
2009	1,048	43,048	21,583	105,420	171,099	42,203	68,144	110,347
2010	1,009	35,342	21,481	103,817	161,649	49,731	65,111	114,842
2011	1,263	47,866	18,988	121,425	189,542	45,031	61,964	106,995
2012	1,507	67,777	21,089	48,926	139,299	46,257	37,724	83,981
2013	1,134	81,137	20,478	46,956	149,705	43,775	34,434	78,209
2014	1,199	89,562	19,210	50,876	160,847	44,143	33,650	77,793
2015	758		15,109	71,754	87,621	37,924	59,138	97,062

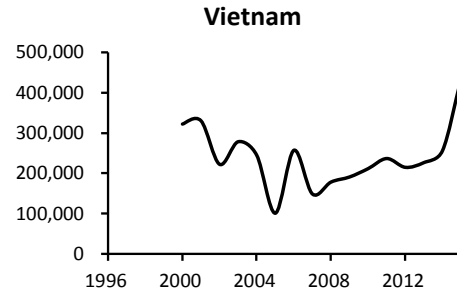
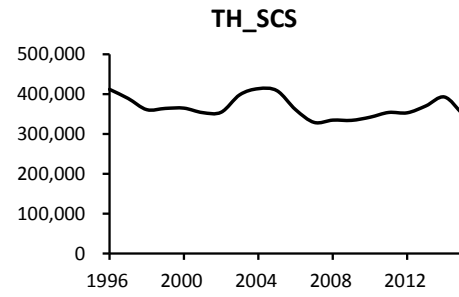
Annual catch, no. of vessels, no. of trips of 3 areas of Malaysia off SCS

MALAYSIA (South China Sea)												
Year	LANDING (mt)				NO. OF VESSEL (units)				TRIPS (trips)			
	ECPM	Sabah	Sarawak	TOTAL SCS	ECPM	Sabah	Sarawak	TOTAL SCS	ECPM	Sabah	Sarawak	TOTAL SCS
1996	83,769	36,172		119,941	548	155	23	726	37,413			37,413
1997	114,962	25,115		140,077	493	177	19	689	39,572			39,572
1998	105,519	41,904		147,423	404	177	21	602	27,587			27,587
1999	147,169	42,145		189,314	520	191	25	736	39,083			39,083
2000	160,760	49,456		210,216	554	191	22	767	38,562			38,562
2001	162,360	43,408		205,768	546	166	22	734	38,983			38,983
2002	170,420	47,750		218,170	567	166	22	755	36,483			36,483
2003	135,049	43,702		178,751	555	166	26	747	34,876			34,876
2004	111,720	51,426		163,146	530	166	26	722	27,855			27,855
2005	101,919	65,641		167,560	529	166	39	734	28,028			28,028
2006	132,638	55,447		188,085	522	166	56	744	30,667			30,667
2007	107,327	62,427		169,754	553	166	47	766	25,868			25,868
2008	145,377	57,767	6,172	209,316	606	202	53	861	27,655		544	28,199
2009	118,185	57,219	6,548	181,952	590	202	42	834	21,583	30,396	1,588	53,567
2010	115,326	55,897	8,688	179,911	589	211	37	837	21,481	35,214	590	57,285
2011	115,771	60,218	8,201	184,190	507	249	39	795	18,988	31,320	500	50,808
2012	123,719	55,911	10,160	189,790	495	274	43	812	21,089	30,770	446	52,305
2013	132,169	64,813	11,023	208,005	487	274	40	801	20,478	34,307	358	55,143
2014	134,979	56,595	10,306	201,880	486	265	40	791	19,210	31,986	303	51,499
2015	235,328	34,261	9,629	279,218	493	268	39	800	15,109	31,830	297	47,236

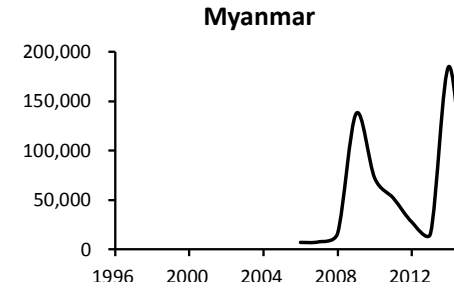
Data screening for analysis using ABC Rule and Production Model

Interannual variation of catch of 8 MCs including 3 areas of MY off SCS

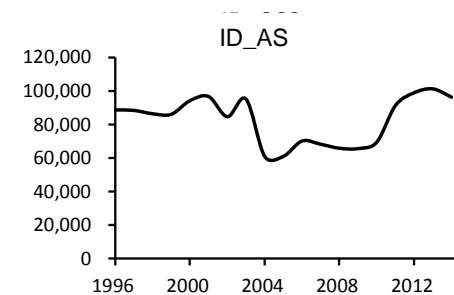
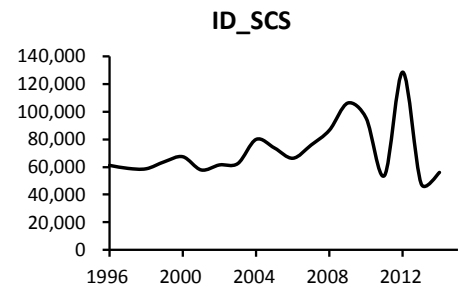
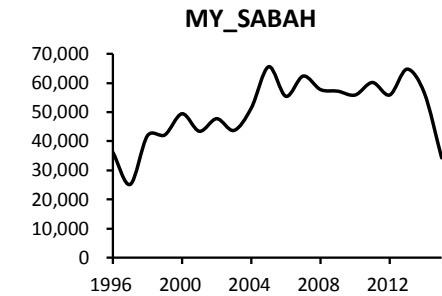
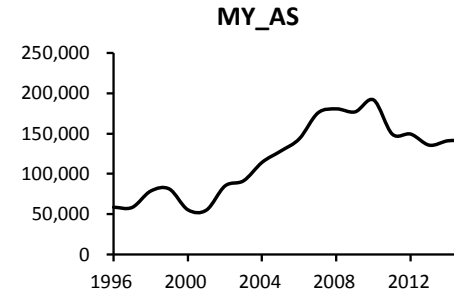
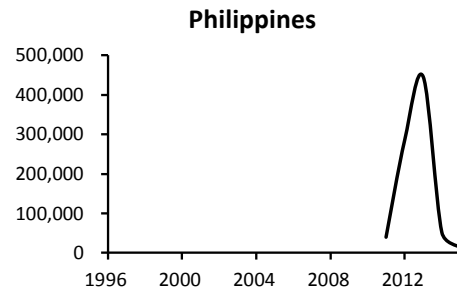
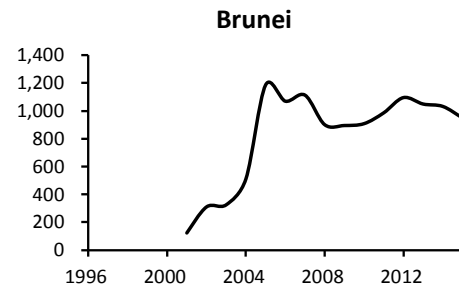
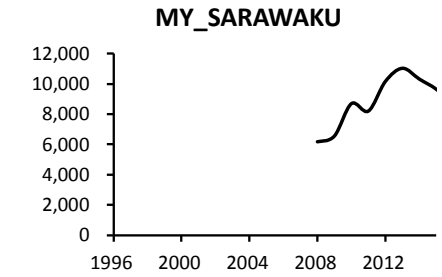
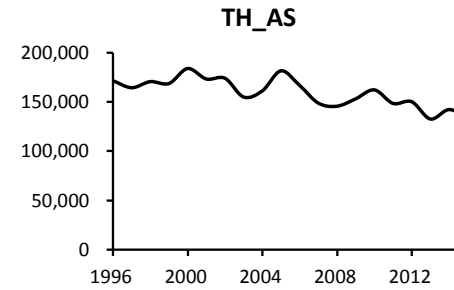
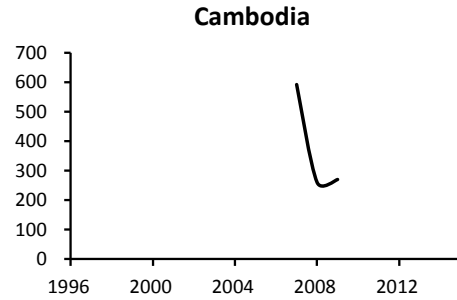
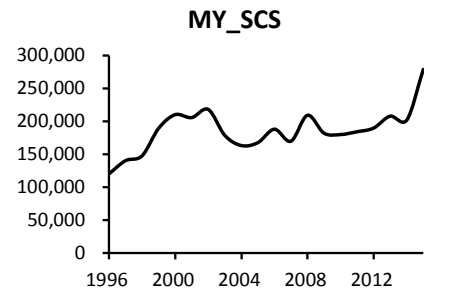
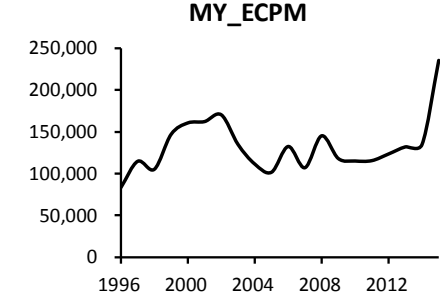
South China Sea

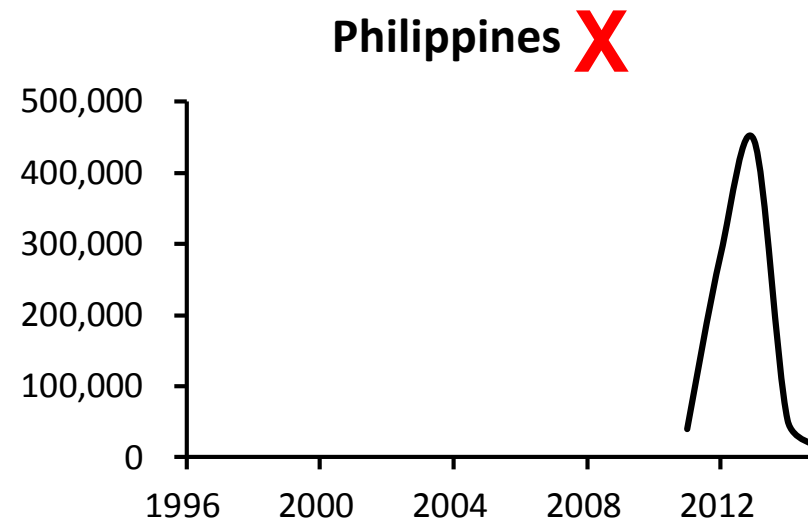
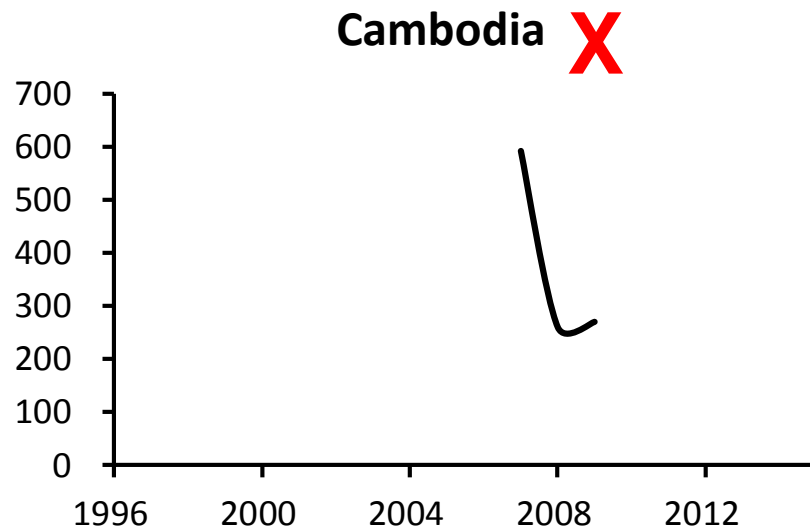
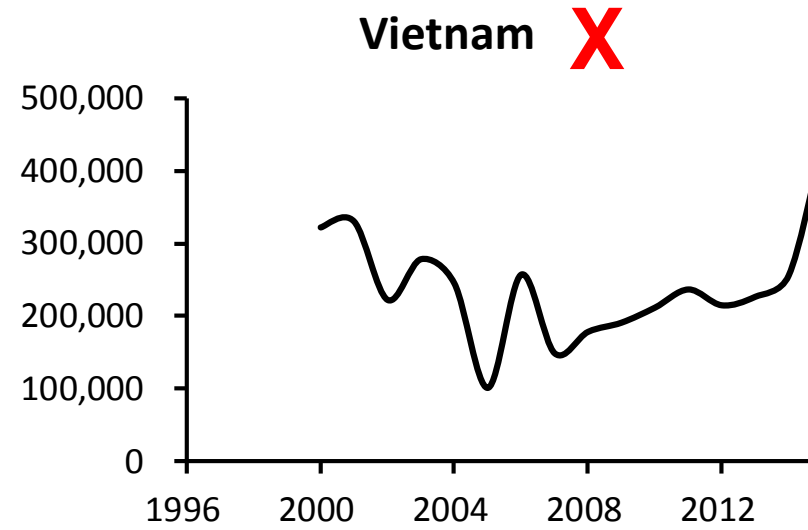
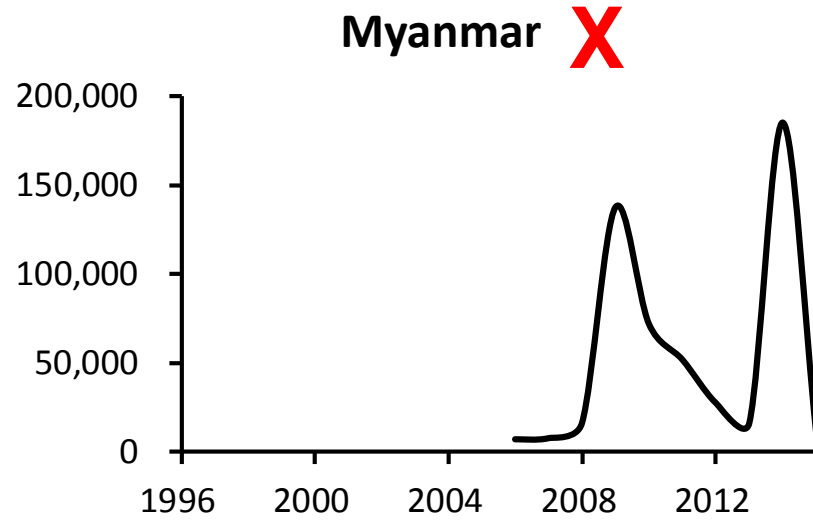


Andaman Sea



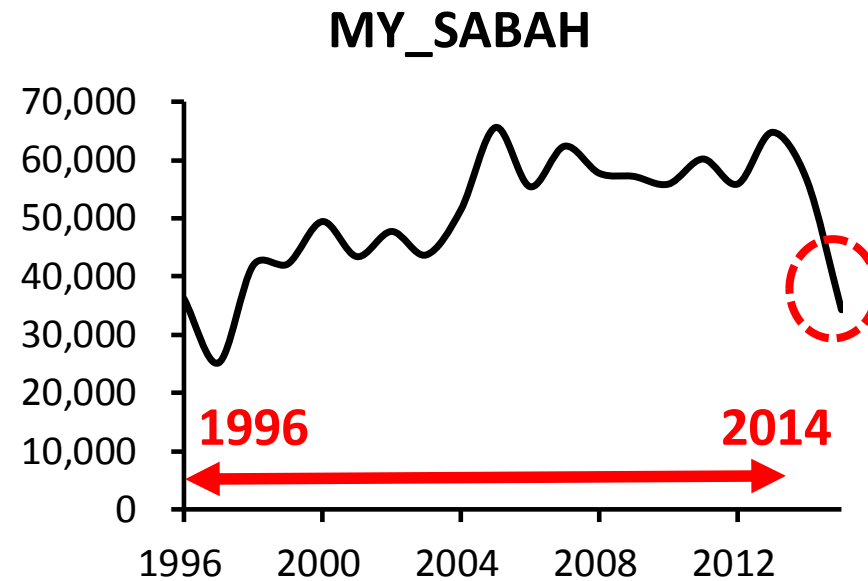
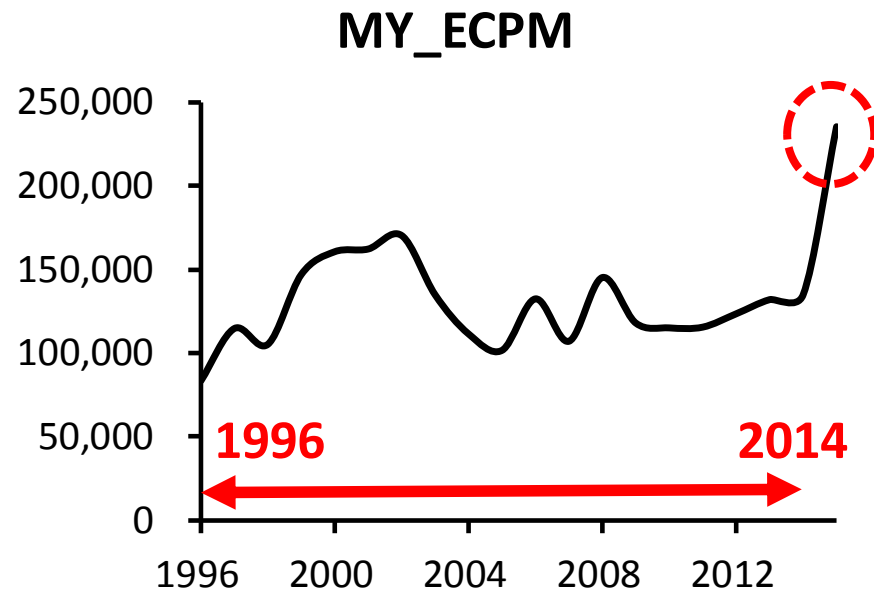
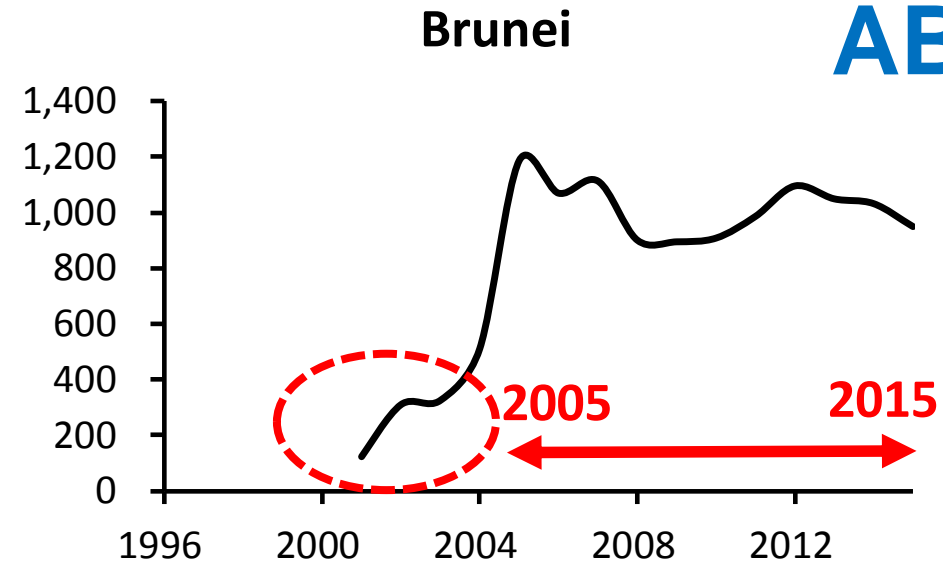
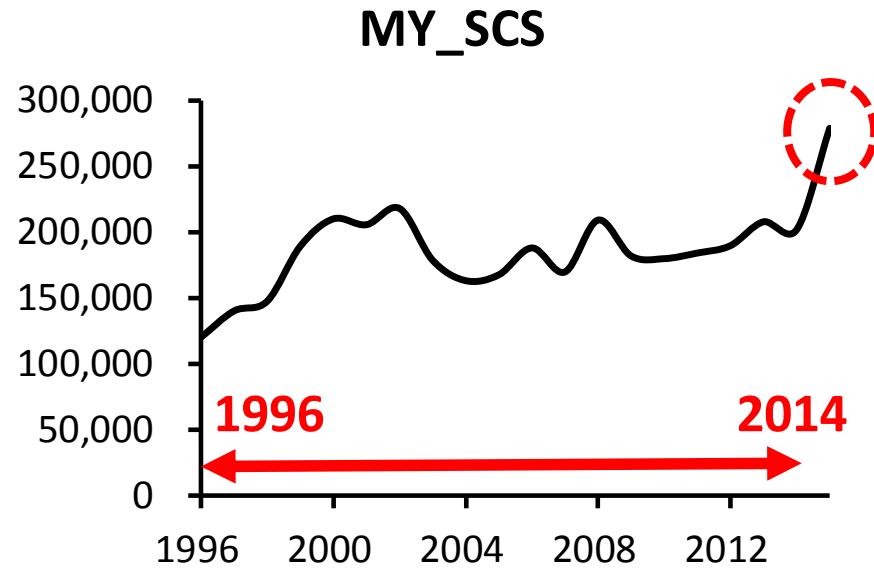
3 areas of MY





We **omitted** the catch data from **KH**, **MM**, **PH**, and **VN** for analysis using both **ABC Rule** and **Production Model** because of **large fluctuation** of interannual variation of catch, although they very kindly provided us with their precious data.

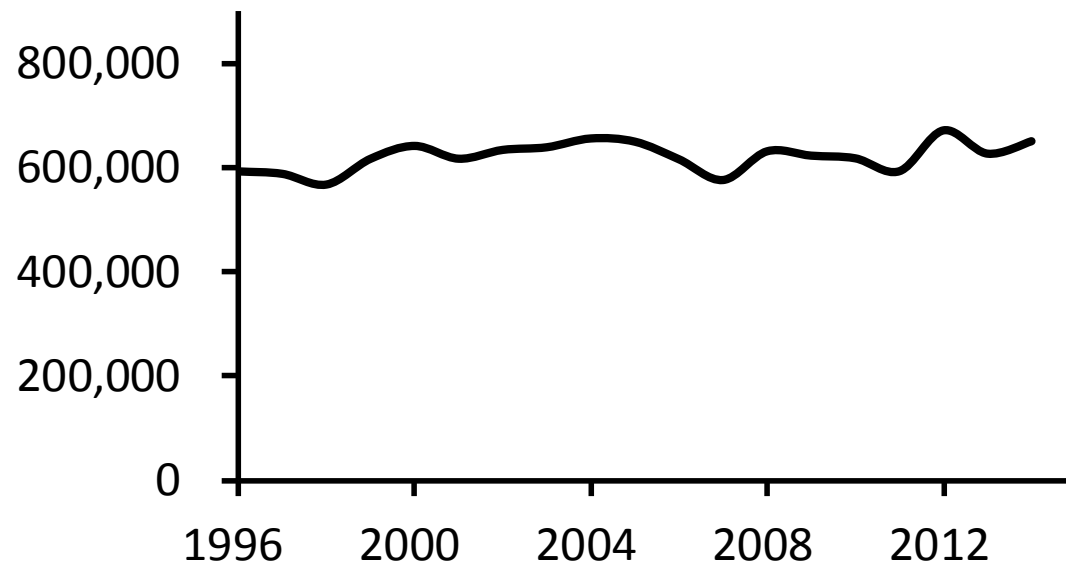
ABC Rule



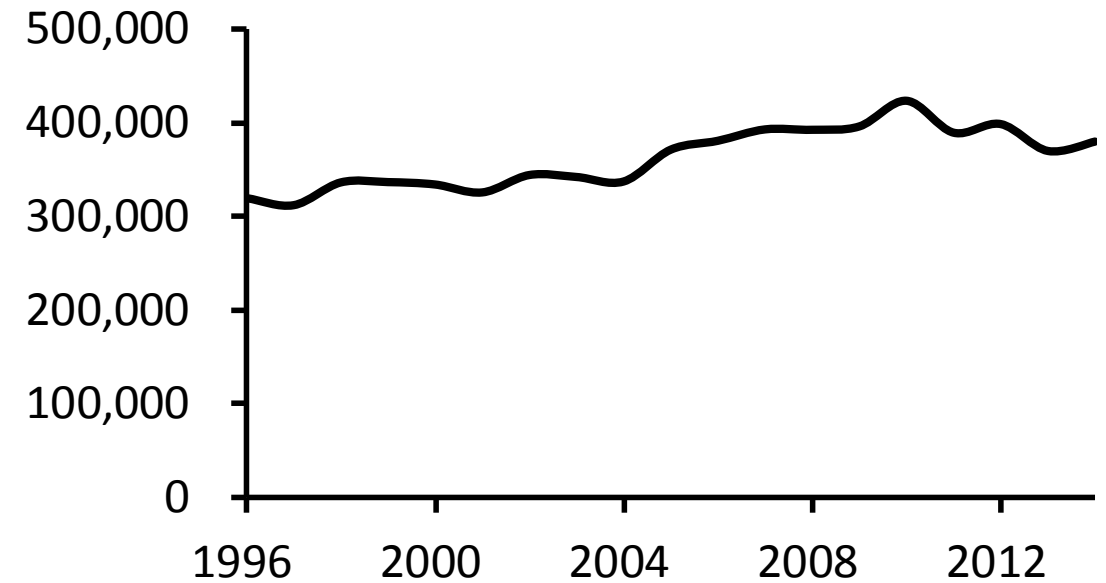
We **omitted** the catch data which shows **steep increase or decrease** and use the data during **stable period** (shown as red arrows) for **ABC Rule** analysis

ABC Rule

SCS of TH, MY, BR, ID

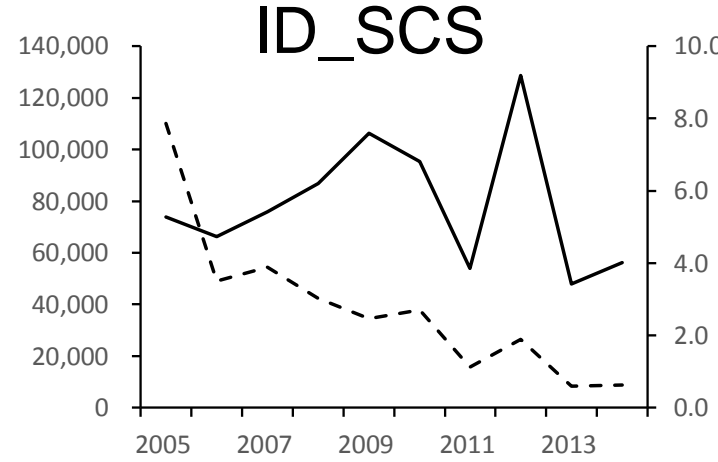
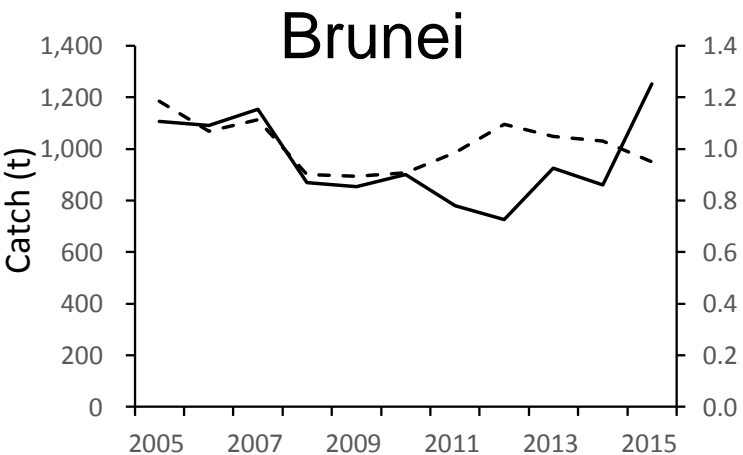
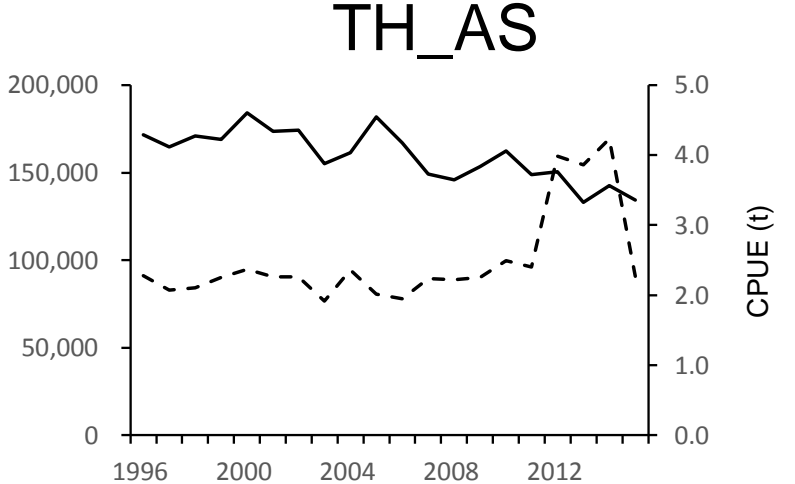
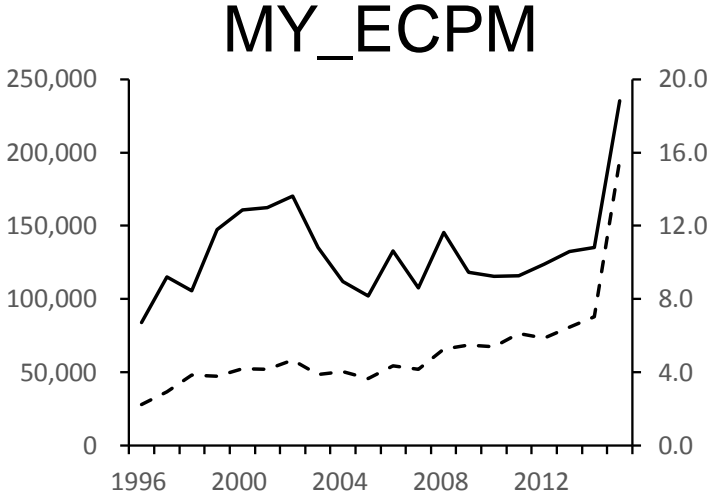
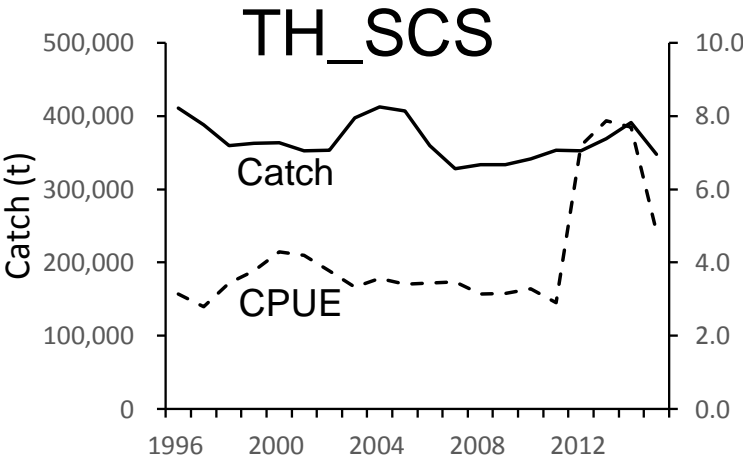


AS of TH, MY, ID



We made ABC Rule analysis for **synthesized SCS** and AS from the catch data of 4 MCs

Production Model



We used the catch and effort data of 4 MCs in SCS and only Thailand in AS for analysis of Production Model.

We used **no. of trips** for effort index which is **more reliable for PM analysis.**

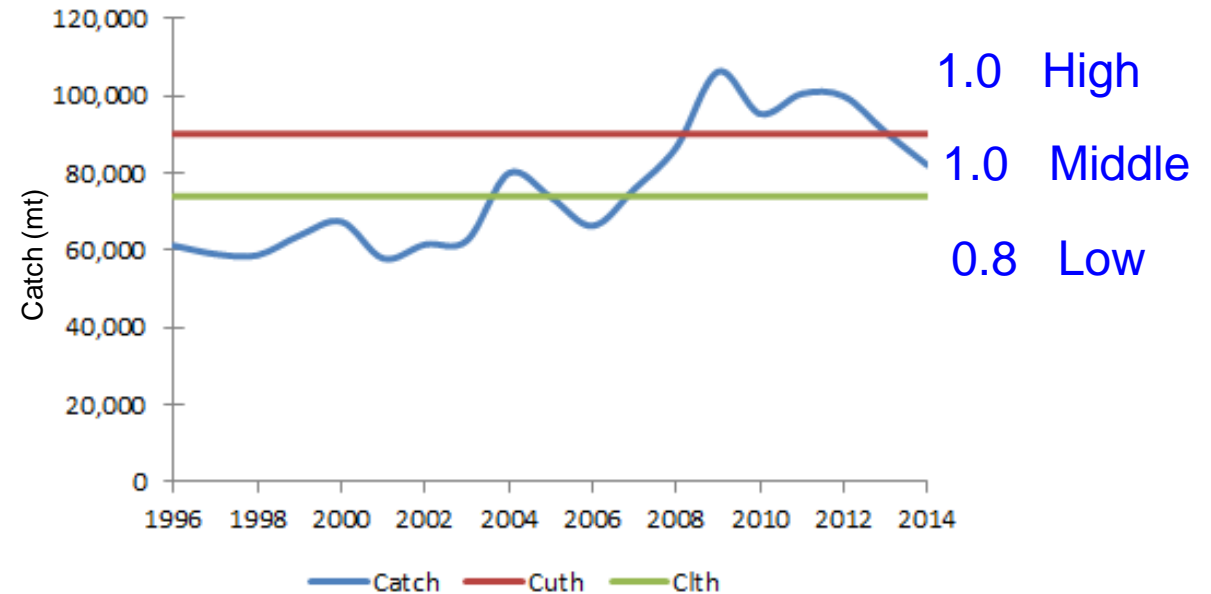
Output of analysis
using ABC Rule 2-2

Formula of ABC (Rule 2-2)

Rule 2-2

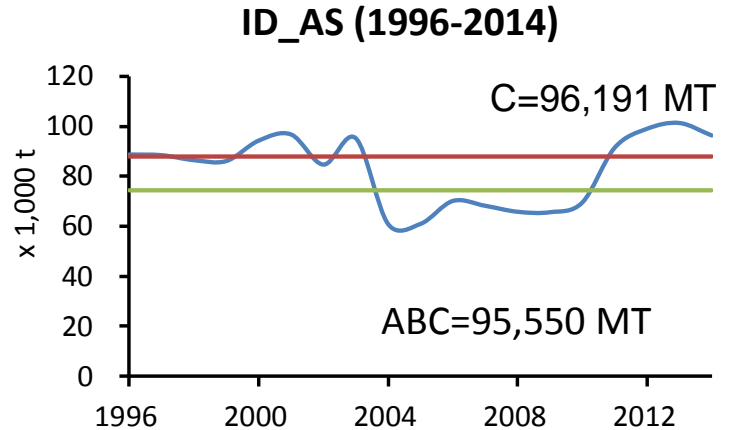
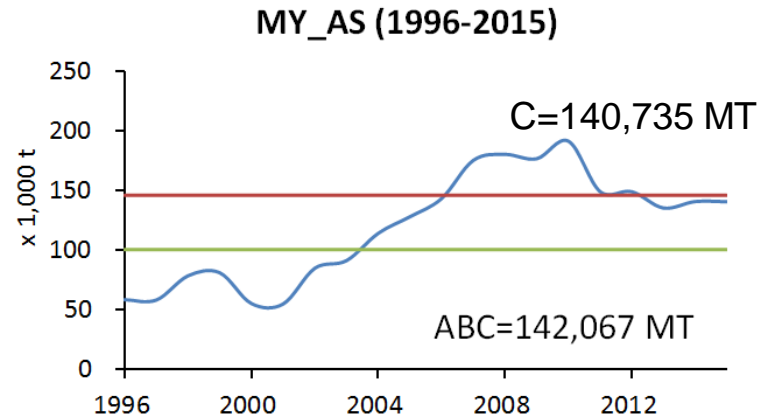
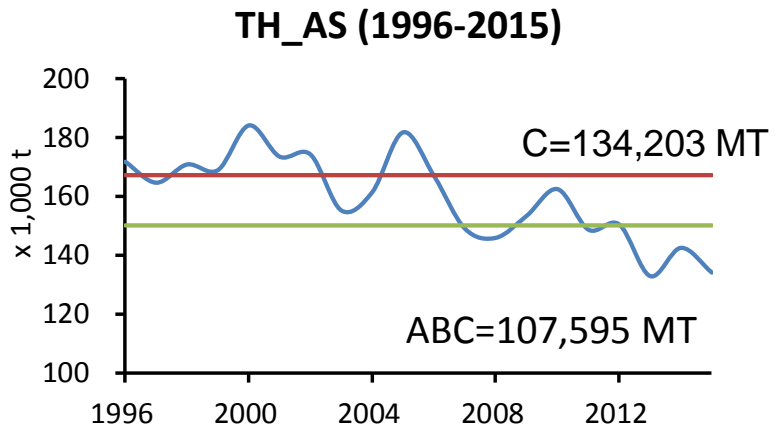
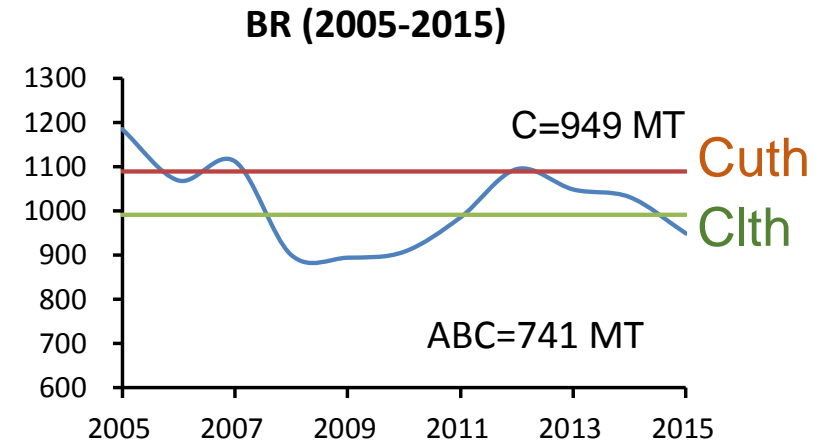
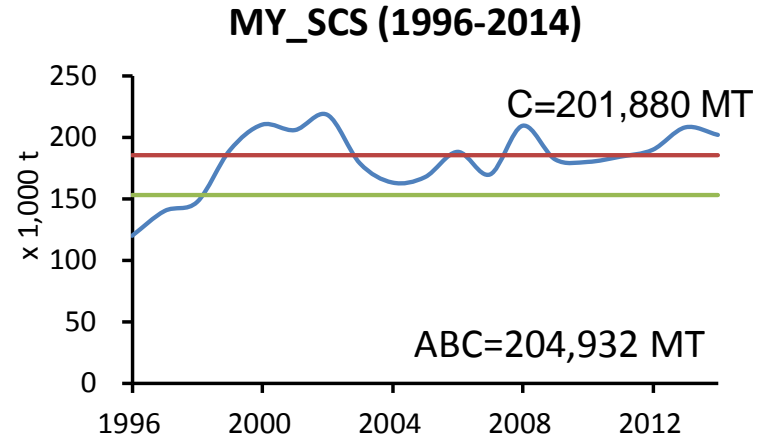
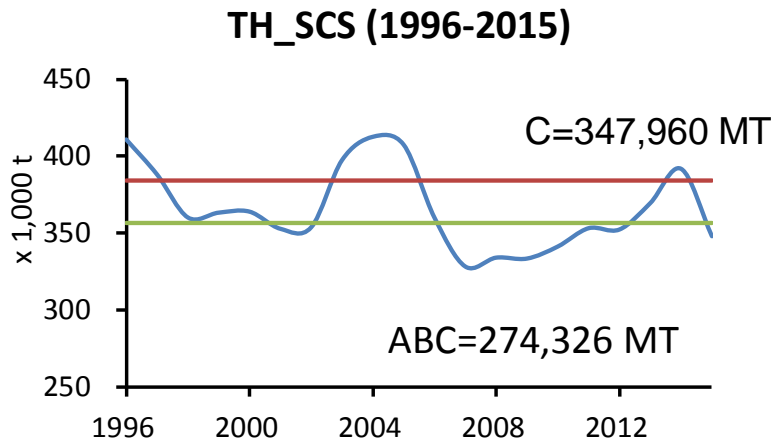
$$ABC = \delta_2 \times Ct \times \gamma_2$$

- $\delta_2 =$ 1.0 (High)
1.0 (Middle)
0.8 (Low)
- Ct = current catch
- $\gamma_2 = 1 + 0.5 (b / l)$
 - b : tangent of the Catch for recent **3 years**
 - l : Average of the Catch for recent **3 years**



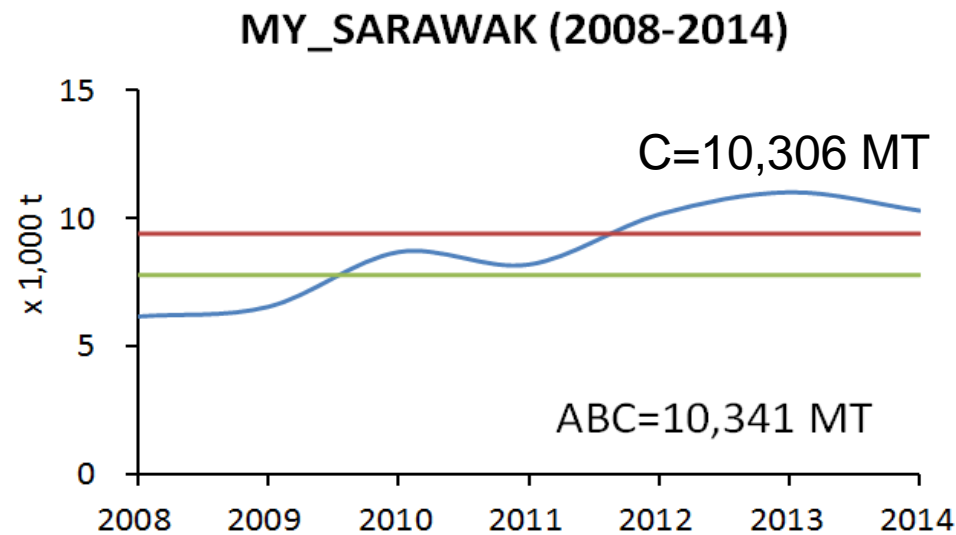
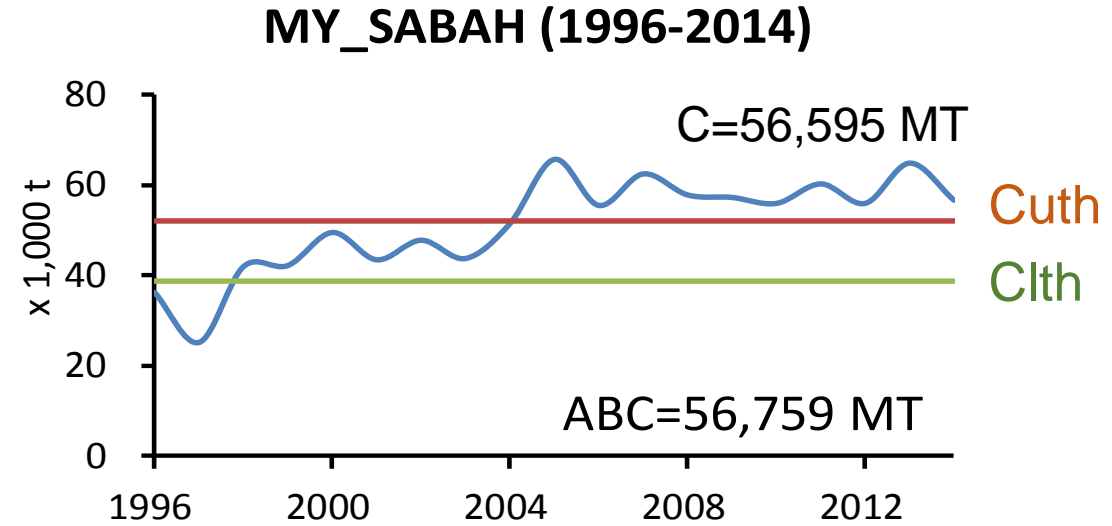
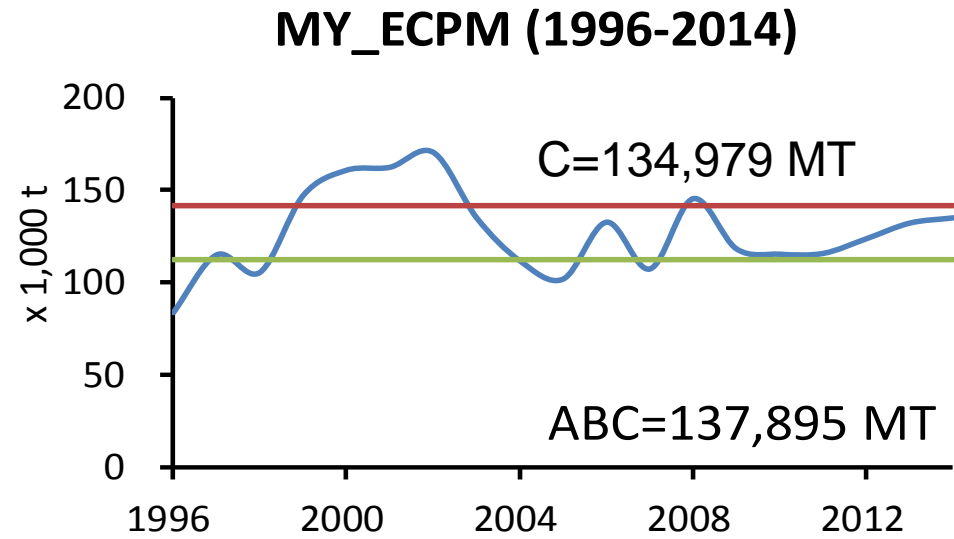
*Material from Dr. Matsuishi workshop (March 2017)

Interannual variation of catch level and ABC of 4 MCs in SCS and AS

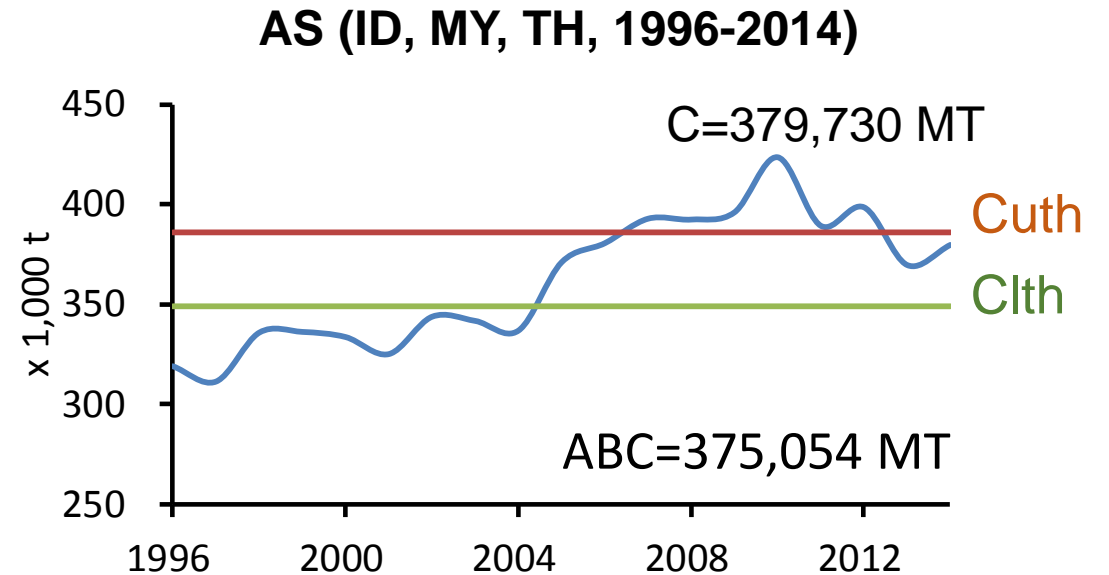
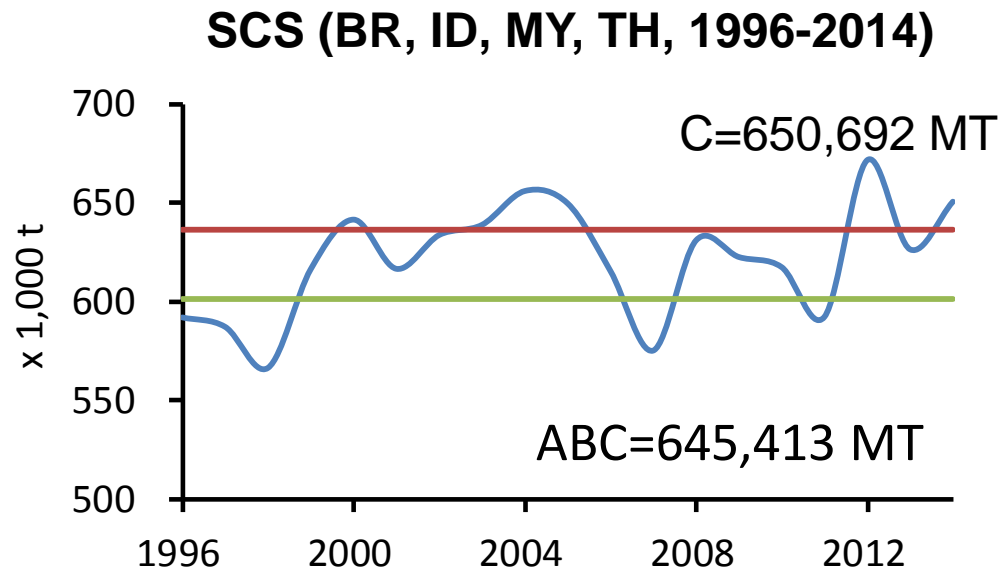


We can examine current catch (C) level using the upper and lower threshold (Cuth and Clth)

Interannual variation of catch level and ABC of 3 areas of Malaysia off SCS



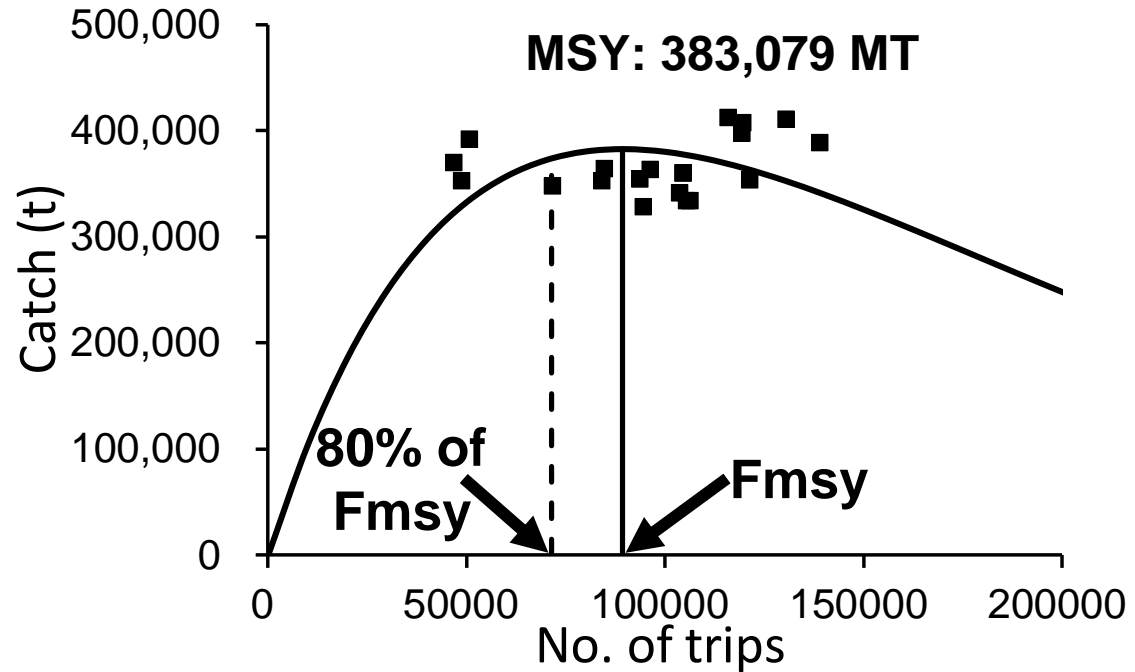
Interannual variation of catch level and ABC of Synthesized SCS and AS



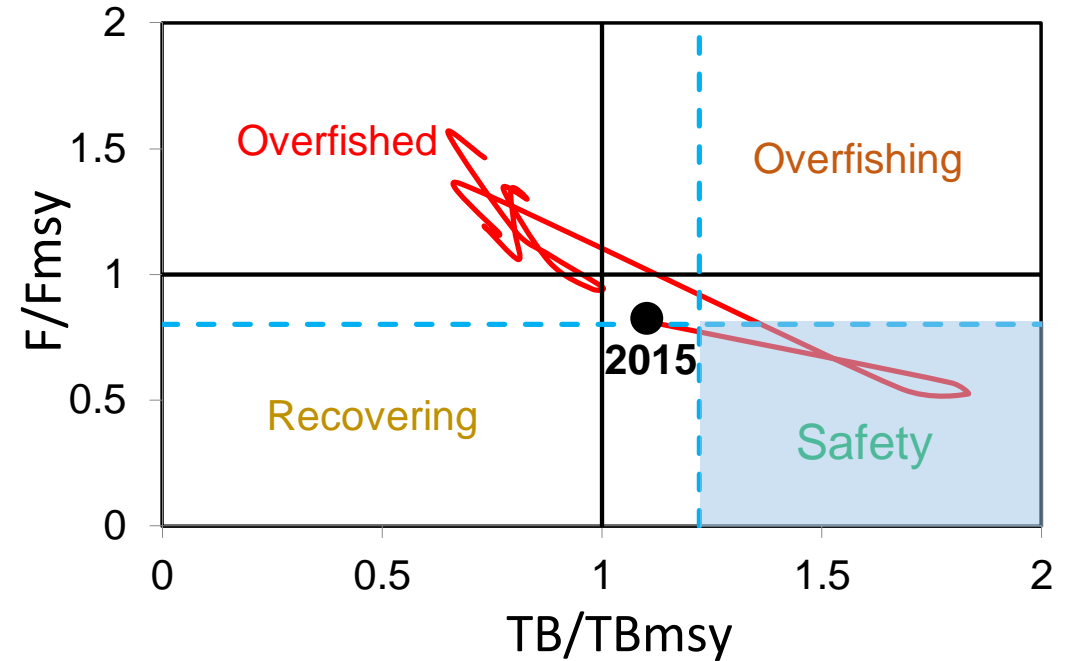
ABC is calculated as 645k tonnes and 375k tonnes for synthesized SCS and AS, respectively

Output of analysis using
Production Model (FOX)

Yield curve (left) and Kobe I Plot (right) for TH_SCS, 1996-2015

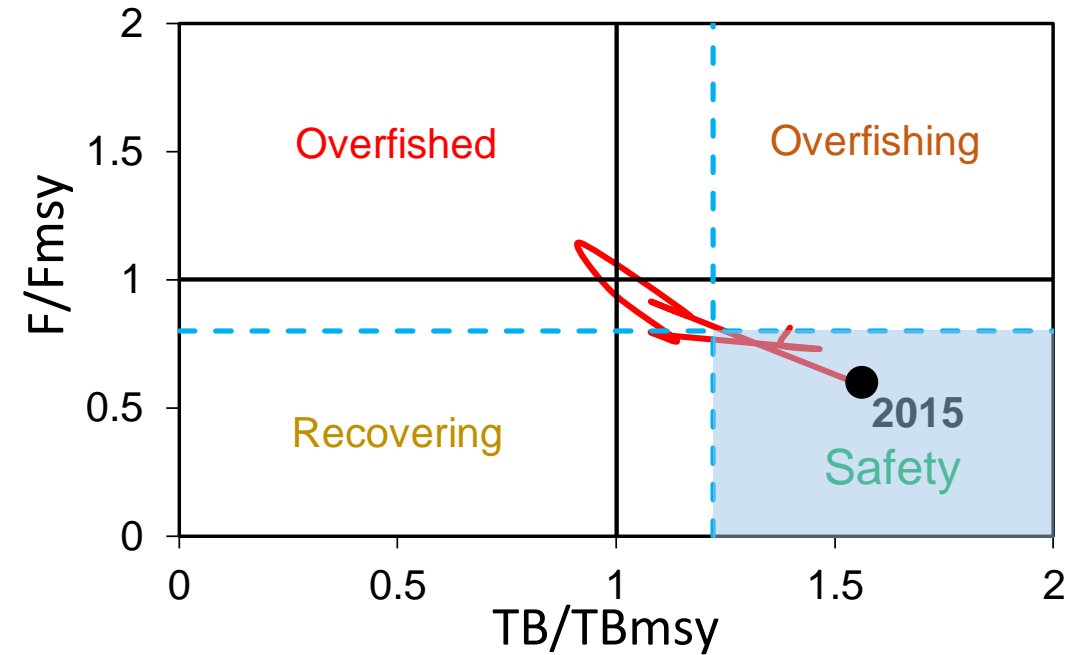
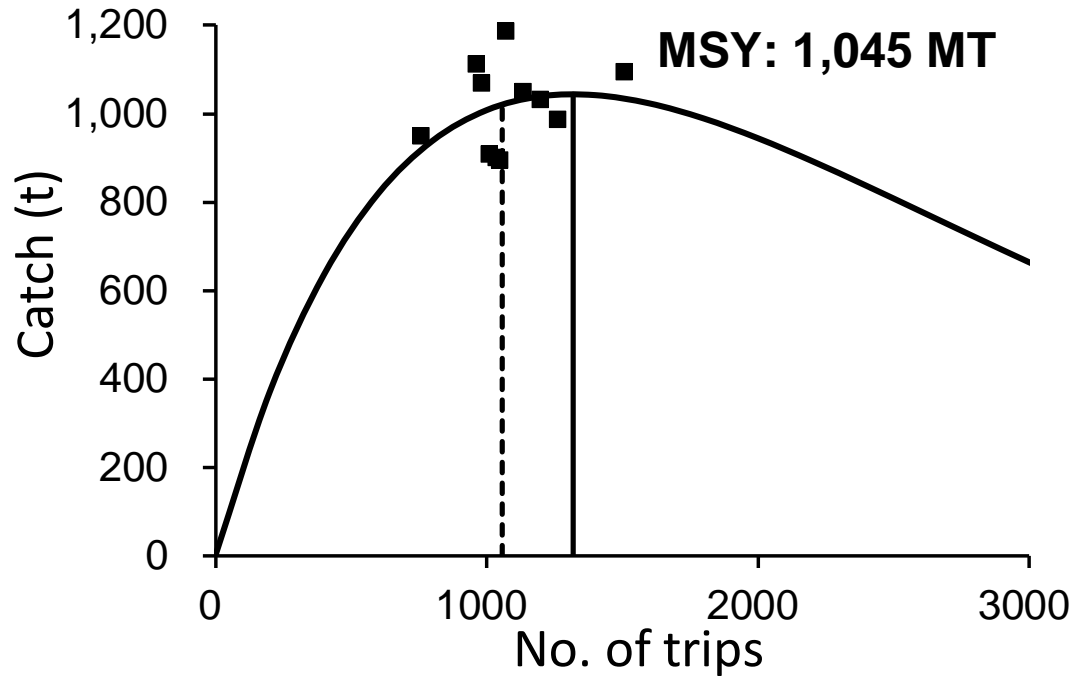


Dotted line shows 80% of Fmsy as recommended by Sparre and Venema (1992)



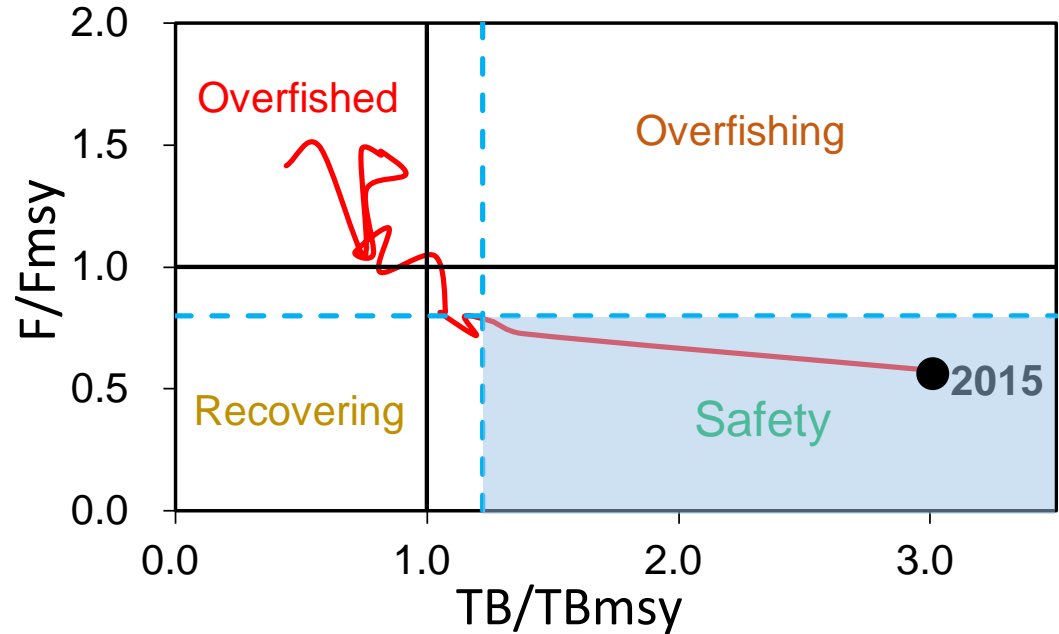
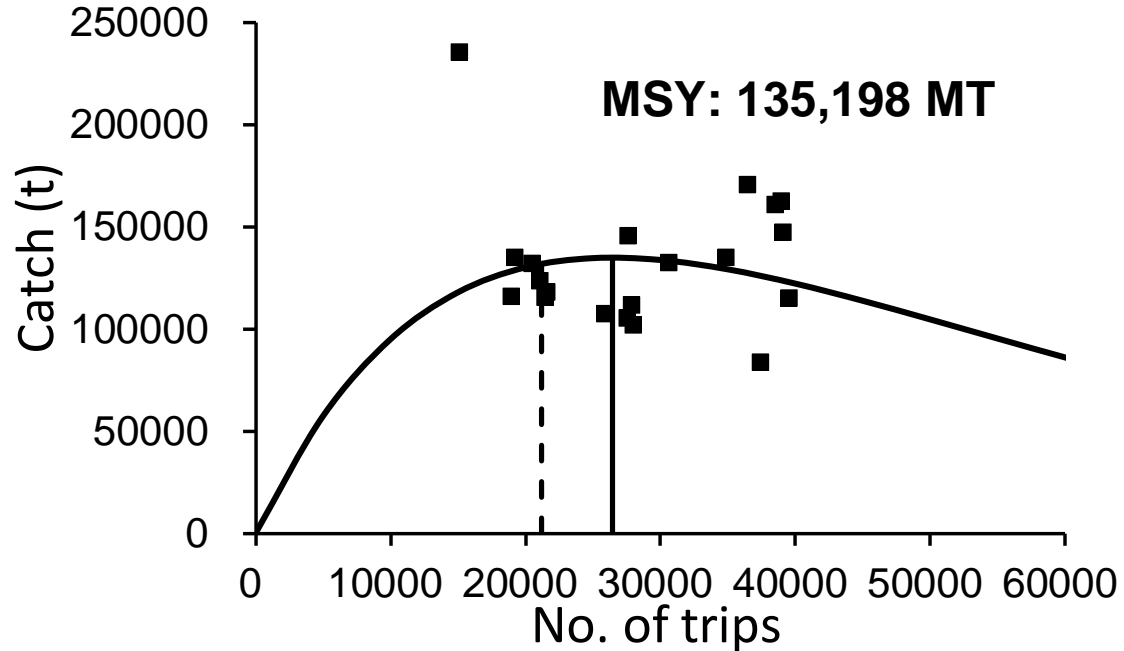
Current (2015) status shown as black point is in Safety zone but not in Target zone shown as the pale-blue area ()

Yield curve (left) and Kobe I Plot (right) for Brunei, 2005-2015



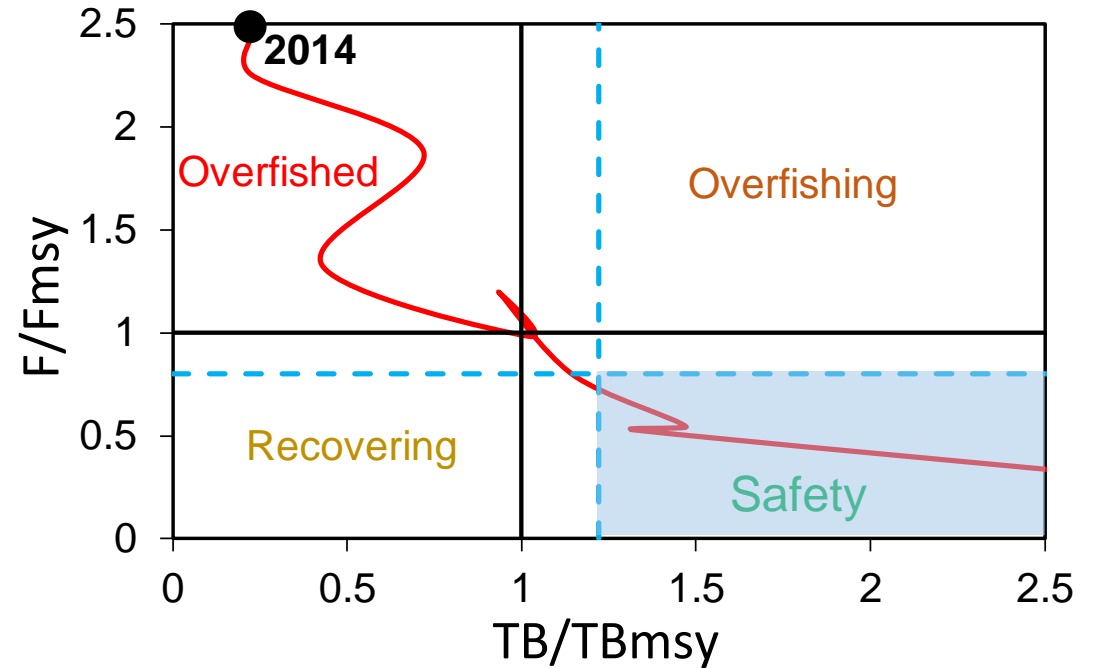
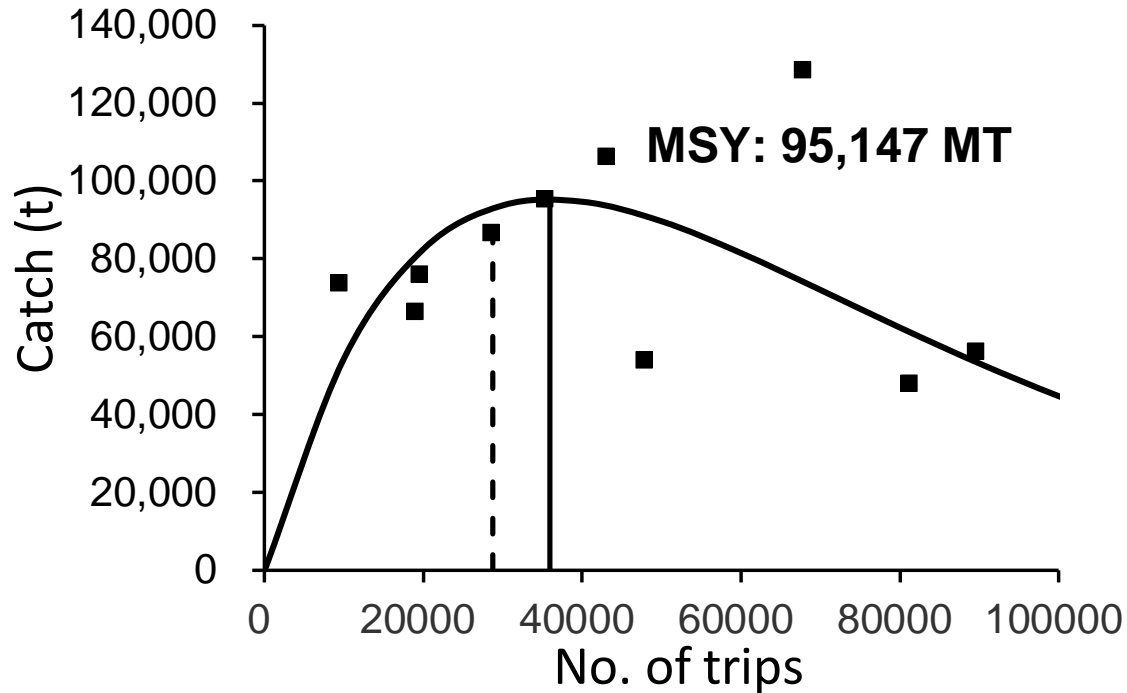
Current (2015) status is in Target zone

Yield curve (left) and Kobe I Plot (right) for MY_ECPM, 1996-2015



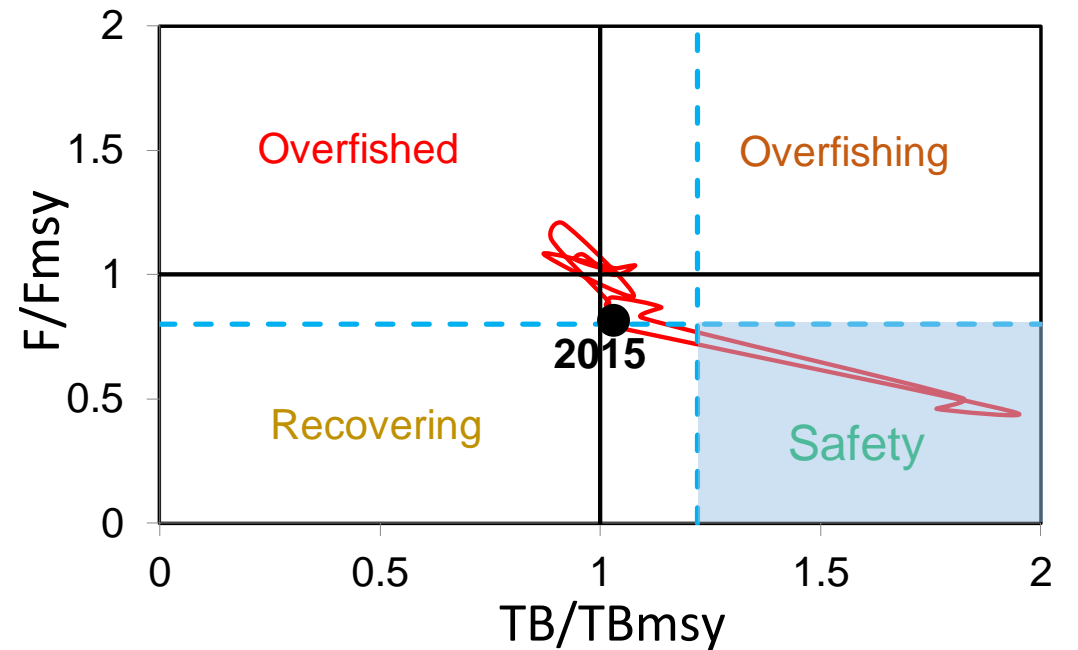
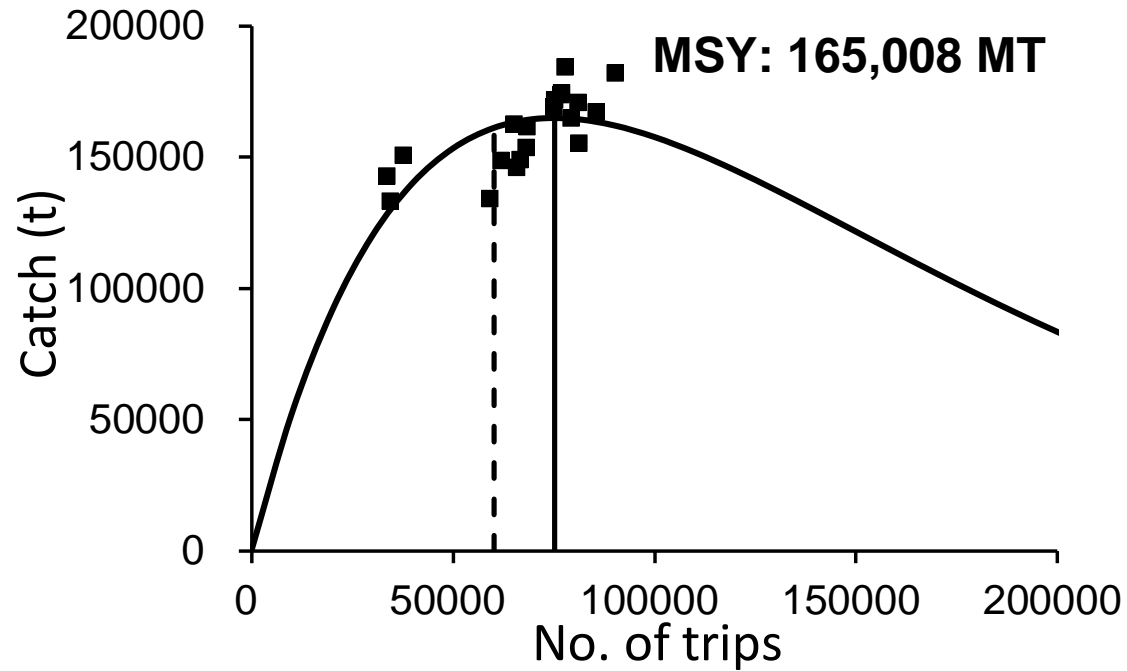
Current (2015) status is in Target zone

Yield curve (left) and Kobe I Plot (right) for ID_SCS, 2005-2014



Current (2014) status is Overfished

Yield curve (left) and Kobe I Plot (right) for TH_AS, 1996-2015



Current (2015) status is in Safety zone but not in Target zone

Current status, MSY, and target Fmsy for 4 MCs in the SCS and AS

Country	Area	Year	Current landing, MT	Current Effort, trips	R ²	MSY		Target
						MSY (MT)	F _{MSY}	0.8 x F _{msy}
BR	SCS	2005-2015	949	758	0.71	1045	1319	1055
ID	SCS	2005-2014	56,128	89,562	0.86	95,147	35,971	28,777
MY	ECPM (SCS)	1996-2015	235,328	15,109	0.60	135,199	26,455	21,164
TH	SCS	1996-2015	347,960	71,754	0.89	382,926	89,286	71,429
	AS	1996-2015	134,203	59,138	0.87	165,008	75,188	60,150

Target effort is much lower than current effort for ID_SCS

Conclusion

- 1) We examined the catch and effort data provided by 8 MCs, and found the data from KH, MM, PH, and VN could not be used for the current analysis because of large fluctuation of interannual variations of catch.
- 2) We used the catch data from 4 MCs (SCS and AS) for ABC Rule 2-2 analysis by:
 - i) Selected MCs;
 - ii) 3 areas of MY off SCS;
 - iii) synthesized SCS and AS.
- 3) We made analysis using Production Model for 4 MCs in SCS and only Thailand in AS and examined the current status using the Kobe I Plot with target zone index (less than 80% of F_{msy}).
- 4) With support and assistance from participating MCs, we could further investigate the reason of fluctuation of interannual variation of fishery data toward improvement of analysis in the future.



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