

COST BENEFIT ANALYSIS OF VESSEL MONITORING SYSTEM (VMS) IN INDONESIA FOR MANAGING THE TRANSITION TO SUSTAINABLE AND RESPONSIBLE FISHERIES



By:

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INDONESIA

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**MINISTRY OF MARINE AFFAIRS AND FISHERIES
REPUBLIC OF INDONESIA**



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**UNU – FTP
FISHERIES TRAINING PROGRAMME**



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JOB :
Lecture

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WORK :
Agency of Marine and Fisheries Human
Resource Development
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BACKGROUND

The 1945 Constitution of The Republic of Indonesia

Article 33 Act (3) :

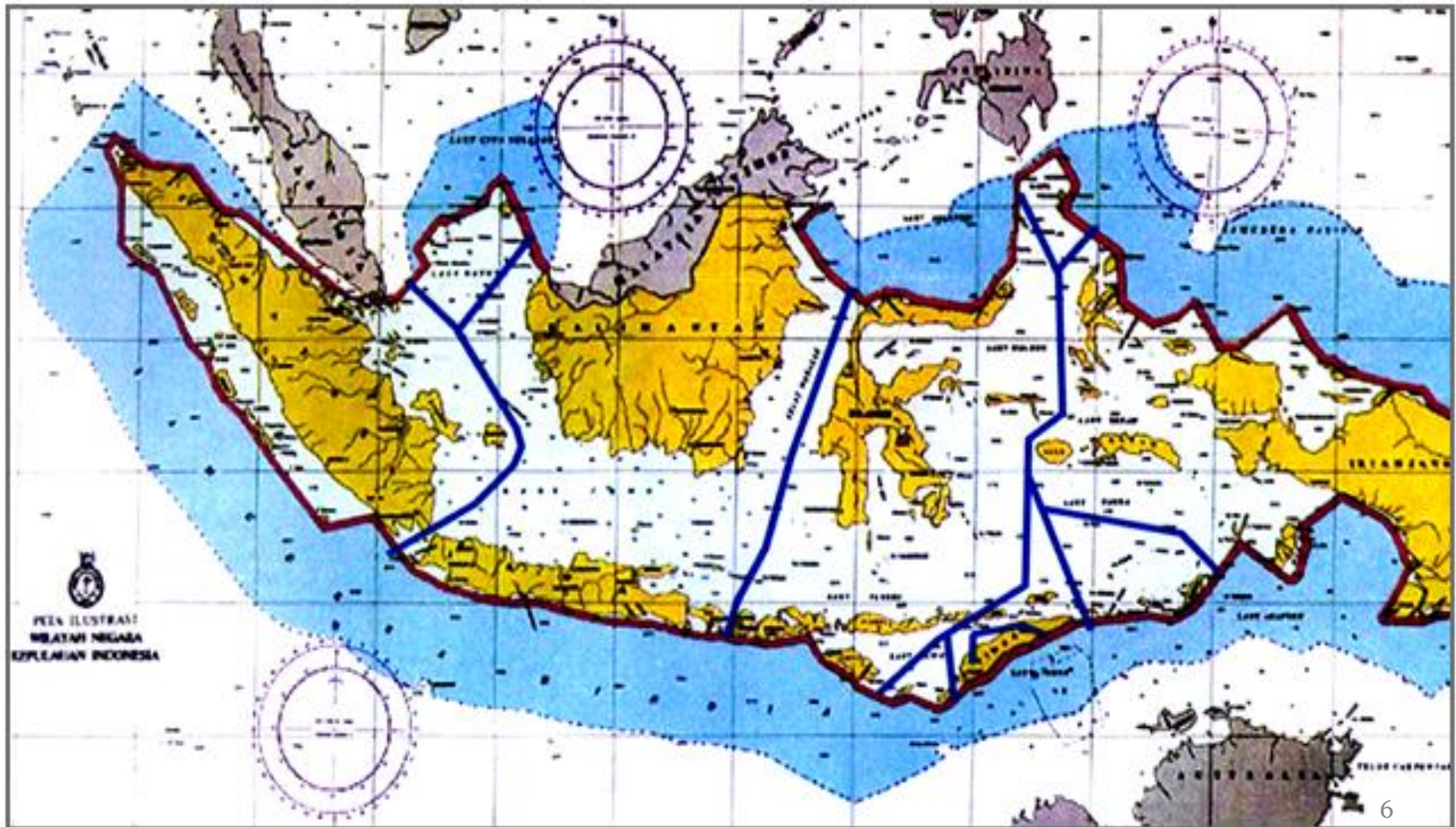
**The land, the waters and the natural resources within
shall be under the powers of the State and shall be used to
the greatest benefit of the people**



INDONESIA IS A COUNTRY WITH THE GREATEST POTENTIAL FOR MARINE FISHERIES RESOURCE

- **The largest archipelago country in the world**
- **2/3 (two third) of Indonesia area are oceans**
- **Land Area 1.910.000 km² and oceans 6.279.000 km²**
(Source:BIG 2014)
- **0,8 Million km² are teritorial oceans and 2,7 Millions km² are Economic Exclusive Zone (EEZ) of Indonesia.**
- **Number of Island 13.466 (Source: BIG 2014)**
- **Coastline 81.000 km, almost 25% coastline world**
- **The potential of the fisheries resource is as much as 6.4 million tons per year, with a current level of utilization of 5.81 million tons per year in 2012 .**
- **The Richest Coral Reef in the world (18% from total in the world)**

The Map of Republic of Indonesia





EXISTING CONDITION:

- 1) The number of Illegal fishing has become a national issue and a priority program to against of the MMAF;
- 2) Indonesia Loss Due until **US\$3 Billion** over last 10 years caused of IUU fishing;
- 3) Current stock of fish resources in the world that still allows for improved catching only **20%**, while **55%** are in a state of full utilization and the remaining **25%** endangered;
- 4) Illegal Fishing, destruction and damage to the environment make desperate fishermen;
- 5) The evidence suggests that monitoring activity result a positive impact on business productivity and incomes of fishermen.

In cooperation with Indonesian Air Force and Navy

Sample of IUU Fishing Activity



PAIR-TRAWLERS



SOME RESULTS OF AIR
SURVEILLANCE

- Illegal pair-trawlers operated in the IEEZ of Arafura Sea, and
- Illegal pump-boat operated in the Indonesia's Territorial waters



PUMP-BOAT

**PICTURE DETECTED BY
INDONESIAN AIR FORCE, BOEING
737 MONITORED**



Two Ships towed one Trawl



Two Fishing Vessels with a trawl





Trawler in fishing operation



**Two fishing ships
approached Fish Carrier**



Effort of vessel to escape from inspection

**FISHING VESSELS MONITORED BY AIR
FORCE B. 737, in the ARAFURA SEA**



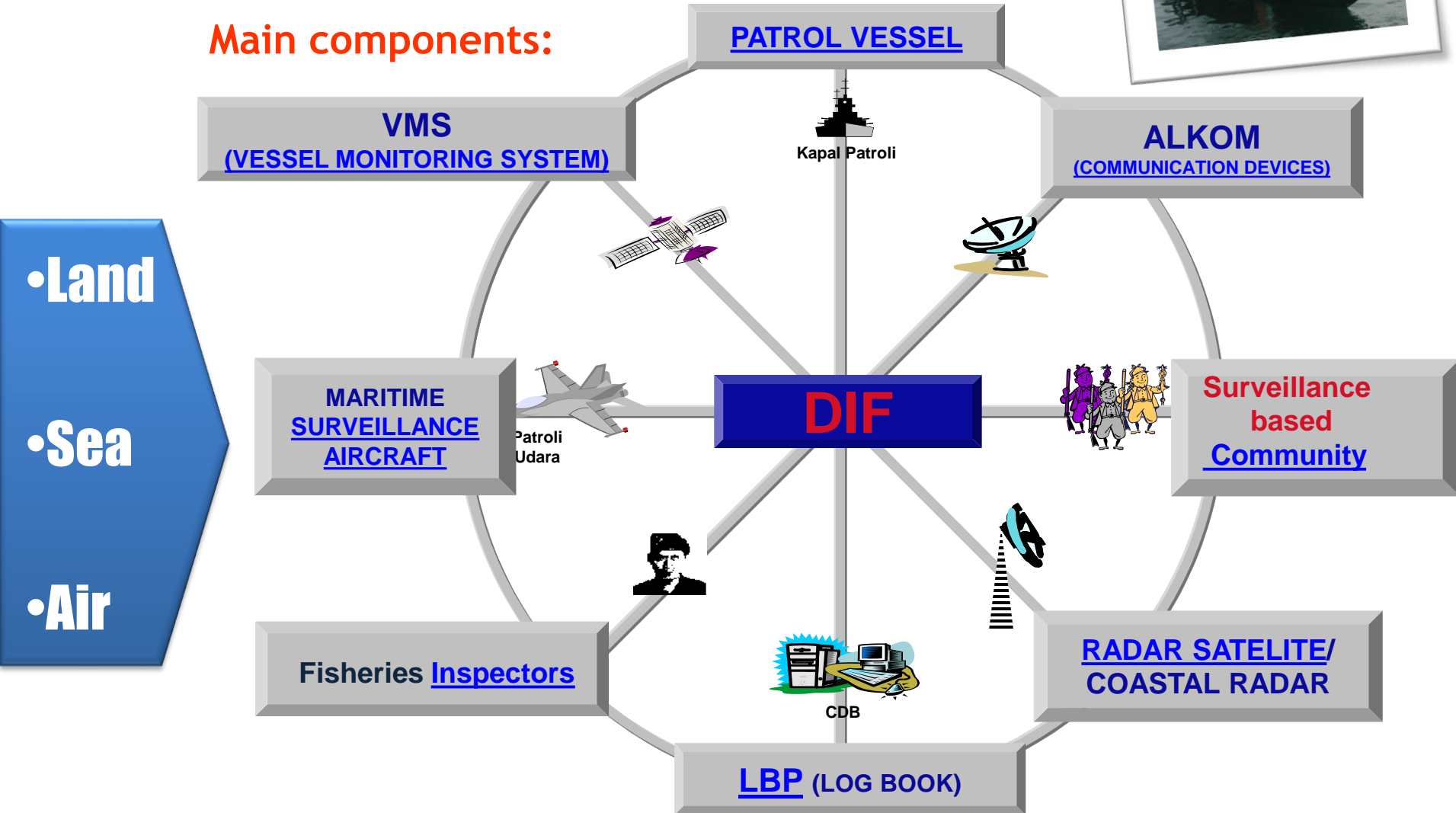
OBJECTIVE:

The purpose of the paper is to analyze of the use of VMS technology in Indonesia and calculate of the Cost Benefit Analysis (CBA) of VMS system in Indonesia and to explore how is the potential for improvement

MONITORING, CONTROL, AND SURVEILLANCE (MCS) IN INDONESIA

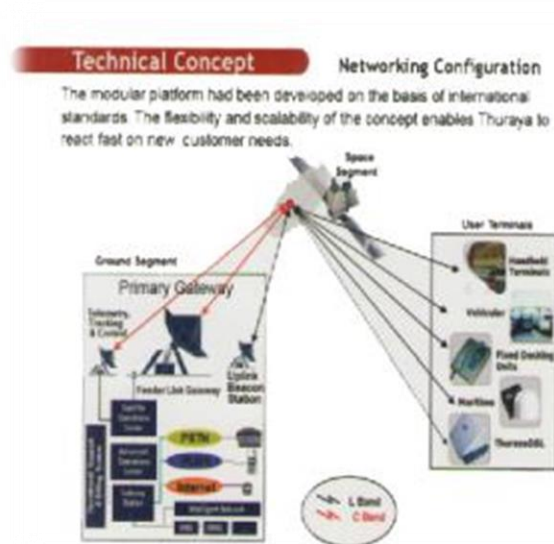


Main components:



VESSEL MONITORING SYSTEM (VMS)

It is a program for fisheries monitoring tool that installed on the vessels and can be provide some information about the vessels position and activities



Transmitter



Satellite



Fisheries Monitoring Centre

VESSEL MONITORING SYSTEM

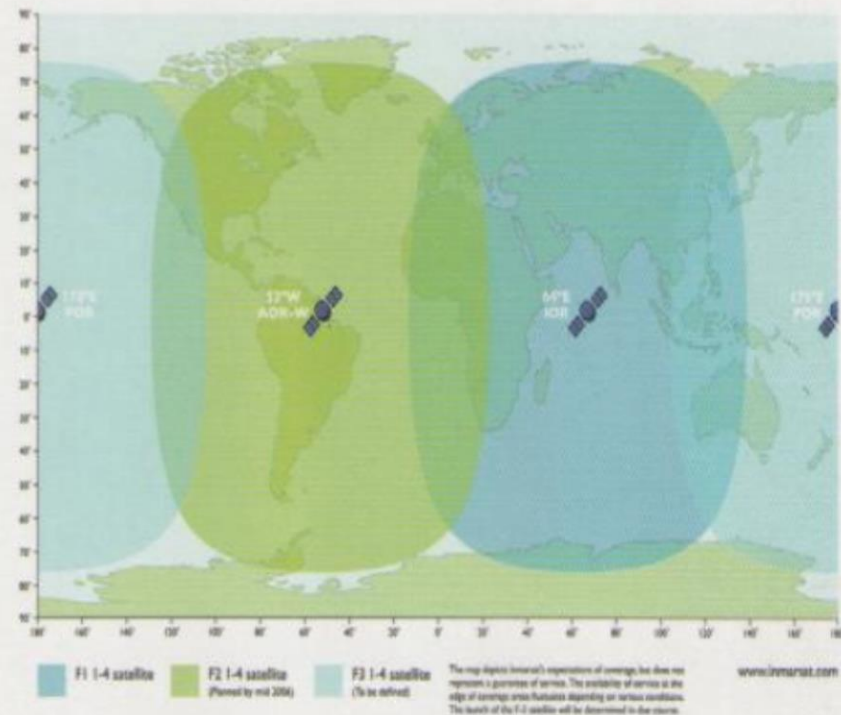
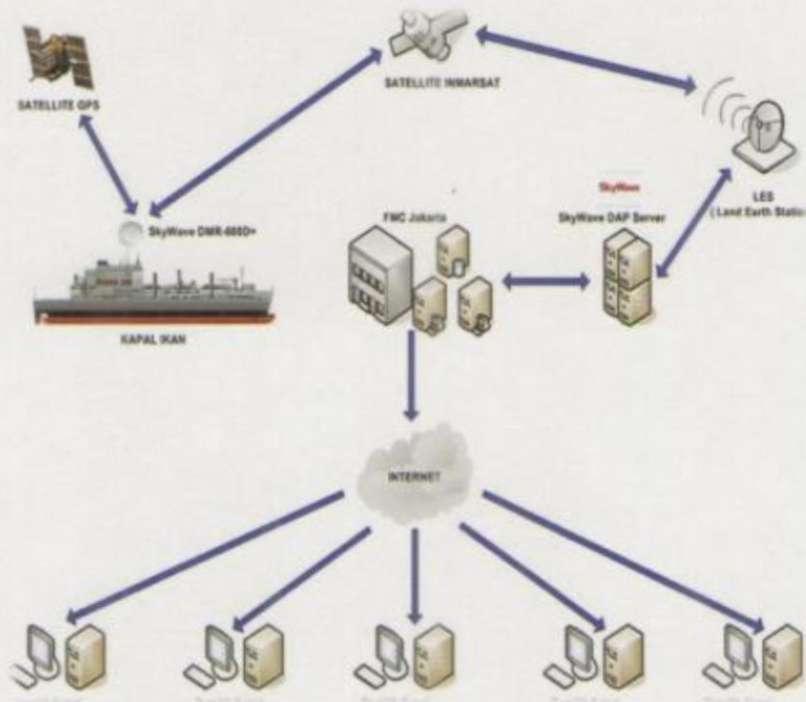
- Enforcement system of supervision and control by Department of Fisheries and Maritime
- Monitoring the position and movement of the vessel
- Obtain the latest information, about the position and movement of the vessel in the catchment area
- Facilitate handling emergencies - SAR operations
- Monitor the position and movement of ships around the world and specifically jurisdiction of the Republic of Indonesia (EEZ)
- Provide marine weather information
- Facilitate the management of licensing vessels
- Provide legal protection for Indonesian Fishermen

**Source from :
PT. SOG INDONESIA**



CONFIGURATION SCHEMES VESSEL MONITORING NETWORK

COVERAGE AREA



**Source from :
PT. SOG INDONESIA**



WEB TRACKING

LICENSE THE MINISTRY
OF FISHERIES AND MARITIME



- Monitoring the movement of the entire ship (position, heading, speed, UTC)
- Transmit through the satellite network
- Coverage areas around the world
- Periodic data updates
- Vessel data base
- Historical data log
- Accessed on 24-hour



JUNCTION BOX &
TRANSMITTER
SkyWave
DMR-800D

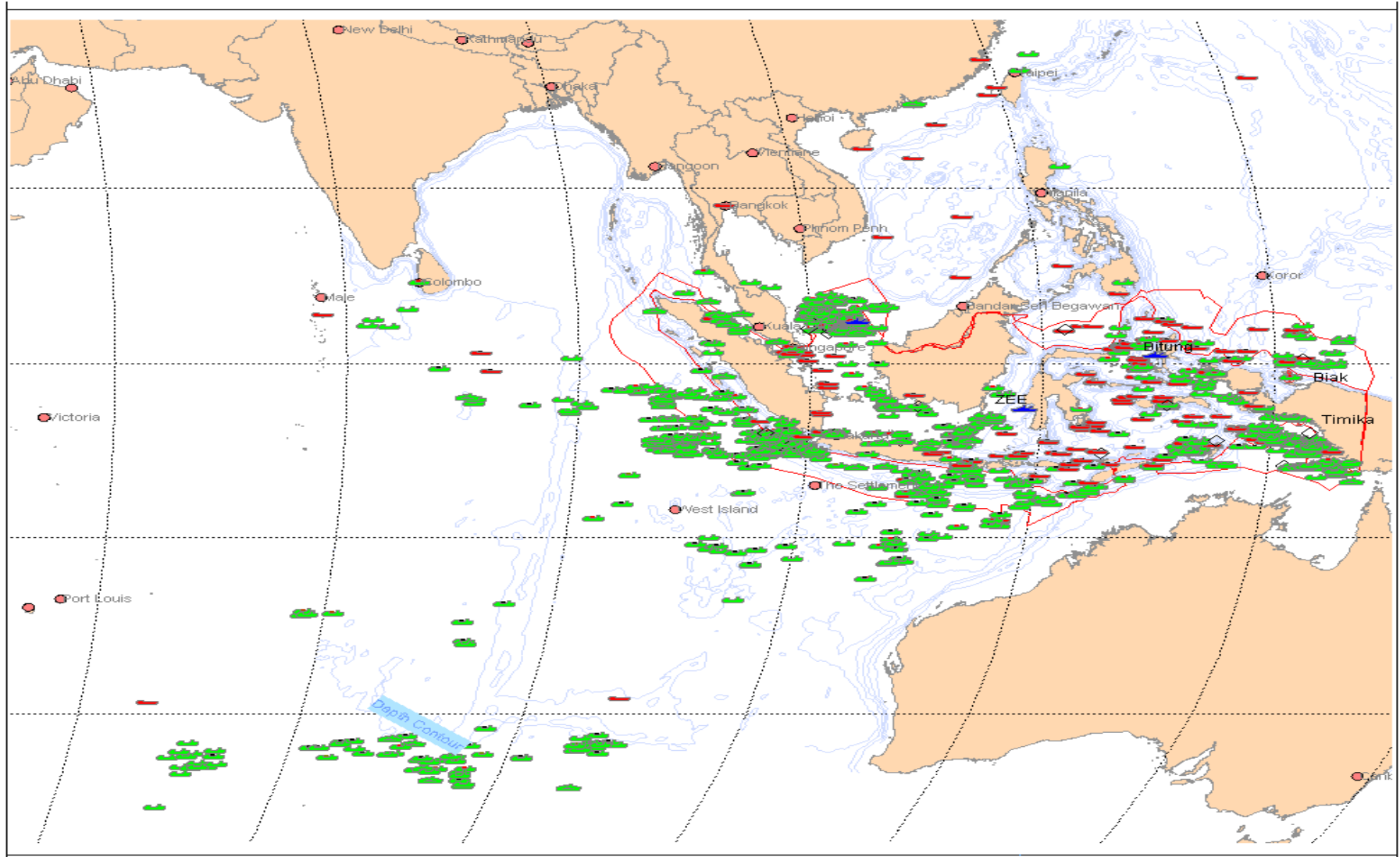
SkyWave
IDP-690



Source from :
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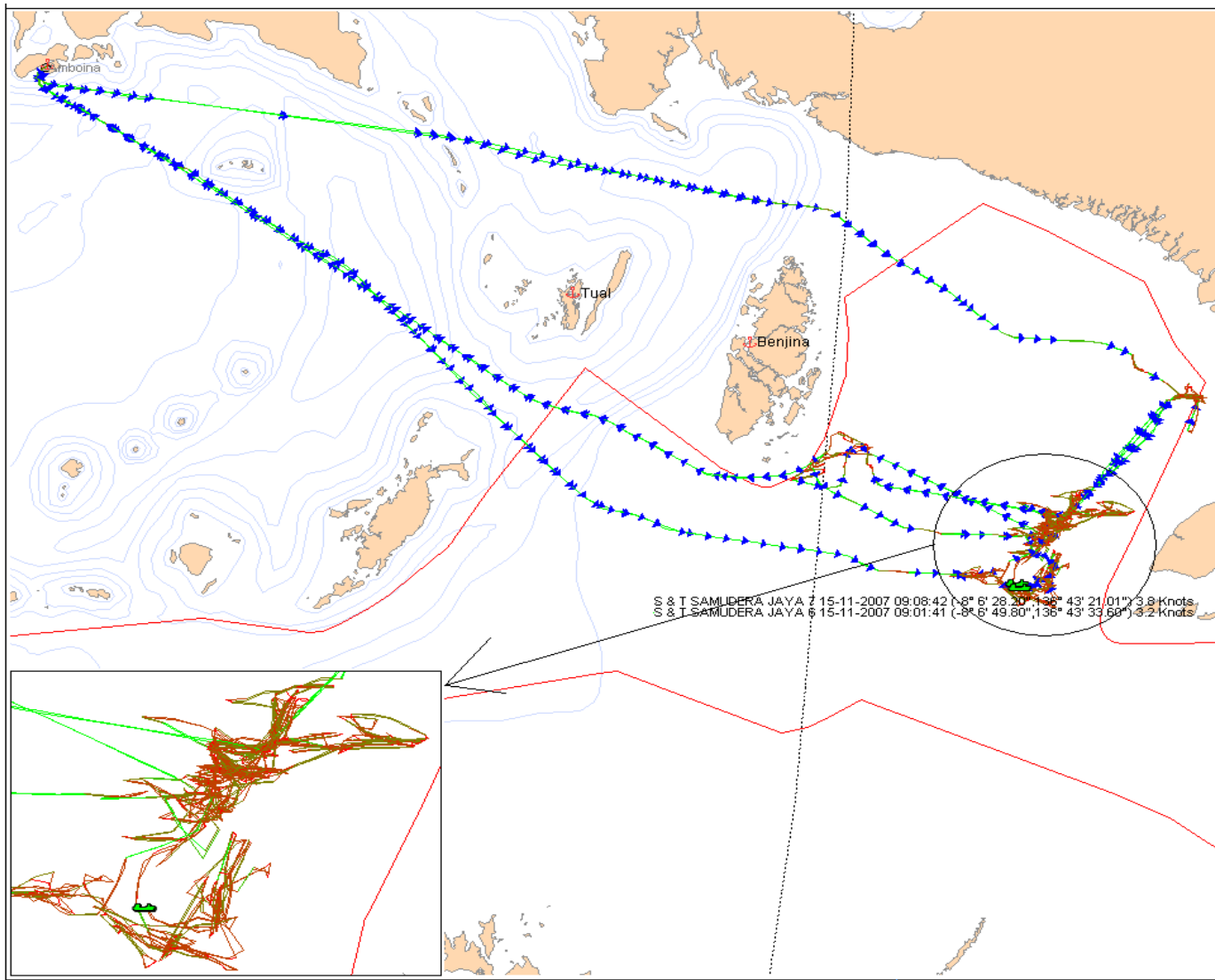


Recent Status of Indonesian Fishing Vessels at Sea (Monitored by VMS)



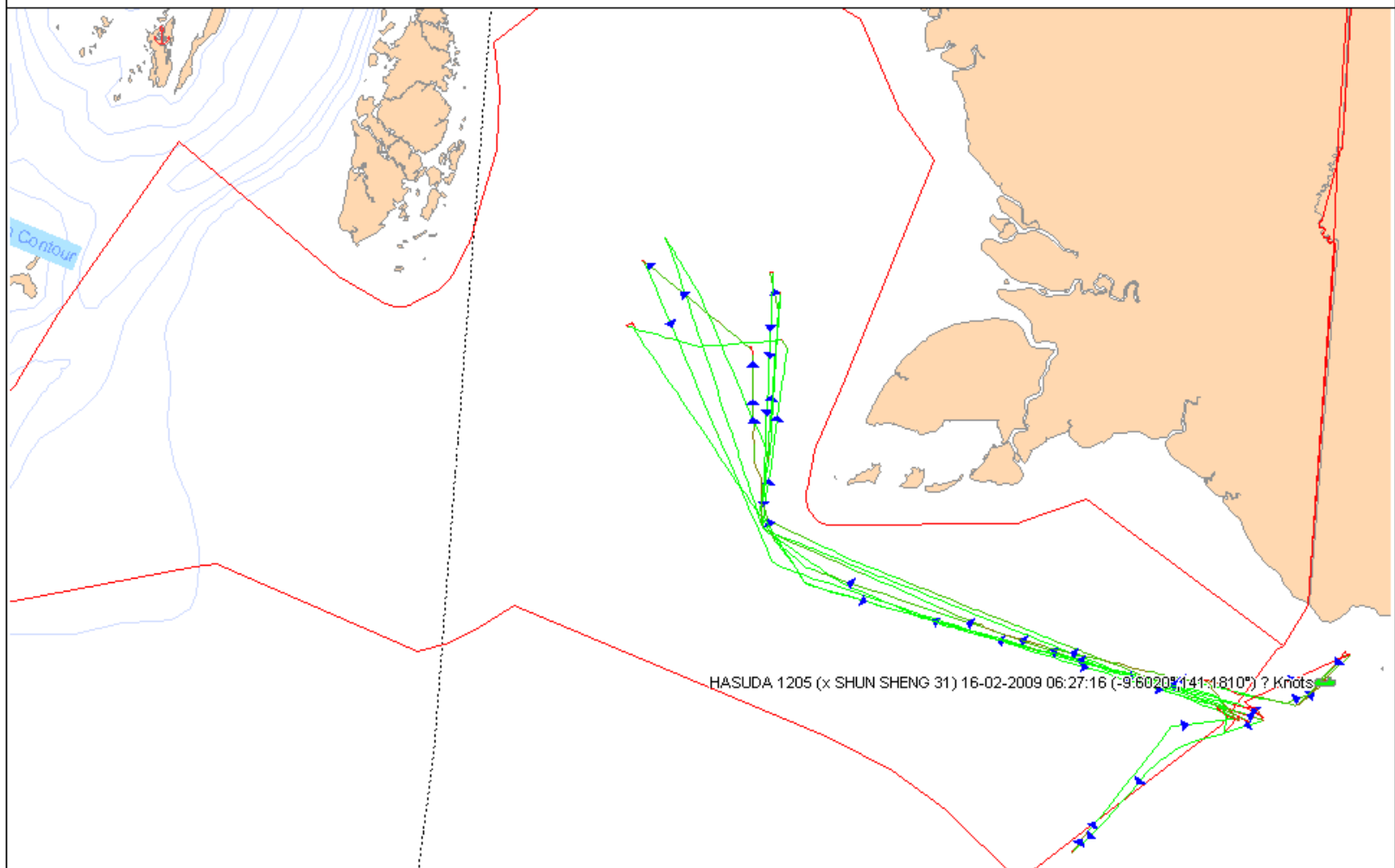
DATE: 22 APRIL 2009 17:15 WIB

Pair Trawling Indication



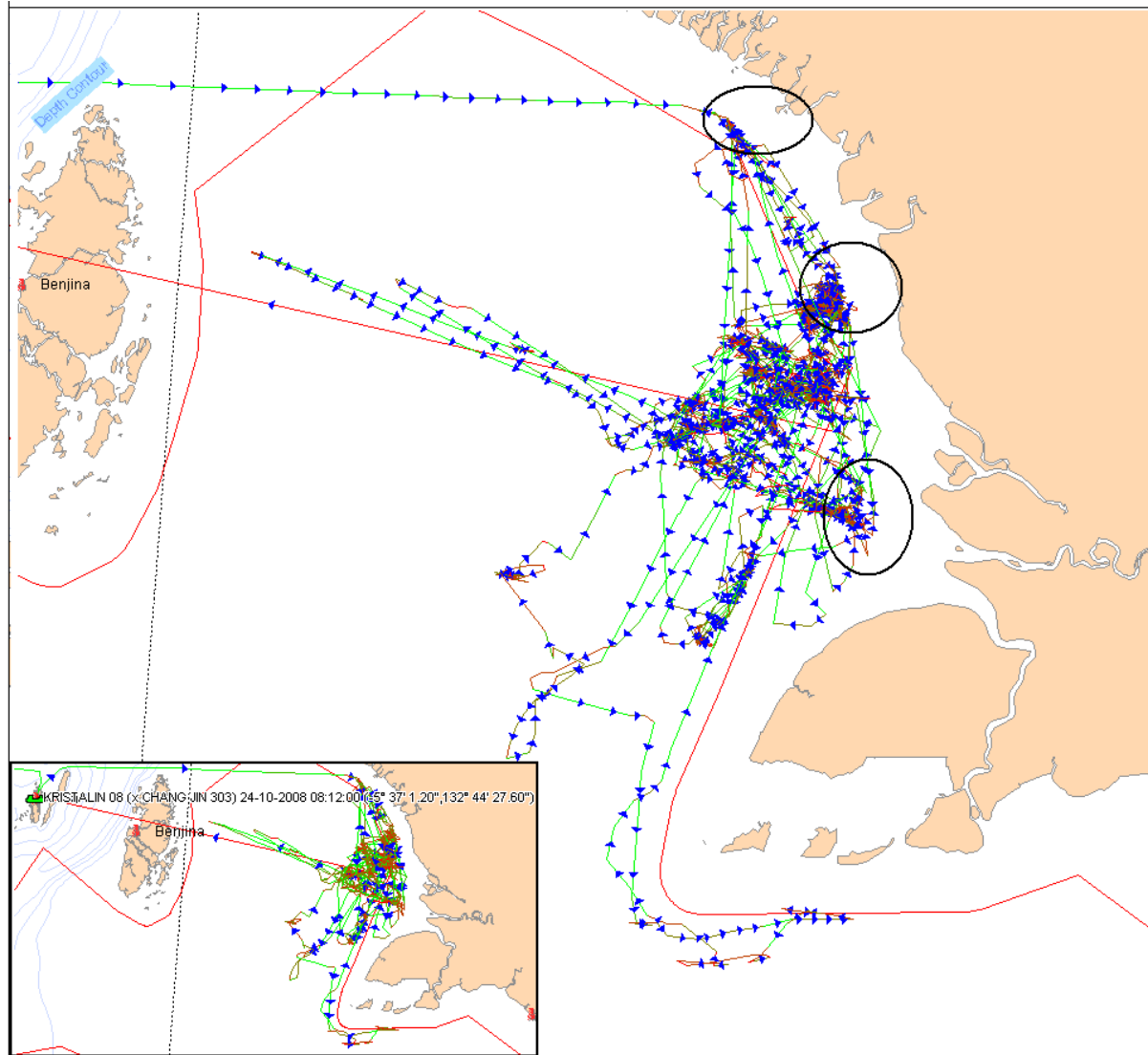
2 VESSELS OPERATING TOGETHER SIDE BY SIDE

Transshipments Indication



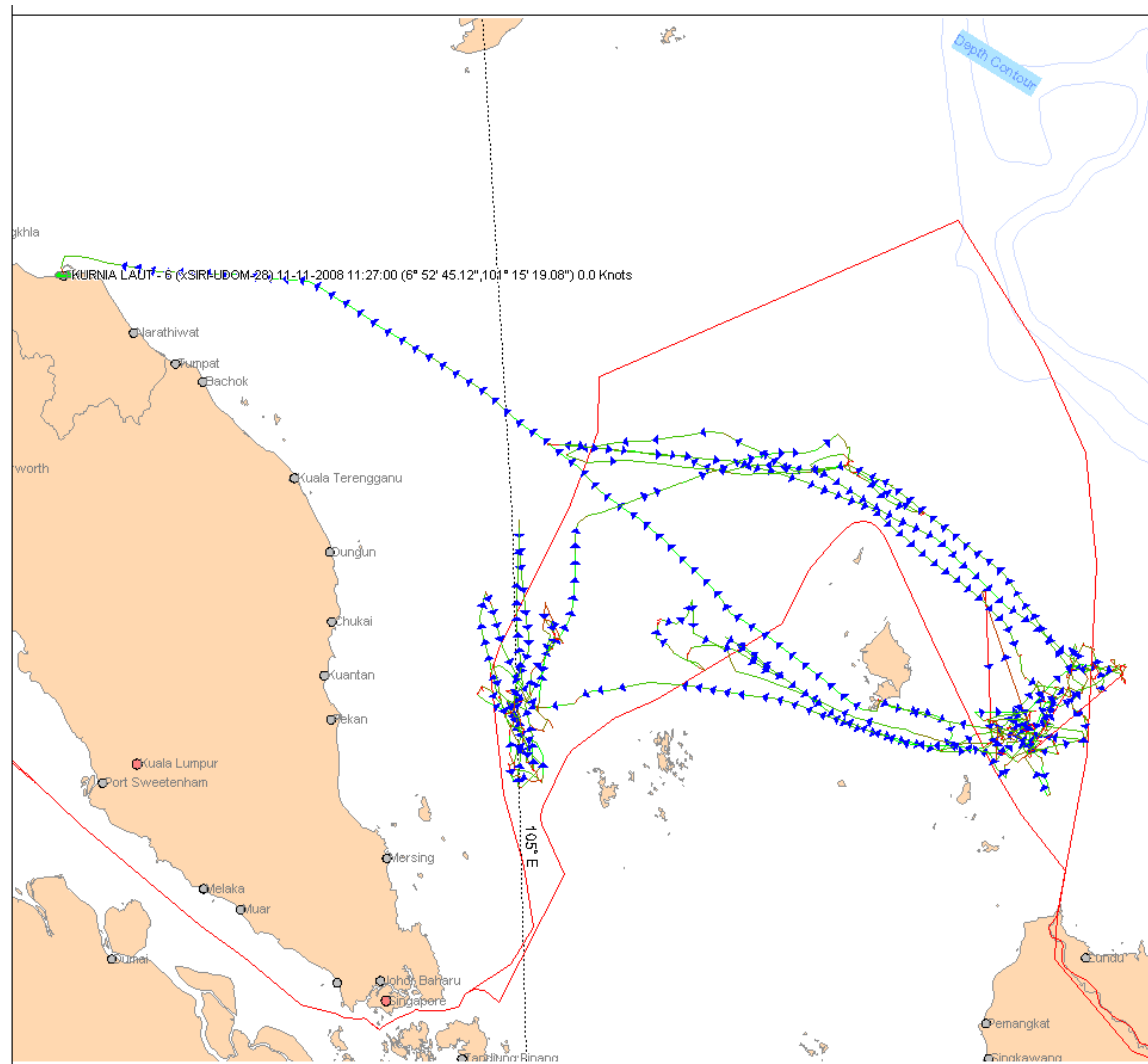
INDICATION OF TRANSHIPMENT WITH OTHER FOREIGN
VESSEL OUTSIDE EEZ

Operating Outside Fishing Ground



FISHING GROUND: EEZ , OPERATING IN TERRITORIAL

Unreported Fishing Vessels



LOADING TO PATANI PORT THAILAND



Cost Benefit Analysis of VMS in Indonesia

Cost To Develop The Real Time VMS In Indonesia

NO	COST/EXPENSE	TOTAL
A.1.1 LABOR DIRECT EXPENCE	USD	783.400,00
<i>A.1.1.1 Developing of Master Plan</i>	<i>USD</i>	<i>51.000,00</i>
<i>A.1.1.2 Software Development</i>	<i>USD</i>	<i>698.400,00</i>
<i>A.1.1.3 Consultation Cost</i>	<i>USD</i>	<i>34.000,00</i>
A.1.2 NON LABOR EXPENSE	USD	68.000,00
<i>A.1.2.1 Allowance for Survey, Instalation & Training</i>	<i>USD</i>	<i>50.000,00</i>
<i>A.1.2.2 Work tools expense</i>	<i>USD</i>	<i>10.000,00</i>
<i>A.1.2.3 Communications Expense</i>	<i>USD</i>	<i>5.000,00</i>
<i>A.1.2.4 Computer Supplies</i>	<i>USD</i>	<i>2.000,00</i>
<i>A.1.2.5 Report</i>	<i>USD</i>	<i>1.000,00</i>
TOTAL	USD	851.400,00
TAX 10%	USD	85.140,00
TOTAL AFTER TAX	USD	936.540,00
A.2 ADDITIONAL COST		
<i>A.2.1 Additional Server, Workstation and LAN</i>	<i>USD</i>	<i>10.000,00</i>
<i>A.2.2 Satellite System Changes</i>	<i>USD</i>	<i>20.000,00</i>
<i>A.2.3 Software and Database</i>	<i>USD</i>	<i>50.000,00</i>
TOTAL	USD	80.000,00
TAX 10%	USD	8.000,00
TOTAL AFTER TAX	USD	88.000,00
TOTAL COST	USD	1.024.540,00



Benefit to Indonesia by develop real time VMS system

- ✓ To open opportunities to used by other institutions; Navy, Water Police, Custom, Immigration, Rescue and Search, Indonesian Maritime Security coordinating Board, etc.
- ✓ Reducing the level of violation in the sea due to IUU Fishing.
- ✓ Increase the level of obedience of under licensed fishing vessels.



The economic loss and the lost revenue for government

The World wide illegal catches estimated the quantity between 11 and 26 million tons, out of a total catch of 145 million tons and the economic loss was estimated between \$10 billion and \$23,5 billion, out of a total value of \$220 billion (FAO, 2012).

In this analysis of Indonesian illegal catches, it is assumed that the loss in economic value is similar to the average for world capture fisheries.

Operation of Patrol Boat Result 2005 - 2012

YEAR	Number of Vessel Inspection	Suspect and Processed in The Court (Vessel)		
		Local Vessel	Foreign Vessel	Local + Foreign
2005	344	91	24	115
2006	1.447	83	49	132
2007	2.207	95	88	183
2008	2.178	119	124	243
2009	3.961	78	125	203
2010	2.253	24	159	183
2011	3.276	29	75	104
2012	4275	-	-	114
TOTAL	15.666	519	644	1.277



ASSUMPTIONS

- An improved VMS could reduce illegal fishing by 50% over the suggested 10 year period of use (investment period of 12 years), 5% a year
- For foreign vessels the loss is the overall gross margin for the entire value chain, assumed to be 33% of landed, plus the loss in license fees to the government (\$200 per license). Foreign vessels are assumed 55% of all illegal vessels (see table 1).
- For domestic vessels the loss is assumed to be the average economic loss of illegal fishing as reported 7,6% of landed value, plus a license fee to the government (\$20 per license). Domestic vessels are assumed 45% of all illegal vessels
- Yearly catch is assumed 2000 kg.
- Average catch price is assumed \$5 per kg.
- There are assumed to be about 4000 illegal vessels in operation that will be effected by the change in the VMS.
- It is assumed that the system could over the period of 10 years achieve the efficiency of similar European systems.
- The real discount rate of the Indonesian government is assumed to be 5%.

- **Cost estimate for foreign vessels:**

$6000 \text{ vessels} * 55\% * 2000 \text{ kg/year/vessel} * \$5/\text{kg} * 33\% = \$7.260.000/\text{year}$

$6000 \text{ vessels} * 55\% * \$200/\text{vessel} = \$440.000/\text{year}$

Total = \$7.700.000/year

- **Cost estimate for domestic vessels:**

$6000 \text{ vessels} * 45\% * 2000 \text{ kg/year/vessel} * \$5/\text{kg} * 7,6\% = \$1.404.000/\text{year}$

$6000 \text{ vessels} * 55\% * \$200/\text{vessel} = \$36.000/\text{year}$

Total: \$1.404.000/year

- **Overall cost of illegal fishing:**

\$9.104.000/year



Assumed; the effectiveness will gradually increase 5% per year. The expected benefits will therefore be:

- Year 3: $9.104.000/\text{year} \times 5\% = 455.200/\text{year}$
- Year 4: $9.104.000/\text{year} \times 10\% = 910.400/\text{year}$
- Year 5: $9.104.000/\text{year} \times 15\% = 1.365.600/\text{year}$
- Year 6: $9.104.000/\text{year} \times 20\% = 1.820.800/\text{year}$
- Year 7: $9.104.000/\text{year} \times 25\% = 2.276.000/\text{year}$
- Year 8: $9.104.000/\text{year} \times 30\% = 2.731.200/\text{year}$
- Year 9: $9.104.000/\text{year} \times 35\% = 3.186.400/\text{year}$
- Year 10: $9.104.000/\text{year} \times 40\% = 3.641.600/\text{year}$
- Year 11: $9.104.000/\text{year} \times 45\% = 4.098.800/\text{year}$
- Year 12: $9.104.000/\text{year} \times 50\% = 4.552.000/\text{year}$

The estimated flow of costs and benefits in the project

Year	Cost	Benefits	Net benefits	NPV
1	307.362		- 307.362	- 292.726
2	717.178		- 717.178	- 650.502
3		455.200	455.200	393.219
4		910.400	910.400	748.988
5		1.365.600	1.365.600	1.069.983
6		1.820.800	1.820.800	1.358.709
7		2.276.000	2.276.000	1.617.511
8		2.731.200	2.731.200	1.848.584
9		3.186.400	3.186.400	2.053.982
10		3.641.600	3.641.600	2.235.627
11		4.096.800	4.096.800	2.395.314
12		4.552.000	4.552.000	2.534.724
Total				15.313.413



The Results

- ✓ It is very profitable to improve the VMS if the outcome is a roughly as effective VMS as European ones. The ratio of benefits to costs is about 17, the benefits are 17 times larger than the cost.
- ✓ The net benefits (benefits net of cost) the ratio is roughly 15.
- ✓ The breakeven point is after only about 15 months, and the internal rate of return is 80%.
- ✓ It is therefore quite clear from these results that this is a highly beneficial project to undertake for Indonesian authorities.

Sensitivity analysis

Key assumptions are:

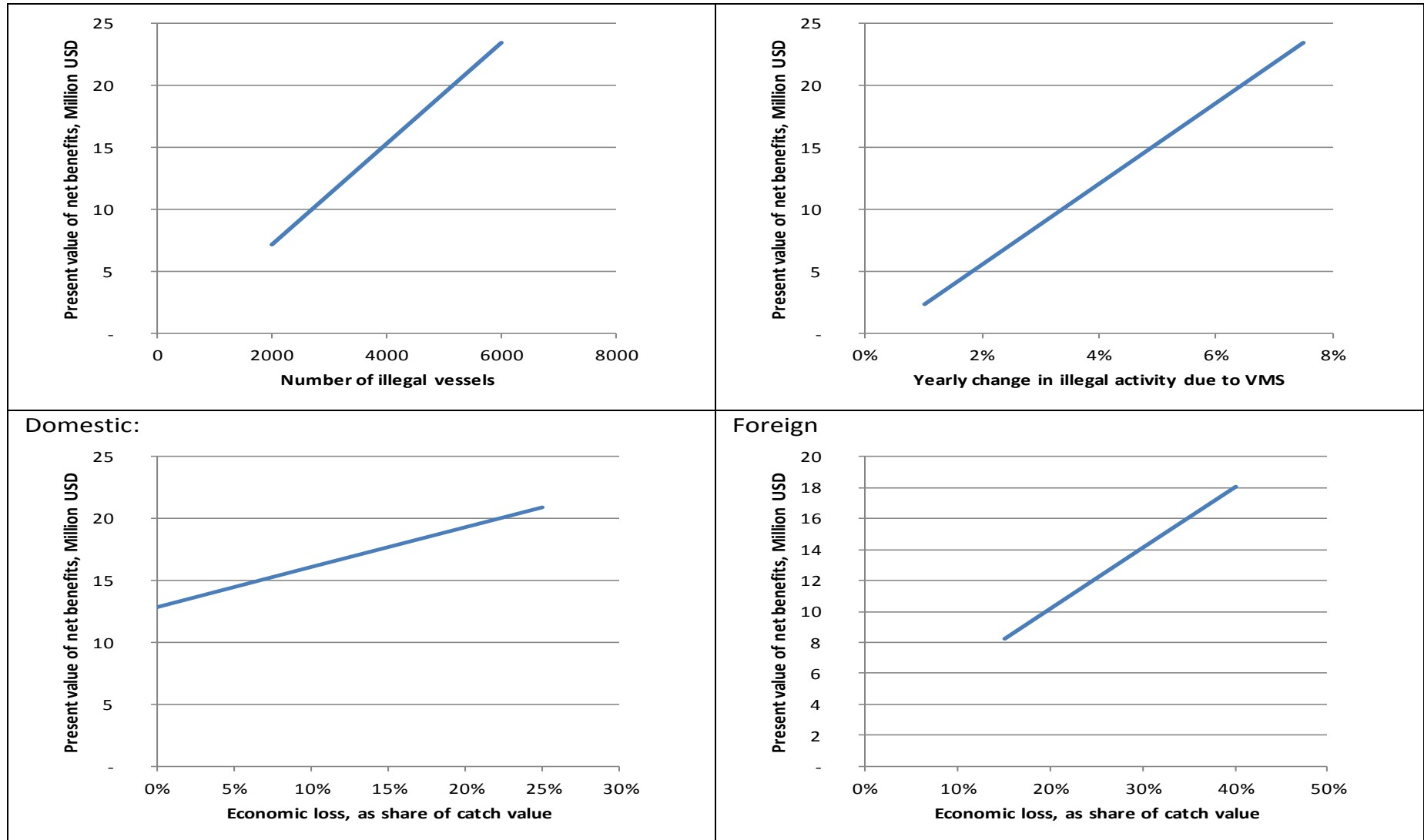
- Number of illegal vessels
- Economic losses of illegal catch
- Effectiveness of the improved VMS against illegal fishing

The following ranges are assumed realistic for these key assumptions:

- Number of illegal vessels: 2000-6000
- Economic losses
 - Foreign: 15-40%
 - Domestic: 0-25%
- Effectiveness of improved VMS: 1-7,5%

Sensitivity analysis for key


Figure 1 shows The results from the sensitivity analysis:





CONCLUSIONS:

- ✓ The costs and benefits of the necessary investment to improve the Indonesian VMS were estimated.
- ✓ The costs were estimated at \$1 million.
- ✓ The extent of illegal fishing was estimated based on available data about the number of vessels involved, their catch, revenue and costs as well as data on the expected number of foreign as compared to domestic vessels.
- ✓ The overall yearly loss of revenue due to illegal fishing in Indonesia was estimated at around \$9 million, where \$1,4 million is due to domestic vessels and \$7,7 million due to foreign vessels.

- 
- ✓ Based on data on the extent of illegal fishing under different VMS systems suggests that an improved VMS might reduce illegal fishing by up to 50% over a 10 year period.
 - ✓ Given these assumptions the benefits of the improvements to the VMS far exceed the cost.
 - ✓ In fact the ratio of benefits to costs is about 17
 - ✓ The benefits are 17 times larger than the cost
 - ✓ The breakeven point is after only about 15 months
 - ✓ The internal rate of return is 80%
 - ✓ The results of sensitivity analysis reveal that the result of positive net benefits is robust against very large changes in model assumptions.



Based on analysis and conclusions, some suggestions delivered:

- 1) Investment in improving the Indonesian VMS towards real time monitoring and improved system interface has very large net benefits and is a very viable investment for the Indonesian government.
- 2) The applications of VMS technology for other purposes than fisheries monitoring has substantial additional benefits that should be further investigated. These include application for Customs, Search and Rescue, Water police, Navy etc.

STOP ILLEGAL FISHING



THANK YOU



**MINISTRY OF MARINE AFFAIRS
AND FISHERIES
REPUBLIC OF INDONESIA**



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