

**ANALYSIS OF FISHING WITH LED LIGHTS IN AND AROUND
INDONESIAN MARINE PROTECTED AREAS AND NO TAKE
ZONES THROUGH VESSEL MONITORING SYSTEM AND
VISIBLE INFRARED RADIOMETER SUITE DATA**

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**GRADUATE SCHOOL
BOGOR AGRICULTURAL UNIVERSITY
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2020**

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Tangerang, June 2020

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SUMMARY

RUBEN VAN BEEK. Analysis of Fishing with Led Lights in and around Indonesian Marine Protected Areas and No Take Zones through Vessel Monitoring System and Visible Infrared Radiometer Suite Data. Supervised by JONSON LUMBAN GAOL and SYAMSUL BAHRI AGUS.

Marine Protected Areas (MPA) and No Take Zones are an effective tool for marine ecosystem preservation. Illegal fisheries can severely harm these areas. Indonesia requires fishing vessels larger than 30 gross tons to use a Vessel Monitoring System (VMS), which is able to track a vessel's geographic location at any given time. Another way to detect fisheries is through Visible Infrared Radiometer Suite (VIIRS) data which detects led light using fishing vessels from space by detecting lights at night time. This research focuses on comparing VMS and VIIRS data in order to identify lights from fishing vessels that were detected through VIIRS.

In order to do this an R package, "LLFI" (Led Light Fisheries Identifier) was created. This package provides several R-function that can calculate the location of VMS using vessels at the overpass time of the VIIRS satellite. Several MPA across the Indonesian Exclusive Economic Zone (EEZ) were chosen as research areas. VMS and VIIRS data for the entire year of 2018 were obtained for these Regions of Interest (ROI). The R-function "vms2viirs" calculated activity for small purse seine fisheries all through the ROI and for Bouke ami fisheries in the south western part of the ROI. The R-function "vms2viirsanalysis" created three buffers (Class A = 500 m, Class B = 1000 m, Class C = 5000 m) around detected fishing vessels by the VIIRS satellite and linked the closest found vessels from the VMS data set.

The amount of identified vessels for Class C was significantly higher than those for Class A and B. Approximately 10% of all detected led lights could be identified with a ship number from the VMS data set. Only around 8% of identified vessels could be found in MPA and around 3% could be found in a No Take Zone. Paths of identified vessels that some vessels did cross MPA and No Take Zones, but it is not clear whether these vessels were actively fishing over there. Almost no vessels were identified in ROI with large purse seine fisheries.

It can be concluded that the LLFI package is working successfully. However, since many led light using fishing vessels have a weight of less than 30 gross ton, it must be noted that those vessels cannot be identified yet. An increase of VMS usage in Indonesian (small scale) fisheries is therefore recommended.

Keywords: Led Light Fisheries, MPA, Vessel Monitoring, VIIRS, VMS

RINGKASAN

RUBEN VAN BEEK. Analisis penangkapan ikan yang pakai lampu LED dalam kawasan perlindungan kelautan dan zona inti melalui Data Vessel Monitoring System dan Visible Infrared Radiometer Suite. Dibimbing oleh JONSON LUMBAN GAOL dan SYAMSUL BAHRI AGUS.

Marine Protected Areas (MPA) dan *No Take Zones* merupakan sarana yang efektif untuk konservasi ekosistem kelautan. Perikanan ilegal dapat sangat membahayakan area-area tersebut. Indonesia mewajibkan agar kapal penangkap ikan dengan berat kotor (*gross*) lebih dari 30 ton menggunakan *Vessel Monitoring System* (VMS), dimana alat ini dapat melacak lokasi geografis kapal pada waktu kapanpun. Adapun cara lain untuk mendeteksi aktivitas perikanan, yaitu melalui data *Visible Infrared Radiometer Suite* (VIIRS) yang dapat mendeteksi led light yang digunakan kapal penangkap ikan dari angkasa dengan cara mendeteksi cahaya pada waktu malam hari. Penelitian ini fokus membandingkan data antara VMS dan VIIRS yang bertujuan untuk mengidentifikasi cahaya dari kapal penangkap ikan yang terdeteksi melalui VIIRS.

Oleh sebab itu, diperlukan R package untuk mengolah "LLFI" (*Led Light Fisheries Identifier*). R package tersebut memberikan beberapa R-function di mana dapat menghitung lokasi VMS yang digunakan kapal penangkap ikan pada saat melewati satelit VIIRS. Beberapa MPA yang tersebar di *Exclusive Economic Zone* (EEZ) Indonesia dipilih sebagai area dalam penelitian. Data VMS dan VIIRS selama tahun 2018 dikumpulkan sebagai *Regions of Interest* (ROI) penelitian ini. R-function "vms2viirs" digunakan untuk menghitung aktivitas perikanan dengan pukat kecil yang melewati ROI dan juga untuk perikanan bouke ami di bagian barat daya ROI. R-function "vms2viirsanalysis" dibuat dengan tiga buffers (Kelas A = 500 m, Kelas B = 1000 m, Kelas C = 5000 m) yang mendeteksi kapal penangkap ikan melalui satelit VIIRS dan dihubungkan dengan kapal terdekat yang ditemukan dari VMS data set.

Adapun jumlah kapal yang teridentifikasi untuk Kelas C secara signifikan lebih tinggi dari kedua kelas lainnya, Kelas A dan B. Kemudian, kurang lebih 10% dari seluruh yang terdeteksi led light dapat diidentifikasi dengan nomor kapal dalam VMS data set. Hanya sekitar 8% dari kapal yang teridentifikasi dapat ditemukan di MPA dan sekitar 3% ditemukan di *No Take Zones*. Jalur kapal yang teridentifikasi, yang mana ada beberapa kapal melewati MPA dan juga *No Take Zones*, namun hal tersebut belum jelas apakah kapal-kapal tersebut memang secara aktif menangkap ikan di lokasi tersebut. Hampir tidak ada kapal penangkap ikan pukat besar yang teridentifikasi di ROI.

Oleh sebab itu, dapat disimpulkan bahwa LLFI package berhasil. Meskipun demikian, karena beberapa led light yang digunakan kapal penangkap ikan memiliki berat kotor (*gross*) kurang dari 30 ton, maka perlu diperhatikan bahwa kapal-kapal tersebut belum dapat teridentifikasi. Oleh sebab itu, peningkatan penggunaan VMS dalam perikanan skala kecil di Indonesia sangat direkomendasikan.

Kata kunci: Led Light Fisheries, MPA, Vessel Monitoring, VIIRS, VMS

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PREFACE

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