

Notes on Light Detection of IUU fishing boats

“NASA’s Black Marble nighttime lights product suite,” *Remote Sensing of Environment*, Vol. 210, 1 June 2018, pp 113-143. Multiple authors.

The Day/Night Band (DNB) sensors of the [Visible Infrared Imaging Radiometer Suite](#) (VIIRS), on board the [Suomi-National Polar-orbiting Partnership](#) (S-NPP) and Joint Polar Satellite System (JPSS) satellite platforms, provide global daily measurements of nocturnal visible and [near-infrared](#) (NIR) light that are suitable for earth system science and applications studies.

detection of sub-pixel scale features, *e.g.*, fires ([Polivka et al., 2016](#)), shipping vessels ([Asanuma et al., 2016](#); [Elvidge et al., 2015](#); [Straka et al., 2015](#))

<<< >>>

“Automatic Boat Identification System for VIIRS Low Light Imaging Data,” *Remote Sensing*, 7(3), 3020-3036, 16 March 2015, Christopher D. Elvidge, Mikhail Zhizhin, Kimberly Baugh and Feng-Chi Hsu

It has been known since the 1970s that low light imaging sensors flown on satellites are capable of detecting heavily lit fishing boats at night [1,2]. In general, these are boats using lights to attract catch. A recent study [3] found that lights from other types of boats can also be detected by satellite sensors at night. There are several published studies documenting the value of these observations to fishery management [4,5,6,7,8,9,10]. Despite the long record of use, to date there has not been an automatic algorithm for extracting and reporting the detection of boats based on lights.

The first system capable of global monitoring of lit fishing boats was the U.S. Air Force Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). NOAA’s National Geophysical Data Center (NGDC) serves as the DMSP archive and source for DMSP data. In year 2000, NGDC was granted permission to distribute 3+ hour old OLS data. Following this change, NGDC established a series of data services, supplying nighttime OLS data to fishery agencies in Japan, Korea, Thailand, and Peru.

The successful launch of the Suomi National Polar Partnership (SNPP) satellite in 2011 marked the advent of a new era in the capability for satellite low light imaging [11,12,13,14]. The primary imager on SNPP is the Visible Infrared Imaging Radiometer Suite (VIIRS). The VIIRS day/night band (DNB) collects low light imaging data with 45 times smaller pixel footprint than the OLS [11]. The VIIRS has other advantages over the OLS in terms of a higher level of quantization, rigorous calibration, and additional spectral bands useful for cloud, ocean and combustion source characterization.

VIIRS is capable of detecting vastly more lit fishing boat features when compared to DMSP (Figure 1). However, the improvements in VIIRS over DMSP comes with a price—a vast increase in data volume. The basic data unit of VIIRS data is an “aggregate” spanning an area 3000 km wide and 2600 km high. The data volume for a DNB aggregate is 540 MB. The corresponding subset from a DMSP orbit tallies out to only 2.4 MB. Thus, the VIIRS data volume is 225 times higher than DMSP.

This data volume increase has emerged as a major obstacle for use of VIIRS fishing boat detections by fishery agencies and others organizations. There are very few organizations with the bandwidth and image processing capabilities to work with the source data. Expanding the user community for VIIRS boat detections is only feasible through a vast reduction in data volume. Recognizing this, we initiated the development of an automatic system for reporting locations of boats from VIIRS data. This paper describes key elements of the system.