ISC/14/SHARKWG-3/01

Description of the Hawaii Longline Observer Program[1]

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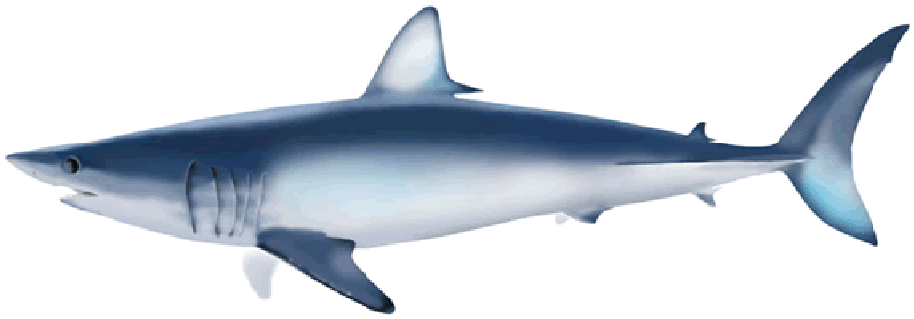

[1]Working document submitted to the ISC Shark Working Group Workshop, 19-26 November 2014, Puerto Vallarta, Jalisco, Mexico. **Document not to be cited without author's permission.**

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Abstract

Due to the expansion of pelagic longline fisheries based out of Hawaii in the 1980s and concerns about interactions with protected species, an observer program was initiated in the early 1990s to monitor the fishery's catch and bycatch. The scope of the program has changed through time, including a shift from voluntary to mandatory participation, increased levels of observer coverage, and improvements in sampling design. The observer program operates in both the shallow-set, swordfish targeting longline fishery as well as the deep-set, tuna targeting longline fisheries. This paper focuses on the deep-set fishery observer coverage since an index of abundance based on the observer data for this fishery was used by the SHARKWG in the ISC North Pacific blue shark stock assessment in 2013. The distribution of observer coverage in the deep-set fishery has changed through time: prior to 2001 coverage was approximately 4%, but has since been very close to 20% with the spatial footprint of observer coverage being more representative of the entire fishery since 2001. However, the probability sampling design used by the observer program is not statistically robust to ignoring the data collection process because of its hierarchical design and unequal distribution of sampling probabilities throughout the year. Sampling probabilities vary through time because of logistical aspects such as availability of funding and observers. As all sets and hooks are sampled when a trip is selected for observer placement, trips can be viewed as clusters whose elements are all sets and hooks deployed during the trip. While some mis-reporting of data in logbooks was identified in this analysis, and other previous studies, the level of compliance with logbook submission requirements is still considered to be high. This paper is an update to a prior version, (Sippel et al. 2014; ISC/14/SHARKWG-1/05) prepared for the January 2014 SHARKWG meeting.

Introduction

The Hawaii longline fishery for pelagic species (i.e., tuna and swordfish) experienced a rapid expansion in the late 1980s, due in part to the relocation of US longline vessels from the Atlantic Ocean and Gulf of Mexico fisheries (PIRO 2013). With reports of interactions with protected species emerging in the early 1990s, an observer program was initiated to monitor these interactions as well to provide a source of verifiable catch data to compare with vessel logbooks. The program was initiated in 1993, starting with voluntary participation which became mandatory in March 1994 (DiNardo 1993).

Currently, the Hawaii longline observer program monitors interactions with protected or endangered species, records catch data from target and non-target species with species-specific tallies of the catch including its condition on retrieval (i.e., live or dead) and subsequent disposition (i.e., retained or discarded), and length of at least one third of the fish caught, as well as operational details such as position, number of hooks, set and haul-back times, target species, and bait type. The program has also developed relationships with the Forum Fisheries Agency (FFA) and the Secretariat of the Pacific Community (SPC) with the intention of sharing information on program practices, species identification, labor issues, data harmonization, data sharing, and the "observer" as an effective management tool (PIRO 2013).

The Hawaii-based longline program consists of 2 fisheries, a deep-set fishery which targets tuna and a shallow-set fishery which targets swordfish. The deep-set fishery observer program is

currently designed with the dual objectives of collecting representative samples of the entire fishery while also achieving maximum cost effectiveness. The cost aspect relates to the challenges of keeping observers ready for sea deployments while not having to pay personnel costs during periods of waiting and/or inactivity. In brief, a two-tier sampling design is used to achieve coverage and cost objectives. Vessels are required to notify the observer program of intent to leave port with at least 72 hours of notice. A random number is assigned to each vessel giving notification to determine if an observer will be sent with them. If the vessel fails to leave in a reasonable time frame, the observer is reassigned to a different vessel and another observer is sent out with the original vessel when they do depart. Due to budgetary and logistical constraints, the sampling design allows observer coverage to vary throughout the year. Periods where coverage is below the targeted 20% coverage are followed by periods where coverage exceeds 20% (McCracken 2012).

Data from the observer program (deep-set in particular) have been used to create indices of abundance for consideration in stock assessments of species such as blue shark and albacore. The purpose of this document is to characterize the nature of the deep-set fishery observer coverage through space and time to help understand the nature of the data being considered for assessments.

Data and Results

Logbook and observer data from the Hawaii-based longline fisheries from 1995-2011 are included in this analysis. The same observer data were used by Walsh & Teo (2013) in developing North Pacific blue shark standardized CPUE time series for the Hawaii longline fisheries. The deep set fishery consists of approximately 12,000 sets per year, while since 2004 the shallow set fishery is limited by regulation to 2,120 sets per year. Observer coverage of the Hawaii longline deep- and shallow-set fisheries has changed through time (Figure 1). From March 1994 to September 2000, observer coverage averaged approximately 4% (Walsh et al. 2009, Figure 2A.). Starting in 2000, the Pacific Islands Regional Observer Program (PIROP) increased the observer coverage substantially, resulting in an over 500% increase in the number of observed trips per year. Since then, PIROP has achieved the objective of approximately 20% observer coverage yearly for the deep-set fishery (Figure 2B.). However, within each year coverage remains variable, at times ranging from less than 10% to greater than 30% as resource availability (funds and personnel) varies. Furthermore, when deployed on vessels, observers sample all sets and hooks. In technical terms, the sampling design involves an unequal probability cluster sample.

The shallow-set fishery was closed in 2002 and reopened in 2004, and since 2005 there has been 100% observer coverage (PIRO 2013) (Figure 1). Changes also occurred in the geographic distribution for both shallow- and deep-set fisheries. In 1996, 1998 and 2000 shallow sets were deployed east of 130˚W, but there was no shallow-set activity in these waters in 2004-2006. Deep sets occurred across 23˚ of longitude from 1995-2000, but occurred across 33˚ of longitude from 2004-2006 (Walsh et al. 2009).

Discussion

The sampling design of the program in the deep-set fishery has improved markedly since

approximately 2001-2002, but prior to that there are concerns about sampling bias and inadequate coverage. Prior to 2001, the geographic extent of observer coverage in the deep-set fishery was noticeably smaller than the extent of the fishery itself, but since then coverage has been much more similar to the fishery (see Appendix for 1996-2010 and data shown in Figures 2A & 2B). The transition from voluntary to mandatory participation, coupled with increased coverage rates and improved design of the observer program has produced a more reliable dataset through time. However, the unequal distribution of observer effort within years (different coverage rates within the year) coupled with the cluster sampling means that ignoring the data collection process can introduce unwanted bias when analyzing the observer data to quantify characteristics of the total fishery on annual basis. More recently the observer program has tried to maintain at least 15% coverage throughout the year to smooth out some of the variation in coverage levels. Furthermore, when using these data to produce standardized indices of abundance the clustered (i.e. correlated) sampling of sets and hooks could be a particular source of bias in model standard errors and confidence intervals if the sampling design is not taken into account (M. McCracken, pers. com.). Since 2004 there has been 100% observer coverage in the shallow-set sector, thus there are currently no sampling concerns in that fishery.

A few instances of observer coverage exceeding 100% within a 5x5 block were identified in this analysis. For example, this is apparent in observer coverage summarized in 2002 and 2010 (see Appendix). The two most likely explanations for this are; 1) differences in the reporting of fishing positions by captains in vessel logbooks as compared to fishery observers, causing logbook fishing effort to be mis-assigned to the 5x5 grid cells used here, or 2) failure to submit logbooks which would inflate observer coverage rates. Previous studies have compared observer and logbook data, revealing a low rate of non-reporting, specifically for blue shark catch, and analyses showed that the records of some captains were not as reliable as others. The percentage of logbook data believed to be false or inaccurate was approximately 2.6%, suggesting that most vessels met their responsibilities even without observers (Walsh et al. 2002).

Acknowledgements

Thanks to Marti McCracken for information about the nature and design of the observer sampling program and for clarifying some important points about interpreting the implications of these sampling design aspects.

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Walsh WA, Bigelow KA, Sender KL. 2009. Decreases in shark catches and mortality in the Hawaii-based longline fishery as documented by fishery observers. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 1: 270-282. DOI: 10.1577/C09-003.1.

Walsh WA, Teo S. 2013. Catch statistics, length data, and standardized CPUE for blue shark, *Prionace glauca*, taken by longline fisheries based in Hawaii and California. ISC/13/SHARKWG-1/05.

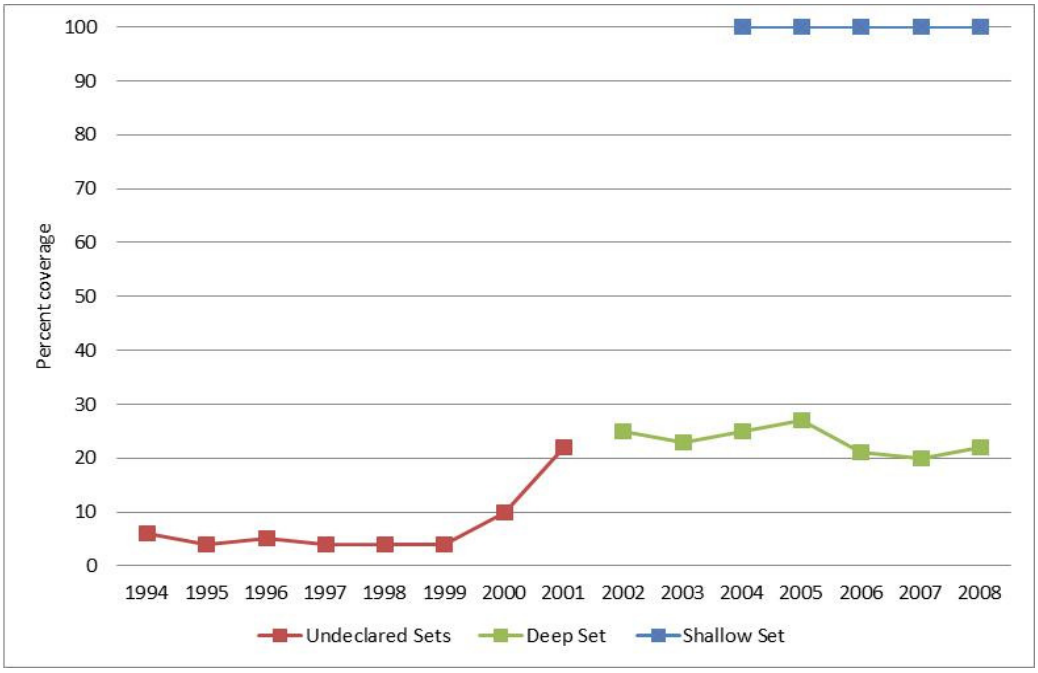


Figure 1. Proportion of observer coverage for the Hawaii longline fishery from 1994 to 2008.

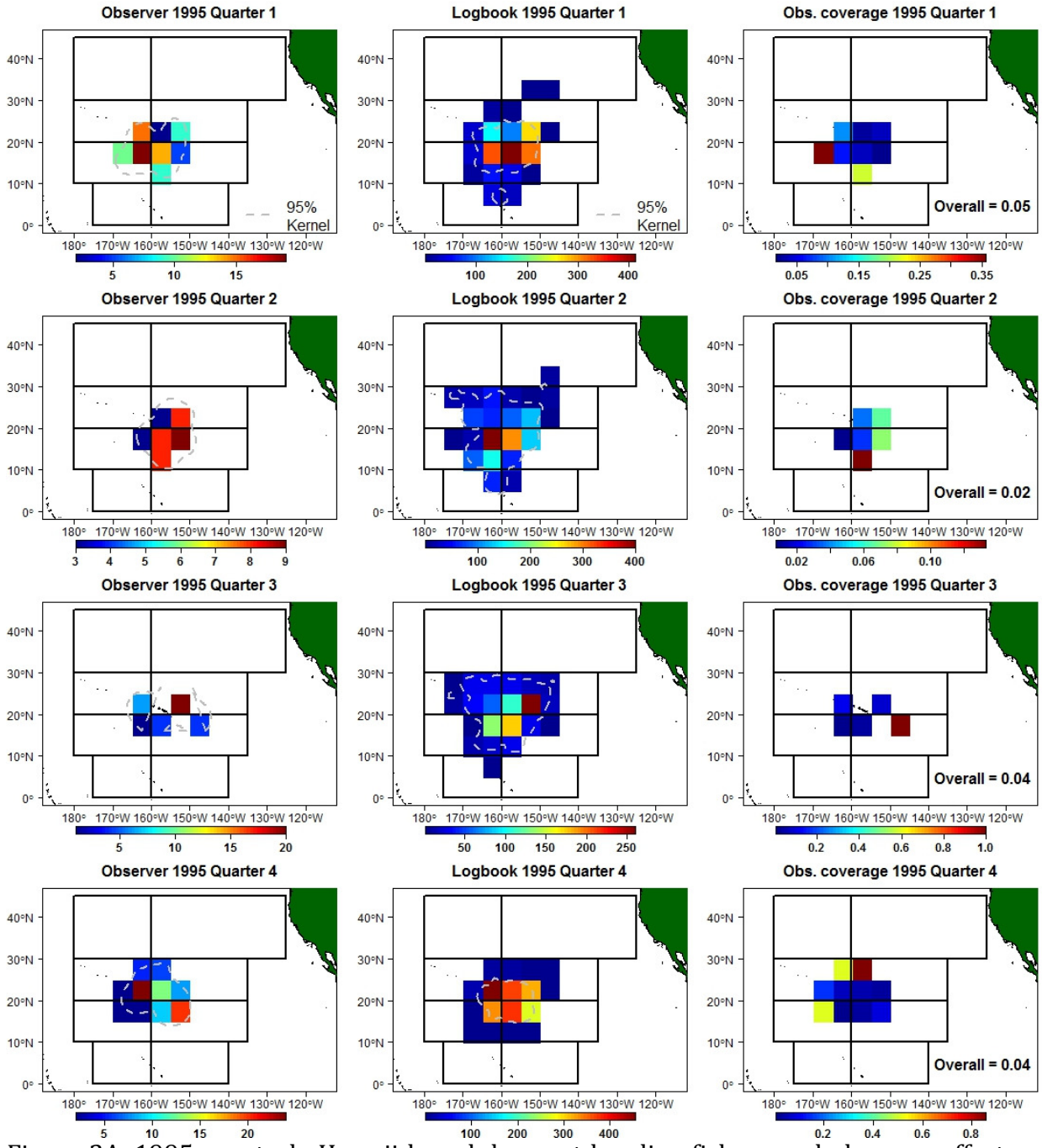


Figure 2A. 1995 quarterly Hawaii-based deep-set longline fishery and observer effort and observer coverage in 5x5° spatial grid cells with the 8 spatial strata used in Walsh & Teo (2013). Rows represent different quarters; column 1 is number of observed sets with 95% spatial probability kernels overlayed to depict the regions of core observer effort, column 2 is number of logbook sets with 95% spatial probability kernels overlaid to depict the regions of core logbook effort, column 3 is the proportion of observer coverage (range 0-1) in each cell with overall quarterly observer coverage rate in lower right corner of panels.

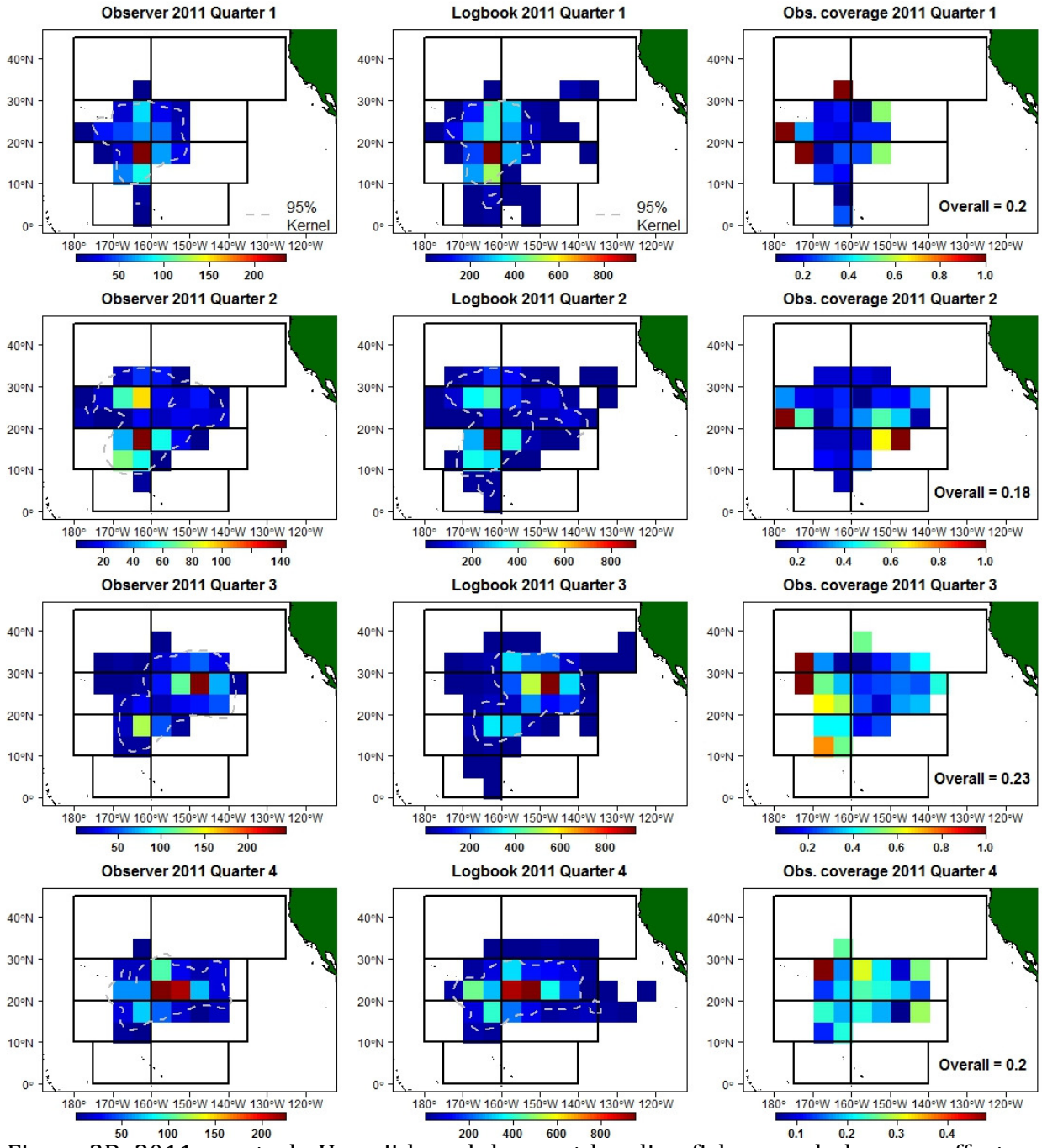


Figure 2B. 2011 quarterly Hawaii-based deep-set longline fishery and observer effort and observer coverage in 5x5° spatial grid cells with the 8 spatial strata used in Walsh & Teo (2013). Rows represent different quarters; column 1 is number of observed sets with 95% spatial probability kernels overlayed to depict the regions of core observer effort, column 2 is number of logbook sets with 95% spatial probability kernels overlaid to depict the regions of core logbook effort, column 3 is the proportion of observer coverage (range 0-1) in each cell with overall quarterly observer coverage rate in lower right corner of panels.

Appendix

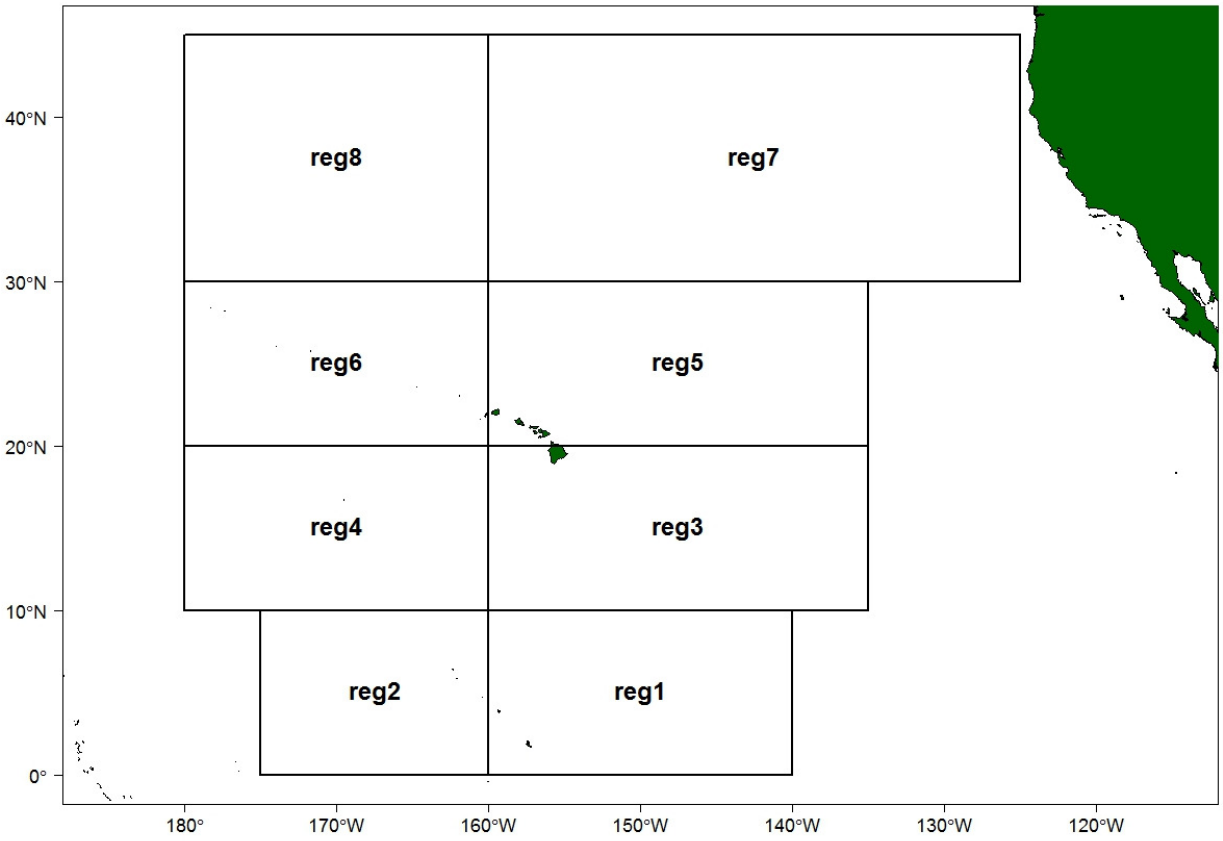


Figure A1. Eight spatial strata used by Walsh and Teo (2013) for standardization of blue shark catch rates.

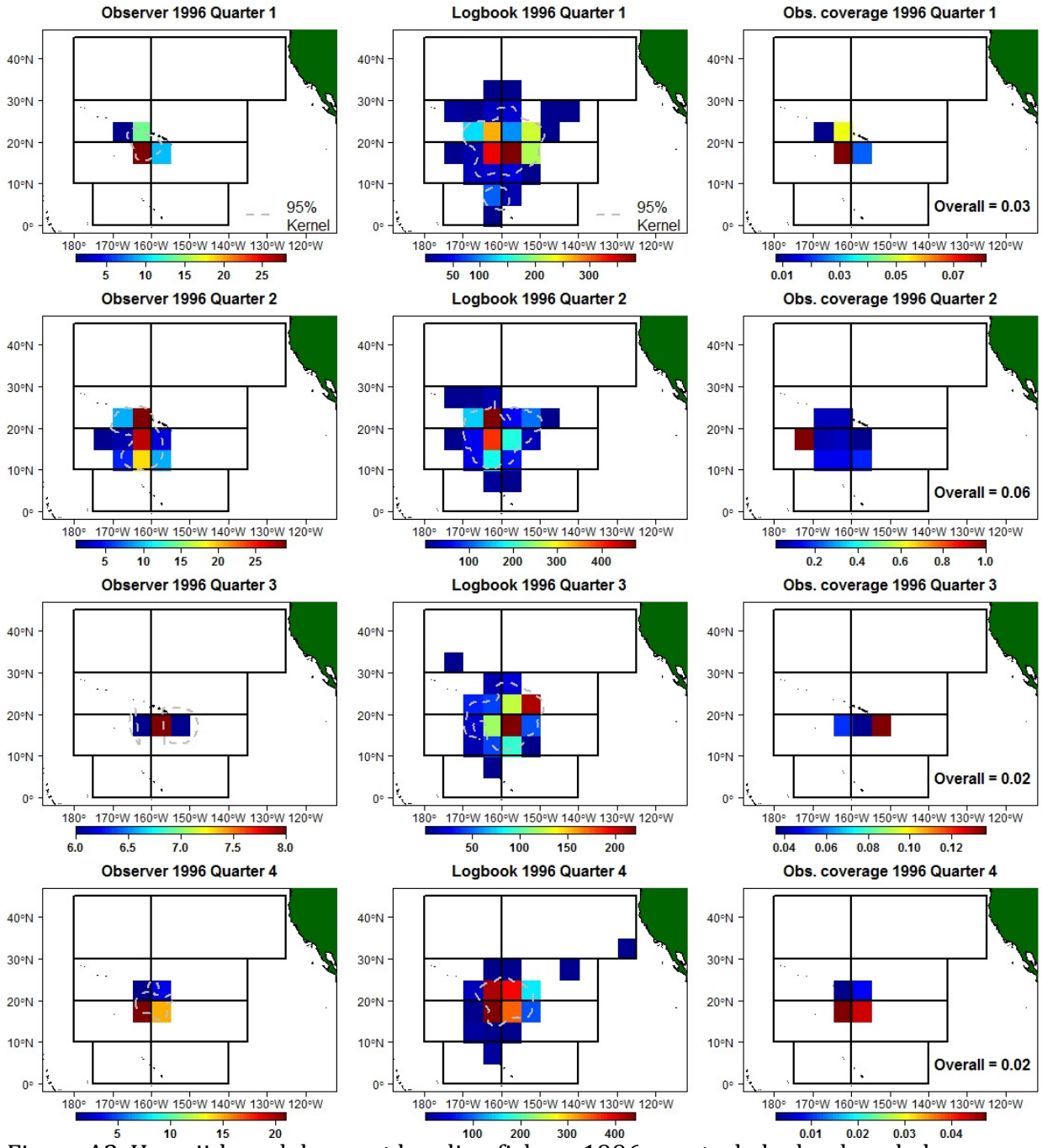


Figure A2. Hawaii-based deep-set longline fishery 1996 quarterly logbook and observer effort and observer coverage summary.

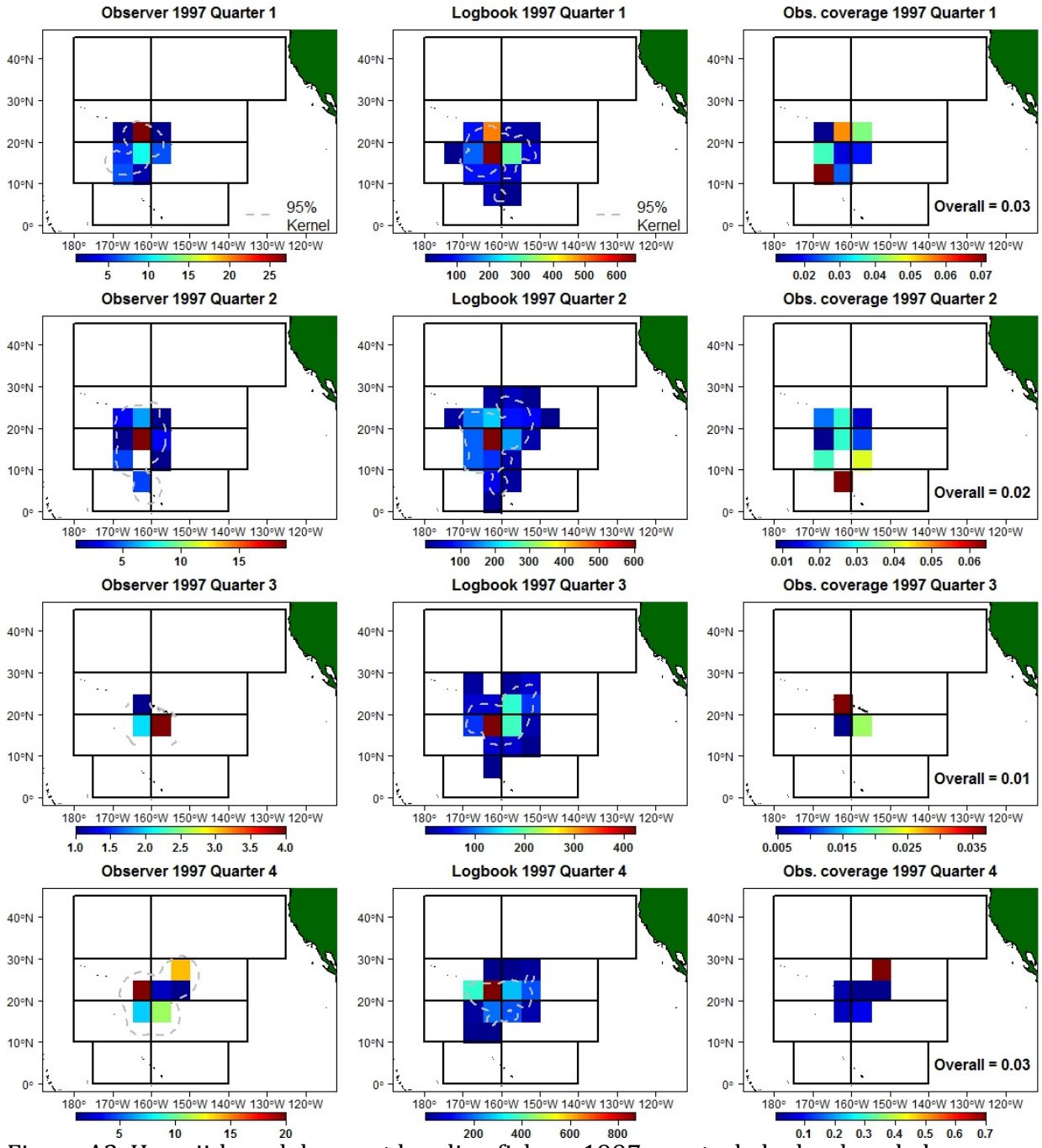


Figure A3. Hawaii-based deep-set longline fishery 1997 quarterly logbook and observer effort and observer coverage summary.

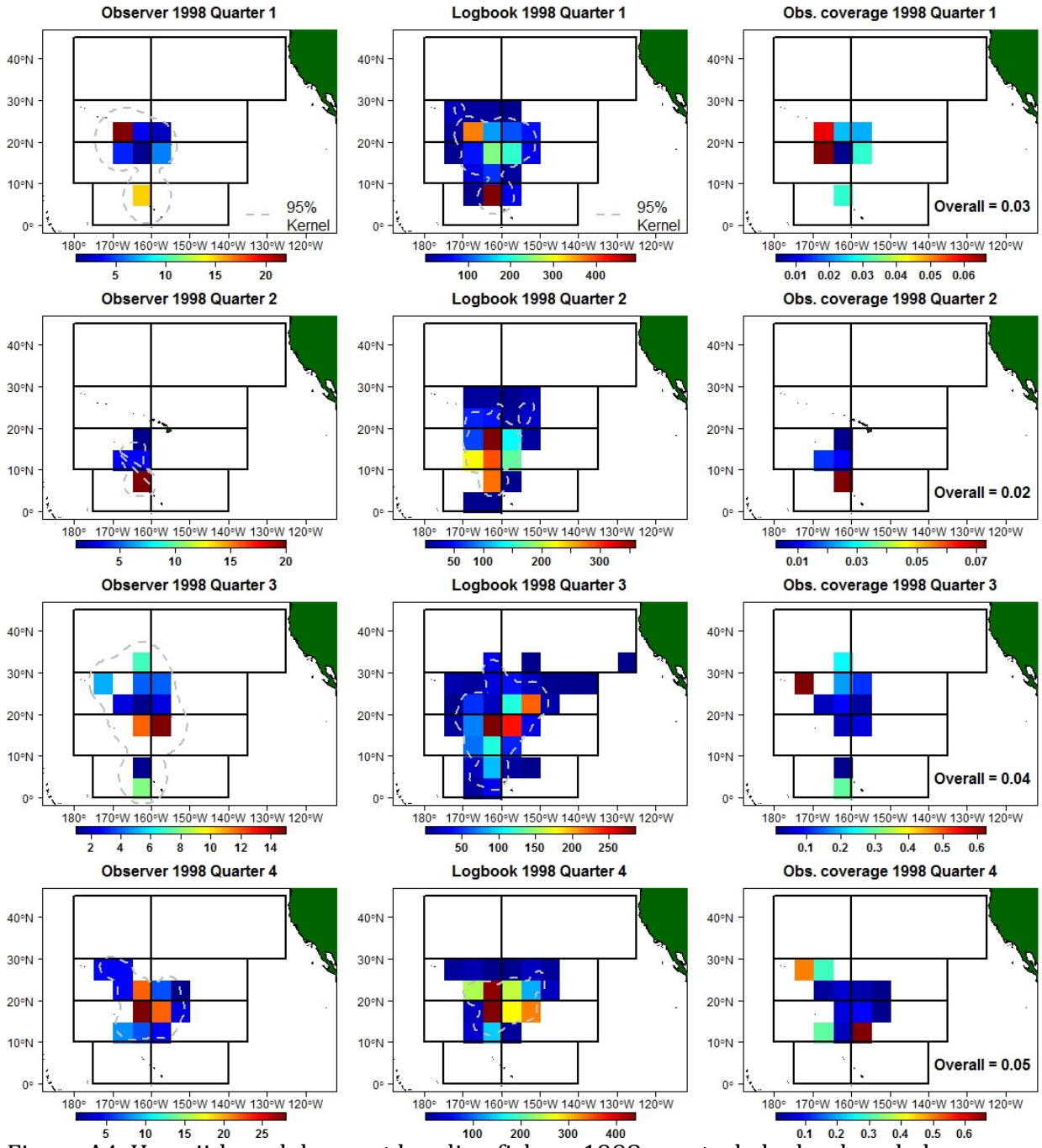


Figure A4. Hawaii-based deep-set longline fishery 1998 quarterly logbook and observer effort and observer coverage summary.

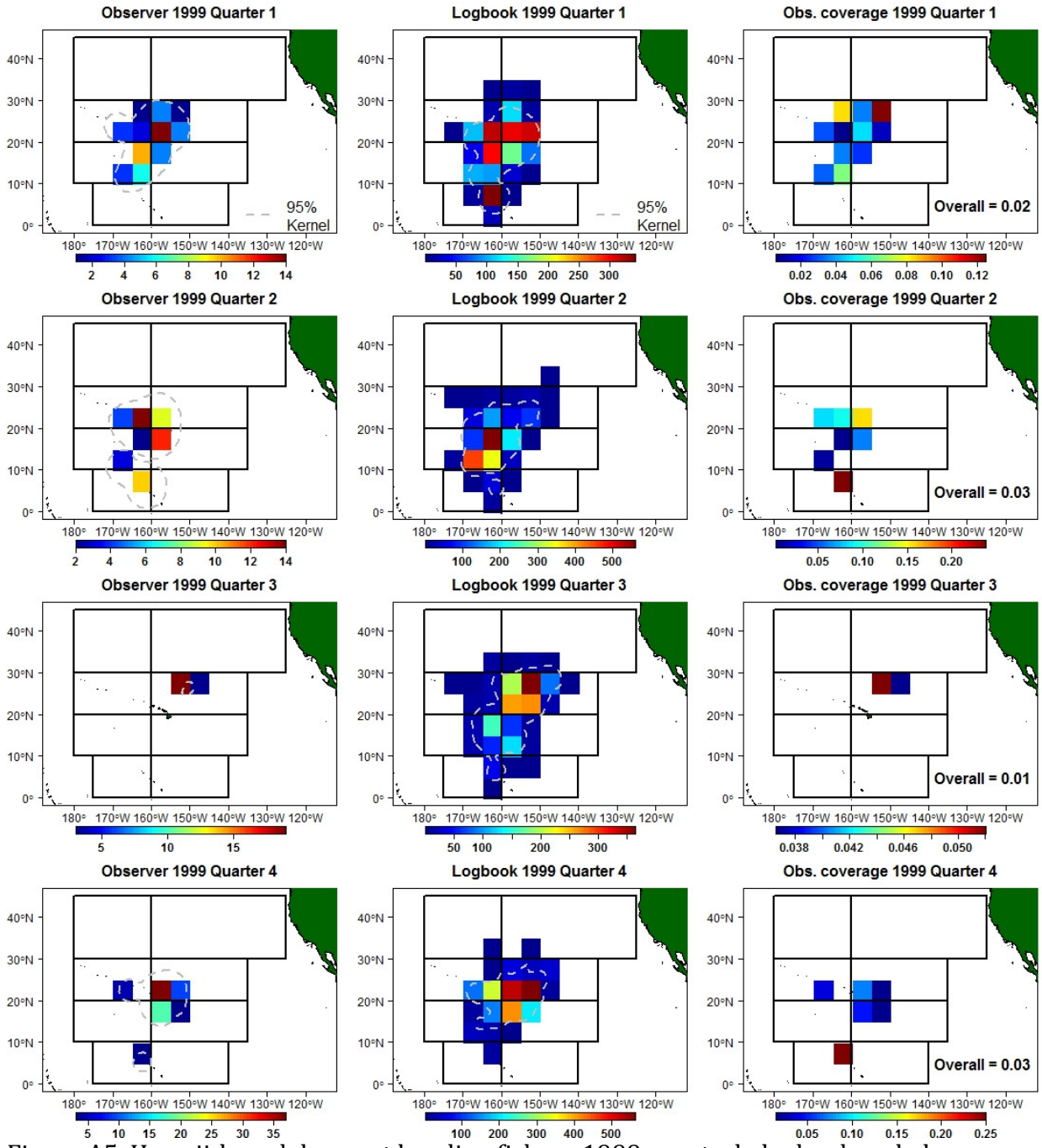


Figure A5. Hawaii-based deep-set longline fishery 1999 quarterly logbook and observer effort and observer coverage summary.

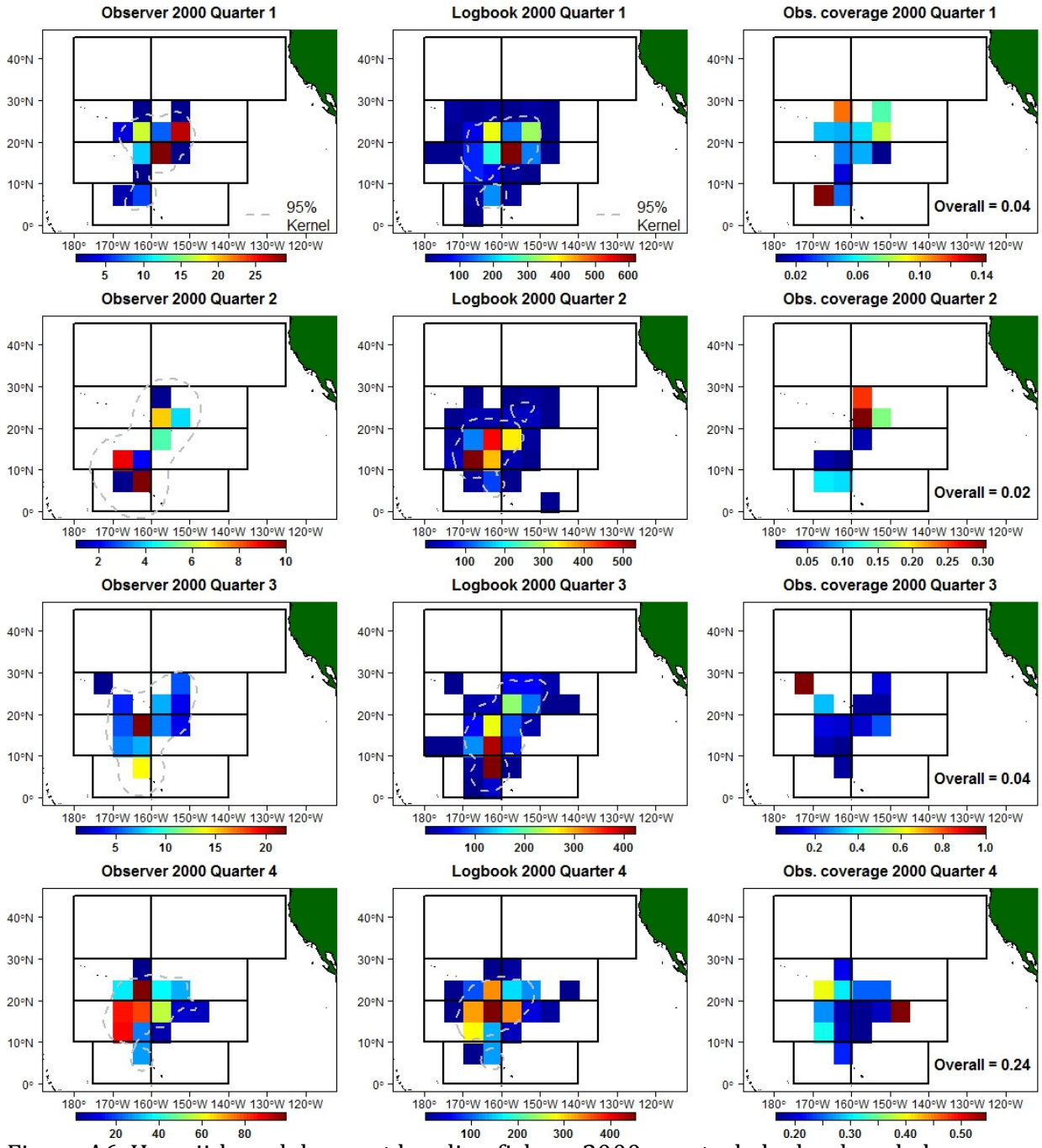


Figure A6. Hawaii-based deep-set longline fishery 2000 quarterly logbook and observer effort and observer coverage summary.

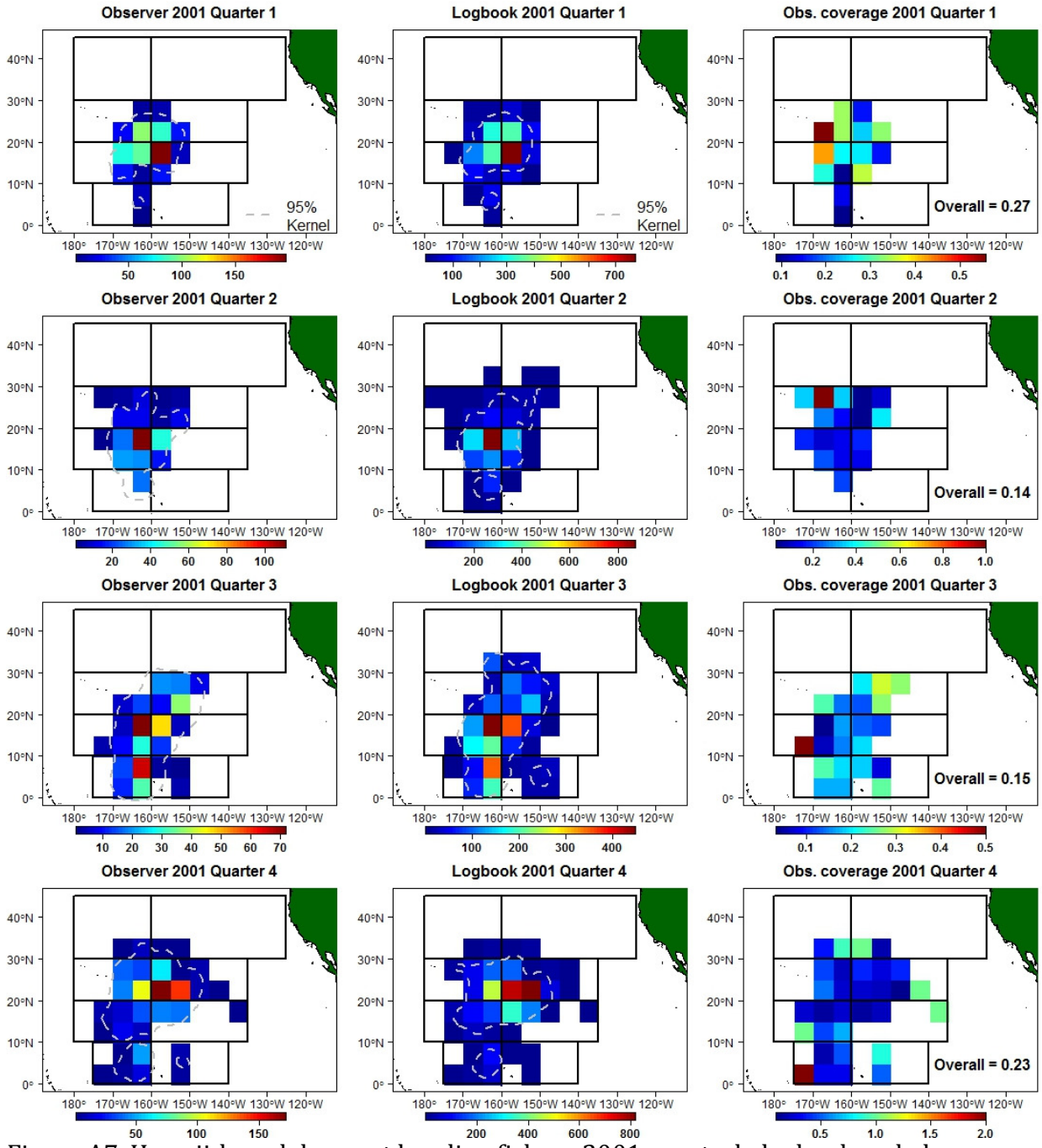


Figure A7. Hawaii-based deep-set longline fishery 2001 quarterly logbook and observer effort and observer coverage summary.

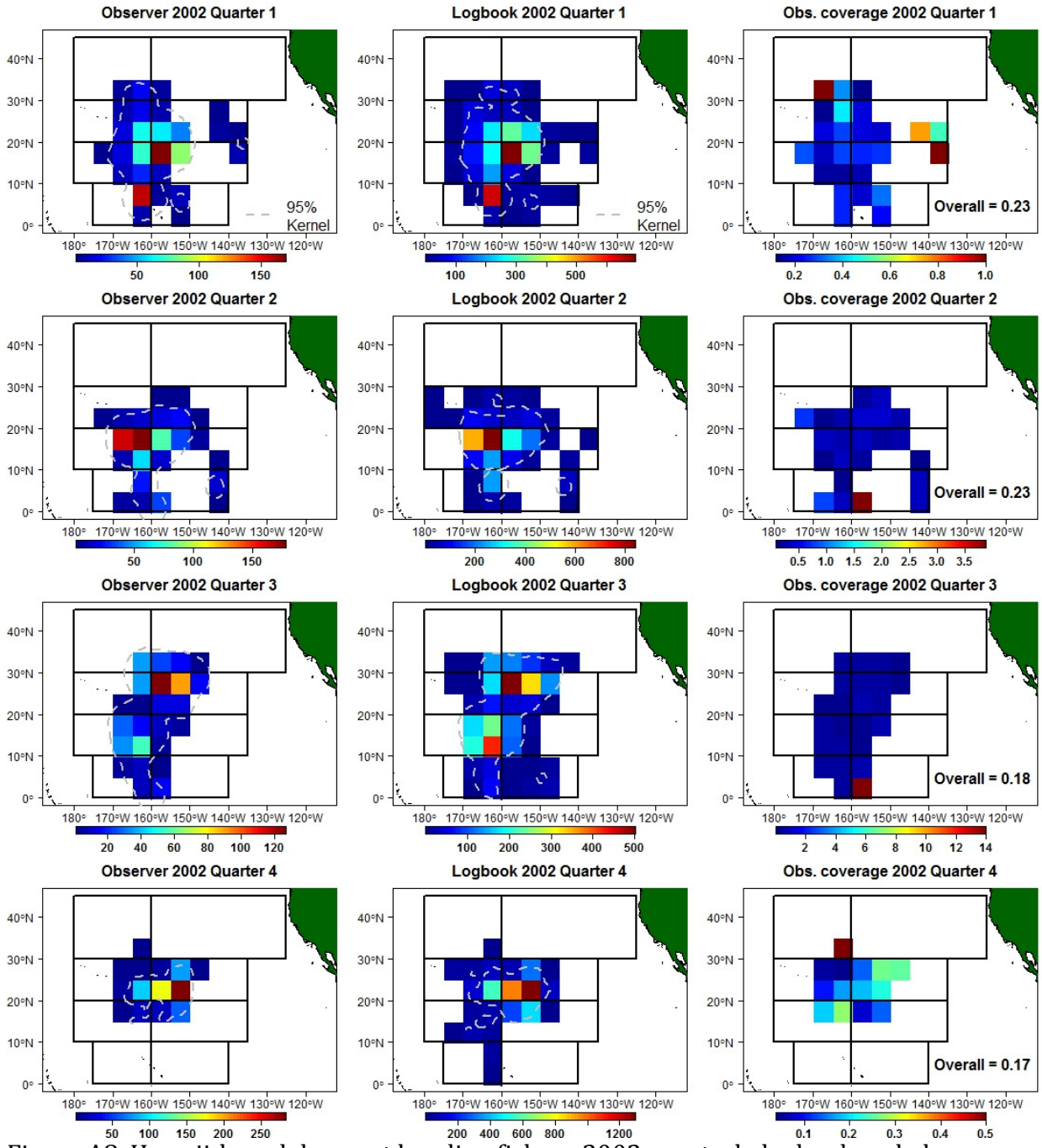


Figure A8. Hawaii-based deep-set longline fishery 2002 quarterly logbook and observer effort and observer coverage summary.

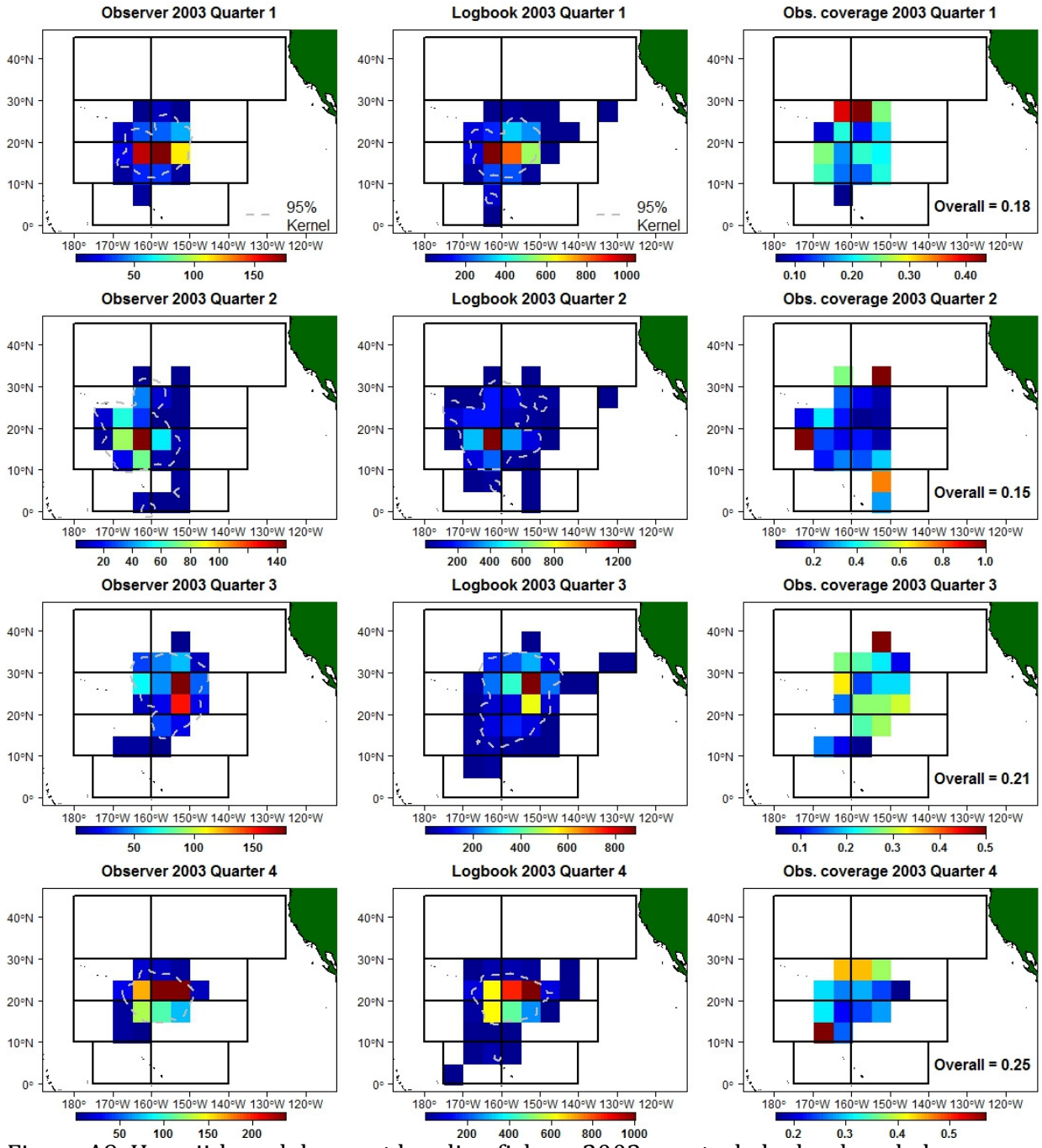


Figure A9. Hawaii-based deep-set longline fishery 2003 quarterly logbook and observer effort and observer coverage summary.

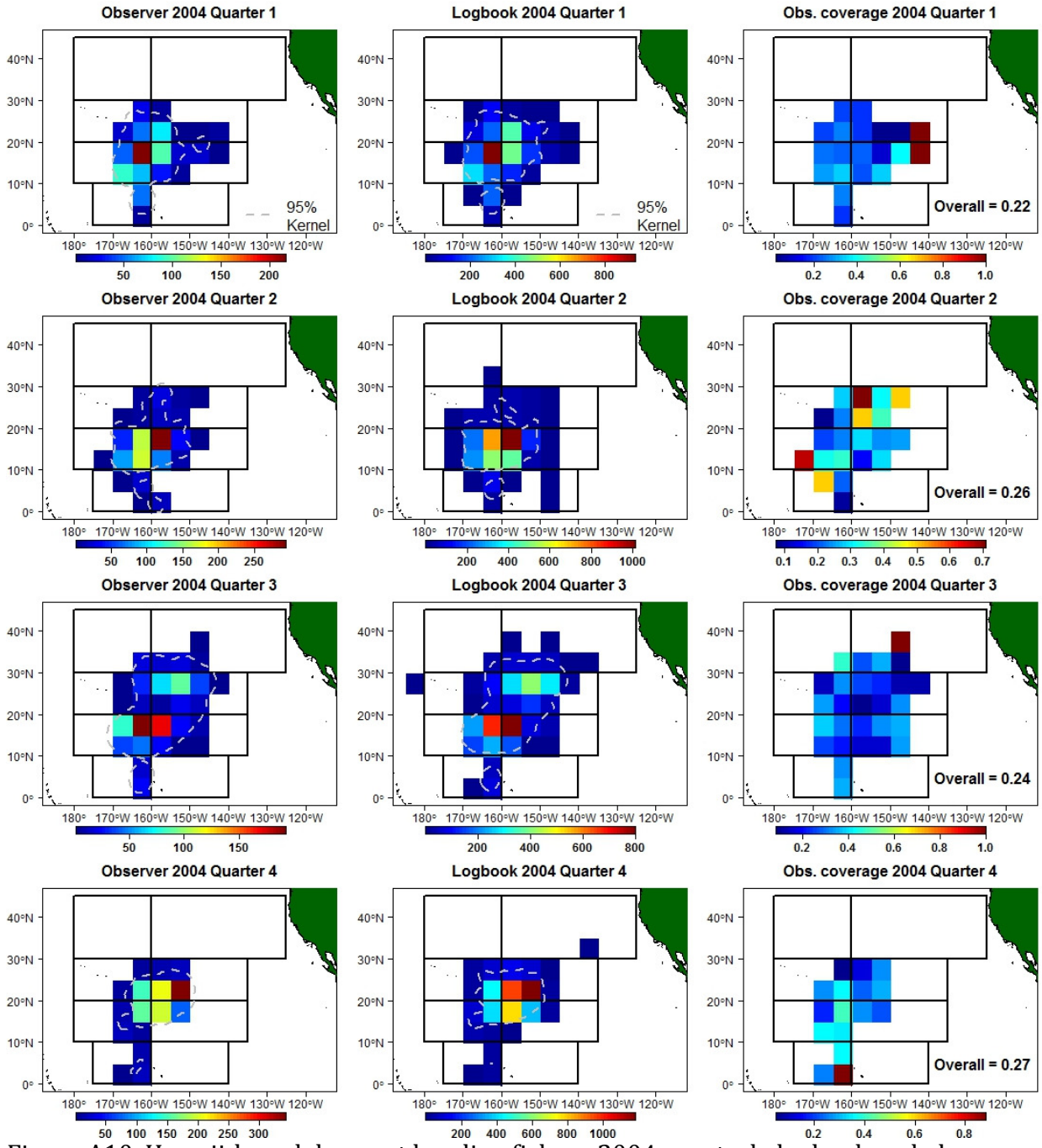


Figure A10. Hawaii-based deep-set longline fishery 2004 quarterly logbook and observer effort and observer coverage summary.

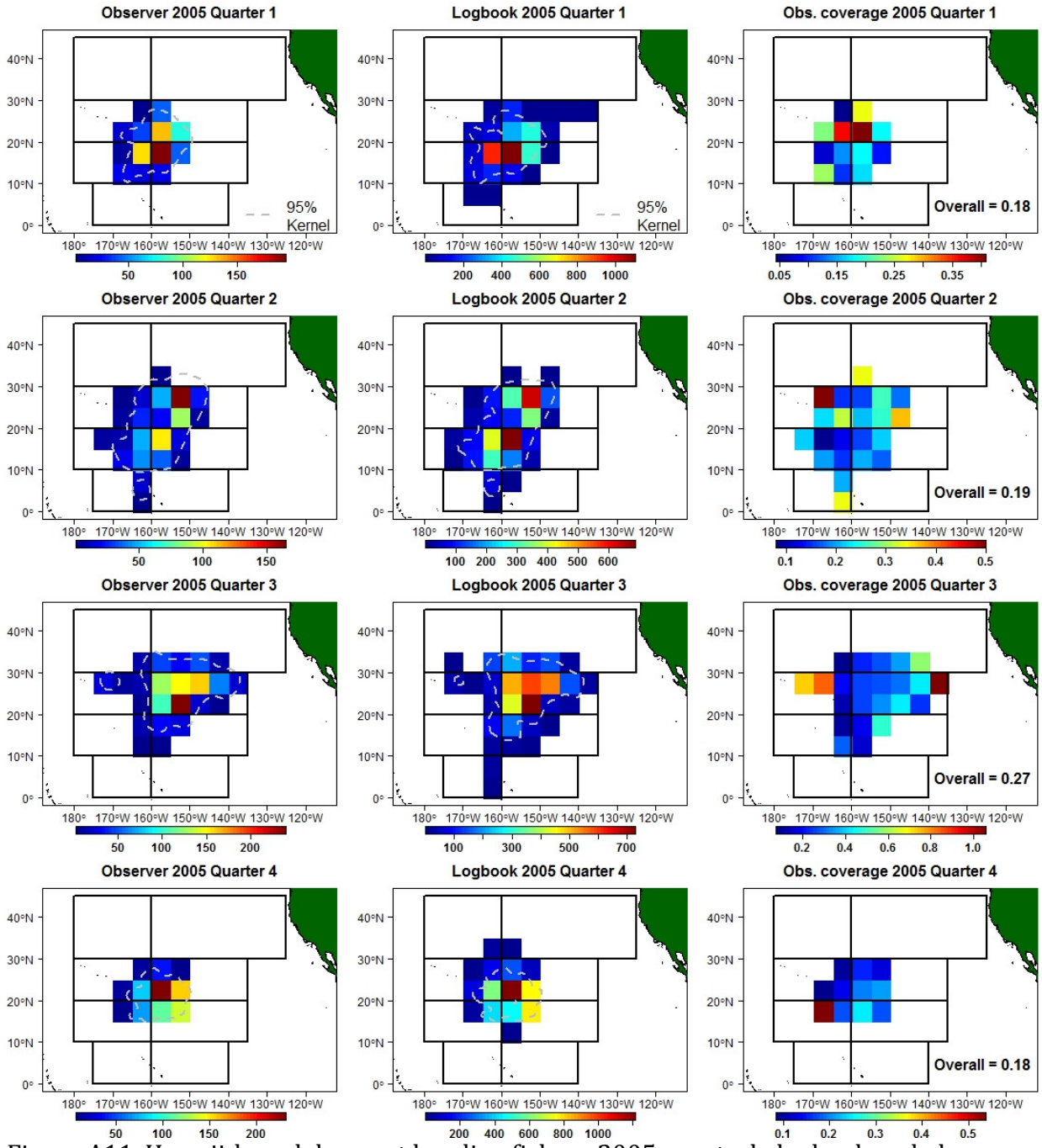


Figure A11. Hawaii-based deep-set longline fishery 2005 quarterly logbook and observer effort and observer coverage summary.

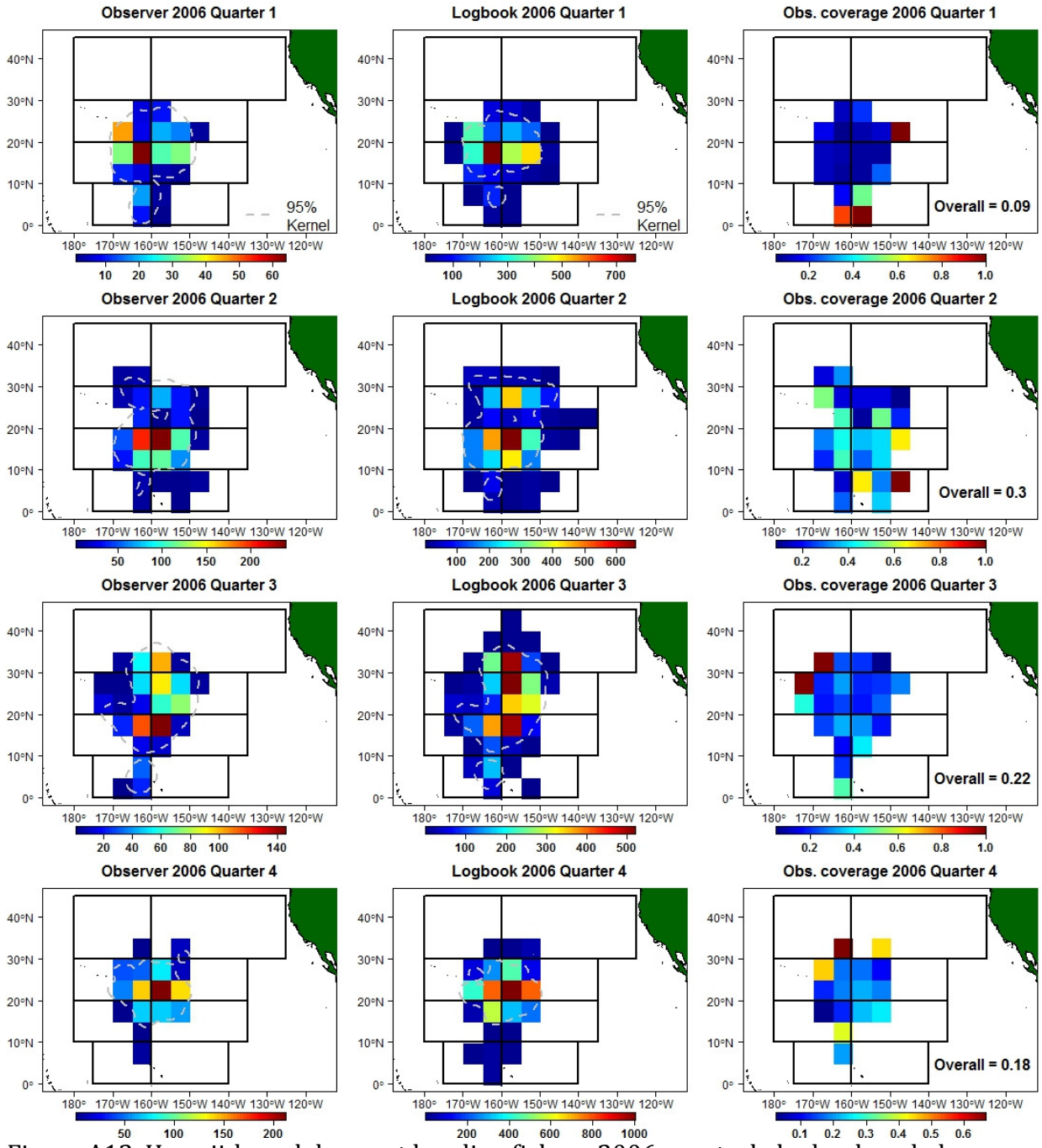


Figure A12. Hawaii-based deep-set longline fishery 2006 quarterly logbook and observer effort and observer coverage summary.

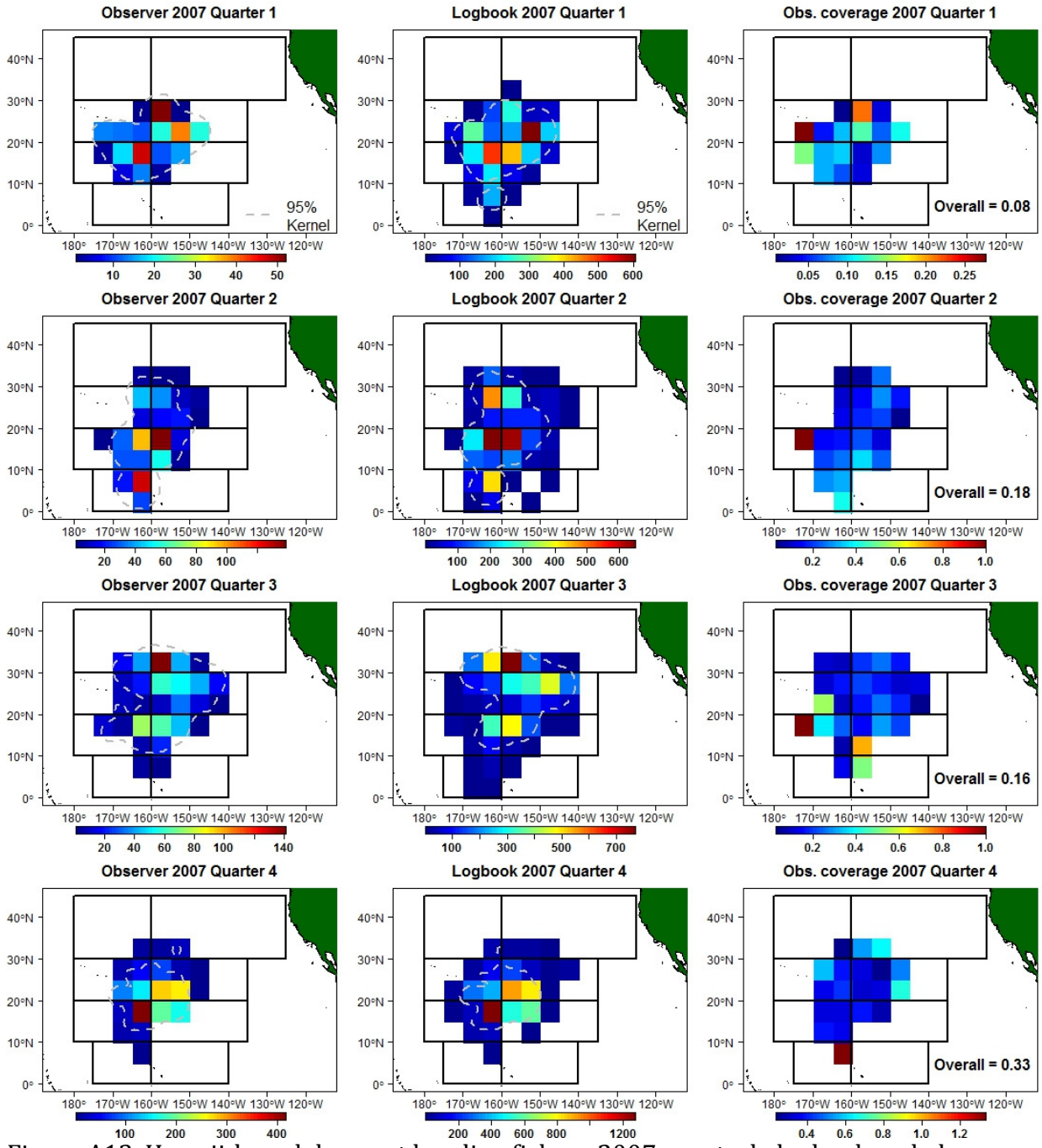
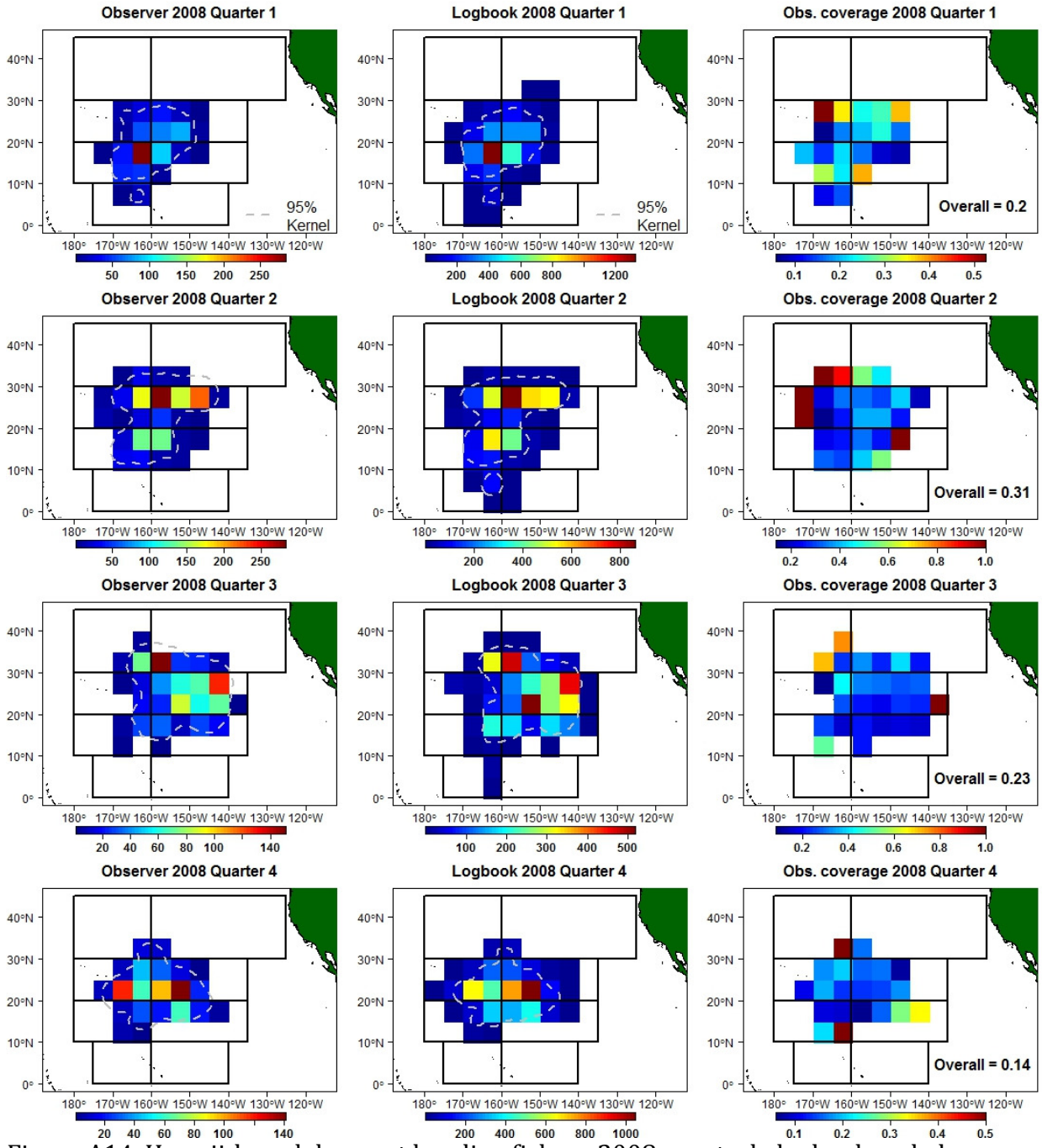


Figure A13. Hawaii-based deep-set longline fishery 2007 quarterly logbook and observer effort and observer coverage summary.



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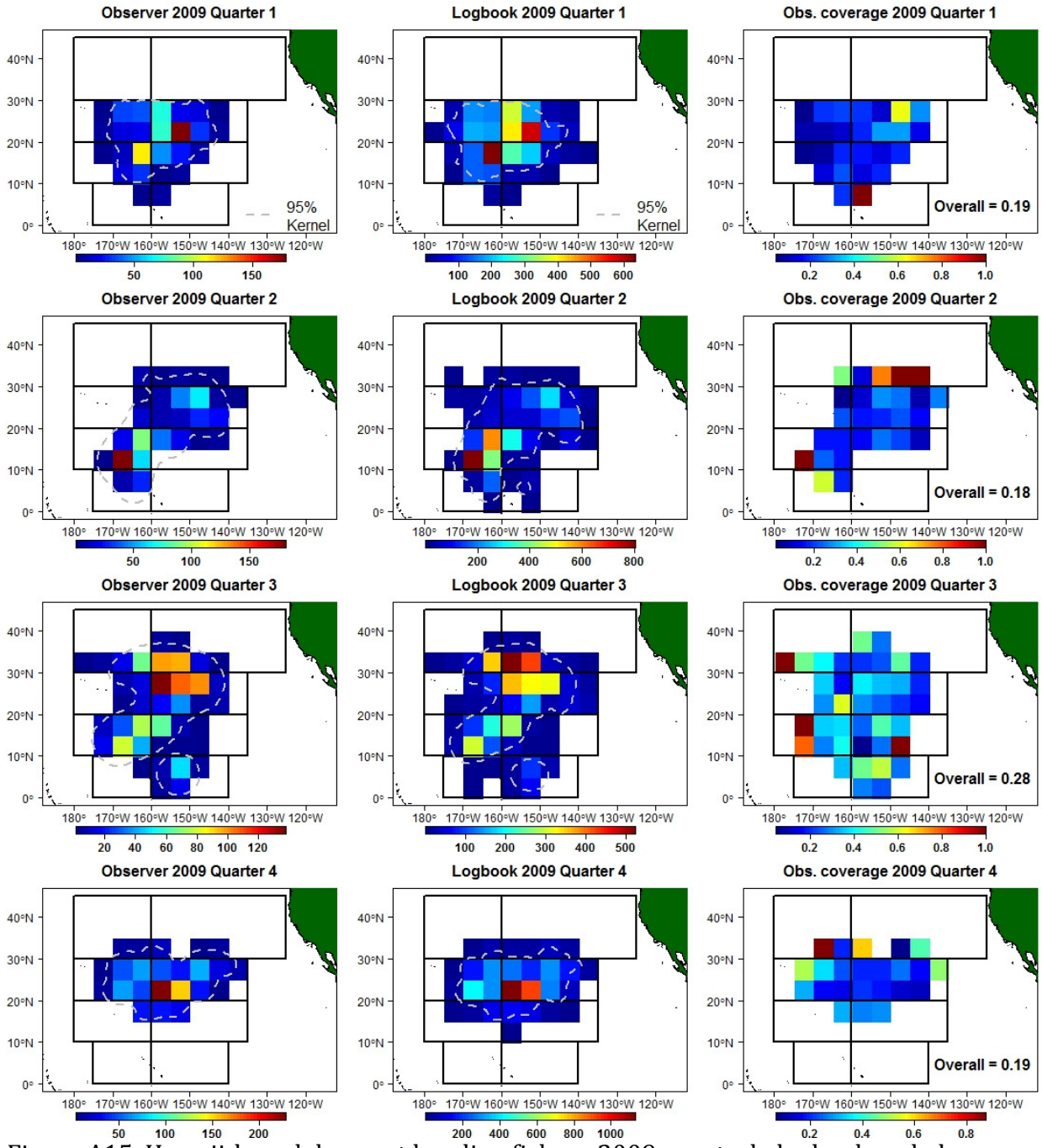

Figure A15. Hawaii-based deep-set longline fishery 2009 quarterly logbook and observer effort and observer coverage summary.

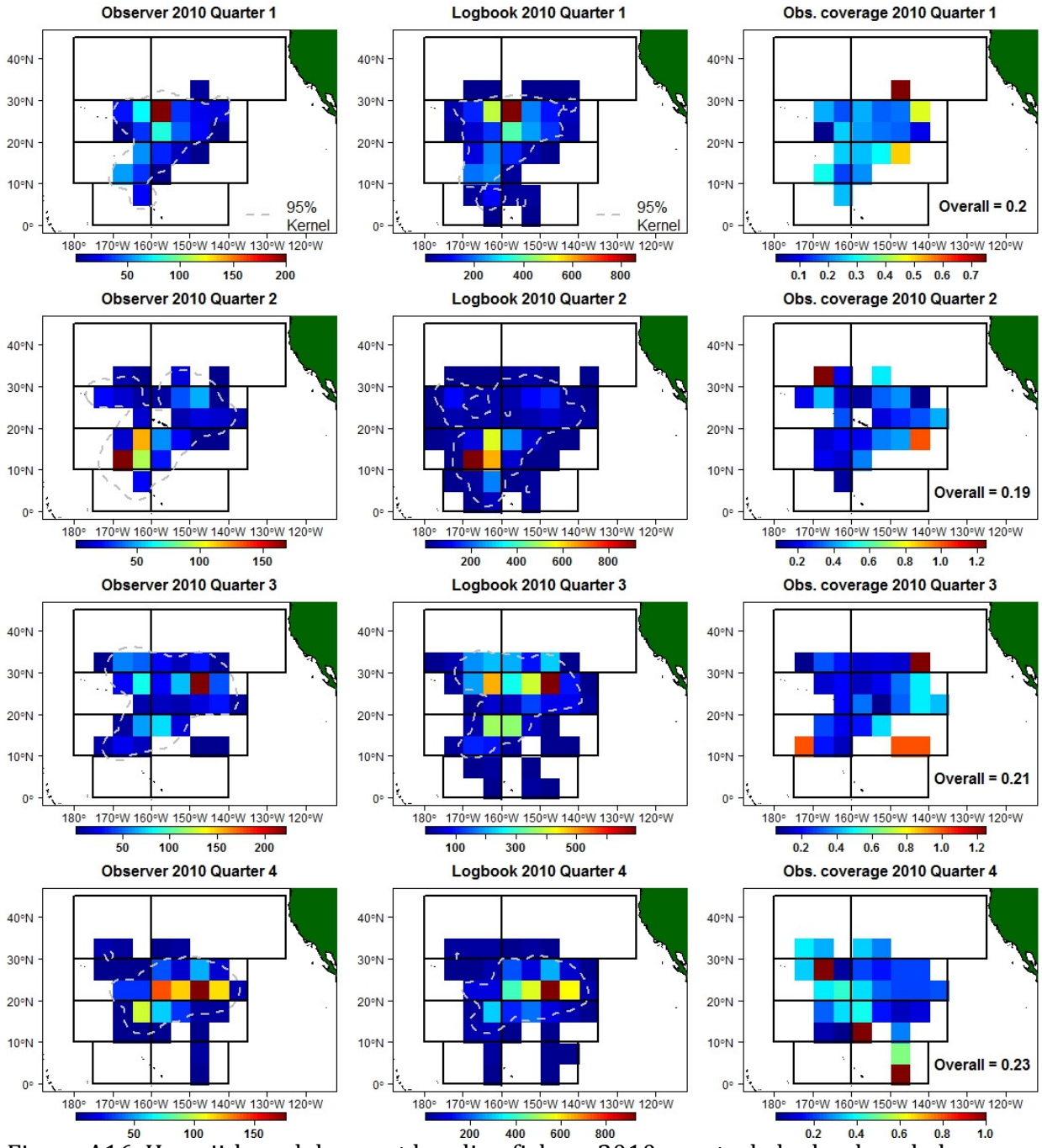

Figure A16. Hawaii-based deep-set longline fishery 2010 quarterly logbook and observer effort and observer coverage summary.