



Institute for Defense Analyses

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Fisheries Law Enforcement: Assessment of Deterrence

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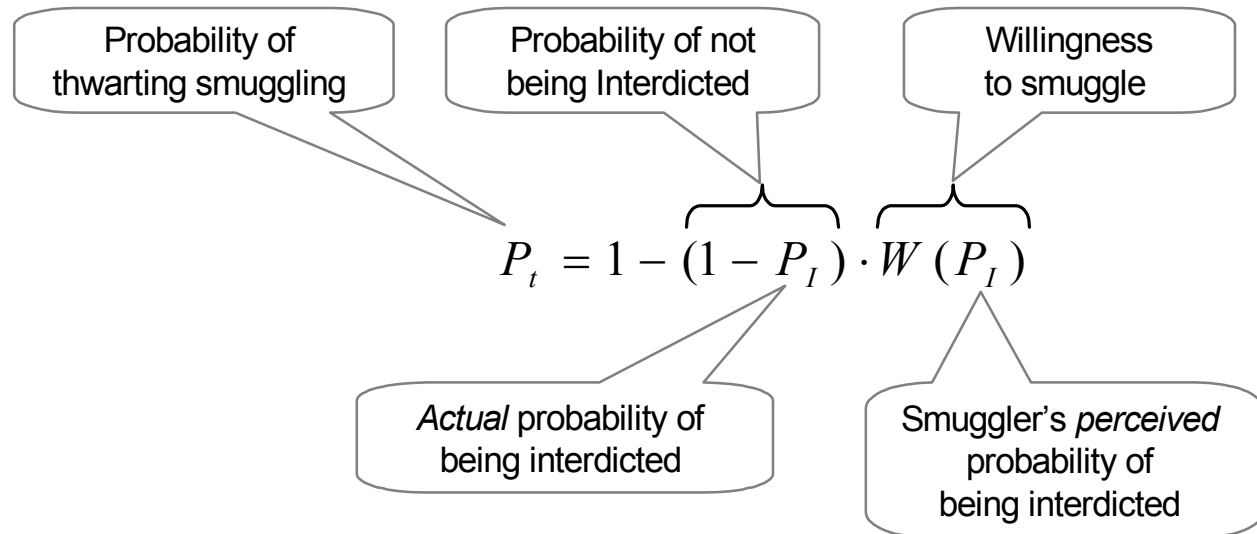
Introduction

- **Study Sponsor: U.S. Coast Guard**
 - Initial phase completed in December 1999
- **Objective**
 - Examine the deterrence effects of Coast Guard fisheries-related enforcement activities
- **Outline**
 - A Model of Deterrence: Drug Smuggling and Counterdrug Operations
 - Deterrence in Fisheries Law Enforcement
 - » Correlation between Coast Guard activities and observed violation rates



Conceptual Model of Deterrence: Developed for Drug Smuggling Into the U.S.

- **Effort started in 1993 (for the Office of the Secretary of Defense)**
 - Assess counterdrug operations, their impact (price, purity, usage), and develop a deterrence model



- **Mathematical form:**

- **Perceptions of potential perpetrators of illicit actions**

- Basic model assumes instantaneous perception
- Perception lags deterrent action
- Perception leads deterrent action
- Perceptions not uniform within perpetrator population

- **Feedback dynamics may be relevant to model extensions**



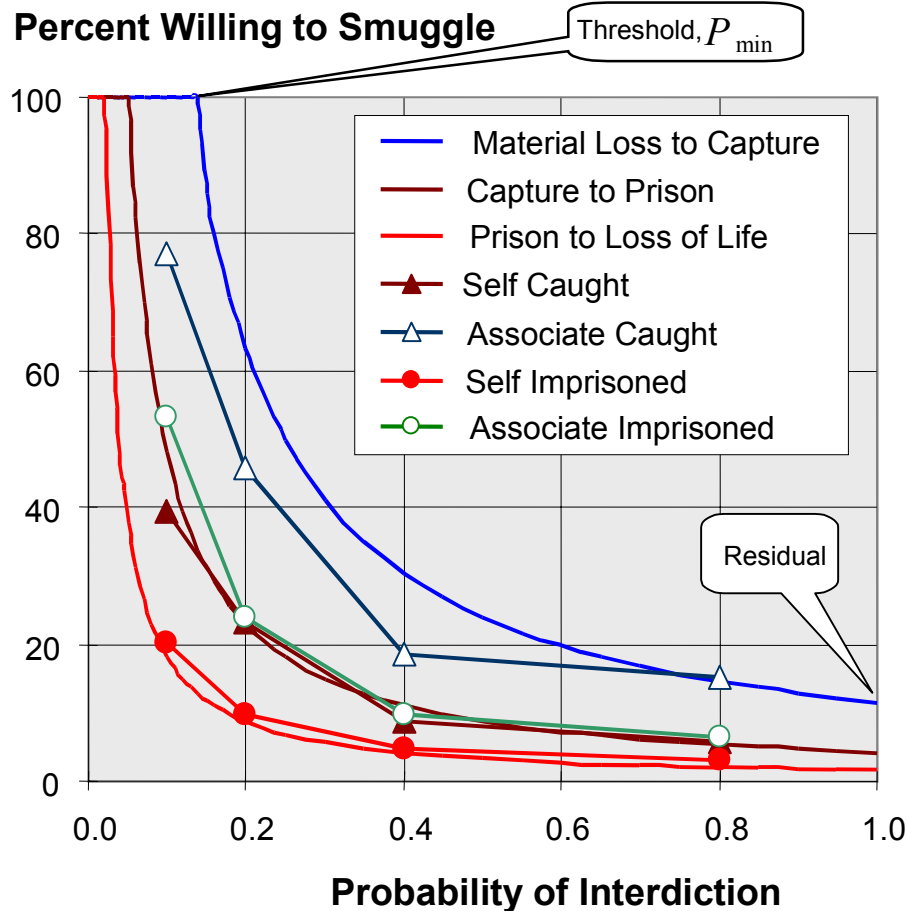
Development of Counterdrug Deterrence Model

- **Case Studies, Calibration, and Validation**
 - Interviews of drug smugglers in federal penitentiaries
 - Air trafficking of coca from Peru to Colombia
 - Air trafficking in the Caribbean
 - Go-fasts in the Caribbean
 - Operation *Frontier Shield* (Puerto Rico)
- **Examined three models (mathematical functional forms)**
 - Risk perception model fits interview and counterdrug operations data remarkably well
- **Corroborating evidence**
 - Psychology of risk perception
 - Statistics from risk taking behavior



Willingness to Smuggle - Functional Form

$$W(P_I) = (P_I / P_{\min})^{-\alpha}$$



- **Analogous data: early automobile usage**

- Risk-Benefit Decisions (Starr, 1972)
- 1900 extreme “sport”
- 1910 sport/prestige
- Thereafter, necessity

- **Experimental psychology and psychophysics**

- Conjoint Expected Risk (CER) model (Luce & Weber, 1997)
- Power laws relating perceptual scales (S. S. Stevens, 1975)

Human perception accurately judges ratios of intensities



Deterrence of Drug Smuggling: Theory and Practice

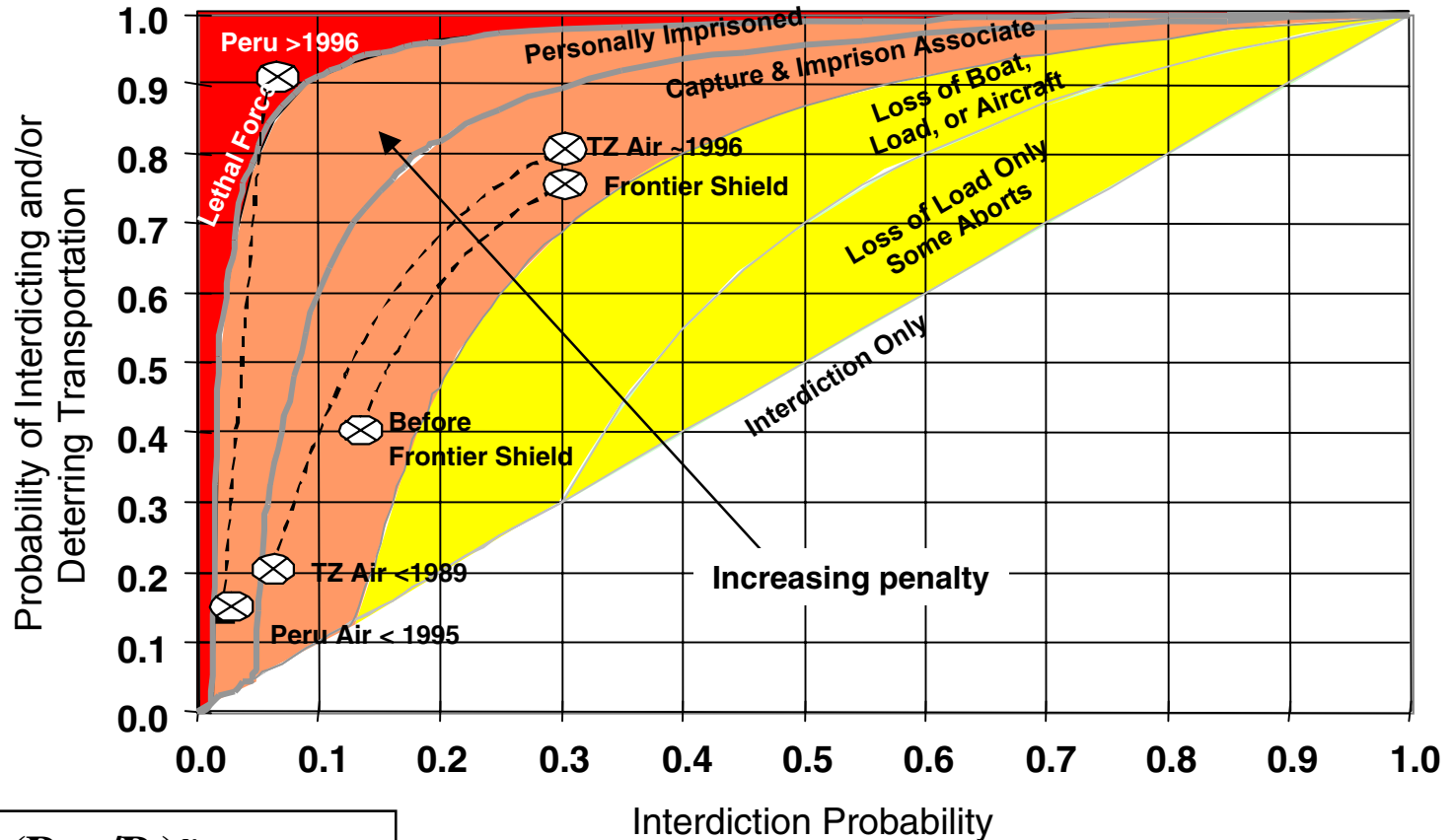
$$P_t = 1 - (1 - P_I) \cdot W(P_I)$$

Probability of thwarting action

Probability of not being Interdicted

Willingness to take risky action

Increasing Deterrence



$$W(P_I) = (P_{\min}/P_I)^\alpha$$

{ $\alpha = 1.03 \pm 0.07$ }

Relevant to fisheries enforcement?

Increasing Risk to Smuggler



Meetings and Discussions That Informed This Study

- **USCG fisheries enforcement personnel**

- Districts 1 (Boston), 5 (Portsmouth), 11 (Alameda), 13 (Seattle), 14 (Herndon and Alameda), and 17 (Kodiak including Air Station Kodiak)
- Visited *Morgenthau* (WHEC 722, Alameda), *Storis* (WMEC 38, Kodiak) and *Monomoy* (WPB 1326, Woods Hole)
- Observed CG quarterly planning and assessment meeting (Herndon), LMR Enforcement Course (NEFTC, Air Station Cape Cod), and North Pacific Anadromous Fish Commission meeting (Kodiak)
- Intelligence support at PACAREA (Alameda) and District 1 (Boston)

- **NOAA/NMFS personnel**

- Enforcement personnel from Juneau and Woods Hole
- Scientists from Alaska Fisheries Science Center (Seattle) and NE Fisheries Science Center (Woods Hole)
- NOAA General Counsel's office

- **Foreign fisheries enforcement representatives**

- Canadian Dept. of Fisheries and Oceans
- Russian Far East Border Patrol
- New Zealand Ministry of Fisheries

- **Academics and industry representatives**

- University of Rhode Island (Dept. of Environmental and Natural Resource Economics), University of Washington (School of Marine Affairs), University of California at Santa Cruz (Dept. of Environmental Studies)
- Groundfish Forum Inc. and Alaskan Dragger's Association



Databases That Were Obtained/Developed For This Study

- **Living Marine Resource (LMR) enforcement weekly summaries**
- **Fishing activity**
- **U.S./Russian Maritime Boundary Line (MBL) 1997/8 case study data**
- **TED case study data**
- **Enforcement Management Information System (EMIS) queries**

Analysis of Coast Guard LMR Enforcement Activities: Methodology

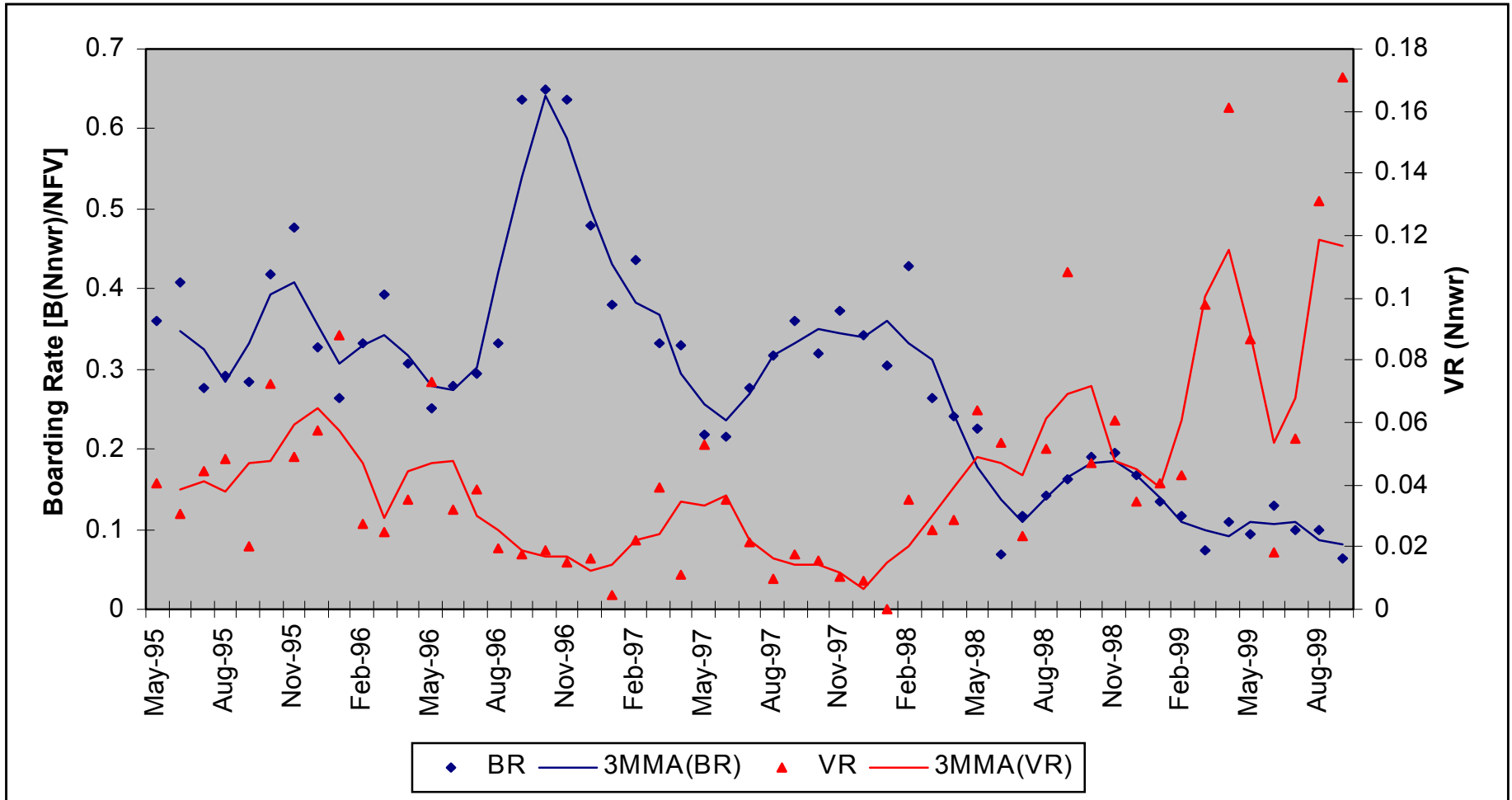


- **LMR enforcement weekly summaries**
 - Focussed on Districts 1, 5, 7, 8, and 17
 - Monthly, bimonthly, quarterly resolutions were examined
 - Coast Guard activities
 - » Ship days, air hours (fixed-wing and rotary-wing), boardings
 - Significant violations
 - » Violation rate (VR) = violations (detected) / boardings
 - » Observed compliance rate (CR = 1-VR)
- **Fishing activity**
 - Estimated number of fishing vessels and vessel fishing days (D1)
 - Estimated landings (D1, D5, D7, D8, and D17) and value of landings (D5, D7, and D8)
- **Boarding rate surrogates - number of boardings per:**
 - Fishing vessels
 - Vessel fishing days
 - Estimated landings and estimated value of landings

Create indices and look for correlation.



Violation Rate and Coast Guard Effort: District 1





Violation Rate and Boarding Rate: District 1

Figure 1. Significant Violation Rate and Boarding Rate: District 1, Monthly

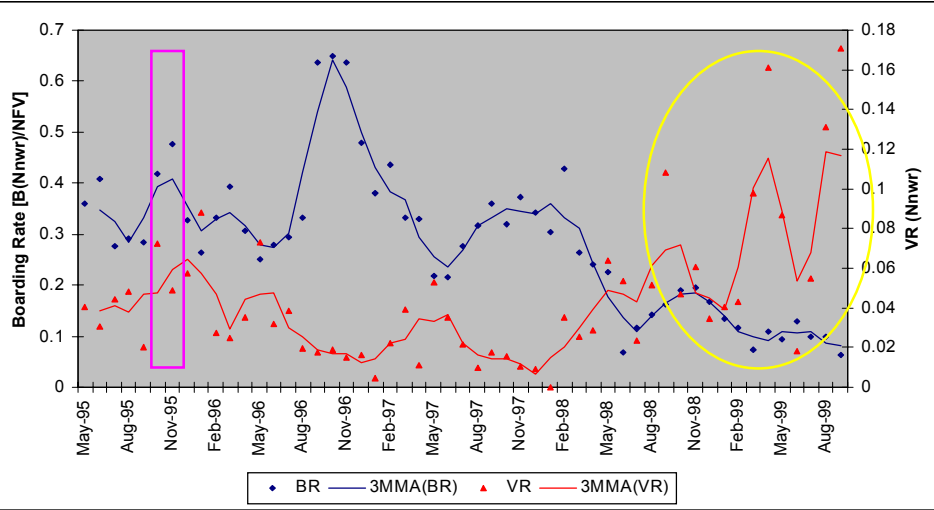


Figure 2. Significant Violation Rate and Rotary-Wing Hours: District 1, Monthly

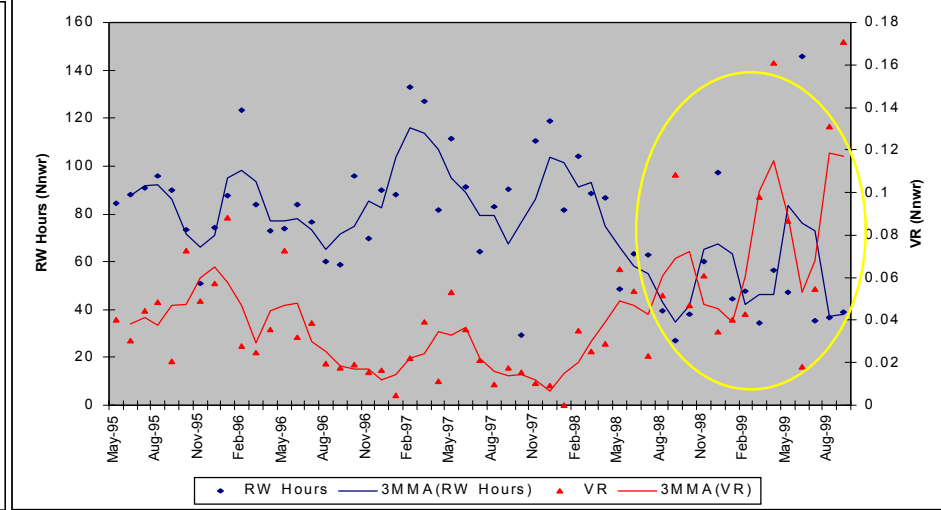


Figure 4. Scatter Plot of VR and BR: District 1, Quarterly Minus Outlier $\{\alpha = 0.97 \pm 0.15\}$

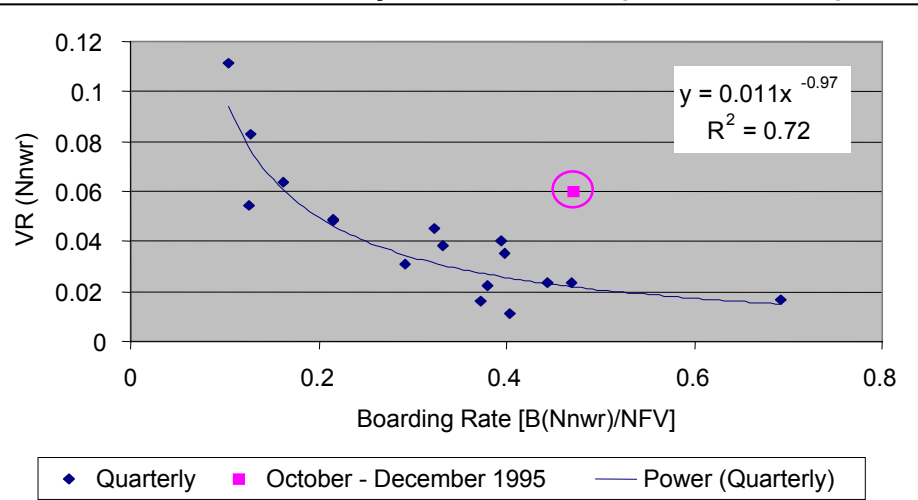
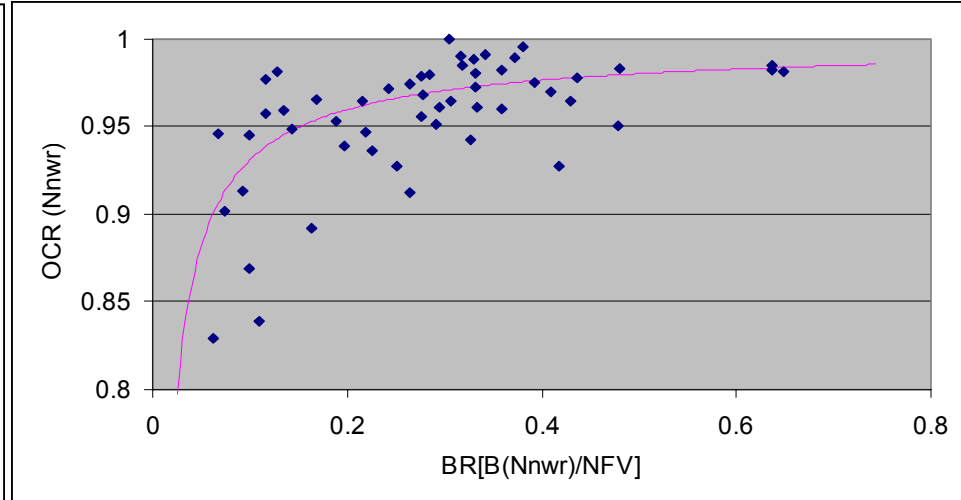


Figure 3. Scatter Plot of Observed Compliance Rate and BR: District 1, Monthly





Violation Rate and Coast Guard Effort: District 7

Figure 1. Significant Violation Rate and BR2: District 7, Monthly

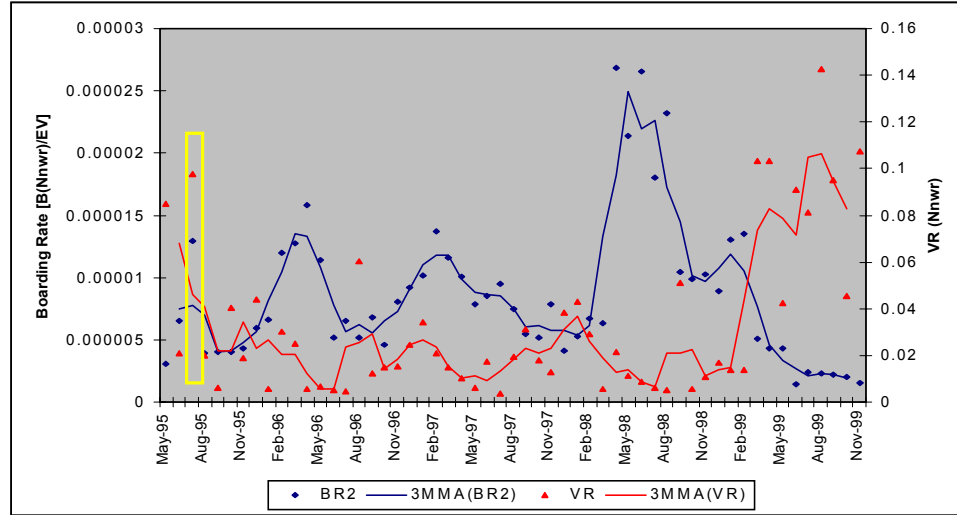


Figure 2. VR versus BR2: District 7, Bimonthly { $\alpha = 0.95 \pm 0.16$ }

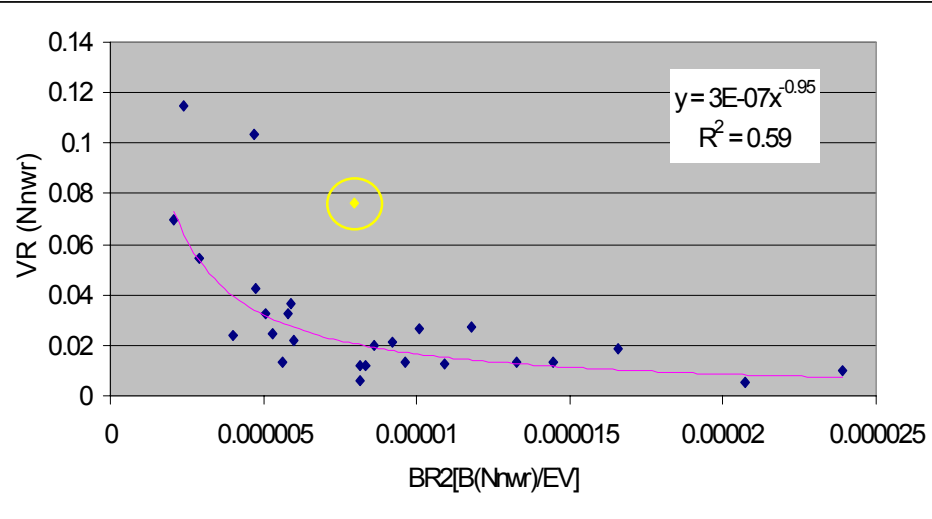
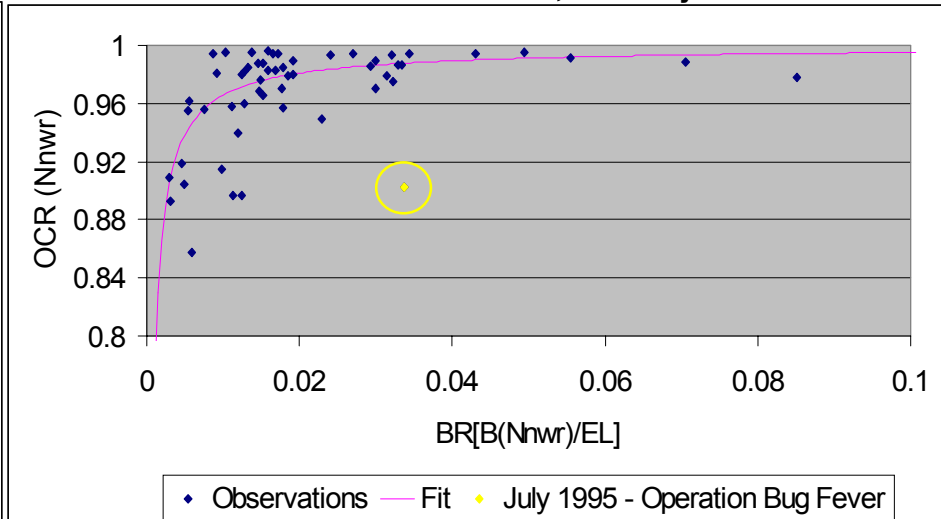


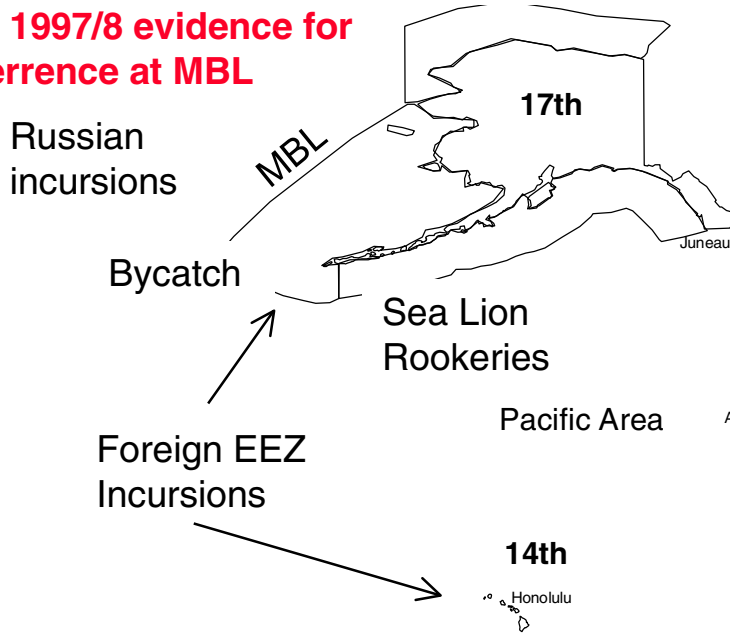
Figure 3. OCR versus BR: District 7, Monthly





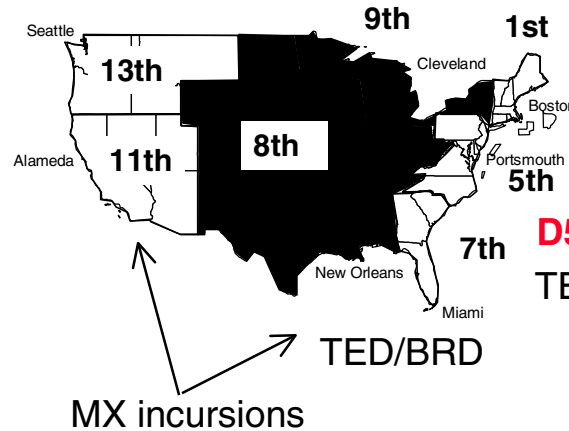
LMR Deterrence: Some Research Results

D17: 1997/8 evidence for deterrence at MBL



D1: Boardings and boarding rate (and helicopter hours) yield evidence,

D1: Penalties alone appear too low



Closed Areas

D5: Marginal evidence TED/BRD

D7: Boarding rate yields evidence

D8: Marginal evidence overall/little evidence of effect of Coast Guard activity on turtle strandings



LMR Enforcement Options: New, Continuing, and Revised Actions

- **Tactics**
 - Pulse operations
 - Unpredictable at-sea presence (helicopters / vertical insertion)
 - Increase LMR enforcement experience (in some Districts)
- **Coordination (CG, NMFS, States, industry, foreign enforcement)**
 - FMC guidance
 - Industry partners (yearly surveys and increased observer programs)
 - Intell cells / develop intell reporting (and analysis) system
 - Individual quota enforcement issues
 - Increase joint NMFS/CG operations
- **Technology**
 - FLIR, VMS, improved communications, tilt-rotor, UAVs
- **Near-term analytical efforts**



Begin Backups

Additional background, analyses, and discussion is available in [IDA Document D-2381](#), “ Fisheries Law Enforcement: Assessment of Deterrence”
Steve Warner, Barry Crane, Melissa Kuchma
December 1999.