

**Valuing Restoration across
Cultures:
Successful Restoration of Species
of Seagrass in Florida, Texas,
Jamaica, and the Phillipines.**

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Cross cultural restoration

- Different cultures
- Different laws
- Different ecosystems
- Different government policies
- Different fisheries
- Different results

All have Loss of seagrasses Same Problems

- Sewage
- Dredge and Fill for land. channels
- Accidental Spills from industry and infrastructure (Oil, mining,
- Riverine output (soil, dissolved organics, heavy metals, lowering water clarity)
- Other pollutants (mining, power plants,

Seagrass usefulness+ fisheries

- Place of Attachment of egg cases+ epizooants
- Apartment house for juveniles
- Stabilizes sediment + feeds sediment browsers
- Direct food (parrot fish,etc), and indirect (detritus and dissolved) ecosystem nutrition
- carbon sequestration
- Restore the seagrass , the fish & invetebrates return

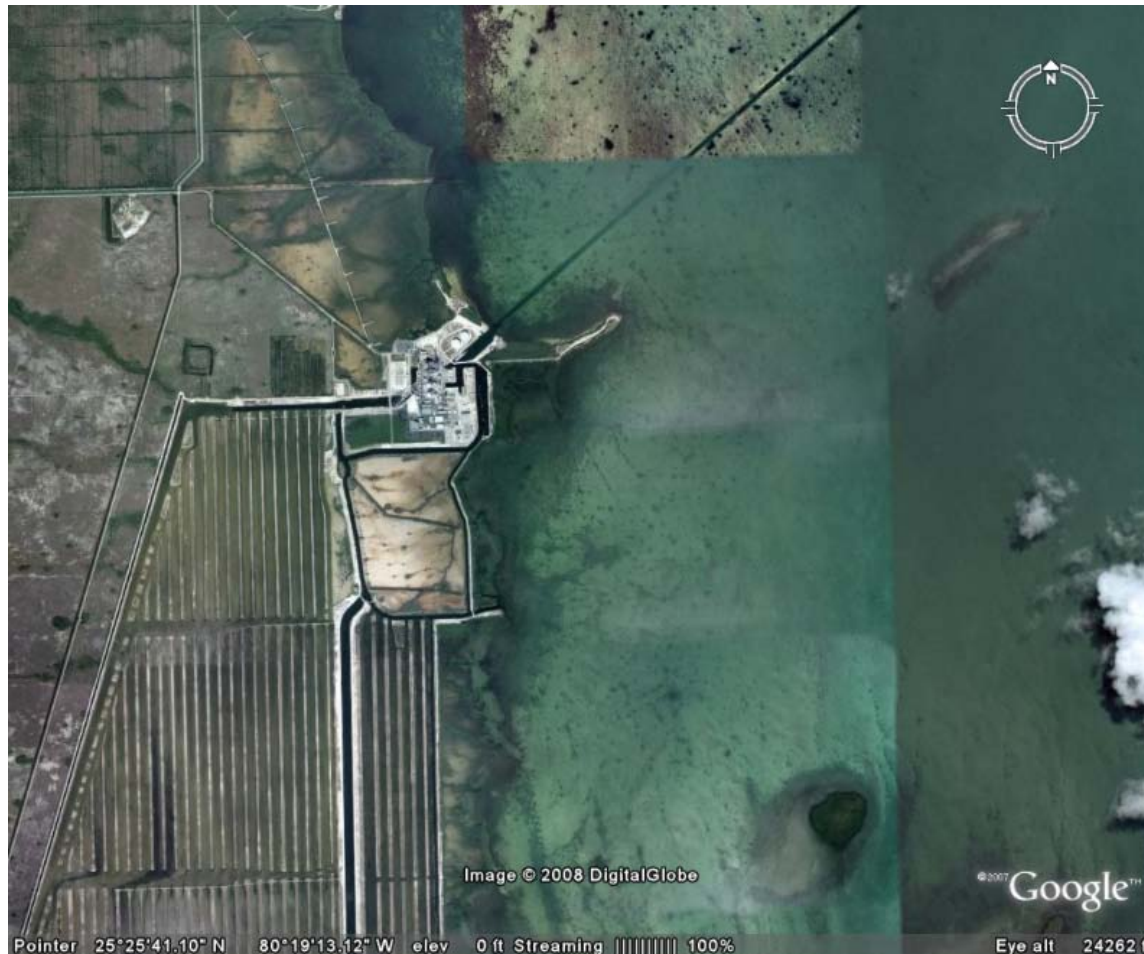
History

- Effort to restore at Turkey Point Nuclear Plant
- **1st large scale seagrass restoration**
- Resulted in **Future of Biscayne Bay** by Thorhaug (1976) wherein I organized all parties to come together to restore the northern areas wherein half had been lost to dredge, fill, sewage.

Results of 7 major and 21 test plots (Thorhaug, 1974, 1976, 1979, 1985, 1987).

- *Halodule* planted best by plug. In calm areas did not differ from turion.
- *Thalassia and Halodule* superior results in most locations
- The test plots (Thorhaug, 1983,1985) ranged from 0 to 100% viability after 3 mo & after 1 yr. 1st set 15-50%, 2nd set 1-100% in 1975, 1979,1980, 2000.
- 7 large plantings all greater than 68%, some 92%. First (TP) was 80%. **Many expanded substantially** (doubled or greater, Years. THORHAUG 1973,1978,1981,1983, 1985, 2000, 2004)

Turkey point 6 years after restoring closed effluent (1972-3).



Restoration of seagrass attracts animal community post-restoration

(McLaughlin, Thorhaug, & *Treat* 1983)

- invertebrate and fish not statistically different from controls (unpolluted bay area) 4 y post-restoration quantitative study of control , restored non-restored.
- Density of animals not statistically different in the mixed *Halodule wrightii* + *Thalassia testudinum* bed from non-polluted controls.
- The pink shrimp particularly abundant.
- Control areas in former plume, **not restored** were statistically different from restored area.

Biscayne Bay



Image NASA
Image © 2008 DigitalGlobe

ter 25°46'36.92" N 80°08'30.35" W elev 3 ft Streaming ||||| 100%

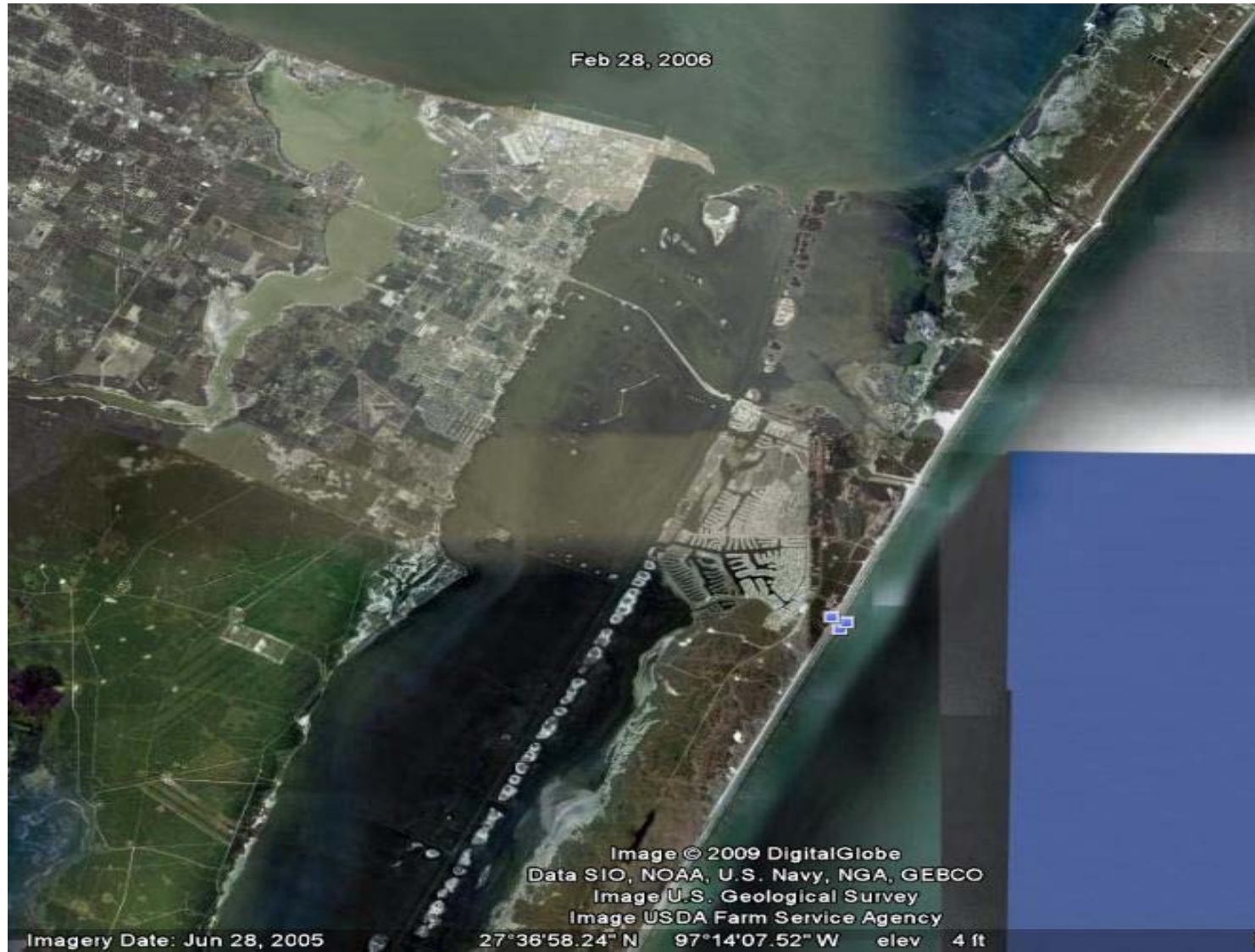
Biscayne Bay



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Laguna Madre



US Army Corps Scape down



Restoration of 78 acres.



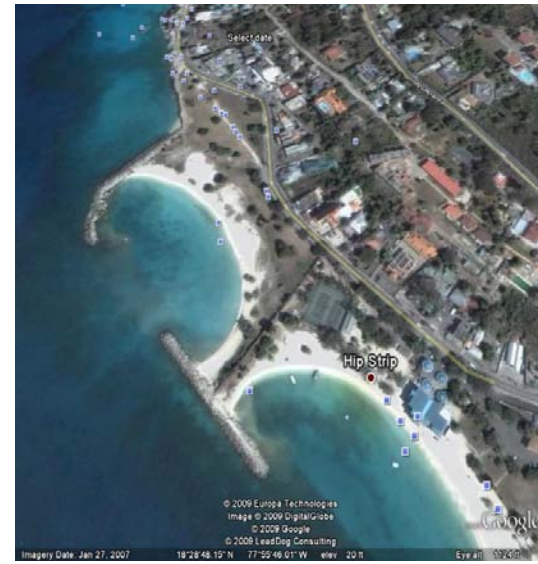
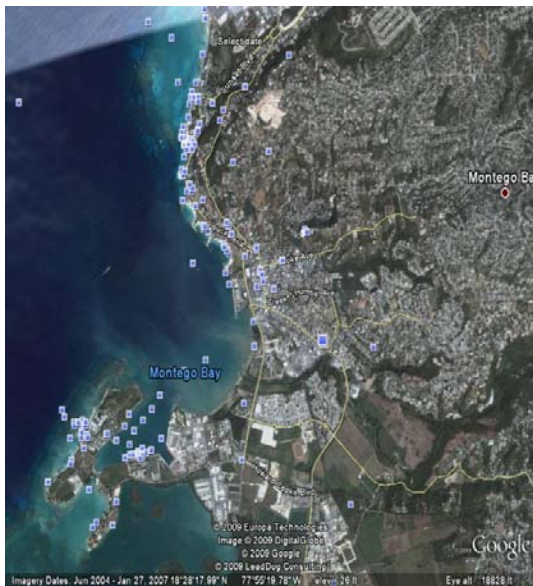
Laguna Madre results 78 acres

- **Site 1 Scrape down. 14.7 acres , expanding into another 1.3 acres. 85.6% survival. 1.5 y full density. 4 m coalescence. (71150 plugs)**
- **Site 2 CCOG. 26 ac 78% pre-hurricane. Part filled blown by major hurricane so resulted into very low in exact area of fill. Non-filled areas high and grew well. (130,000 plugs)**
- **Site 3 Canal. 35 acres. 3 parts shallow S end 80%, N. End (shallow and med. Depth 78%, deep 1.8m 63%). (175000)**

Jamaica . 19 pollutant sites. Govt chose sites. Govt+Univ. worked with us



Large scale sites Jamaica



Philippines. Govt. chose pollutants. UN Project with model for SE Asia



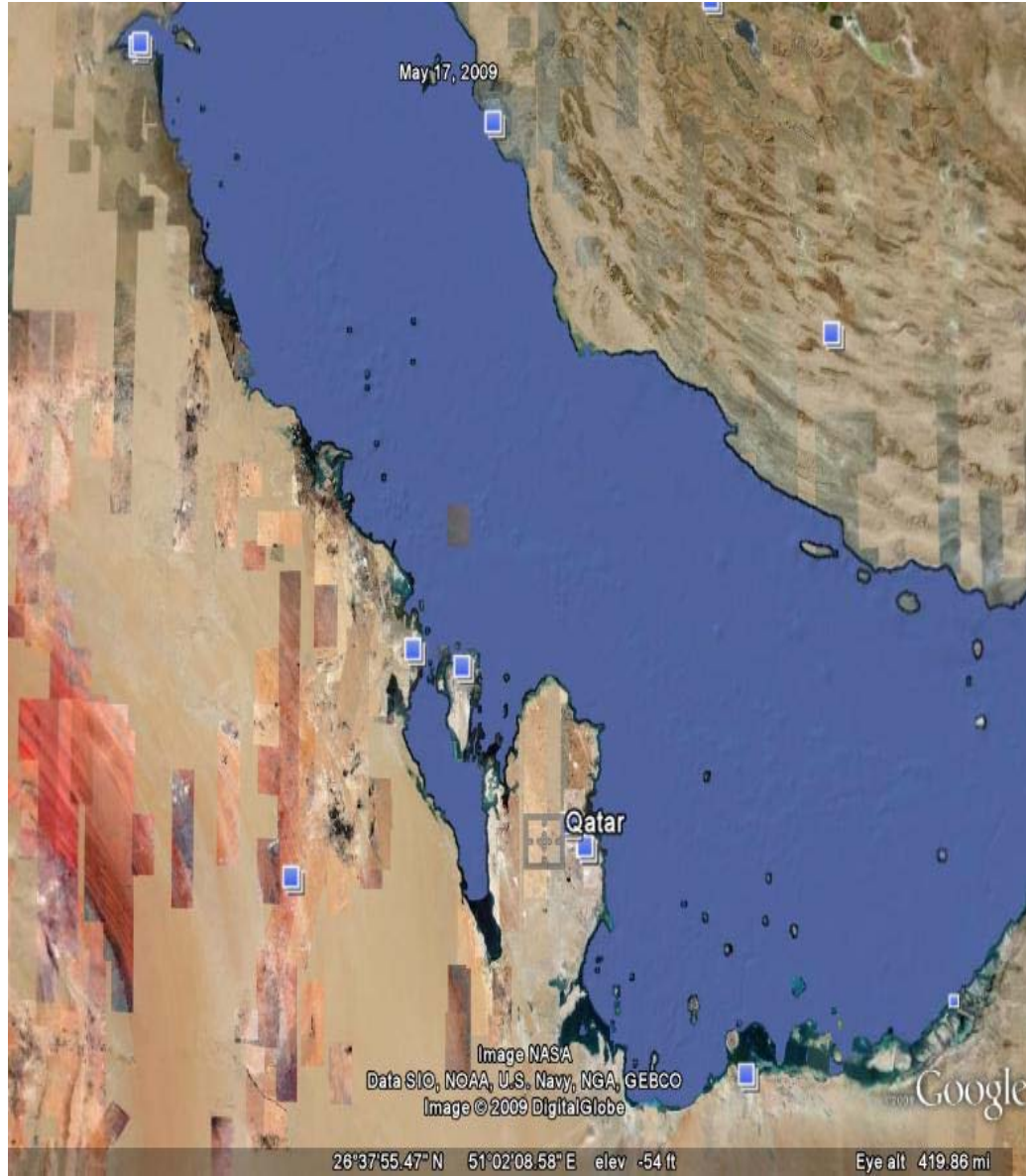
Kenya . Parlimentary democracy



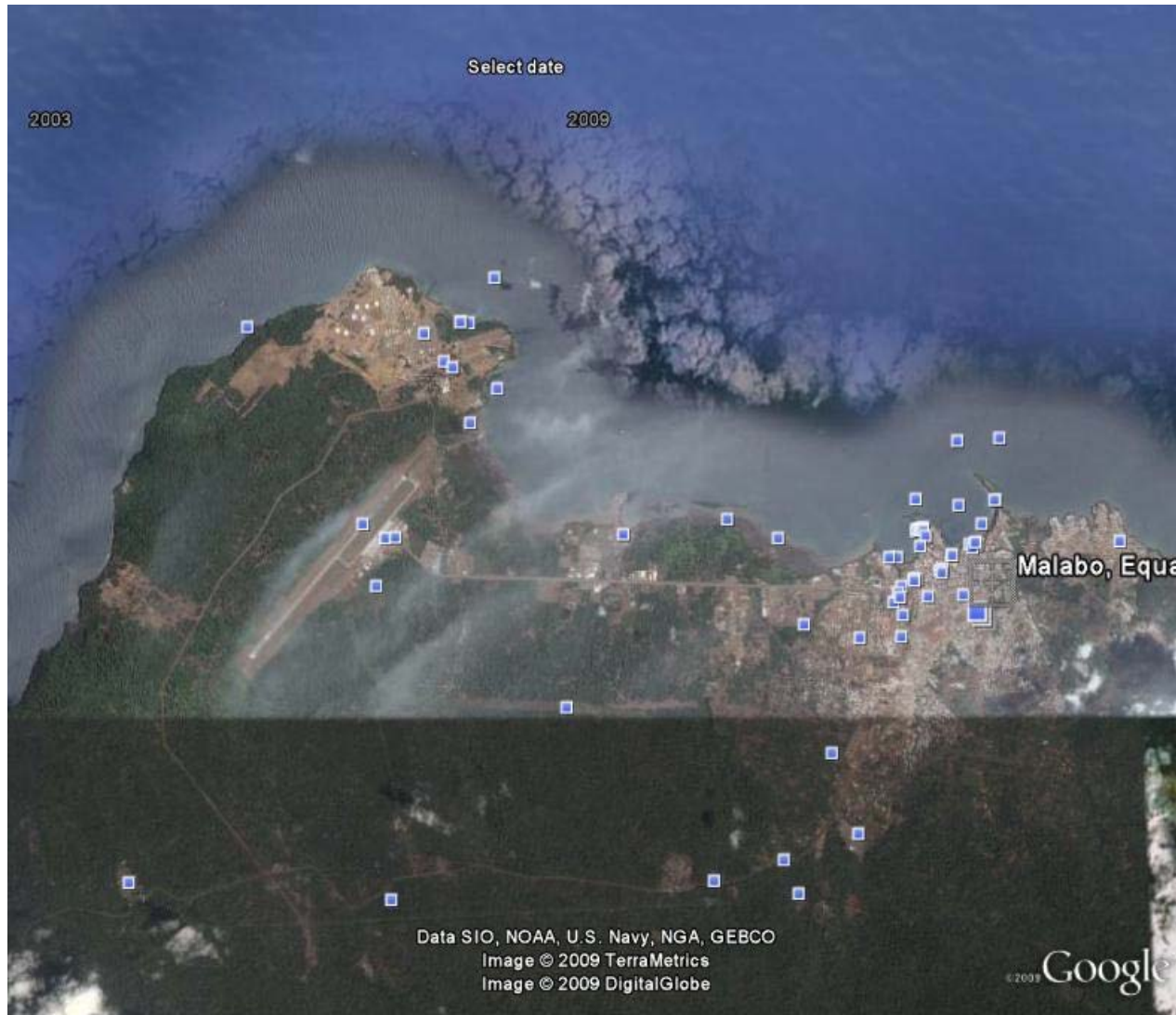
Kenya. World Bank-UN Project



Arabian Gulf . Oil spill damage. Gulf War I.



Equatorial Guinea



What did the cultures value?

- 1.) USA: No net habitat loss. Replacement for lost habitat. “Takings of habitat with like-kind”
- 2.) Jamaica : Fish and employment for fisheries. Water clarity for Tourism.
- 3.) Philippines: Fish protein supplies, fisheries jobs, secondarily sustaining their marine environment, UNEP sustainability.
- 4.) Arabian Gulf: Sustaining environment as UN and FAO would mandate.
- 5.) Kenya, Equatorial Guinea: World Bank Rules abided by. Kenya: sustain habitat for tourism
- 6.) Equatorial Guinea . World Bank Rules

Types of Legal Systems

- USA : Constitutional Democracy (320 Million)
- Jamaica: Constitutional parliamentary democracy(2.9 million)
- Philippines: Republic democracy. (89 million)
- Arabian Gulf. Monarchies and assemblies of Monarchies +Iranian People's Republic (50 million all nations)
- Kenya: Parliamentary democracy (39 million)
- Equatorial Guinea: multiparty constitutional Republic (0.5 million)

Roles of restoration scientists

- 1.) USA: medium-many layers of bureaucracy above restoration scientists.
- 2.) Jamaica: Strong . Could speak directly to Prime Minister and Ministers.
- 3.) Philippines: strong into President and Ministers directly.
- 4.) Arabian Gulf. Weak. Only advisory.
- 5.) Kenya. Relatively weak within power structure except the Leakeys.
- 6.) Equatorial Guinea . Weak only weak advisory.

Cairn's (1980) Scale of restoration

- 1.) Anti-Inertia (Viability of organisms in stable ecosystems, redundancy, proximity to thresholds, .)
- 2.) Resiliency (overall recovery rate, of preturbed , natural , unrestored species)
- 3.) Elasticity (existence of epicenters:dissemules, habitat regional management)
- 4.) Regulatory framework level of governance control over environment
- 5.) Political Will
- 6.) Project results.

What did the data tell us per pollutant ? Halodule

site	Con-trol	Dre-dge	sew-er	Hi-eng	Dep-th	Low-sal	ther-mal	Min-tail	
BB	100	96	77-88	26		26	83	np	
LM	97	81-100	100	70	33(1.6)	53	np	np	
Jam	96	96	94	61	65	38	52	58	
Phil	94	84-96	38	22	np	30	74	84	

	fish cath	fish men	Pop Mil.	dem ocr	co	polic y	inco me
BB				10	10	10	
LM				10	10	10	
Jam	9.5M T	2000 0	2.5M	10	10	7	40M
Phil	2400	2 M	81M	10	10+	7	1.8B
a.gul	2800 M	155 000	50M	1	2	3	\$400 M
keny a	200 MT		39M	5	4	3	90 M\$