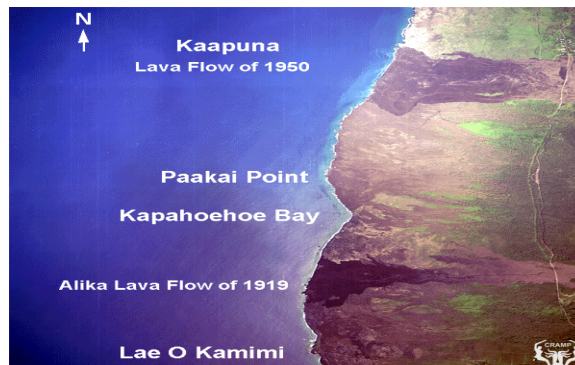


Kaapuna, Hawaii

19° 16.198' N 155° 53.626' W

Management Status: Open Access

Area Description: Residential ranching and farming. Recent lava flow (1950's). Coastline low basaltic cliffs, headlands and boulder/black sand beaches. Complex benthic topography consisting of wave-rounded boulders, cobble, basaltic sand channels, basalt pavement, lava tubes, large basal blocks, ledges, and arches. Intertidal dominated by coralline algae, subtidal basalt outcrops and boulders with low coral cover and uncolonized channels. Southern site exposed to south swell and Kona storm waves.



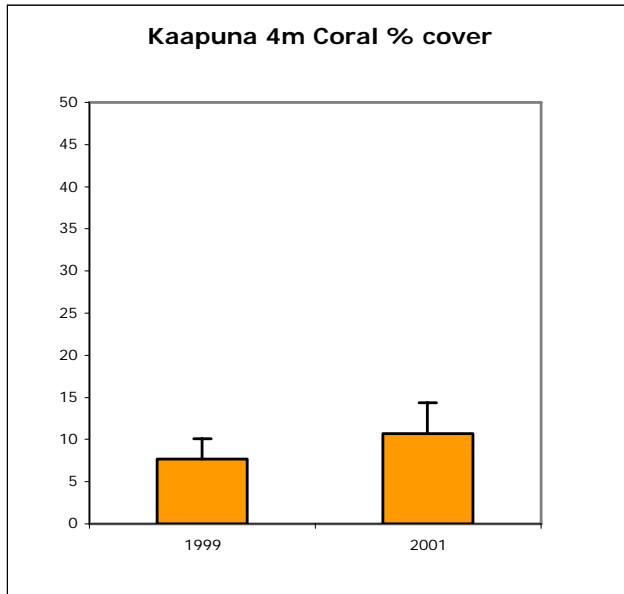
Inshore waters at times turbid. Light use for diving and fishing. Selected for study of benthic successional patterns.

Benthic Habitat Data: 4 m

| | Depth (m) | Rugosity | Sediment Composition (% wt.) | | Sediment Grain Size (% wt.) | | | |
|------|-----------|----------|------------------------------|--------------------------------|-----------------------------|--------|------|------|
| | | | LOI | H ₂ CO ₃ | Gravel | Coarse | Fine | Silt |
| Mean | 4 | 1.46 | 0.18 | 0.15 | 95.90 | 3.09 | 0.80 | 0.21 |
| S.D. | | 0.16 | 0.14 | 0.47 | 4.09 | 2.97 | 0.99 | 0.13 |

Video Transect data (4 m):

| % Cover: Species | 1999 | | 2001 | |
|-------------------------------|-------------|-----|-------------|-----|
| | Mean | SD | Mean | SD |
| <i>Cyphastrea ocellina</i> | 0 | 0 | 0 | 0 |
| <i>Fungia scutaria</i> | 0 | 0 | 0 | 0 |
| <i>Leptastrea purpurea</i> | 0 | 0 | 0.1 | 0.2 |
| <i>Montipora flabellata</i> | 0.1 | 0.2 | 0 | 0 |
| <i>Montipora patula</i> | 0 | 0 | 0.1 | 0.2 |
| <i>Montipora studeri</i> | 0 | 0 | 0 | 0 |
| <i>Montipora verrucosa</i> | 0.2 | 0.3 | 0.4 | 0.5 |
| <i>Pavona duerdeni</i> | 0 | 0 | 0 | 0 |
| <i>Pavona maldivensis</i> | 0 | 0 | 0 | 0 |
| <i>Pavona varians</i> | 0.1 | 0.2 | 0 | 0 |
| <i>Pocillopora damicornis</i> | 0 | 0 | 0 | 0 |
| <i>Pocillopora eydouxi</i> | 0 | 0 | 0 | 0 |
| <i>Pocillopora ligulata</i> | 0 | 0 | 0 | 0 |
| <i>Pocillopora meandrina</i> | 4.7 | 3.5 | 6.8 | 5.1 |
| <i>Porites brighami</i> | 0 | 0 | 0 | 0 |
| <i>Porites compressa</i> | 0 | 0 | 0.0 | 0.0 |
| <i>Porites evermanni</i> | 0 | 0 | 0 | 0 |
| <i>Porites lichen</i> | 0 | 0 | 0 | 0 |
| <i>Porites lobata</i> | 2.7 | 2.4 | 3.2 | 2.6 |
| <i>Porites rus</i> | 0 | 0 | 0 | 0 |
| <i>Psammocora nierstraszi</i> | 0 | 0 | 0 | 0 |
| Unknown Coral | 0 | 0 | 0 | 0 |
| Total Coral | 7.7 | 5.8 | 10.7 | 7.7 |
| Species Richness: | 5 | | 6 | |
| Species Diversity: | 0.85 | | 0.88 | |
| Macroalgae | 0 | 0 | 0.1 | 0.1 |



Photoquadrat Data (4 m): Photo analysis pending

Findings: Low coral cover dominated by *P. meandrina* and *P. lobata* expected for an exposed, wave impacted environment. Low species richness and diversity typical of heavily disturbed Hawaiian coral reef habitat. No statistically detectable change in coral cover over three year survey period. Initial coral cover rank is 50 among 60 reefs. Low macroalgae coverage. High percentage of crustose coralline algae and turf algae. Low percentage of fine sediments. Sediment composition dominated by basalt. No rare or unusual species observed.

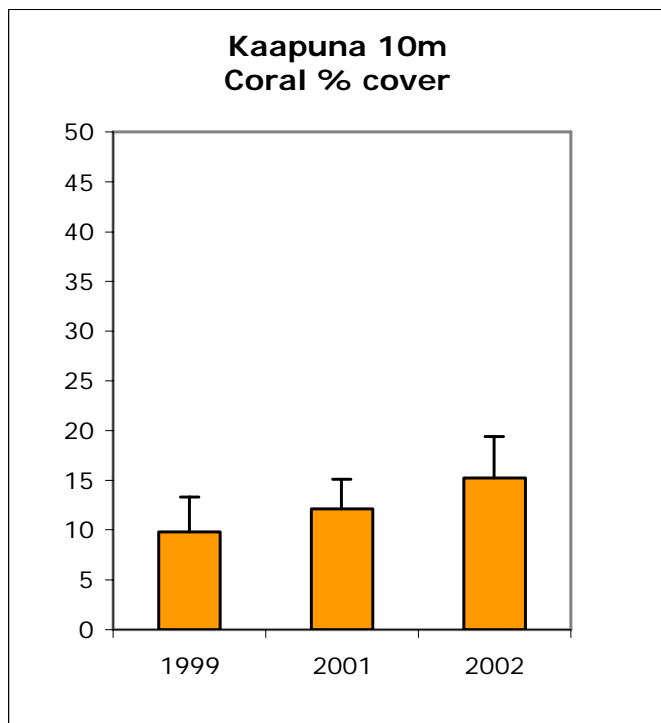
Kaapuna, Hawaii

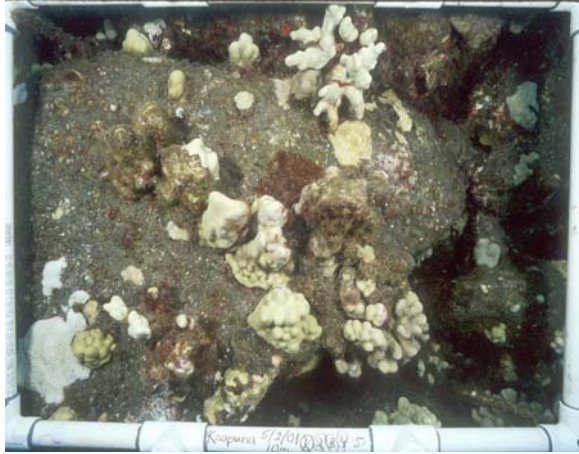
Benthic Habitat Data: 10 m

| | Depth (m) | Rugosity | Sediment Composition (% wt.) | | Sediment Grain Size (% wt.) | | | |
|------|-----------|----------|------------------------------|--------------------------------|-----------------------------|--------|------|------|
| | | | LOI | H ₂ CO ₃ | Gravel | Coarse | Fine | Silt |
| Mean | 10 | 1.68 | 0.31 | 1.09 | 66.64 | 27.22 | 5.81 | 0.33 |
| S.D. | | 0.17 | 0.03 | 0.01 | 4.60 | 4.47 | 0.19 | 0.06 |

Video Transect data (10 m):

| Species | % Cover: | | 1999 | | 2001 | | 2002 | |
|-------------------------------|-------------|------------|-------------|----------|-------------|------------|-------------|------------|
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| <i>Cyphastrea ocellina</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Fungia scutaria</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Leptastrea purpurea</i> | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Montipora flabellata</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Montipora patula</i> | 0.4 | 0.6 | 0.5 | 0 | 0.2 | 0.4 | 0.4 | 0.4 |
| <i>Montipora studeri</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Montipora verrucosa</i> | 1.2 | 1 | 2.8 | 2 | 3.2 | 2 | 3.2 | 2 |
| <i>Pavona duerdeni</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Pavona maldivensis</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Pavona varians</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Pocillopora damicornis</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Pocillopora eydouxi</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Pocillopora ligulata</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Pocillopora meandrina</i> | 2.5 | 1.5 | 2.3 | 2 | 4.9 | 5.2 | 4.9 | 5.2 |
| <i>Porites brighami</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Porites compressa</i> | 0 | 0.1 | 0.1 | 0 | 0.4 | 1.1 | 0.4 | 1.1 |
| <i>Porites evermanni</i> | 0 | 0 | 0 | 0 | 0.2 | 0.5 | 0.2 | 0.5 |
| <i>Porites lichen</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Porites lobata</i> | 5.7 | 4.6 | 6.5 | 4 | 6.2 | 4 | 6.2 | 4 |
| <i>Porites rus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Psammocora nierstraszi</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unknown Coral | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Coral | 9.8 | 6.9 | 12.1 | 6 | 15.2 | 8.4 | 15.2 | 8.4 |
| Species Richness: | 6 | | 5 | | 6 | | 6 | |
| Species Diversity: | 1.09 | | 1.15 | | | | | |
| Macroalgae | 0.3 | 0.6 | 0 | 0 | 0.1 | 0.1 | 0.1 | 0.1 |





Photoquadrat Data (10 m): Photo analysis pending

Findings: Low coral cover dominated by *P. lobata*, *P. meandrina* and *M. capitata*. No statistically detectable change in coral cover over three year survey period. Initial coral cover rank is 46 among 60 reefs. Low macroalgae coverage. High percentage of crustose coralline algae and turf algae. Low percentage of fine sediments. Sediment composition dominated by basalt. No rare or unusual species observed.

Kaapuna, Hawaii

Fish Data: 4 and 10 m

| | Density (#/125m ²) | | | | Biomass (g/125m ²) | | | |
|----------------------------------|--------------------------------|------|------|------|--------------------------------|--------|--------|--------|
| | 4 m | | 10 m | | 4 m | | 10 m | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| <i>Acanthurus achilles</i> | | | 0.5 | 1.0 | | | 9.3 | 18.7 |
| <i>Abudefduf abdominalis</i> | 3.5 | 4.7 | | | 216.5 | 311.6 | | |
| <i>Acanthurus achilles</i> | 1.0 | 1.2 | | | 64.2 | 87.8 | | |
| <i>Acanthurus blochii</i> | 1.5 | 1.9 | 1.0 | 2.0 | 166.3 | 216.6 | 98.0 | 196.0 |
| <i>Acanthurus dussumieri</i> | 2.5 | 1.9 | 2.0 | 2.3 | 342.0 | 254.2 | 314.1 | 382.3 |
| <i>Acanthurus leucopareius</i> | 156.5 | 56.8 | 15.0 | 6.6 | 17534.0 | 6758.3 | 1704.3 | 737.0 |
| <i>Acanthurus nigricans</i> | 0.5 | 1.0 | | | 17.2 | 34.4 | | |
| <i>Acanthurus nigrofuscus</i> | 8.0 | 5.7 | 15.0 | 12.3 | 251.5 | 171.8 | 695.0 | 648.9 |
| <i>Acanthurus nigroris</i> | 0.5 | 1.0 | 6.0 | 12.0 | 19.3 | 38.5 | 382.8 | 765.7 |
| <i>Acanthurus olivaceus</i> | 1.0 | 1.2 | 1.0 | 1.2 | 156.1 | 180.2 | 223.9 | 259.7 |
| <i>Acanthurus triostegus</i> | 0.5 | 1.0 | | | 14.1 | 28.1 | | |
| <i>Anampses cuvier</i> | 1.0 | 1.2 | | | 211.6 | 331.7 | | |
| <i>Aphareus furca</i> | | | 0.5 | 1.0 | | | 16.7 | 33.4 |
| <i>Arothron meleagris</i> | | | 0.5 | 1.0 | | | 105.8 | 211.6 |
| <i>Canthigaster amboinensis</i> | 0.5 | 1.0 | | | 18.1 | 36.2 | | |
| <i>Canthigaster coronata</i> | | | 1.0 | 2.0 | | | 28.5 | 56.9 |
| <i>Canthigaster jactator</i> | 1.0 | 1.2 | 6.5 | 4.1 | 7.3 | 8.4 | 43.2 | 28.6 |
| <i>Caranx melampygus</i> | 0.5 | 1.0 | | | 111.3 | 222.6 | | |
| <i>Cephalopholis argus</i> | 0.5 | 1.0 | 1.0 | 1.2 | 59.4 | 118.7 | 221.7 | 323.2 |
| <i>Chaetodon lunula</i> | 1.0 | 2.0 | 2.5 | 5.0 | 61.4 | 122.9 | 124.0 | 247.9 |
| <i>Chaetodon multicinctus</i> | 3.0 | 3.8 | 3.5 | 4.7 | 83.7 | 111.0 | 102.5 | 138.4 |
| <i>Chaetodon ornatissimus</i> | 3.0 | 3.8 | 1.0 | 1.2 | 429.2 | 535.5 | 90.9 | 106.3 |
| <i>Chaetodon quadrimaculatus</i> | 2.5 | 3.0 | 2.0 | 2.3 | 166.8 | 193.7 | 136.9 | 160.5 |
| <i>Chromis agilis</i> | | | 12.0 | 9.9 | | | 38.8 | 26.4 |
| <i>Chromis ovalis</i> | 21.5 | 36.6 | 1.0 | 2.0 | 46.2 | 90.3 | 28.8 | 57.7 |
| <i>Chromis vanderbilti</i> | 106.5 | 37.3 | 22.0 | 23.6 | 184.2 | 72.7 | 50.9 | 51.4 |
| <i>Chromis verater</i> | 0.5 | 1.0 | 49.0 | 77.1 | 14.2 | 28.4 | 2251.3 | 3631.0 |

| | | | | | | | | |
|------------------------------------|-----|-----|-----|-----|-------|-------|-------|-------|
| <i>Cirrhitus pinnulatus</i> | 0.5 | 1.0 | | | 55.4 | 110.9 | | |
| <i>Coris gaimard</i> | 1.0 | 1.2 | | | 31.1 | 59.0 | | |
| <i>Ctenochaetus hawaiiensis</i> | 3.0 | 2.6 | | | 582.3 | 527.3 | | |
| <i>Ctenochaetus strigosus</i> | 6.0 | 9.4 | 3.0 | 3.5 | 335.5 | 526.8 | 179.5 | 182.2 |
| <i>Forcipiger flavissimus</i> | 0.5 | 1.0 | 1.0 | 2.0 | 14.9 | 29.7 | 33.5 | 67.0 |
| <i>Forcipiger longirostris</i> | 2.5 | 3.8 | 0.5 | 1.0 | 108.3 | 170.2 | 23.4 | 46.8 |
| <i>Halichoeres ornatissimus</i> | 5.0 | 4.8 | 2.0 | 1.6 | 47.1 | 52.7 | 14.5 | 14.0 |
| <i>Kyphosus bigibbus</i> | | | 0.5 | 1.0 | | | 102.5 | 205.0 |
| <i>Labroides phthirophagus</i> | 1.5 | 1.9 | 1.0 | 1.2 | 2.9 | 4.2 | 2.6 | 3.1 |
| <i>Lutjanus kasmira</i> | 1.0 | 2.0 | | | 71.4 | 142.8 | | |
| <i>Melichthys niger</i> | 1.0 | 1.2 | | | 326.5 | 382.7 | | |
| <i>Melichthys vidua</i> | 1.0 | 1.2 | 0.5 | 1.0 | 182.2 | 221.3 | 166.9 | 333.8 |
| <i>Monotaxis grandoculis</i> | | | 0.5 | 1.0 | | | 232.1 | 464.2 |
| <i>Mulloidichthys vanicolensis</i> | 2.0 | 4.0 | | | 237.9 | 475.8 | | |

Kaapuna, Hawaii Fish Data: 4 and 10 m

| | Density (#/125m ²) | | | | Biomass (g/125m ²) | | | |
|---|--------------------------------|------------|--------------|------------|--------------------------------|--------------|----------------|--------------|
| | 4 m | | 10 m | | 4 m | | 10 m | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| <i>Naso lituratus</i> | 6.5 | 5.3 | 2.0 | 2.8 | 1385.1 | 1195.9 | 419.7 | 614.9 |
| <i>Naso unicornis</i> | 0.5 | 1.0 | 0.5 | 1.0 | 141.4 | 282.8 | 141.4 | 282.8 |
| <i>Ostracion meleagriss</i> | 0.5 | 1.0 | | | 3.1 | 6.2 | | |
| <i>Ostracion whitleyi</i> | | | 0.5 | 1.0 | | | 5.1 | 10.2 |
| <i>Paracirrhites arcatus</i> | 7.5 | 6.6 | 14.0 | 7.8 | 77.9 | 83.8 | 188.9 | 137.9 |
| <i>Paracirrhites forsteri</i> | 1.0 | 1.2 | 0.5 | 1.0 | 51.6 | 79.2 | 41.8 | 83.5 |
| <i>Parupeneus bifasciatus</i> | 0.5 | 1.0 | | | 82.5 | 165.0 | | |
| <i>Parupeneus cyclostomus</i> | | | 1.0 | 2.0 | | | 331.9 | 663.9 |
| <i>Parupeneus multifasciatus</i> | 3.0 | 1.2 | 2.5 | 2.5 | 391.1 | 283.3 | 287.7 | 313.6 |
| <i>Plagiotremus goslinei</i> | 0.5 | 1.0 | | | 0.4 | 0.8 | | |
| <i>Plectroglyphidodon johnstonianus</i> | | | 1.0 | 1.2 | | | 6.2 | 7.1 |
| <i>Pseudocheilinus octotaenia</i> | | | 1.5 | 3.0 | | | 12.7 | 25.3 |
| <i>Pseudocheilinus tetrataenia</i> | | | 2.5 | 3.8 | | | 13.9 | 23.1 |
| <i>Rhinecanthus rectangulus</i> | 1.0 | 2.0 | | | 94.4 | 188.7 | | |
| <i>Scarus rubroviolaceus</i> | 3.0 | 2.6 | 0.5 | 1.0 | 2870.7 | 3979.5 | 391.5 | 783.0 |
| <i>Stegastes fasciolatus</i> | 1.5 | 1.0 | 2.0 | 4.0 | 22.6 | 15.1 | 36.9 | 73.7 |
| <i>Sufflamen bursa</i> | 3.5 | 3.0 | 3.0 | 1.2 | 321.6 | 352.5 | 319.6 | 135.8 |
| <i>Thalassoma ballieui</i> | 0.5 | 1.0 | | | 39.5 | 79.1 | | |
| <i>Thalassoma duperrey</i> | 11.0 | 3.8 | 10.0 | 4.3 | 262.1 | 112.9 | 265.2 | 122.8 |
| <i>Xanthichthys auromarginatus</i> | | | 3.5 | 4.7 | | | 322.3 | 446.3 |
| <i>Zanclus cornutus</i> | 1.0 | 2.0 | 1.0 | 2.0 | 126.2 | 252.4 | 126.2 | 252.4 |
| <i>Zebrosoma flavescens</i> | 6.0 | 4.0 | 6.5 | 3.0 | 611.7 | 444.9 | 701.4 | 335.2 |
| Total/Depth ± Avg SD: | 389.5 | 4.8 | 204.5 | 5.1 | 28652.4 | 403.6 | 11034.5 | 304.6 |
| Species Richness | 50 | | 45 | | | | | |
| Species Diversity | | | | | | | | |

Findings: Among 60 reefs, Kaapuna 4m ranked 4 in species richness, 8 in density, 11 in biomass, and 42 in diversity. Kaapuna 10m ranked 14 in species richness, 32 in density, 36 in biomass, and 8 in diversity.

The most abundant species were the Whitebar surgeonfish (*Acanthurus leucopareius*) and Threespot chromis (*Chromis verater*) at the 3m and 10m reefs respectively. The species with the highest biomass were the Whitebar surgeonfish (*Acanthurus leucopareius*) and the Threespot chromis (*Chromis verater*) at the 3m and 10m reefs respectively. *Ostracion whiteyi* and *Canthigaster coronata* presence notable as these species are not common to surveyed sites.