STATUS OF STREAM CHANNEL MODIFICATION IN HAWAII AND ITS EFFECTS ON NATIVE AQUATIC FAUNA

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A three-year, statewide study was made of the occurrence and consequences of channelization in Hawaiian streams. The 366 perennial streams of the State were inventoried for the first time, and some basic information was catalogued on their physical characteristics, complete status of channel alteration, and macrofaunal communities. Fifteen percent of the State's streams have channels altered in at least one of six forms. There are 151 km of altered channel, 89% of which is on Oahu. Forty percent of the modified channel length is concrete lined--the form of alteration found to be most ecologically damaging.

Field measurements showed that channel alterations commonly caused large changes in environmental parameters. Whereas the average pH value in natural streams was 7.2, the yearly mean mid-afternoon pH in lined channels was as high as 9.9. Conductivity and dissolved oxygen were significantly increased. The range of daily temperatures in lined channels was 17.8 - 36.2°C as compared to 19.5 - 26.8°C in natural channels. The diel insolation cycle of exposed, artificial channels caused extreme diel change in all these environmental parameters. The native species tested in the laboratory had less tolerance of high temperatures than exotics, and some native had upper lethal temperature limits within the temperature range measured in channelized streams.

Twenty-five species of fish and decapod crustaceans were collected statewide, of which only eight were native. Native species were not abundant in most areas intensively surveyed; they appeared to thrive only in areas remote from development. Certain introduced species, notably poeciliid fishes, were abundant in the most heavily channelized sections, whereas native species were almost entirely absent.

Channelization in its various forms (1) increases turbidity; (2) destroys natural substrate habitat; (3) creates wide, shallow, unnatural flows; (4) causes excessive illumination, water temperatures, and pH levels; and (5) creates topographical difficulties for upstream migration. Effects (2) and (4) are believed to create especially serious problems for the native macrofauna that is benthic/demersal, cryptic, and obligately diadromous. As a result, present channelization practices appear to be damaging the quality of extensive stream habitat for native species and contributing to their replacement by hardy, useless exotics.

Mitigation should include (1) minimizing channelization projects; (2) maintaining the natural length of channels; (3) maintaining (replanting) the vegetative canopy; (4) maintaining natural bottom material wherever possible; (5) using intermittent sections of natural bottom between minimum sections where lined channel is unavoidable; (6) building a narrow, low-flow notch into the bottom of flat lined channels; (7) installing minimum length culverts in ways that will avoid downstream elevations above stream level (waterfalls).