BRIEFING PAPER ON CWT's

Gary S. Morishima

April 14, 1986

What are Coded–Wire–Tags (CWT's)?

A CWT is a piece of wire approximately 1 millimeter in length and one–quarter millimeter in diameter (photo 1) which is etched with notches representing a two digit binary code on each of four sides (photo 2). CWT's are used mainly on coho, chinook and steelhead. Pink, sockeye and chum juveniles are generally too small for full sized CWT's when they migrate to sea; half–size CWT's are, however, sometimes used to tag pink and chum salmon. CWT's are placed in the nose cartilage of fish by a tagging machine after the fish have been anaesthesized (photos 3 and 4). CWT's are usually applied to juveniles. The costs of adult tagging are high and results uncertain because of the additional mortality caused by the tagging operation and the difficulty of recovering fish which may return to several locations. Because the tag is not visible to the naked eye, the adipose fin is removed (photo 5) to show that the fish may contain a CWT (not all fish lacking adipose fins are tagged, some are simply born without the fin and some fish do not retain the tags).

How are CWT's used?

The eight digit code on CWT's (six digits are used for the code itself and two digits identify the tagging agency) permits managers to uniquely identify over 260,000 groups of fish. Analysis of CWT recovery data provides information on catch composition, fishery contribution patterns, exploitation rates, survival rates, and hatchery management practices.

Information on tagging agency, the size, species and race of fish tagged, hatchery facility (or river if the fish tagged are wild) producing the fish, release site and date, purpose of the study, and proportion of fish tagged are reported to the Pacific Marine Fisheries Commission for reference on a coastwide basis.

CWT fish are recovered by management agencies according to various time and area strata used for fisheries management, at hatchery facilities and during spawning escapement surveys.

What information of use to the Pacific Salmon Commission do CWT's provide?

CWT's are among the most useful and versatile techniques available for stock assessment. The general types of information that can be obtained from CWT studies include harvest rates, resource status, and interception levels.

The basic principles of the Pacific Salmon Treaty involve the prevention of overfishing, the reduction of interceptions (the harvest by one country of fish originating in the rivers of the other country) and equity (the concept that each country is entitled to catch fish equivalent to the production of fish originating in its river systems).

At this time, CWT's are the only developed and operationally proven method of stock–specific identification for chinook and coho. Stock–specific data for these species are essential to implementation of the Treaty's principles and are critical to the estimation of interception levels and exploitation rates necessary to evaluate chinook and coho management regimes established under the Treaty.

CWT data collected during previous seasons are employed in making stock size projections for the coming season. Recovery data for a given age class of a CWT group are commonly used to predict the abundance of that group in subsequent years.

Lastly, CWT data provide information that can be used to increase the effectiveness and efficiency of investments in hatchery facilities and operations (a matter of particular concern when considering adjustments under the equity principle in a manner that minimizes disruption of existing fisheries). Information on the effects of diet, size, time and location of release upon survival rates and fishery contribution patterns will be important factors in deciding how available resources can best be allocated.

What are typical costs associated with CWT programs?

Tagging Costs: Costs of CWT programs vary depending upon the location and number of sites where fish are to be tagged. Tagging fish with CWT's requires the use of a specially-constructed trailer (current acquisition cost approximately $110,000 with an estimated useful life of ten years), labor, supplies, and travel. On average, a fully scheduled trailer operating at a hatchery facility can be expected to tag 4 million fish per year at a cost of approximately $74/M for fish larger than 200 to the pound and $85/M for fish smaller than 200 to the pound (costs include CWT's, chemicals, personnel and travel). For wild fish, total CWT tagging costs can be expected to range from $600 to $1000 per thousand fish since portable tagging machines are required and trapping costs must be incurred (trapping costs vary widely depending upon the sites and species involved).

CWT Recovery Costs: Costs of recovering and decoding CWT's are part of catch sampling and escapement estimation programs. CWT recovery costs cannot be readily separated.

Is a typical CWT program a one-year or multi-year effort?

The two basic types of CWT studies proposed under the budget request for the Pacific Salmon Treaty are: (a) an indicator stock program to provide data necessary to monitor the effectiveness of management actions on exploitation patterns and escapement response; and (b) a program to determine the degree to which indicator stocks are representative of a particular type of production from a given geographic area. Type (a) studies must be employed on a continuing basis. Type (b) programs usually involve wild stocks (wild stocks are critical to the evaluation of management objectives under the Treaty) and must be conducted for a sufficiently-long time period to determine the minimum number of indicator stocks necessary for monitoring fishery regime impacts.

Can other methodologies provide the same information at less cost?

No. No other proven method is available which can provide the flexibility to tag the number of different groups of fish required for stock composition, distribution, or productivity studies. The CWT program is currently unique in that: (1) the large number of possible tag codes permits replication of experiments to enable scientists to determine the statistical reliability of estimates derived from analysis of recovery data; and (2) a coastwide CWT tag recovery program is operational.

Fin-clipping does not provide the capacity to mark a sufficiently large number of different groups, alters survival and distribution patterns of marked fish, and can suffer from data problems resulting from misidentification of species or fin mark combinations.

For some species, CWT use is limited because of the small size of juveniles at the time of seaward migration (although half-size tags are sometimes used for pink and chum) and difficulties of working with adult fish. For coho and chinook, CWT programs can provide more reliable information at lower costs than adult tagging.

For some species and fisheries, Genetic Stock Identification (GSI) techniques can be employed with sufficient accuracy to separate major stock groupings. GSI is currently not capable of distinguishing between individual stocks for most rivers and species, although preliminary research results indicate that this technique could potentially be practically applied in the future.

Although scale analysis is extensively used for sockeye stock identification purposes, it is currently only capable of discriminating between three broad categories of chinook and coho production (normal and accelerated releases of hatchery fish, and wild fish). Additional research would be required to determine if scale analysis would be capable of discriminating between particular stocks of management concern.

Some research is currently being conducted to determine if chemical marking of scales and otoliths of hatchery-reared fish can be practically implemented. Such techniques could provide a relatively inexpensive means of marking large quantities of fish, permitting managers to distinguish between fish of hatchery and wild origin; however, it is uncertain whether a sufficiently large number of chemical marks could be developed to distinguish between individual stocks and a new system for catch sampling and analysis would be required.

How is CWT data integrated with other data sources?

CWT recovery data are obtained through catch-sampling and escapement assessment programs and voluntary returns (photo 6). Heads of fish with missing adipose fins are recovered in the sampling process and shipped to a laboratory for examination along with information on the location of the recovery and the total number of fish sampled. A core is taken from the head and tested for the presence of a CWT (photo 7). CWT's are extracted and decoded by a technician (photo 8). Data from recoveries are then recorded and analyzed in conjunction with release information and catch statistics to estimate contributions to fisheries, resource status and escapements.

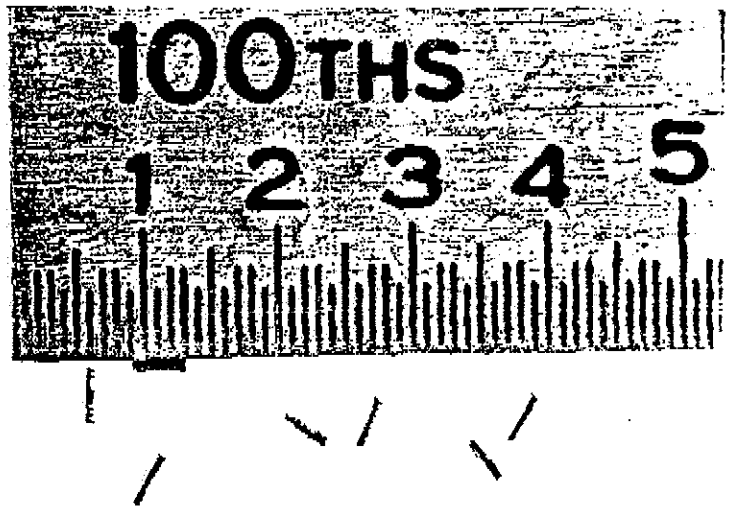

Photo 1: CWT's shown to scale. A CWT is approximately 1 mm in length and .25 mm in diameter.

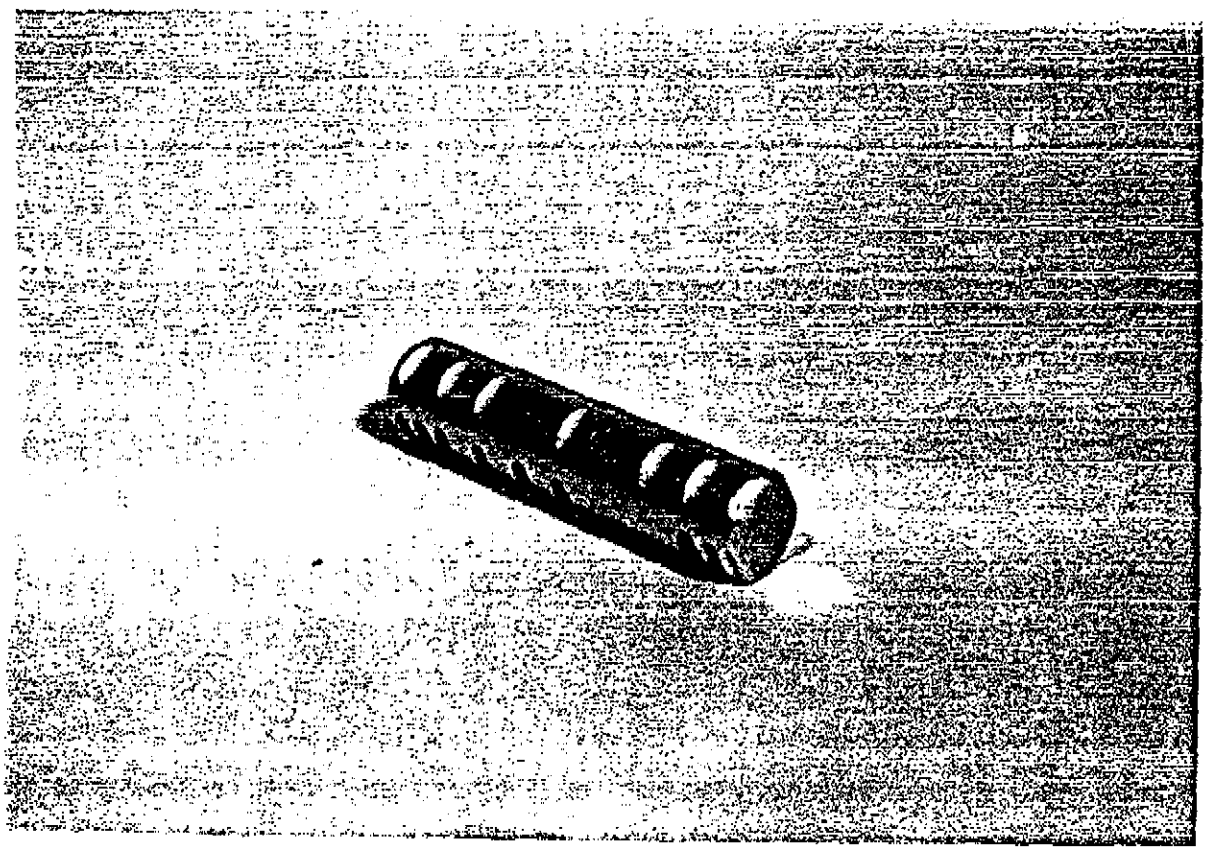

Photo 2: Close-up of a CWT showing etched codes.

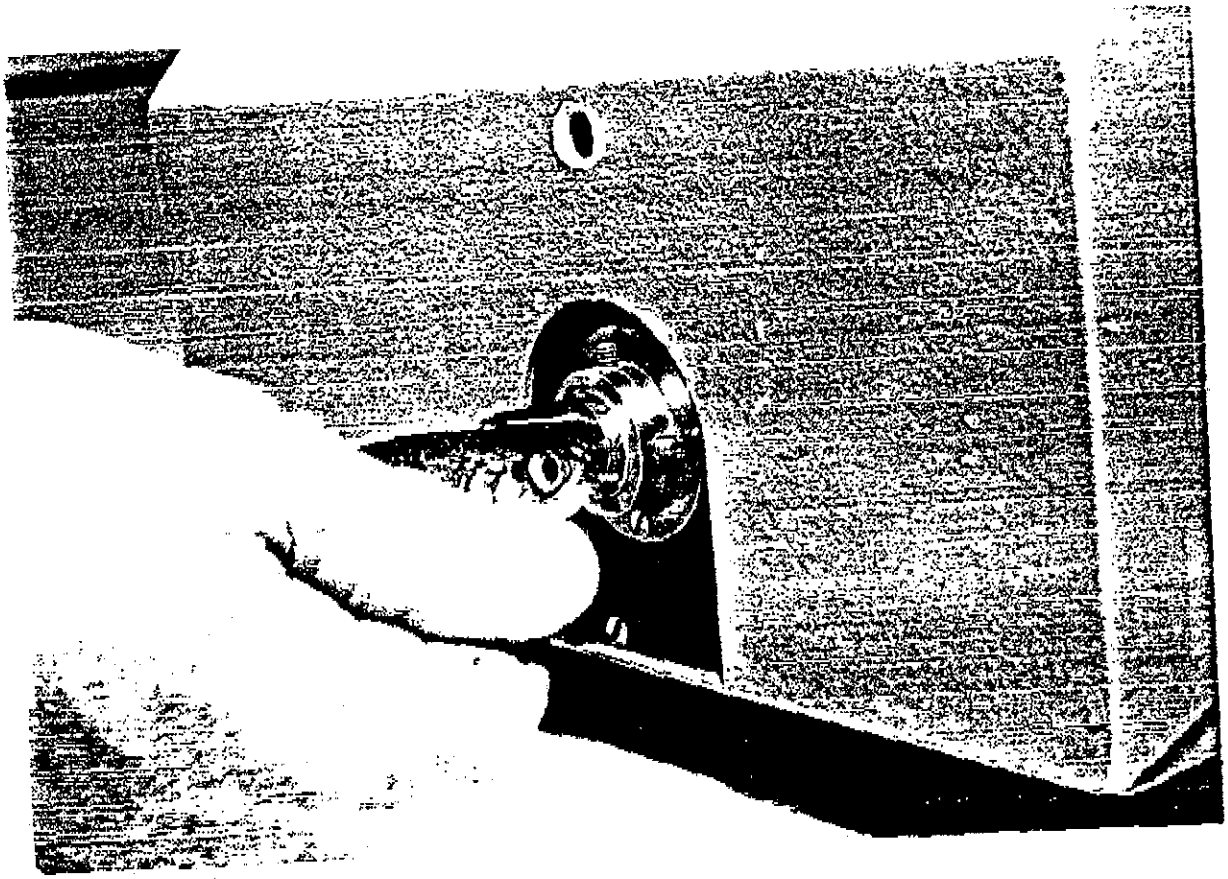

Photo 3: Juvenile salmon being tagged.

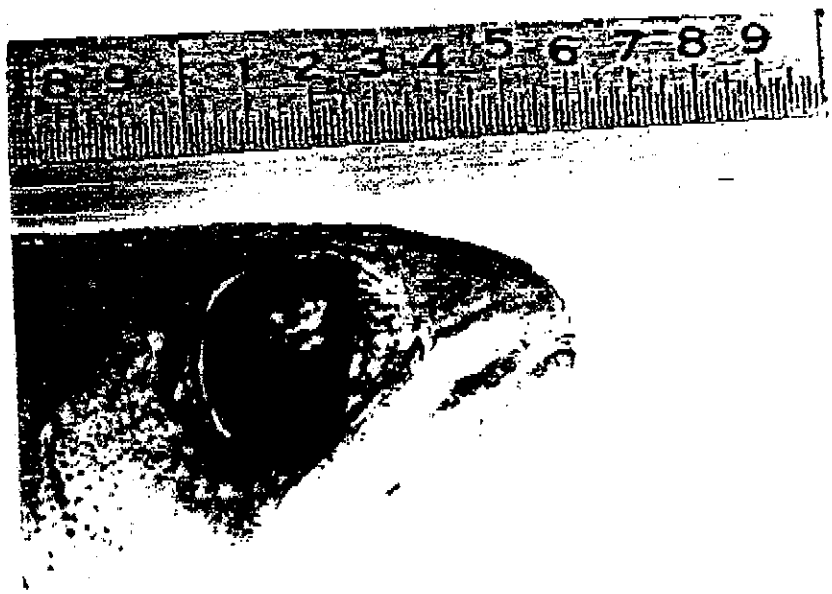

Photo 4: Close up of CWT in nose cartilage of juvenile salmon.

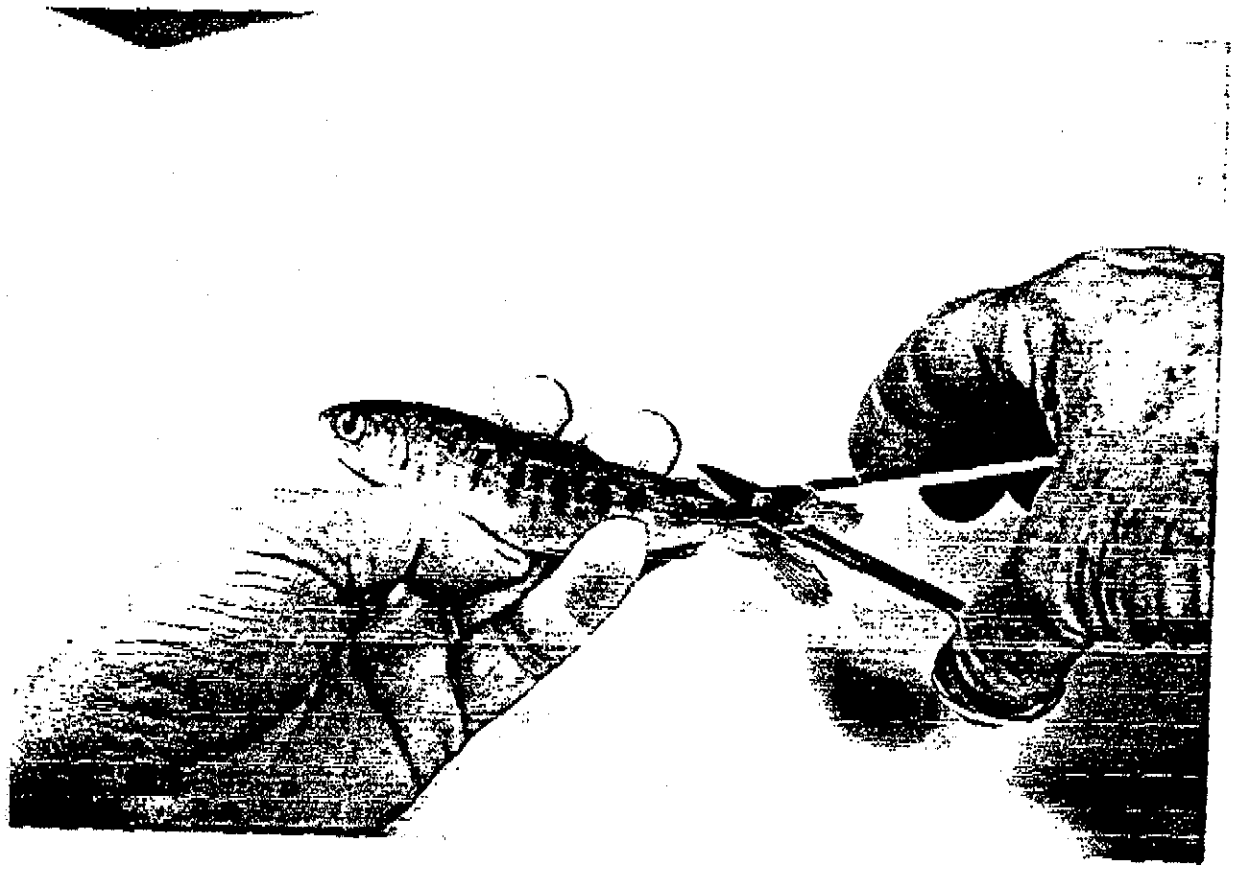

Photo 5: Clipping the adipose fin of a CWT'd juvenile salmon.

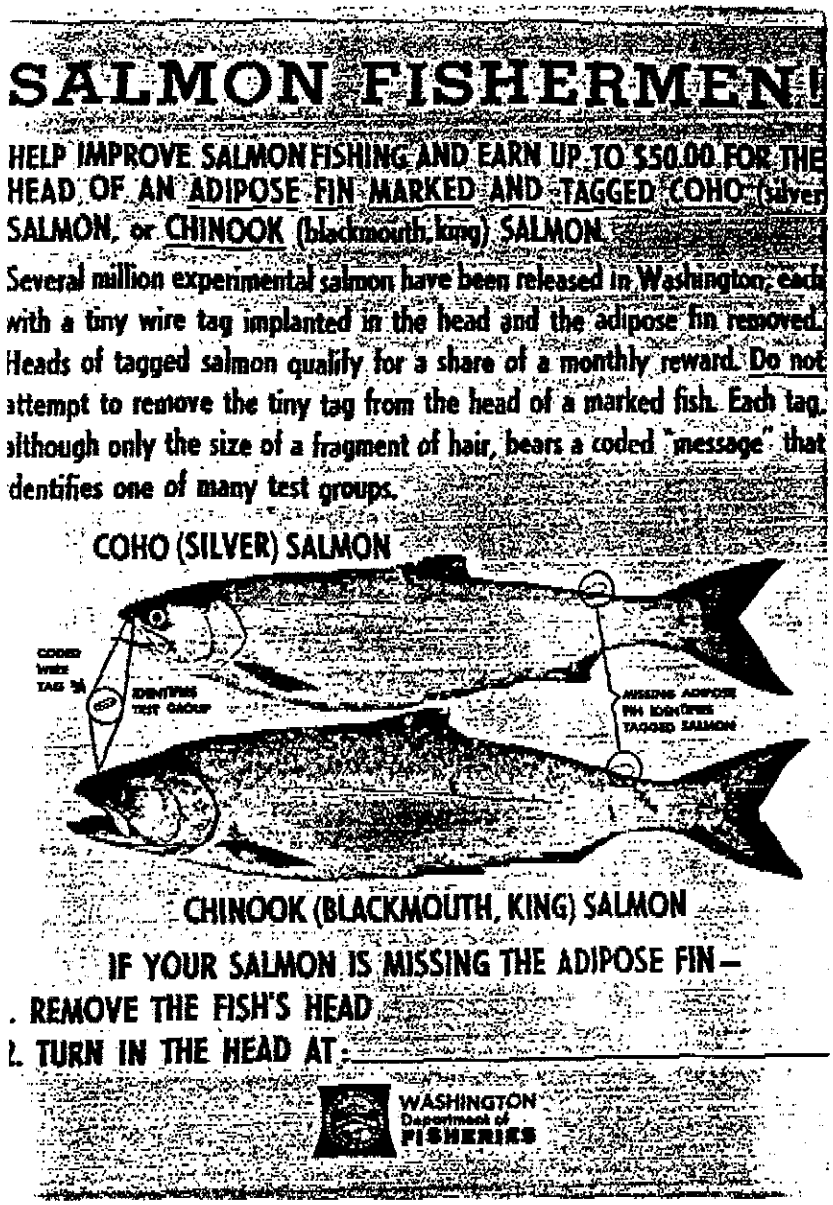

Photo 6: Notice to recreational fishermen informing them that a missing adipose fin indicates the possible presence of a CWT.

Photo 7: Technician scanning a core taken from the head of an adipose clipped adult salmon to detect the presence of a CWT.

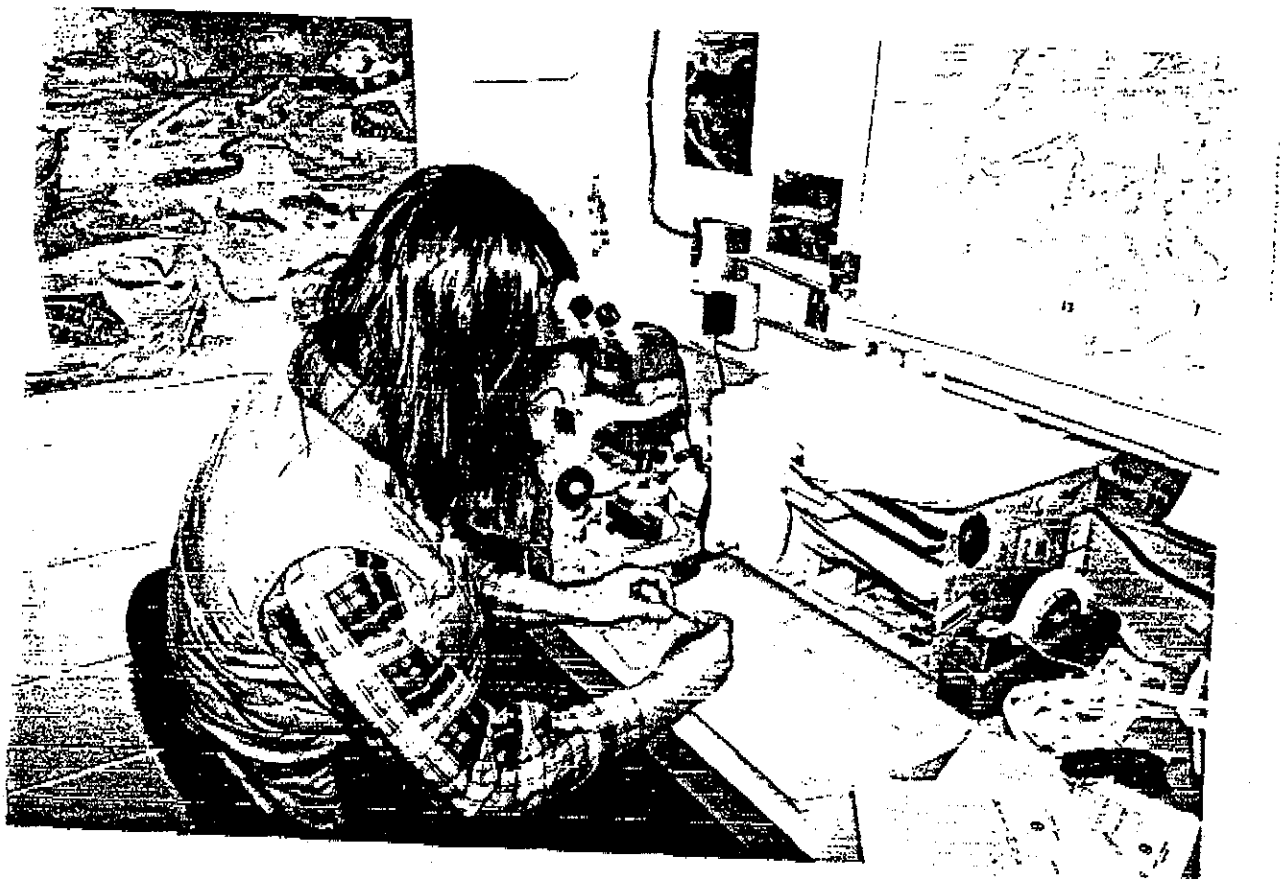

Photo 8: Technician reading a CWT and entering information on a data recording form.