# Towards Empowering Fisheries Officers to Manage the Fish Stocks, Biodiversity and Environment of Kyoga Basin Lakes

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## Course: BASIC PRINCIPLES OF FISHERIES MANAGEMENT

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  Stocks
  Under-exploited stocks
  Heavily exploited stocks
- Practical questions posed by fishery managers
- Resource evaluation studies
  - Exploration
  - Taxonomic studies (but also in biodiversity studies)
  - Ecological studies
  - Early warning signals

- MSY – where is it?

- Objectives of fisheries development and management
- Development and management issues
- Monitoring the fisheries
  - research questions and their suitability
- Problems in fishery management
- Aquatic resources management vs fisheries management
  - how far are we?
- Information gaps and practical issues for the way ahead:

Exercise (homework)

- What kind of information is required but is not available to the managers for: *Management of fish stocks, aquatic biodiversity and environment of Kyoga basin lakes?*

## Course Objective

FIRRI is mandated to undertake, promote and streamline fisheries research in Uganda and ensure dissemination and application of research results.

Major aims of this course are:

- to equip participants with practical issues encountered in fisheries management, and

- to establish links and introduce synergy between research and management objectives for sustainable capture fisheries.

The course assumes basic training and is interactive.

Participants will evaluate the value of the course content with respect to their roles in the field as well as make recommendations.

## Facts about capture fisheries

- Are major natural resources
- Biological Information is needed to ensure optimum utilization
- But capture fisheries present multi-disciplinary problems
- The researcher needs to be aware of the questions posed by the manager *as much as*
- The manager needs to be aware of the potential value of the research information

Examples:

→The annual catch needs to be known

→Is it exceeding the sustainable levels?

## Homework:

- Prepare data for monthly, annual catch from landings under your jurisdiction, county and district production and overall lake production.

- Outline practical steps that are required to generate catch data from landings to district to Lake Fish production by month and year in view of the decentralized structures.

- What are the Advantages of routine/regular reporting of the status of fisheries?

- What kind of information and what data types do you routinely report and to who?

## Constraints to optimum capture fisheries production potential

- Declining catches and fish species diversity due to:
  - excessive fishing effort
  - use of destructive fishing gears and methods
  - capture of immature fish
  - exotic species stockings.
- Pollution and degradation of the fish habitats including wetlands
- Invasion by the water hyacinth and other weeds
- Low aquatic productivity due to inadequate knowledge of Lake Productivity processes
- Ineffective management of the fisheries due to limited community participation
- Limited application of research results

**In order to fulfil its mandate, FIRRI ADDRESSES THE CONSTRAINTS UNDER THE RESEARCH UMBRELLA:**

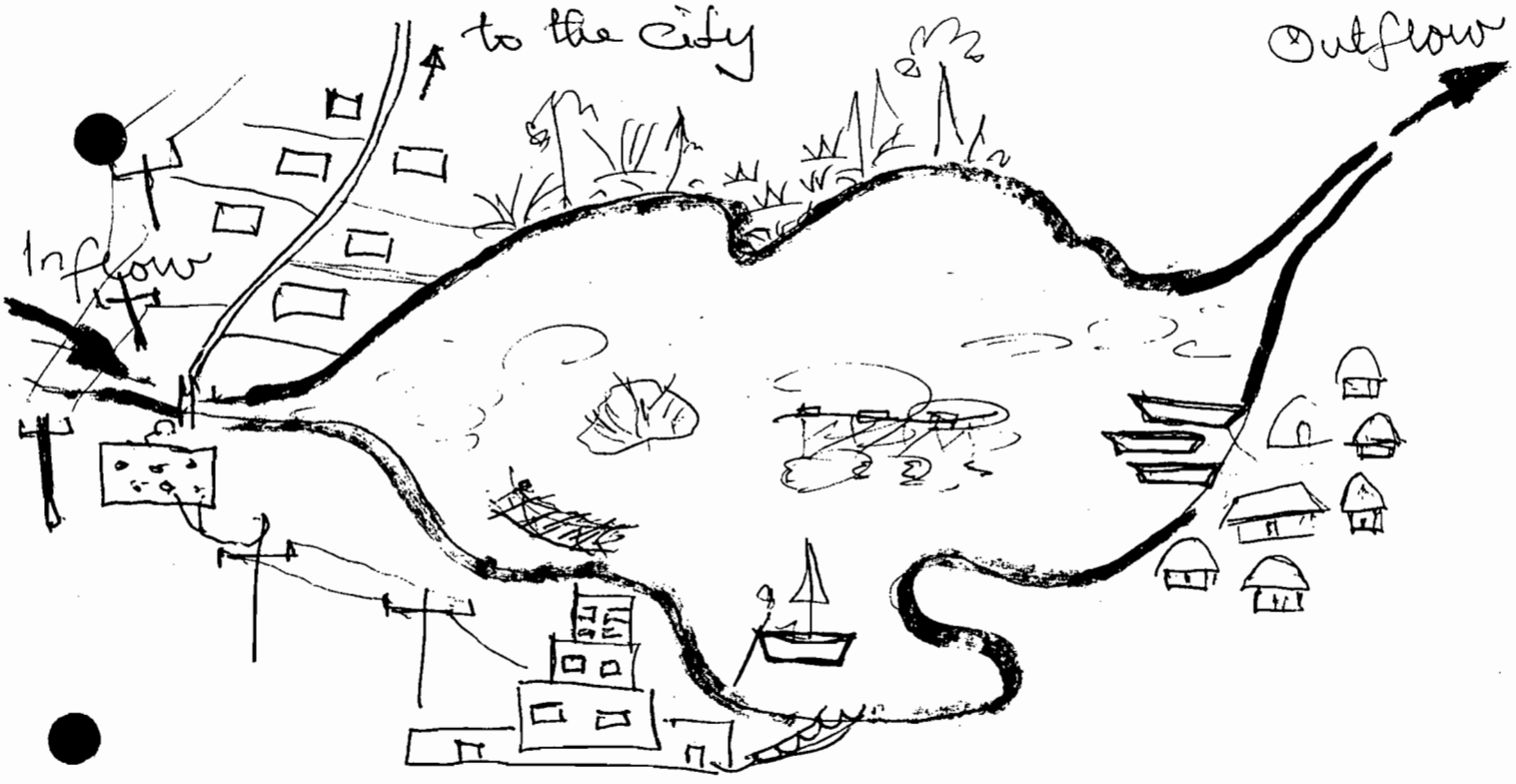
***Management of capture fisheries resources, aquatic biodiversity and the environment of aquatic ecosystems.***

# General characteristics of a fishery

**What is a fishery? Some answers:**

- **It is one when it is exploited**

***A hypothetical fishery***

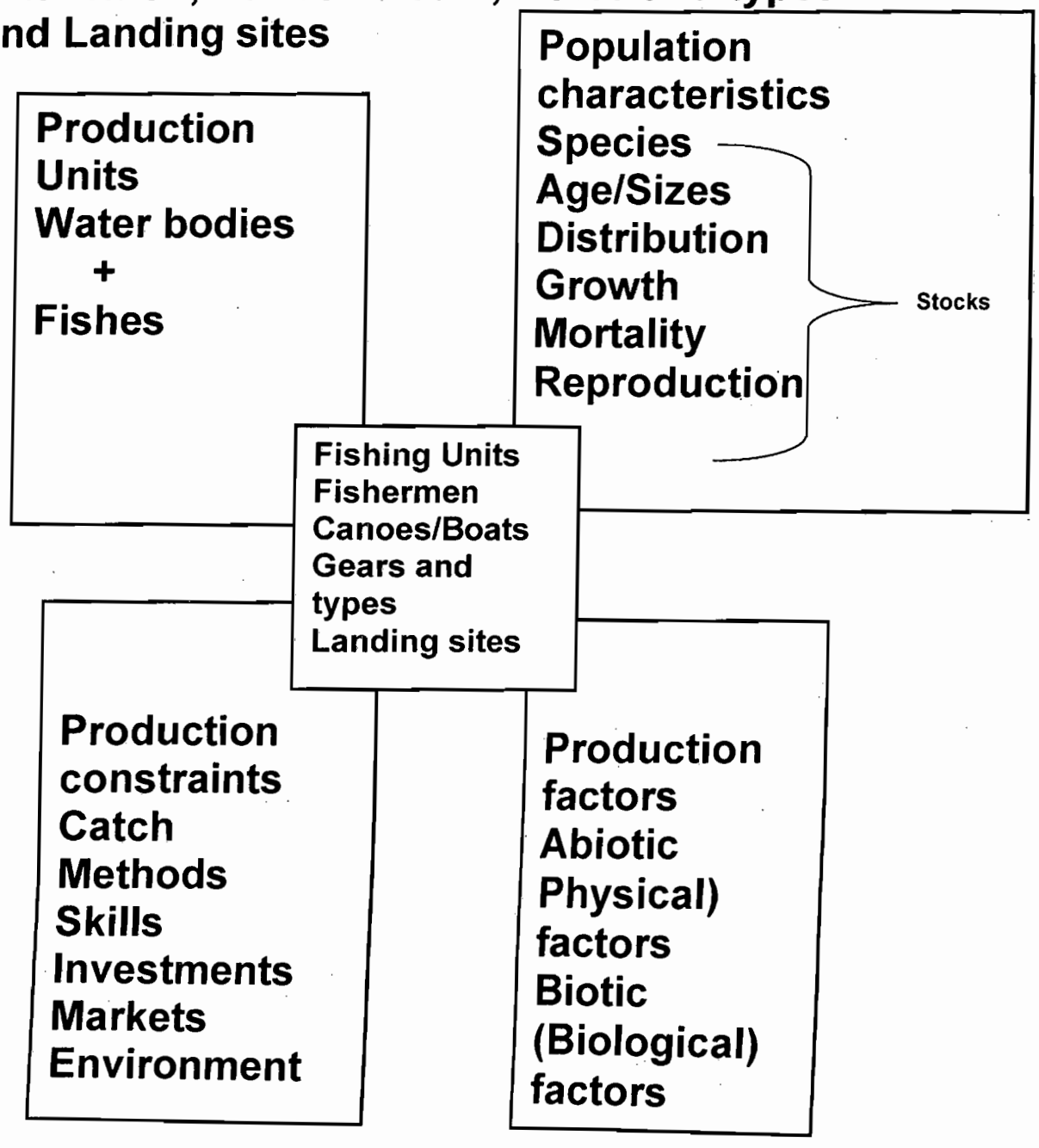



**It has linkages within the fishery and between the fishery and surroundings.**

- **A fishery comprises of:**

  **Water body, Fishes, and fishing units**

## Basic Fishing units:
## Fishermen, Canoes/Boats, Gears and types and Landing sites



## Types of fisheries

**Often defined by**

1. ***Water body***

**Lakes = lake fisheries**

**Rivers = Riverine fisheries**

**Stream =**

**Swamps/wetland =**

**Other resources = e.g. shrimp, marine, etc**

***A fishery can also be defined by other features:***

2. **Major stocks (species fishery)**

   **e.g. Nile perch fishery, Tilapia and Mukene fisheries**
   **also Whale, Salmon, etc. fisheries**

3. **Area of water body fished**

   **e.g. Open water/deep water/pelagic**

4. Method of capture (capture fisheries)

Light fishery, seine fishery, Gill net fishery

# Evolution of the Kyoga fisheries

| Date | Total landings of wet fish<br><br>*Tons* | Landings of *T. esculenta* and *variablis*<br>*Tons* | Landings of *Lates*<br><br>*Tons* | Landings of *T. nilotica*, *zilli* and *leucosticta*<br>*Tons* |
|---|---|---|---|---|
| 1963 .. .. | 16,551 | 6,002 | Not recorded | 742 |
| 1964 .. .. | 18,261 | 5,929 | 657 | 589 |
| 1965 .. .. | 18,027 | 3,597 | 4,374 | 517 |
| 1966 .. .. | 19,577 | 2,590 | 7,422 | 947 |
| 1967 .. .. | 25,905 | 2,172 | 13,000 | 5,017 |
| 1968 .. .. | 32,580 | 1,617 | 17,725 | 7,644 |
| 1969 .. .. | 48,945 | 2,158 | 26,920 | 13,171 |

Relative Importance of the Lake Kyoga fisheries in the 1970s (1970 Records from all lakes)`

| Lake | Catch (mt) | % total |
|---|---|---|
| Kyoga | 62,070 | |
| Victoria | 34,790 | |
| Edward | 5,731 | |
| George | 4,242 | |
| Albert | 17,530 | |
| Wamala | 5,960 | |
| Albert Nlie | 4,840 | |
| Others | 3,990 | |

**Exercise: Calculate the percentage contribution to total catch from Uganda fisheries.**

**Prepare bar-graphs (weight and %ages) the catch from each water body. Is the catch sustainable? Describe the state of the fishery**

# Fish Populations

**A population is a group of organisms belonging to the same species that are capable of inter-breeding and are living in the same area, which can be geographically defined. Therefore, such a population may be living in an area separated by geographical/ physical or other features of the environment.**

**Examples:**
**- Nile tilapia populations in Lakes Victoria, Kyoga and Albert.**

**- Mukene populations of open and sheltered habitats**

***A population has individuals of the same species definable by the following variable parameters that distinguish that population from others:***

- **Distribution pattern within geeographical boundaries**
- **Sex ratio**
- **Age group/Size structure**
- **Growth rates**
- **Reproductive/Breeding pattern**

## A fish stock

- It is part of a population

- A fish stock has the attributes of a fish population characterised by individuals that have bred at the same time, in the same locality and whose offspring have grown together in a nursery area, migrating to a feeding and growing area before returning to breed where they were bred. A unit stock is of the same age and is sometimes referred to as a cohort.

May not always be applicable.
Compare with:

- Species stocks
- Continuous breeding
- Diffuse breeding and feeding grounds

*Main elements in a stock:*

Unit stock

From a fishery perspective = a stock is a uniform unit

Stock = defines limit (boundary) of a population

Concerns a particular species (therefore, there are stocks)

- a stock is approx. a population

characteristics:

stays the same in space and time
free gene flow
influenced by uniform environmental factors
responds as a whole
feeding, breeding, migration = *synchronised in time and space*

## synchrony in a fish stock

- a group of fish in a bay is separated from other groups by depth, temp., differences
- every year, adults migrate at a partic. time and breed in a a partic. area
- spawning in the whole group takes place at a particular time
- the same group of fish migrate to feeding grounds
- the fertilized eggs move/drift to nursery grounds at the same time

- **the juveniles move to feeding grounds, grow and migrate to join the adult stock**

***the cycle is predictable and the stock is integrated***

**better demonstrated in temperate fishes**

**Usefulness of the stock concept:**

- **Breeding grounds can be mapped**
- **Fishes can be caught at an acceptable age for size.**

**The fishing process first removes the larger forms**

## Basis of management

- **Problems from development call for regulation**
  - **Arise from knowledge of fish biology and population dynamics**
  - **As well at anyone time**

$$P_1 = G + R + Z$$

**Where**

$P_1$ = population (stock) size at $t_1$
G = growth
R = recruitment
Z = mortality
($Z = F + M$)

  - **So, with fishing, a new stock level:**

$$P_2 = P_1 + G + R + Z$$

$P_2$ is population size at time $t_2$

**SO: If the stock (population size) is to remain constant,**

$$R = Z$$

Therefore calculate the number of fish left in a year class (cohort) after one year of fishing and Nature mortality (F + M).

Convert numbers into weights to obtain biomass.

Other factors to be evaluated:

- Growth
- Reproduction (fecundity)
- Condition
- Distribution
- Environmental factors
- Socio-economic factors

So: Why and what management (control/regulations)?

- Why = initially, MEY

  Followed by MSY

- What if investments are in place?
  e.g. - Boats, engines, nets,
  - fishermen
  - factories
  - exports

- A fishery is then over-capitalised

## Developmental stages in fishery exploitation

- Initially a fishery is productive – many individual fish are of old age and therefore big fish predominate
- Mesh sizes of nets are big
- Simple tools are adequate = under-exploited
- Subsistence fisheries become transformed
- Leads to influx of capital = a fishery becomes heavily exploited if not managed in time

## When should a fishery stop expanding and how?

## MSY

## Objectives of fisheries development and management

- What is the best initial approach for the sustainable use of the resource?

In the interest of:

- The community as a whole
- The stakeholders

- At first, encourage development of the fishery

- Slow down development (CPUE)

- Indicators for action:
  - Falling CPUE
  - Falling acceptable sizes
  - Falling total catch

- Apply restrictive management

**If management**

**Restrictions on:**

- **Mesh size(s) + quality of gear**
- **CPUE/Nets, boats, etc**
- **Closed seasons**
- **Closed grounds**
- **Closed fisheries**
- **Shifting of fisherfolk to other roles**
- **Registration of fisherfolk, boats, nets**

➢ **Encourage co-management**

**Problems:**

- **Management measures may be brought in too early before a stock is fully exploited**
- **Or too late when the stock is depleted**
- **Or economic damage to the industry has set in.**

**Other issues in management**

- **Enforcement**
- **Open access tradition**
- **Multi-national fisheries (Lake Victoria) and Multi-district (Kyoga)**
- **Profitability = addition of another vessel to fishing fleet = based on assessment that the vessel will be profitable.**
- **How much fish is needed locally, how much can be exported, what is MSY?**
- **Can you provide subsidy or alternative employment?**
- **Is pricing controlled?**

- Different groups of people with different interests = are decisions for the majority or for factory?

- Many species and many sizes in a fishery

- Fisheries restricted to zones = shallow water: commercial Vs artisanals fisheries

## Fish communities

## The Evolution of the Lake Kyoga fisheries

- The Lake Kyoga Complex
- The fisheries of Lake Kyoga in the 1920s
- The Kyoga fisheries between 1950s and 1970
- The Kyoga fisheries between 1970s and 1990s

***Exercise 1: Literature searches and Information Gathering***

## Practical Issues relating to fishery resources

## Objectives of fishery development and Management

## Monitoring the fisheries

## Information needs for the fisheries and identified gaps

## Aquatic resources management vs fisheries management

## Practical Issues relating to fishery resources

- Stocks
- Under-exploited stocks
- Heavily exploited stocks

## Phases in Resources Evaluation

- Exploitations
- Taxonomic Studies
- Ecological Studies
- Under-exploitated Stocks
- Heavily-exploited stocks
- MSY

## Fisheries monitoring for Management

## Researchable areas

**Priority constraints defined by *strategic congruence with fisherfolk (farmer) demands***
***And:***
***Targeting natural resource sustainability including environmental concerns***

**FIRRI Studies on:**

- **population characteristics of fish, stock densities and methods of exploitation;**
- **endangered fauna and flora;**
- **aquatic food webs;**
- **causes, sources and intensity of eutrophication and pollution;**
- **roles of wetlands and riparian zones;**
- **impact assessments of projects (e.g dams);**
- **dynamics and impacts of water hyacinth;**
- **contribution of fish to the national economy;**
- **income opportunities for community groups and for investments;**

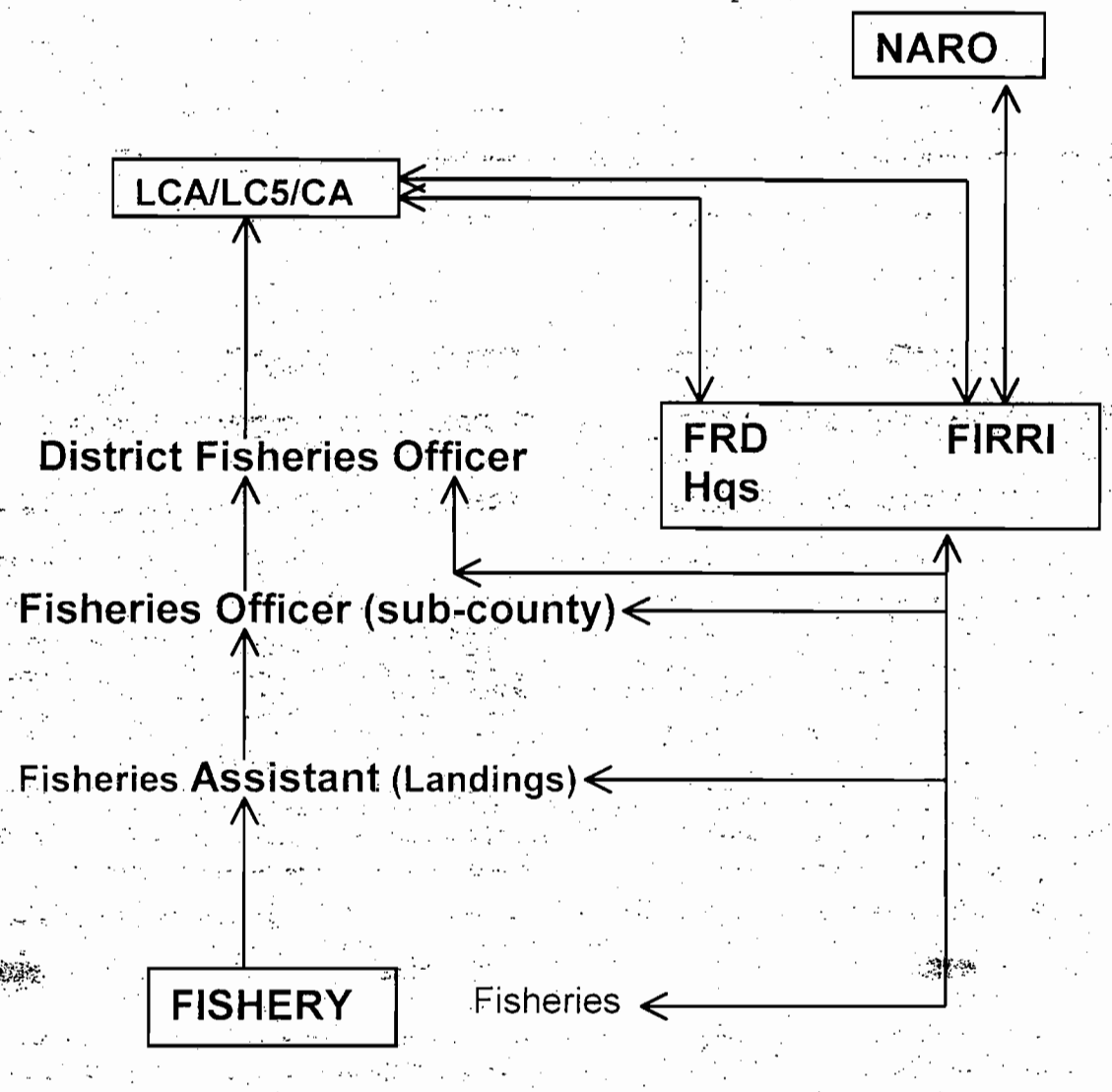
- environmental knowledge and practices among fisher communities;

- conditions for introducing co-management;

- diverse aspects in aquaculture

LEADING TO:
Technology (information) generation & Technology transfer and dissemination

## Relational Diagram flow of fisheries management information




## Exercise No.2:

***Fill in between the arrows on the diagram the type of information (e.g. no. of boats, frequency of recording , etc) that is required at each level.***