18.1 Introduction

- Versatile and cost-effective
- Collects information on
  - Composition
  - Distribution
  - Abundance
  - Behavior
Introduction (cont.)

- Best when other methods not effective
- Only effective in clear water
- Limited to visibility eg, cannot tell weights
18.2 Underwater observation techniques and equipment

- **Snorkel**
  - Requires least equipment
  - One of simplest ways to observe organisms
  - Can be used in remote locations
Snorkel

- Equipment includes
  - Mask
  - Snorkel
  - Wet or dry suit
  - Swim fins or wading boots
Snorkel especially useful for observing:

- Spawning
- Behavioral interactions
- Favored feeding
- Resting positions
- Movement
- Estimating numbers and sizes of populations
Snorkeling Protocol

- Divers enter up or down stream
- Short resting period to allow settling
- Divers in deep water proceed downstream
  - By floating
- Divers in shallow water proceed upstream
  - Pull themselves along the bottom
Consistency of data depends on

- Light conditions
- Time of day
- Differences in fish behavior
Scuba

- More specialized equipment required
- Divers wear tanks filled with compressed air
- Mouth piece to regulate air flow
Scuba (cont.)

- Equipment used
  - Depth and pressure gauges
  - Buoyancy compensator
  - Watch
  - Weight belt
  - Wet or dry suits

- Limited to easily accessible areas
Scuba (cont.)

- Remain submerged for long
- Protocol similar to snorkeling
- Longer resting periods required to acclimate divers
- Noisier than snorkeling and may frighten fish

Air capacity 1 hr
Hookah...

- Collecting aquatic organisms
- Ship and oil rig maintenance
- Suction dredging
Divers use hookah rings

- Air delivered through umbilical hose
- Divers range limited by umbilical
- Allows maximum time beneath the surface
- Clear voice communication possible
- Most useful in larger rivers, lakes and ponds
Alternative methods

• Use of underwater cameras
  – Take pictures at predetermined frequencies
  – Work at day or night
  – Expensive to buy and maintain
  – Should be used with other methods for best results
Record keeping

- Recorded by diver or communicated to assistant
- Use waterproof slates, cuffs, or scrolls
- Pencil attached to divers hand
Alternatives for diver recording

- Sign language or verbal communication
- Electronic data recording devices such as radios, tape recorders, and cameras
  - Expensive
18.3 Safety and training

• Hazards Include:
  – Fast moving water
  – Cold water temperatures
  – Poor visibility
  – Physical obstruction
  – Environmental factors
  – Contaminants and dangerous organisms
Never dive alone!

- Have a partner
- Can be in or out of the water
- Assess potential hazards
- Check for water release times in regulated waters
Never:

- Attach ropes or lines to divers
  - In streams, lakes, or rivers with strong currents
  - In streams, lakes, or rivers with tidal changes
- Always avoid areas of extreme turbulence
Hypothermia

- Potentially lethal below body temperature condition
- Night divers at highest risk
- Divers submerged for lengthy periods
To prevent hypothermia

- Wear appropriate protective clothing
- Eat high-energy foods
- Drink plenty of liquids
- Take periodic breaks
- Have first aid training
Hyperthermia

- Abnormally high body temperature

- Feel
  - Lightheaded and dizzy
  - General muscular weakness
  - Faint trembling sensations
Avoid hypothermia by

- Taking frequent breaks
- Being appropriately outfitted
- Drinking plenty of fluids
Other hazards

• Turbid water
• Underwater obstructions
• Chemical and microbial contaminants
Giardia lamblia

- Protozoan
- Causes giardiasis when ingested
- In freshwater throughout the world
- Avoid ingesting water that's not filtered
Marine environments

- Beware of dangerous organisms such as sharks
Training

- Essential for success
- Helps ensure crew safety
Training should address

• Safety
• Equipment
• Observation techniques
• Data collection and recording
18.4 Environmental Influences

- Survey accuracy influenced by
  - species
  - environmental features
Depth

- Sufficient depth to submerge a mask
- Shallow-limit divers view
- Too deep-light and air limitations
Temperature

- Carry calibrated thermometer
- Measure before sampling and periodically
- Organism behavior may change with temperature
Visibility

- Clarity can limit divers abilities
- Dependent on species
- Should be sufficient to
  - See the bottom
  - Identify species
  - See fleeing organisms
- Should not assume adequate without measurement
Cover

- Type and abundance can limit survey
- Less cover is better
- Describe and quantify cover in results
18.5 Applications - Precision and Accuracy

- Replicate counts temporally or spatially
- Variation is typically small
- Accuracy difficult as population density not known
Underwater Survey Procedures

- In flowing waters, move upstream when possible
- Measure habitat features after fish counting
Direct enumeration

- Equal chance of being seen and counted
- Count all organisms in a single pass
- Precision evaluated by multiple passes

Pass#
1  -  20 clown fish
2  -  15 clown fish
3  -  25 clown fish
4  -  21 clown fish
Expansion estimates

- Total populations in individual habitats
- Partition sample into homogenous strata
- Randomly assigned lanes
- Density, variance and confidence intervals obtained
Basinwide Estimates

- If consistent relation between diver count and population
- Divers count fish in sample
- Crew determines true number of fish
  - Typically by electrofishing
- Equations of relation are founded
Mark - Recapture Estimates

- Marked with visible tags
- Recaptured
- Use marked and unmarked to get population estimates
Line Transect Estimates

• Divers travel along well defined line
• Multiple lines set
• Divers identify fish on either side of lines
Habitat Use Estimates

- If do not change behavior with disturbance
- Unbiased information on habitat use
- Can be used to study life stages
- Develop estimates of fish habitats