Chapter 21

Commercial Fisheries Surveys
Introduction

- Methods for sampling commercial fisheries
- Factors affecting design of sampling
Economic benefit from harvest of:

- Fish
- Shellfish
- Marine plants
- Other aquatic resources
Commercial fishery sampling focuses on

• Catch
  – Quantity of resource captured

• Attributes of fishery
  – Operation of fishing units
21.2 Sampling Approaches

- Not an easy task
- Define objectives unambiguously
Sampling Approaches
(cont.)

- Choose sampling approach—consider:
  - Structure of fishery
  - Target levels of precision
  - Cost considerations
Sampling Approaches (cont.)

- Design sampling plan
  - Simple random
  - Stratified random

- Decide number of samples
- Monitor data quality

2001 North Atlantic groundfish sample

20 samples - 20 random sites
Approaches for catch determination

- Effort expended
- Censuring
  - Complete enumeration
- Sampling
  - Examining a portion
21.3 Characterization of the commercial catch

- **Catch** - all resources captured
  - i.e. - sum of landings and discards

- **Landings** - portion of catch brought to market

- **Discards** - undesirable part of catch
Length composition

- Catch + landings in length interval
- Used to estimate age of catch
Age composition

- Number/weight of each age
- Growth analysis
- Mortality estimation
- Prediction of yield
- Estimation of absolute population

<table>
<thead>
<tr>
<th>Absolute population</th>
<th>Life span</th>
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<tbody>
<tr>
<td>23,000,000</td>
<td>6-10 years</td>
</tr>
</tbody>
</table>
Sex Ratio

- Proportion of males to females
- Useful with length and age data
- Estimate spawning stock biomass

$\frac{\text{females}}{\text{males}} = \frac{4}{1}$
Sex Ratio (cont.)

- Important for species that show sexual dimorphism in:
  - Growth
  - Distribution
  - Habitat use
  - Vulnerability to capture

2yr. Female

Habitat: Deep water with rocky structure

2yr. Male
Methods for data collection

- Direct
- Indirect
- Methods not mutually exclusive
Direct Methods

• Onboard sampling
  – Detailed information on a fine scale
  – Costly
  – Fishers must cooperate
  – May make fishers uncomfortable
Direct Methods (cont.)

- Port sampling
  - Most common
  - Contact between data collector and fishing unit
  - Sampled before unloaded for sale
Indirect Methods

- Past recorded data
- Verbal reports
  - Extensive biological characterization not possible
  - Likely to be biased
  - May have language barriers
  - Highly cost effective

How much did that marlin you caught weigh?

Yo no hablo ingles
Biological Characterization of the Commercial Catch

- Inferences on
  - Abundance
  - Age structure
  - Sex ratios
  - Maturation rates
  - Stock composition

Abundance: very high
Age structure: 0-2 = 45% 3-6 = 40% 7-10 = 15%
Sex ratios: 1 to 3 male to female
Maturation rate: between 2nd and 3rd year
Stock composition: 1 out of 400 is a stocked fish
21.4 Characterization of a Commercial Fishery

- Fishing effort
  - Changes in stock density
  - Abundance of entire population
  - Important for fisheries managed by effort
Definition of effort

• If single species
  – Investment of time
  – Number of gear units employed
  – Combination of time and number

Species

Channel catfish

<table>
<thead>
<tr>
<th>Time invested</th>
<th>Gear units</th>
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<tbody>
<tr>
<td>72 hrs.</td>
<td>6 hoop nets</td>
</tr>
<tr>
<td></td>
<td>3 boats</td>
</tr>
</tbody>
</table>
### Appropriate units

- **7 trap nets**
  - 15 min. to lay net
  - 20 min. to bring in

- **10 hoop nets**
  - 7 min. to lay
  - 15 min. to bring in

- **5 lobster traps**
  - 10 min. to set
  - 15 min. to bring in

- Measured reliably and accurately
- Account for time of gear operation
- Account for number of gear units deployed
Directed effort in multi-gear fisheries

- Complicated with multiple gear

- Total effort cannot be calculated directly
Directed effort in multi-species fisheries

- Difficult to estimate effort for single species
- Done for predominant species in catch
Collection of Effort Data

• Depend on
  – Intended use of effort data
  – Details of fishery operations
  – Costs of sampling
21.5 Catch per Unit Effort Statistics

- Direct index of population biomass
  - Cohort analysis
  - Virtual population analysis
  - Catch at age models
The following assumptions have to be met:

- Gear efficiency and catchability constant through time
- Effort units operate independently
- Stock are equally vulnerable to the fishery
Catchability ($q$)

- Stock captured by a standardized unit of effort
  - 'q' should not vary
  - Fishing power change affects estimation of 'q'
  - Spatial distribution change affects estimate of 'q'