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STOCK ASSESSMENT REPORT ON WEST COAST VANCOUVER ISLAND PACIFIC HERRING

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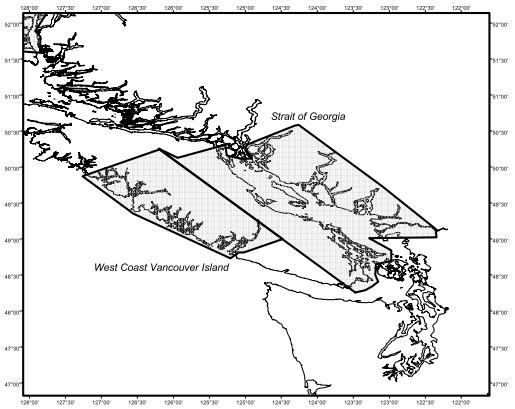

Map of West Coast Vancouver Island

Context

Pacific herring is a pelagic species which occurs in inshore and offshore waters of the North Pacific. In the eastern Pacific it ranges from California to the Beaufort Sea. Herring mature and recruit to the spawning stock predominantly between ages 2 and 5. Within this range, age-at-recruitment tends to increase with latitude. The west coast of Vancouver Island (WCVI) herring stock is one of five major B.C. herring stocks. The fishery began here at the turn of the century but did not become extensive until the expansion of the dry-salted fishery in the 1920s and reduction fishery in the 1940s. Between 1918 and 1966 the catch from this stock averaged 18,000 t. This stock declined as part of the coastwide collapse from overfishing in the early 1960s, and the commercial reduction fishery was closed in 1967. Following a combination of favourable environmental conditions and a low harvest rate, the stock recovered by the mid-1970s. The current roe fishery began in 1972. Unfavourable oceanic conditions returned in 1978, and since then the stock has been in a low productivity state. The target harvest rate of roe herring is fixed at 20% of the forecast mature stock biomass, when the stock size is sufficiently above the threshold or minimum spawning stock biomass (Cutoff). The current assessment indicates that the forecast mature herring biomass is below the fishing threshold (18,800 t).

SUMMARY

- All herring spawning within Statistical Areas 23 to 25 are assumed to belong to the west coast of Vancouver Island (WCVI) herring stock that migrates inshore in the late fall and leaves, after spawning, in mid-March through April.

- The roe herring seine total allowable catch (TAC) in 2005 was 2,722 tonnes or 11% of the coastal total and the validated catch 2,955 tonnes. The roe herring gillnet TAC in 2005 was 1,120 tonnes or 4% of the coastal total and the validated catch 896 tonnes. Additional seine catch of 418 tonnes was taken to offset the cost of test fishery and spawn assessment programs.

- The forecast stock biomass for 2006 is 18,380 tonnes, which is below the fishing threshold (18,800 t), and will not sustain a commercial fishery in 2006.

DESCRIPTION OF THE ISSUE

From the mid-1940s until the late 1960s, herring were harvested and processed (reduced) into relatively low value products such as fish meal and oil. The largest catch, 70,000 t, was taken in the WCVI in 1959. Catches increased dramatically in the early 1960s, but were unsustainable. By 1965, most of the older fish had been removed from the spawning population by a combination of overfishing, and a sequence of weak year-classes, attributed to unfavourable environmental conditions and a low spawning biomass. As a result, the commercial fishery collapsed in 1967 (Fig. 1), and was closed by the federal government to rebuild the stock.

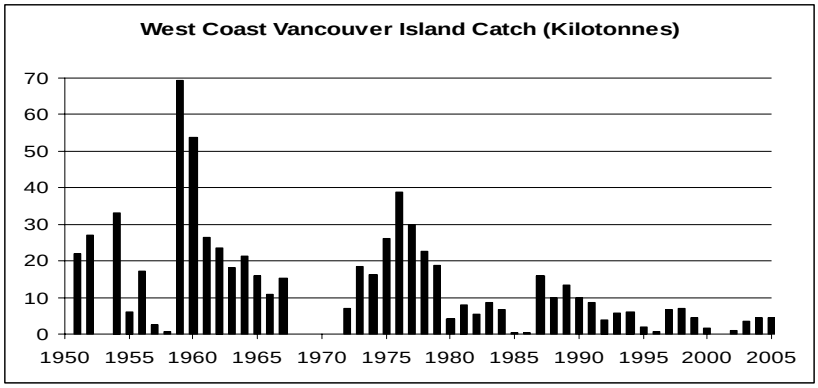

Figure 1. Total herring catch in the West Coast Vancouver Island from 1951-2005.

Following the fishery closure, a series of above average year-classes occurred in the early 1970s rapidly rebuilding the stock and providing new fishing opportunities.

During the closure from 1967-1973, the small traditional fisheries continued locally for food and bait (Hourston 1980). At this time there was a growing interest to harvest roe herring for export to Japan, as their stocks became decimated. A small experimental roe harvest began in 1971, and expanded rapidly until 1983, when fixed quotas were introduced to regulate the catch. A significant quantity of WCVI herring is also utilized for spawn-on-kelp, and aboriginal food fish.

The objective of the current herring fishery is to obtain a low volume, high-quality product that is economically profitable and ecologically sustainable. The fishery is managed by setting a fixed quota based on a harvest rate of 20% of the forecast mature stock biomass. To meet management objectives, the harvest strategy also enforces a minimum spawning stock biomass. If the forecast biomass falls below the fishing Cutoff threshold (18,800 t) managers have chosen to close the commercial fishery to allow for stock recovery. The harvest strategy is designed to minimize the number of years of commercial fishery closures. In response to reduced stock levels the WCVI fishery was closed in 1985 and 1986 and again in 2001. Subsequently, the stock has rebuilt and sustained an average roe catch of 3,360 t over the past decade[1].

[1] Excluding years where commercial fisheries were closed. Only anecdotal reports of food, social, and ceremonial harvests are available and so are not included here. Spawn-on-kelp (SOK) allocation (short tons) refers to live fish impounded to develop product.

Recent removals from this stock have been:

West Coast Vancouver Island catch (ktonnes)

2001	2002	2003	2004	2005	
0.0	0.8	3.5	4.5	4.3	
0.0	*0.6*	*0.4*	*0.4*	*0.4*	*SOK allocation*

ASSESSMENT

Assessment of current abundance for 2005 is obtained using an age-structured model (ASM). The analysis is based on the 55-year time series of total catch, spawn abundance, weight-at-age, and age structure data and the model is tuned used information on the total spawn deposition from egg surveys. Forecasts of abundance for the upcoming season are based on projections of current biomass assuming average levels of growth and natural mortality.

Herring stock assessments utilize information from biological samples for determining the population age composition and average weight-at-age, historical catch data, and an assessment of the distribution and intensity of egg deposition in the stock assessment area. Prior to the 2002 assessment, the forecast of the pre-fishery biomass of mature herring was estimated by two assessment models: an age-structured and an escapement model. For the current assessment only the age-structured model assuming two spawn conversion parameters was adopted as the best estimator of stock abundance (Schweigert 2004).

The ASM model indicates that herring abundance in the west coast of Vancouver Island assessment region has declined steadily from 1989 through 2005, with moderate increases in 1997 and 2003 (Fig. 2). The pre-fishery biomass for the area is estimated at 21,360 t in 2005, a decrease of 2,220 t, or 9% below the 2004 level. During the past decade most year-classes have been poor except for the 1994 year class which was good. The average 2000 year-class accounted for 28% of the 2005 run, while the recruiting 2002 year-class contributed 33% to the total. Based on an offshore survey of the stock in August 2005 the abundance of the recruiting 2003 year-class is forecast to be poor, accounting for about 1% of the run and overall stock levels continue to be depressed from the highs of the 1970's and late 1980's. The recent pattern of a generally below average recruitment to the stock is not expected to improve until the current warm climate moderates, and returns to an average, or cool state.

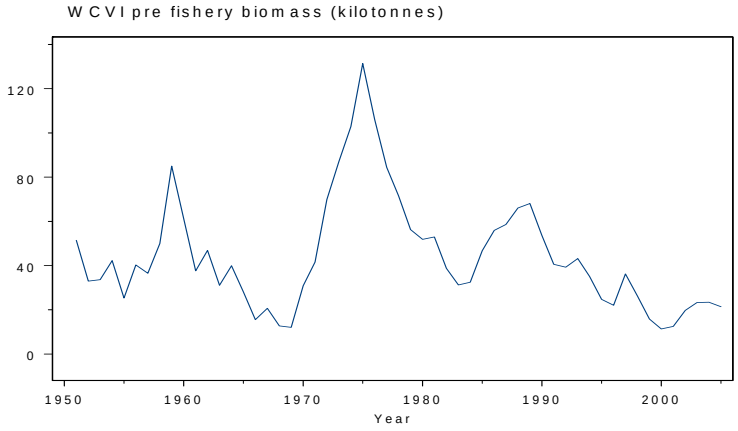

Figure 2. Estimated mature pre-fishery herring biomass from 1951 to 2005.

CONCLUSIONS AND ADVICE

Herring stocks are managed with a fixed 20% harvest rate, in conjunction with a fishing threshold or Cutoff level. A decision rule has been adopted by management to close off all commercial herring fisheries when the stock is forecast to be below the Cutoff level. The Cutoff levels are established at 25% of the estimated unfished average mature biomass.

On the west coast of Vancouver Island, the recruiting 2003 year-class is forecast to be poor based on the offshore survey, thus a poor recruitment option was adopted for 2006 resulting in a pre-fishery biomass forecast of 18,380 t which is just below the Cutoff level. Any harvest below the Cutoff is expected to reduce the rate of stock rebuilding.

OTHER CONSIDERATIONS

Research has shown that the growth and survival of WCVI herring are sensitive to natural variations in ocean climate. These recurring climatic changes, which last for a decade or two, cause significant shifts in the structure and productivity of the coastal ecosystem where the herring live. Specifically, the productivity of the WCVI herring stock changes in response to interannual and decadal time scale variations in the climate of the coastal ocean (indexed by water temperature), and spawning biomass (Ware 1991). Recruitment is the most important process determining the productivity of B.C. herring populations. Long-term research has shown that both recruitment and adult survival tend to be below average in warm years, particularly when migratory herring-predators (like Pacific hake and mackerel) are abundant off the west coast of Vancouver Island. The coastal ocean has been in a protracted warm state since 1978. When this occurs, the productivity of the copepod and krill populations that herring feed on, appear to decline (Ware 1991). Also, more Pacific hake migrate for the summer to the WCVI stock assessment area, where they prey on herring. Pacific mackerel and hake tend to be particularly abundant during warm El Niño summers.

Stock reconstructions indicate that herring cohorts born in cool years are twice as large, on average, as those born in warm years. Surplus production calculations indicate that the unfished carrying capacity of the WCVI population is about 111,000 t when the environment and ecosystem are in a cool climate state, but is less than half as large (about 49,000 t) during a warm climate state (Ware 1996). Retrospective stock production analyses indicate that the WCVI stock can sustain catches exceeding 20,000 tonnes during cool climate states. However, the sustainable catch is less than 8,000 t during warm climate states.

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