

Appendix E

BC Stock Assessment

I. Salmon

The 2003 Salmon stock outlook (<http://www.pac.dfo-mpo.gc.ca/ops/fm/Salmon/index.htm>) reviews salmon stock status for 49 stock groupings on a four point scale. 17 of 49 (35%) stock groupings are considered to be of conservation concern or below average status, 23 (47%) stock groupings are considered to be normal or above average status and 9 (18%) are mixed between these categories. The general status of sockeye, coho, chinook, pink and chum salmon species is provided in Chapter 4, Exhibit I. The stocks of conservation concern are:

South Coast

- Interior Fraser River Coho – The critical status of Thompson River coho stocks was the prime motivation for the 1998/99 coho closures. Escapement improved considerably in 2001 and 2002, but current management objectives are to maintain the Canadian exploitation rate at 3% or less.
- Cultus Lake Sockeye and Late Run Fraser sockeye – There are continuing concerns about high in-river mortality of late run Fraser sockeye and the Cultus Lake stock remains depressed.
- Sakinaw Lake Sockeye – escapement has declined by over 98% over the past three sockeye generations (12 years), mean escapement since 1996 is about 60 fish, in contrast to mean escapements of approximately 5,000 fish from 1955 to 1985.
- West Coast of Vancouver Island Chinook – outlook for returns of wild age 3 fish is poor, outlook for hatchery fish is positive. Lower exploitation rates (11-15%) set to enhance re-building.
- Other stock concerns include interior Fraser steelhead, Okanagan and Nimpkish sockeye, and early Fraser River chinook.
- Inshore Rockfish - bycatch is an issue and, commencing in 2003, salmon fishing (commercial and recreational) is restricted (not permitted) in the designated rockfish conservation areas.

North Coast

- Rivers Inlet and Smith Inlet sockeye – currently under a recovery plan and no fishing opportunities are anticipated in the near future.
- Northern and Central Coast Coho – management goal is to maintain a low exploitation rate (10%) to permit re building of the stock.
- North Coast Chum – many stocks are considered to be depressed and no or reduce fishing opportunity is anticipated for the near future.
- Inshore Rockfish – as per south coast areas.

II. Groundfish

Pacific Cod

- Relatively rapid growth, mature at 3 years, 4 separate stocks, harvested by trawl.
- Stock size at historic low in 1994-96, currently below average recruitment levels, a significant management concern for the BC trawl fleet.
- Harvest restrictions are relatively recent with no quota prior to 1992, area closures for protection of spawning stock.
- stocks are expected to remain at low levels over the short term, but recent evidence of increased recruitment.

Hake

- A schooling, migratory species which spawns off Baja California and migrates north to the west coast of Vancouver Island in the summer. There is a separate resident stock of hake in the Strait of Georgia.

- The largest biomass of fish harvested in British Columbia, formally fished by both Canadian and joint venture fisheries (Canadian vessels landing fish to foreign processing vessels). Since 2002 all hake landings have been on shore to Canadian fish processors.
- Stock assessments are conducted jointly by Canadian and American scientists, however until recently both sides disagreed on quota allocation resulting in overfishing the quota by 10% for over 10 years. In 2003 an agreement was reached on stock assessment, management, and quota allocation of the transboundary hake stock to take effect in 2004. Canada will get 26.12% of the TAC.
- Surveys in 2001 indicate lowest biomass since surveys initiated in 1977 (10% of 1977 levels) however a strong 1999 brood year indicates that rebuilding of the stock.
- Current management concerns include strength of new recruitment and distribution of the stock in Canadian waters.

Sablefish

- Rapid growth but long lived (to over 100 years), fished to depths of 1000m, managed as a single stock in British Columbia.
- Harvested by trap as well as hook and line, managed under IVQ system, highly developed co-management regime with industry funding a significant research component.
- Stock size in BC considered stable but uncertainty as to current level of recruitment resulted in quota reductions since 1999. Generally below average recruitment during the 1990s with stronger year classes in 1997, 1999, 2000.
- Management issues include bycatch, (particularly inshore rockfish but also marine birds on longline gear), integrated fishing plans (sablefish are also caught by the trawl fleet), and strength of recent brood year classes.

Flatfish (Rock, Dover, English and Petrale sole)

- Rock sole stocks are relatively stable but lower than late 1980s due to unfavorable ocean conditions and high harvest levels prior introduction of quotas in 1996.
- Dover sole catches increased significantly in late 1980s as the trawl fishery expanded into deeper water, current stock abundance considered average and fishing quotas likely to remain stable.
- English sole populations reached a 50 year peak in 1997, with more recent declines due to unfavorable ocean conditions.
- Petrale sole (Brill) stock status remain below historic levels, TAC allocated in the trawl IVQ fishery has remained relatively constant since 1996.

Pacific Halibut

- Halibut have been managed internationally since 1923 by Canada and the USA under the International Pacific Halibut Commission (IPHC). IPHC sets total quota, the allocations between countries and conducts stock assessment.
- The halibut fishery is a globally recognized model for international fisheries management and sustainable fishing practices.
- Current stock status is considered above average and will likely remain so for several years, but poor ocean conditions since 1996 indicate the stock size may decrease in the future.
- Current management concerns include bycatch of inshore rockfish, the accuracy of recreational and First Nations catch estimates and seabird bycatch (mandatory seabird bycatch reduction devices were introduced in 2003, after one year of voluntary use).

Shelf and Slope Rockfish

- A group of about 30 rockfish species inhabiting the continental shelf and upper continental slope, harvested by trawl and hook and line fisheries.
- Rockfish are long lived species (some species over 100 years) and population size is determined by relatively few strong year classes. Many species are dominated by early 1980's year classes followed by

a sustained period of low recruitment. Stocks are slow to rebuild as some species do not mature until 20-25 years old.

- Outlook is stable or declining for most species. Stock assessment data is often poor for this complex species group but observer catch data since 1996 has greatly improved the catch and biological information available.
- Thorneyhead rockfish (short and long spined species) have increased in importance to the BC trawl fleet as deeper areas are fished. Recently catch per unit effort has declined and there is uncertainty as to stock size.
- Bocaccio rockfish has recently been listed as Threatened by the Committee of the Status of Endangered wildlife in Canada (COSEWIC).

Inshore Rockfish

- A group of 5 rockfish species generally found at shallower depths than slope and shelf species, usually associated with complex rocky bottoms (i.e. reefs)
- These species are vulnerable to overfishing due to their longevity, territoriality and accessibility.
- All inshore rockfish species are considered at low levels of abundance and Strait of Georgia populations have continued to decline significantly despite measures to limit catch.
- Recently rockfish conservation areas (no recreational, commercial or First Nations harvest) have been implemented to protect and maintain spawning biomass.
- In recent years observer and electronic monitoring programs have improved rockfish catch and discard information in commercial hook and line fisheries (halibut, sablefish and ZN fisheries). Catch information is still considered poor for the recreational fishery.
- The outlook is poor over the short to medium term and catch limits may continue to decrease. Inshore rockfish bycatch remains a significant management issue in hook and line and trawl fisheries

Lingcod

- Important First Nation, recreational and commercial species harvested by trawling and hook and line
- Lingcod are vulnerable to overfishing due to their non-migratory habits, association with distinctive bottom features such as rocky reefs and moderate longevity (to 14 years)
- Strait of Georgia stocks are extremely low and the area is closed to both commercial (since early 1990's) and recreational (since 2002) fishing. Offshore stocks remain at moderate levels but there is no evidence of strong year class recruitment during the 1990's for either St. of Georgia or offshore lingcod stocks.
- The introduction of bycatch limits and effective quota monitoring by on board and dockside observers has, since 1996, reduced targeting on lingcod by the groundfish trawl fleet.
- Current management concerns include development of accurate abundance indices for St. of Georgia stocks, rockfish bycatch by targeted lingcod hook and line fisheries and integrated fishing plans (lingcod are bycatch in several hook and line fisheries, including salmon troll fisheries)

III. Pelagic Fish

Eulachon

- Small, anadromous fish which spawns in about 30 rivers in BC. Eulachon are particularly vulnerable to overfishing and other human activities as there less than 100 spawning rivers on the Pacific coast (Northern California to the Bering Sea).
- An important First Nation fishery, historically there has been a small commercial fishery on the Fraser River.
- Spawning stocks declined dramatically in 1994, particularly in more southern rivers, possibly due to ocean climate conditions. All fishing was closed in 1998.

- Most stocks recovered significantly 2000-03, First Nation and recreational fishery in the Fraser River re-opened in 2003. Central coast stocks remain weak.
- Currently eulachon are listed as “Threatened” by COSEWIC.
- Management issues include bycatch in trawl fisheries, particularly the shrimp trawl fishery, which now mandates use of fish exclusion grates to reduce fish bycatch.

Pacific Herring

- The most important pelagic commercial fishery on the Pacific Coast.
- Stocks collapsed in late 1960’s due to overfishing, recovered rapidly and the current roe fishery was initiated in 1972.
- Five fisheries management areas (North Coast, Central Coast, Queen Charlotte Islands, West Coast of Vancouver Island, and the Strait of Georgia).
- The BC herring fishery is considered a model precautionary approach for fisheries management and uses area quotas, a conservative harvest rate (20%), a minimum threshold for spawner biomass in order to open the fishery and pooled fishing effort to ensure that quotas are not exceeded.
- Stock status and outlook varies by management area, Currently St of Georgia, North and Central Coast stocks are strong, WCVI and QCI are uncertain or low. Strait of Georgia stocks are considered to be at historic levels.
- The status of minor spawning stocks is a management concern, particularly in the Strait of Georgia where almost all the spawner biomass is located in a single spawning area.

Pacific Sardine

- Like hake, sardine are a migratory species spawning in southern and Baja California and, under suitable water temperature conditions and population levels, migrate off the west coast of Vancouver Island in summer.
- Stocks collapsed in the 1940’s due to both overfishing and changing environmental conditions. Scale data from sediment cores indicate that sardine populations cycle dramatically over a cycles which average about 60 years.
- The Pacific sardine population appears to be recovering to pre-1940s levels, and approximately 10% of the stock migrates into Canadian waters.
- Conservative harvest rates (15%) suggest that approximately 15,000 tonnes could currently be harvested in Canadian waters, this quota is currently not fully utilized.
- Under current climatic conditions the outlook is good but decreases in water temperature could result in greatly reduced number of sardines migrating to Canadian waters. On a sustained basis, large fluctuations in abundance of this species should be expected due to climatic cycling and biological interactions.

Albacore Tuna

- A highly migratory, open ocean species distributed throughout the warmer waters of the Pacific Ocean.
- Canadian vessels participate in coastal (within Canadian or US waters) and high seas albacore fisheries and land about 3% of albacore caught in the Pacific (most being landed by Asian vessels). The Canadian fishery is a troll fishery.
- The fishery is not intensively managed but Canada has catch and effort reporting obligations under agreements with the US and the UN Agreement on Highly Migratory fish stocks.
- Albacore stocks are considered to be relatively high but there is concern about increasing fishing pressure particularly on younger fish (ages 3-5).
- Current management concerns include non-compliance with catch recording requirements, and implementation of the Canada/US Albacore Tuna agreement.

IV. Invertebrates

Geoduck

- Long lived (to 100 years) subtidal clam, with 4 to 12 year time period to recruitment to the fishery.
- 3 year area- rotational fishery, conservative annual harvest rate (1% of estimated biomass), refugia of deeper water, unharvested beds.
- Location and size of geoduck beds are well documented.
- Outlook is stable, fishery is fully exploited unless current enhancement efforts result in significant increases in biomass.
- Management issues include uncertainty associated with biomass estimates, the rapid expansion of sea otters (prey on geoduck), product discards (Hi-grading) and illegal harvest.

Red Sea Urchin

- Occur in discrete beds on rocky substrate, cannot be aged reliably, juveniles are often aggregated under adult urchin spines.
- Area- rotational fishery, conservative annual harvest rate (2-3% of estimated biomass), minimum size limit, location and size of beds are well documented,
- Outlook for stock is stable but fishery is fully exploited.
- Management issues include the need for better biological information (i.e. reliable aging method), the rapid expansion of sea otters which prey on urchins, and improved information on First Nation and recreational harvest.

Giant Sea Cucumber

- Occur on a variety of bottom substrates, cannot be aged but thought to recruit to the fishery at 4 years or more.
- Since 1997 sea cucumbers have been managed using a precautionary approach whereby only 25% of the coast is commercially fished, 25% is designated for experimental fishing and 50% is unfished. This fishing plan will continue until 2007.
- There is currently no stock status concerns under the precautionary approach outlined above, the management plan is designed to address the current lack of biological information for this species.

Intertidal Clams

- Three species are harvested by hand digging, native littleneck clams, butter clams and manila clams. The latter species was accidentally introduced to the coast in the 1930's with Pacific oyster seed and now forms over 80% of the commercial harvest.
- Rapid expansion of licensed harvesters in the late 1980s until licences were limited in 1998. This was the last fishery in BC to move to limited licences and therefore the only fishery with easy entry in the 1990s.
- Managed by area openings and size limit, most of the central and north coasts have been closed to harvesting since 1963 due to lack of PSP testing.
- Stock outlook is stable but overharvesting of specific beds in the Strait of Georgia and west coast of Vancouver Island is a management issue.
- The impact of recently introduced varnish clam on manila clams stocks (they inhabit similar intertidal habitats) is unknown.

V. Dungeness Crab, Prawns, and Shrimp

Dungeness crab and prawns are currently managed using some form of the “Triple S” (size, sex and season) management system rather than quota management. The triple S system is commonly applied to crustacean trap fisheries. The shrimp fishery is managed under area quotas and season. These fisheries experienced a large increase in fishing effort in the late 1980’s and early 1990’s, in part due to restructuring of the salmon fleet. Licence limitations were imposed in the early 1990s and subsequently trap limitations imposed in the crab and prawn fisheries.

Dungeness Crab

- Currently managed by size limit, non-retention of females and soft shell closures.
- Effort is limited by trap limitations and area designations.
- Stocks are considered to be stable but the fishery is fully exploited and there are continuing concerns about oversubscribed fishing effort.
- Management concerns include handling mortality of soft shelled crab, sea otter predation, need for better catch data for First Nations and recreational fisheries and compliance with trap limits.

Prawns

- A large species of shrimp inhabiting rocky substrate to depths of 500m. Short lived (4 years), maturing at one year of age.
- Managed by season, spawner index (fishery closed when # of berried females exceeds a predetermined threshold) and trap limits.
- Stocks are considered to be stable but the fishery is fully exploited and there are continuing concerns about oversubscribed fishing effort.
- Current management concerns include compliance with trap limits, growth of and lack of catch data for the recreational fishery, illegal harvest.

Shrimp

- Up to seven shrimp species are caught by the BC shrimp trawl fleet, short lived (to 4 years).
- Rapid expansion of fishing effort in mid-1990s primarily due to re-structuring of salmon fleet.
- Managed by area quotas, but no landings validation program except through fishing logs.
- Stocks are considered to be stable but the fishery is fully exploited and there are continuing concerns about oversubscribed fishing effort.
- Current management issues include bycatch reduction (particularly for eulachon and rockfish), fleet overcapacity and lack of abundance survey data.
- Fish exclusion devices are now mandatory on shrimp trawl vessels and have helped address the bycatch issue.

