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Pacific Coast Shrimp Trawl Fisheries: New Management and Assessment Co-management Programs.

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Abstract

The diverse and complex Pacific shrimp trawl fishery takes place along the British Columbia coastline, in a number of small inshore areas and large offshore grounds. The fleet of 248 licences is a mix of beam and otter trawls. There are seven Pandalid species harvested commercially and fisheries vary in complexity from single to multiple species fisheries with a variety of markets, including machine-peeled, hand-peeled, frozen-at-sea, fresh and live shrimp.

Landings peaked at over 7,300 tonnes, with annual landed values reaching $Cdn 13.6 million. Landings have declined since 1996, to annual levels ranging from 2,000 to 3,000 t @ $Cdn 5 to 7 million, due to low stock levels in offshore areas and more restrictive, precautionary management practices.

Fishery management has developed rapidly from passive management at relatively low levels of efforts to a complex suite of management programs starting in 1997, including time and area closures, catch ceilings (arbitrary precautionary limits, historically based or forecasted) and quotas assigned to more than 30 new shrimp management areas.

In-season area-swept trawl surveys using commercial and research vessels have led to fishery independent biomass indices and exploitation rates of 25-33% have been set initially. A long-term collaborative management and assessment program is being developed with stakeholders. It will include logbooks, catch monitoring, biological sampling, and fishery independent surveys.

At-sea observers on board commercial vessels, research cruises and plant sampling have been undertaken to determine the catch composition and develop preliminary estimates of bycatch, with an emphasis on eulachon and halibut. There have been efforts in the fleet to develop gear improvements and a code of responsible fishing practices.

Introduction

Pacific invertebrate fisheries

More than 35 species of Pacific molluscs, crustaceans and echinoderms are harvested from coastal British Columbia, Canada (Fig. 1) by a variety of nets, traps, by divers and others hand-harvesting at depth and in the intertidal zone (Harbo, 1998). Annually there are 17 fishing plans and several experimental fisheries for invertebrates supporting >1,000 intertidal harvesters and 1,500 licensed vessels.

Shrimp Trawl Fishery of British Columbia

Pacific shrimp species

The diverse and complex Pacific coast shrimp trawl fishery takes place along the British Columbia coastline in a number of protected inshore areas and large offshore grounds. There are seven Pandalid species harvested commercially (Butler, 1980) and fisheries vary in complexity from single to multi-species fisheries with a variety of markets, including machine-peeled, hand-peeled, frozen-at-sea, fresh and live shrimp. The majority of landings are a mix of "pink shrimp" (>90%), including *Pandalus jordani* (smooth pink, Ocean shrimp), *P. borealis eous* (northern or spiny pink) and *P. goniurus* (flexed shrimp), and the sidestripe shrimp, *Pandalopsis dispar*. Traditionally humpback shrimp *Pandalus hypsinotus*, coonstripe (or dock) *P. danae* and spot prawns *P. platyceros* have been caught incidentally in small quantities and recently in more directed fisheries. There is an active trap fishery for prawns, *P. platyceros*, and retention in the trawl fishery is restricted to minor, incidental landings.

Fleet size, composition, landings and landed value

The fleet of 243 vessels with 'S' licences (1999; eligible licences) is a mix of beam and otter trawls. An analysis of 186 active vessels (1999) indicated 136 beam and 42 otter vessels and 8 others that had not geared up, or had alternated gears. Effort and landings peaked at 222 active vessels and landings of 7,400 tonnes in 1996 (Fig. 2); the peak annual landed value of $Cdn 13.6 million was in 1995 (Fig. 3). Landings and value have since declined due to lower abundance of offshore pink shrimp and the implementation of precautionary catch ceilings and quotas.

The fleet is mostly comprised of small vessels (<13.85 m or 55 ft.) generally deploying beam trawls in the inshore protected waters. The larger vessels using otter trawls have tended to fish offshore areas.

Changes from passive to active management

Few management and assessment programs were in place prior to the 1990's and the fishery was open year round without catch limits in most areas. Licences were limited as early as 1977, logbooks were implemented in 1987 and total allowable catches were set for the offshore pink shrimp fishery off the west coast of Vancouver Island.

In the early 1990's a number of events led to a rapid increase in effort and landings in the shrimp trawl fishery. Changes in the management of groundfish fisheries and poor salmon returns coincided with a peak abundance of offshore pink shrimp (*P. jordani*) and high shrimp prices. The shrimp trawl fishery also expanded into many new areas, directing new and increased effort to harvest a variety of species for a variety of markets.

At the same time the department of Fisheries and Oceans Canada was moving to more precautionary management and risk averse principles and promoting selective fishing practices. Preliminary assessments were undertaken for the inshore shrimp fisheries (Boutillier et al. 1998) and the offshore pink (*P. jordani*) fishery off the west coast of Vancouver Island (Boutillier et al. 1997). Rapid changes over 1994-1995 showed an increase in active shrimp trawl vessels from 165 to 222, effort doubled from 7,311 days to 14,324 days, shrimp landings doubled from 3,192 t to 6,777 t and the landed value increased from $Cdn 4.7 to $13.7 million (Southey et al., in prep.).

Industry and Department of Fisheries and Oceans Canada Cooperative Programs

Over the period of 1996-1997, a number of changes were implemented that required the support and funding by industry. Following difficult consultations and a fishery closure, these changes were supported initially by a collaborative agreement with industry and later by a Treasury Board submission. Management and access fees of $Cdn 355K were set to support a regional fishery manager, catch monitoring and catch sampling programs. Annual industry funding has represented 2.6%-6.7% of the landed values. In 1999/2000, a contribution agreement was reached with the Pacific Coast Shrimpers' Cooperative Association (PCSCA) to provide funds for catch monitoring and selective fishing studies. The department continues to undertake catch sampling programs.

Shrimp Trawl Fishery Co-Management Programs

A regional fishery manager and several area biologists and fishery managers monitor the fishery in-season. In-season surveys (discussed later) are undertaken by stock assessment.

To control effort and landings 36 shrimp management areas were created and 31 catch ceilings or area quotas were set. Seasonal closures were implemented for the offshore pink shrimp fishery.

Fishers are required to hail out and provide timely and detailed landing records to a Service Bureau that provides weekly reports of landings by shrimp management area.

Shrimp Trawl Collaborative Assessment Programs

Catch sampling

The department of Fisheries and Oceans Canada undertakes a catch sampling program at-sea, dockside and at processing plants. Estimates of bycatch, with an emphasis on in-season estimates of eulachon and halibut bycatch are undertaken.

Fishery independent area-swept trawl surveys

For inshore fisheries and most offshore areas, fixed arbitrary, historically based, or forecasted catch ceilings were assigned to each shrimp management area. These catch ceilings can be adjusted in-season, if information from fishery independent biomass indices indicate that the area can sustain fishing pressure either less than or greater than the initial levels. The biological reference points for sustainable fishing pressure that are used are 25-33% of the estimated biomass of the area (Boutillier et al. 1998, 1999).

This is a long term program to assess the conservative thresholds. The management and assessment program will be designed to collect information on a number of key issues including the biotic and abiotic factors that affect the population, quantifying biological compensatory mechanisms, calculating depensatory mortality thresholds, evaluating factors affecting availability, developing survey designs which quantify shrimp in untrawlable areas, and accounting for variations in availability to trawl surveys due to vertical migrations (Boutillier et al. 1998 a,b,c,d).

Currently, due to the time and cost of surveys, only 12 shrimp management areas can be surveyed annually. Over time, index areas may be used to extrapolate and adjust catch ceilings for adjacent areas. Surveys have been undertaken with the support of industry vessels and currently by Fisheries and Oceans Canada research vessels.

There are many complexities associated with the different species of shrimp caught in this fishery. The habitat, behaviour and migration of shrimp are important criteria that vary for each species. Some species, such as *Pandalus jordani*, show substantial changes in distribution over the year, both in vertical distribution and spatial distribution. Some stocks of sidestripes (*Pandalopsis dispar*) indicate very limited movement.

Catch sampling and estimates of bycatch with an emphasis on eulachon

Preliminary monitoring and assessment of bycatch by gear and area in the 1997 and 1998 shrimp trawl fisheries in British Columbia identified concerns (Hay et al., in prep.). Selective fishing practices have been adopted voluntarily by the fleet but issues remain to be resolved. There are general concerns about the quantity and diversity of the bycatch and there are conservation concerns about bycatch of a particular species, the anadramous smelt, the eulachon *Thaleichthys pacificus* (Osmeridae). Eulachons are one of the most abundant of the bycatch species and there is a developing conservation concern for eulachons in many areas of the Pacific coast. Eulachons spawn in relatively few rivers from California to Alaska and many of the populations are at historically low levels. These fish are rich in oil and have a significant historical and cultural importance, especially to First Nations (Hart, 1973, Stewart,1975 and Kuhnlein et al. 1981).

In general, the catch by beam trawls was composed of 30 to 50% non-target species in a number of areas, but captured few eulachons. The otter trawls had lower overall bycatch, 10-20 %, but accounted for the majority of the eulachon bycatch. Halibut were rarely taken in beam or otter trawls during the sampling program (Boutillier et al. 1999).

Two methods of estimating eulachon bycatch are discussed by Hay et al.(in prep.). In-season estimates are derived from a catch proportion (CP) using a weight of eulachon to weight of shrimp ratio, based on the relative proportion of eulachon to shrimp in the catches observed at-sea and extrapolated to the in-season estimate of shrimp landed in the fishery. Estimates based on catch rates (CR) can only be undertaken post-season, using logbook records of effort and catch.

The major strategies to reduce bycatch, in order of priority are to monitor, avoid, exclude, escape and release non-target species. Selective fishing strategies for Pacific fisheries have been announced. The commercial sector will become more selective by minimizing encounters of stocks of concern, experimenting with alternative fishing gear, adopting modifications to existing fishing gear, employing new fishing methods and by improving existing gear and practices that reduce mortality and injury when releasing non-target species. The target dates for meeting the selective fishing objectives will be the year 2001 for salmon fisheries and the year 2005 for groundfish and shellfish fisheries (Anon. Fisheries and Oceans Canada. 1999).

Current Issues for the Future of the Shrimp Trawl Fishery

- *Overcapacity*. There appears to be too many vessels fishing for the current total allowable catches and additional licences are not currently active. Greater effort and economic dependency has been created by the retirement of salmon licences that has left many vessels with only a single licence to trawl for shrimp.

- *Complex management and assessment.* The current management and assessment programs are complex with 35 shrimp management areas and multi-species quotas in 31 areas. Quarterly openings for some areas in 1999/2000 have resulted in short fisheries, some only two days long. Varying types of gear also complicate management actions and the development of selective fishing practices.

- *Selective fishing*. The bycatch of eulachons continues to be a conservation concern and efforts will have to be directed to reducing bycatch of this species. Targets and schedules for selective fishing practices will have to be developed in cooperation with industry and stakeholders.

- *Assessment time frames*. The development of stock assessment data from fishery independent area-swept trawl surveys and fishery dependent data from logbooks and observers is a long-term process. Industry is frustrated by the limited number of surveys that can be undertaken annually and questions many of the precautionary catch ceilings. It is hoped that survey data and fishery data will provide indices for setting catch ceilings in unsurveyed areas.

- *Enhanced fishery values*. Fishers are working on selective fishing practices to reduce bycatch and to develop size specific and species specific fishing methods and practices for shrimp.

- *Funding of management and assessment programs*. Industry may have to contribute money through their associations or continue to pay increased management fees to support the new initiatives.

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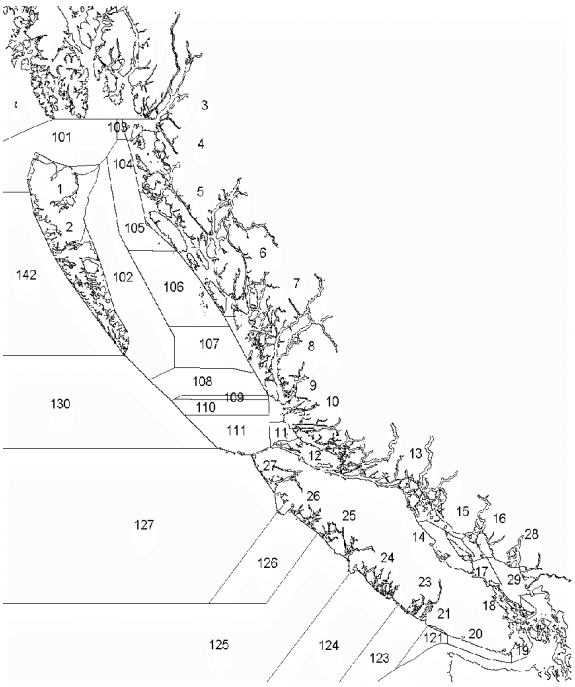

Figure 1. Pacific Fishery Management Areas (PFMA) of B.C.

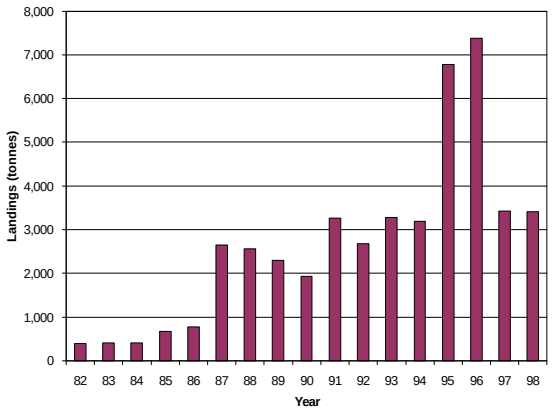

Figure 2. Landings (tonnes) of shrimp, 1982 – 1998 (NB : 1998 landings are preliminary). Area quotas were introduced in 1997.

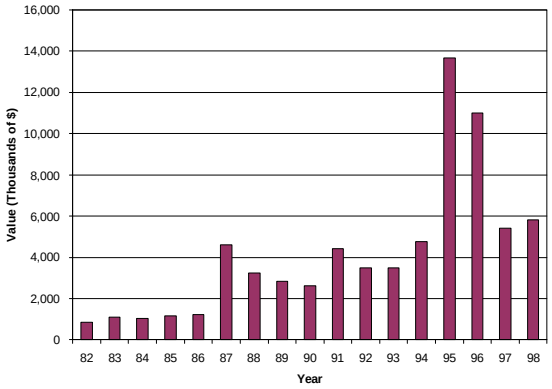

Figure 3. Landed value (in thousands of dollars Cdn) of the B.C. shrimp fishery, 1982 – 1998 (NB: 1998 landed values are preliminary).