Day 2

**David Fishman**

Herring data flow

4 regions use the tool; tools within for collecting different types of data

The boxes displayed are chosen by you based on the activity you are completing.

Ecosystem survey – designed for a survey and used with other computers, tablets, etc.

Port sampling app – designed as a stand alone tool on a tablet.

HERMAN

* Needs to be on the network
* Sample information stored as well as specimen information
* Works well with herring measuring board – board unfortunately has been discontinued
* Fish detail – looking for specific information before it calls the record complete
* Progress report – lets you see a real time report of the progress made for a year selected

DFO dots - hope that it will serve as a general repository for information for ageing. Stand alone database including annotated images and information that can be used to calculate growth increments, etc.

Data collected -> fed into Herman -> lab processing -> otolith processing -> export of data to another DB

**Questions:**

Can this work be done all in Andes, and not in Herman? Can Andes be used in the lab?

* Yes, this can be done in Andes, but here the herring group has their own flow and use Herman as a separate tool. But this could be implemented in Andes. Likely a result of specific data collections and data storage needs for the data from herring (storing it in Oracle). Another group has chosen to store all data, including historical data, on Andes.
* Advantages of Andes compared to Oracle – can more easily make changes to the setup and data collection methods.

**Sanaollah Zabihi-Seissan – NFLD Acoustics**

Stock complexes originally delineated in 1970’s/80’s.

Consistent mix of spring and fall spawners but assessed separately.

Historic survey 1938-2001 – only surveyed 4 areas, not 5. Surveys ended due to funding cuts and poor performance.

Survey during overwintering. Alternate year to year between the survey areas.

Survey 12 hours a day during the day, due to safety of transiting mainly.

Mainly use a purse seine to collect samples, but fish can move deep in cold temps (beyond seining depth), and seine can become frozen to deck and not available to fish.

2021 they opted to a blister bolted to charter vessel to hold the echosounder. Used to use just 120 kHz, now use 120 kHz but also 38 kHz as well.

Not mainly use charter vessels – not always able to get Coast Guard vessels.

Aim: to collect 55 fish per survey.

**Survey design:**

Stratified survey design. Division of regions was done in 1970’s/early 1980’s, and the regions were separated based on gepgraphical feaures (bays, etc).

Strata assigned sampling ratio that takes into account the previous fish biomass from that area, the difficulty of the survey in that area. Going forward: hoping to bin these values grouped for years rather than done each separate year.

Strata area - strata go to 120 m or 2 nmiles from shore. Problematic that right now they only cover a small area, but extrapolate the value to a larger, historically calculated sampling area (done by paper charts).

**Data processing:**

All biological backscatter that is within a transect considered to be herring. Potentially problematic.

May also use a different equation than other regions (Wheeler).

**Maintaining a timeseries:**

May move to equidistant transects. May do some verification to see if this is comparable to random transects.

Area coverage from survey to survey – some vessels go further out from shore than others.

**Questions:**

If you do not go close to shore, and consistently do not go close to shore, they are being consistent over time. If you stop at 20 m depth, and make the assumption that you are not missing survey area, you may have more success with depth of survey.

Diel behaviour during the night on the West Coast makes surveying difficult at night as species mix. So, they do acoustic surveys in the day.

In the past, random allocation of transects was done mainly, but it has been shown that systematic transects have greater precision but more difficult to calculate error (would have to use geostatistics). Random allocation of transects easier to calculate error.

**Uncertainty is difficult to quantify in acoustics surveys – harder to explain the error to management as this can just show the patchiness in species distribution. What is actually a sampling unit?**

**Shani Rousseau – Atlantic herring in the norther Gulf of St. Lawrence: a New acoustics survey design and methodology**

3 acoustic timeseries for herring surveys. 1991 – 2002 (reliable).

2009-2022 (stopped because of problems)

2019-present (new survey)

Doubts in terms of timing of coverage, and location. Did not see decline in cohort abundance in catch curve as expected.

Full methodological review in 2022 conducted but did not allow problems to be resolved. So they started a new survey entirely.

Last summer they implemented changes but hope this is the last time they implemented these changed. 2021 acoustic telemetry data project informed much of what they did with this new survey design.

4R is the current survey region, but 4Sw is going to be implemented. Very little commercial fishing except in 4Sw.

Collect data at night. Summer survey, 4 weeks long. Added strata in strait of Belle-Isle based on feedback showing large amounts of herring in that area. Significant mixing between fish of 4R and 4Sw. In August, most herring found in Northern strata. Used to have systematic survey design, but moved towards to systematic, parallel transect.

Charter a trawling vessel, and only have the vessel for 10 days, so cannot conduct direct validation of work. Try to get a min of 2 samples per strata. Use samples to disaggregate densities by age and spawning stock, biomass.

Acoustics classification of herring:

Older tools were not compatible with Echoview. Wanted to move away from expert judgement and keep it as objective as possible.

Bottom and surface definition – bottom is still manually reviewed. Deadzone calculated based on Ona and Mitson.

Add volume backscattering from all three frequencies, then threshold this < -70dB.

Step 3 – remove everything without a swim bladder. Use output of step 2, to use 200-38kHz.

Step 4 – fish with swimbladders – cannot separate only through multi freq response. Instead, use proportion of swim bladdered fish species in trawl and apply this to acoustic data.

For redfish, they are deep, so they are included in a 120m cutoff line. Everything below 120m for acoustics surveys is assumed to not be herring.

Future:

Underwater cameras to validate herring are seen. Broadband acoustics, eDNA. Continue work to understand fish migration.

Questions/Comments:

Stephane -use 18, 120, 38 kHz sounders. Tri colour to delineate species. Have they looked at other things such as schooling behaviour of species to differentiate between species?

* Hoping to develop method looking at environment variables.
* Multispecies survey – the schooling patterns are all different, and difficult to define good herring schools in all circumstances. Looking at cell based analysis, depth of signal.
* Using sampled amount that does not quite match in space and time difficult to apply. Also, catachability not the same for all species. However, percentage of herring in the area so much higher than that of any other species in the area.

Midwater trawl being used, how are they choosing fishing areas?

* Ideally give vessel random stations. Before, they would fish and only collect herring as they were only interested in biological information.
* Give the vessel diagonal transects across the area, and when they see something they fish it. Once they have fished, they move to the next point given to them to avoid double counting.

Are they able to capture acoustic data from the trawling vessel to compare that as well?

* Has been discussed, but they do not yet. May discuss the idea of recording it in future.
* Chris Rooper – used to collect ES60 data off of fishing vessels and it was not that difficult.

**Chris Rooper – Pacific Region Small Pelagic Fish Surveys**

ICES working group in slam pelagic fishes – project to compile small pelagic fish survey data. They would welcome folks to contribute to database – Chris will send a link.

**Potential issued with small pelagic fishes in Pacific.**

Gear changes over time, vessel change, net changes. Technology creep, such as incorporating GPS data differently.

Large changes over time can be significant. Try to account for these changes that occurred out of necessity.

Incomplete coverage of species distribution. Can be highly variable. Data gaps can be problematic.

**Tools for evaluating trawl performance**

Look at within haul trawl patchiness. Use stereocameras mounted within the net to look at selectivity and patchiness within the water. Patchiness even within the individual trawl when it comes to species composition.

Pocket nets were also included on the outside of the trawl to capture things that escaped the trawl. Used this to measure selectivity. Without these nets, would have assigned all backscatter to Pollock, when other species were found in these pocket nets and therefore the trawl only caught one species, but the acoustics found more than one.

**Calibration of new gear/technology**

Were the lengths obtained from the new board the same from the old board? Confirmed there was no difference between the two methods.

**Constant re-evaluation of methods**

Trying to look at efficiencies in trawl survey data collections. Checked data and then went back to see how well things worked afterwards.

**Integrated Pelagics Ecosystem Survey**

Combined vessel time to do 3 surveys together, which lead to a change from a day time/night time survey to a combination day/night survey. Survey changed to random stratified when it was different before. Modelling gives you the ability to tie older historical data in with newer data.

**Herring spawn deposition surveys**

Surface overflight surveys – 1951-present

Change in methodology. Incorporating into stock assessment: Moved from a separate index to a blended index, instead of a discontinuous model. Way to deal with discontinuity in time.

**Interruptions in time** **series**

ICES workshops established guidelines on dealing with these interruptions in the short and long term.

**Incomplete coverage of surveys – Strait of Georgia Age 0 herring**

At each transect they do up to 3 blind sets with a purse seine. Could they add acoustic data to increase value of this work? They now use a pole mounted echosounder to do up to two passes over each area before each set to see if they can incorporate this information. Timing of this survey, how does this correspond to timing of herring presence? Used upward looking acoustic setups to see when fish passed by. Also used seafloor moored echosounders.

**Surveys – SLYCAM to increase sampling efficiency**

Tried to lower a stereocamera (30 mins of work) to reduce sampling time compared with fishing with a trawl to verify acoustic targets. Able to collect good data on length frequencies.

**Summary**

Whatever survey you run will be an index. Be consistent with your sampling. Using a standard statistically robust method will make things easier.

High variability with small pelagics poses a challenge.

Consistent effort to pair research with monitoring – e.g. ecosystem conditions, gear selectivity, etc.

Try not to do single species surveys in Pacific now, with limited time and trying to maximise survey time. Lots of opportunity to collect diet information, etc., during the same surveys.

**Questions:**

How difficult is it to mount the camera?

* Slycam – put on CTD winch. But down into target school for 15 mins, and then bring back on board. Done this on other vessels opportunistically, but weather is a factor. Can be made small enough to be easy to use.
* Mounted on a net – once you get a mount for the net worked out, it is relatively easy to take it in and out and use it. Difficult to get set up and looking in the correct direction.

Camera and moored echosounder, how often did they take photos?

* 1 photo every 5 seconds – chosen so the battery would last 24 h
* Someone at NOAA working on a trigger photo – only take a photo when a fish passes by

Stephane: Stereocamera inside trawl is a bigger system – need to install square box in front of cod end.

Alternative to this is a camera in side the trawl, not a stereocam, looking just in front of the cod end. Helps estimate selectivity. Can help you separate fish species for acoustics to see where these fish are. Has been using this for years and it can be very useful.

Hard to find ready to made system – Stephane is looking at some ready to made systems to upgrade their systems. Hoping to add this to the bottom trawl for Qc and MAR regions.

* Strobe lights needs to be pointed backwards to avoid changes in fish behaviour.
* Mounted close to cod end, light looks down and camera points towards cod end.
* Need to be mindful of the time cost associated with analysis of this data, but there are methods to automate fish detection and identification that are available and could be explored.
* All regions should discuss these things together so that we do not duplicate work.

**The good, the bad and the Ugly – Acoustics survey design**

Challenge – how to deal with historical data

Assumptions of acoustic surveys – assume spatial domain encompasses survey area. Assume doing a survey at the time when the survey population is available. Stationarity – assume fish are stationary when you are sampling them.

Now: more statistical (e.g. geospatial methods) now available. Cannot go back in time to address problems from previous surveys.

Always going to be a relative index.

Consistency across surveys and regions.

Need to do research to inform monitoring.

Stephane for hake – conducts one year as a survey year, the next as a research year. Industry has pushed back in the passed when biomass is low so they skipped the research year to continue monitoring.

You don’t know what you don’t know. Might be areas of low biomass actually measured right next to an area of high biomass. Some surveys continue past the point where the fish ends by a certain distance.

Coast Guard vs charter/industry based vessels. Reliability, flexibility? Still have constraints with other fishing seasons, other charter users, etc. Optically paying industry vessels for work can not always look the best by external folks.

What about use of autonomous vessels? Stephane in Pacific has used Saildrones for hake. Alaska fisheries science survey was complimented by using Saildrone during Covid.

Drix – diesel powered unmanned vessel. Can run parallel transect at the same time as your traditional survey.

* Trawling or other validation methods not yet possible using these vessels.

Jaclyn – started using satellite imagery for spawn presence. Can download based on conditions you set out (such as % cloud coverage).

* Gulf region – looked into this, but for now, do not have the human power to do this.
* Too turbid in the Bay of Fundy

A good survey should cover most of the population, not all. Prone to problems if distribution changes.

Biomass estimate – is it just an index, or is it a partial estimate of the population? If it is an index, the scale of the index is irrelevant.

* Assume it is a constant part of the population.
* Relative biomass relative to itself.
* In the end, we should be able to be more than it is an index.
* We can be wrong, but as long as we are consistently wrong, it is okay.
* Can get around some bias an unknown things through automation, multi frequency data, etc.
* Index not a biomass because: coverage – are you getting full population, and TS to length relationship.
  + In Qc – do not really have a TS to Len relationship that they can trust, because using equations were developed on herring in Europe, not here.
  + Ona was selected because it is the average of the rest.
* Being one order of magnitude off or less when using an index, not that big of a deal.
* Important that industry recognizes that these surveys are not designed to accurately estimate the biomass of fish.
  + Types of surveys that chase industry ideas of where fish are located, change over time just in response to this criticism.