Description of PIT-tag time series on North East Atlantic mackerel and Norwegian Spring spawning herring

This data series is originally developed at the Institute of Marine Research in Bergen (IMR), Norway for the purpose of stock assessment and research. Note, that over the years the tagging program has developed to become an international co-operation, with recaptures at factories in more countries, and with tagging experiments carried out by Iceland and UK, but the central data base and data management is hosted by IMR. Hence, there are several data contributors and responsible scientists included as coauthors to the data publication of the time series. A lot of effort has been put into building up this time series, which now has reached a length making it interesting for use in research. There have been requests for access to the raw data in this project, which is why the data has been made open. We hope the time series may be used to increase the knowledge of mackerel and herring biology in addition to stock assessment purposes in the future. However, it is advised to include responsible scientists in discussions about the use of these data in scientific publications. Please contact responsible scientist Aril Slotte aril@hi.no prior to use of data outside stock assessment purposes in ICES WGWIDE, to secure a full understanding of the data, to avoid any conflicts of interest with ongoing research and to discuss potential research cooperation.

APIs/JSON links to the various time series on mackerel relevant for studying migrations and running estimations to include in stock assessment are given below, together with more detailed descriptions. To download data on herring, please just shift species name from 'mackerel' to 'herring' in the link. Note that there is an interface update from data base one time per day (Norwegian time 04.00), and an R-package https://github.com/IMRpelagic/taggart has been developed to download data from the APIs.

1. **Data relevant for PIT-tagging experiments and recaptures**

http://smartfishsvc.hi.no/api/data/Expeditions/mackerel Tag-recapture data of PIT-tagged mackerel. Release data are updated on daily basis, recapture data on continuous automatic basis.

http://smartfishsvc.hi.no/api/data/BioRawdataExpeditions/mackerel Biological data from all mackerel sampled during the years with PIT-tagging. Updated one month after each new survey.

http://smartfishsvc.hi.no/api/data/BioSamplesExpeditions/mackerel Links to the specific biological data allocated to the various PIT-tagging experiments on mackerel. Updated after survey.

2. **Data relevant for landing scanned for PIT-tagged mackerel:**

http://smartfishsvc.hi.no/api/data/Catches/mackerel Catch information data on landing scanned for PIT-tagged mackerel. Updated annually during quarter 1 for the preceding year.

http://smartfishsvc.hi.no/api/data/BioRawdataCatches/mackerel All biological data from catches landed in areas and the years with scanning of PIT-tagged mackerel. Updated annually at the latest by end of quarter 2 for the preceding year.

http://smartfishsvc.hi.no/api/data/BioSamplesCatches/mackerel Links to the specific biological data allocated to the landings from various years, areas, and periods with scanning of PIT-tagged mackerel. Updated annually at the latest by end of quarter 2 for the preceding year.

3. **Data on factories and periods where recapture efficiency is not acceptable for use in stock assessment**:

http://smartfishsvc.hi.no/api/data/OutOfOrder Updated randomly as issues are discovered.

All variables included in the different datasets and the links between them are described in Figures 1-2 and Tables 1-2 below.

Expeditions		BioRawDataExpeditions
Expedition		IndividualFishID
ExperimentNo		————————————————
ReleaseNo		StationNo
ReleaseDate		SampleNo
ReleaseBirds		Nation
ReleaseWaves		CatchGear
ICES_Rectangle		CatchDate
Tagger		Longitude
Assistant		Latitude
RFID		ICES_Rectangle
Length		ICES_Area
Longitude		FishNo
Latitude		Weight
RecaptureDate		Length
CatchID		Sex
FactoryID		Maturity
BioSample		Age
BioSampleID		YearClass

BiosamplesExpeditions

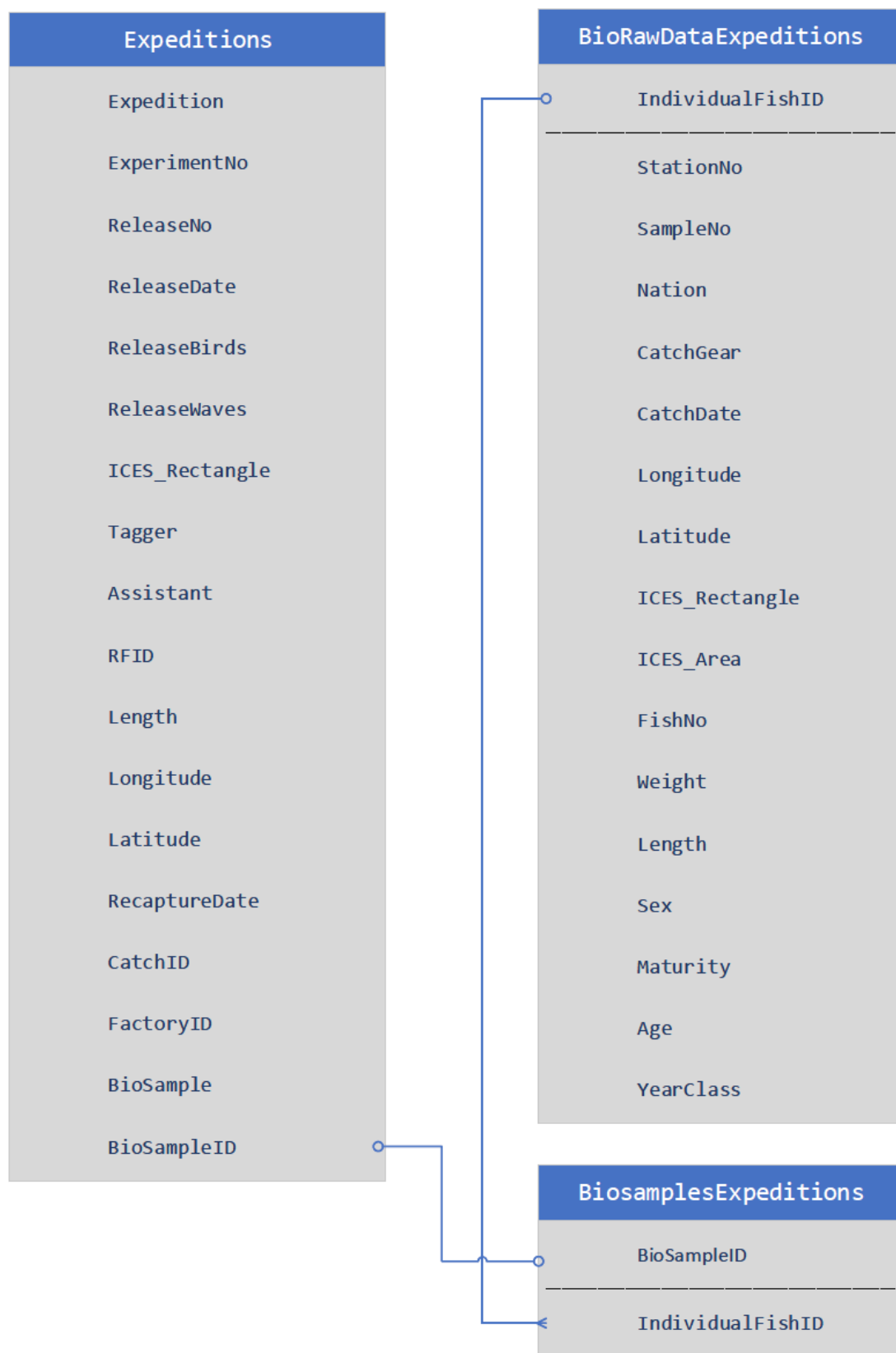| BioSampleID |
|---|
| ———————————————— |
| IndividualFishID |

Figure 1. Overview of variables in the tagging expeditions and the links to exact biological data forming the basis for estimating numbers released and recaptured by age/year class as basis for stock assessment. Note that each tagged fish has an allocated BioSample, and based on Length at release and an ALK (Age Length Key) from individual Length and Age of fish in allocated BioSample, a relative age distribution is estimated for each tagged fish. This distribution follows from release until recapture. Hence, a single recapture would show probabilities (0-1) of ages based on release length, signifying that over a year the sum of recaptures per age will be with decimals. See Tables 1-2 for detailed explanations of variables.

Figure 2. Overview of variables in the catch data and the links to exact biological data and info on factories/periods with unacceptable recapture efficiencies (OutOfOrder=not used in stock assessment) forming the basis for estimating numbers scanned by age/year class as input to stock assessment. Note that each catch has an allocated BioSample, and based on the relative age distribution of individual fish in this sample as well as number of fish in catch (CatchWeight/AvgFishWeight), numbers by age/year class can be estimated in same way as in the stock assessment. Note that AvgFishWeight is analysed per catch at each factory, but may occasionally be missed, and then AvgFishWeight should be same as average weight in the allocated BioSample.

Table 1. Overview and descriptions of variables in the data sets from Expeditions, including ID links to biological data (BiosampleExpeditions, BioRawDataExpeditions), see the diagram linking data in Figure 1.

Expeditions	
Expedition	Name of tagging survey, could be a number or combination of letters and numbers
ExperimentNo	Numbering from 1-n, defining experiments with several releases within same area and period, when survey moves area or there is a gap in time, number changes
ReleaseNo	Numbering from 1-n, typically defining days 1-n of an experiment, but could also change if survey moves a little area within same day
ReleaseDate	Exact UTC date-time (dd.mm.yyyy hh.mm.ss) of a tagged and released fish with given RFID
ReleaseBirds	Subjective scale (none, medium, lots) of presence of gannets, bird predators on mackerel that may prey on tagged individuals immediately after release and affect recapture rates
ReleaseWaves	Subjective scale (none, medium, lots) of wave heights that may affect the handling of jigged mackerel and potential future survival
ICES_Rectangle	Position of released fish in terms of 0.5 deg latitude and 1 deg longitude areas used to by ICES to report landings ICES statistical rectangles
Tagger	Initials of the person inserting the PIT-tag into abdomen of the mackerel, recording tag code and total body length of the fish
RFID	Radio Frequency Identification Code of the PIT-tag
Assistant	Initials of the person dipnetting the mackerel from holding tanks, that measures the total body length of the fish, holds it with belly up for tag insertion, and releases the fish through pipes of running water to the sea after tagging
Length	The total body length of the tagged mackerel
Longitude	Exact longitude of a tagged and released fish through GPS (can also be manually set)
Latitude	Exact latitude of a tagged and released fish through GPS (can also be manually set)
RecaptureDate	Exact Norwegian date-time (dd.mm.yyyy hh.mm.ss) of a recaptured mackerel
CatchID	Reference to the identification code (ID) of the scanned catch with recapture
FactoryID	Identification code (ID) of the factory scanning the catch with recapture
BioSample	Name of sample with representative biological data of the tagged mackerel
BioSampleID	Reference to the identification code (ID) of the exact data set found to be representative for released fish
BiosSampleExpeditions	
BioSampleID	Reference to the identification code (ID) of the exact data set found to be representative for released fish
IndividualFishID	Reference to the identification code (ID) of biological data from individual fish included under BioSampleID for expeditions
BioRawDataExpeditions	
IndividualFishID	Reference to the identification code (ID) of biological data from individual fish in the raw data from all years and all expeditions
StationNo	Name/number of the sampling station from a specific survey or commercial catch
SampleNo	Number specific for a sample taken during an expedition within a year, but could be the same between years
Nation	The nation of origin for the vessel sampled. Note that data on vessels used to sample are anonymized in open data, but exist in data base.
CatchGear	Type of gear used to catch fish in sample, could be name or a code number
CatchDate	Date (dd.mm.yyyy) of catch sampled
Longitude	Longitude of sampled catch
Latitude	Latitude of samples catch
ICES_Rectangle	Position of sampled catch in terms of 0.5 deg latitude and 1 deg longitude areas used to by ICES to report landings ICES statistical rectangles
ICES_Area	Position of sampled catch in terms of larger statistical areas used to by ICES to report landings Maps and spatial information (ices.dk)
FishNo	Fish 1-n, identifying where in a sampling sequence the fish was sampled
Weight	The total body weight in grams (g)
Length	Total body length in centimeters (cm)
Sex	Definition of sex, female (1) or male (2)
Maturity	Subjective scale for maturity 1-n, definitions could differ between country sampling (1-2=immature, 3-4=maturing, 5=ripe, 6=spawning, 7=spent and 8=resting
Age	Age in years based on otoliths
YearClass	Year the sampled fish was born (year of sample minus age)

Table 2. Overview and descriptions of variables in the data sets from Catches, including ID links to OutOfOrder factories and biological data (BiosampleCatches, BioRawDataCatches), see the diagram linking data in Figure 2.

Catches	
CatchID	Reference to identification code (ID) of the catch that was scanned
CatchNo	Identification of a catch scanned for PIT-tagged mackerel, a number from 1-n, specific for a year, but could be similar between years. Note that vessel info is anonymized.
Nation	The nation of origin for the vessel landing the catch. Note that data on vessels used to sample are anonymized in open data but exist in data base.
CatchDate	Norwegian date-time (dd.mm.yyyy hh.mm.ss) of catch, note that time is set to 00.00.00 when time is not given
ICES_Rectangle	Position of catch in terms of 0.5 deg latitude and 1 deg longitude areas used to by ICES to report landings ICES statistical rectangles
ICES_Area	Region of catch in terms of areas used to by ICES to report landings
Factory	Name of factory where the catch is landed and scanned for PIT-tags
FactoryICES_Rectangle	Position of Factory in terms of 0.5 deg latitude and 1 deg longitude areas used to by ICES to report landings ICES statistical rectangles
ProcessingDate	Norwegian date-time (dd.mm.yyyy hh.mm.ss) of processed landing. Note that time is set to 23.59.00 when time is not given (2012-2019), else the exact time defines when processing is finished of the specific catch
CatchWeight	Catch weight in kilo (kg)
AvgFishWeight	Average weight of mackerel in the catch in gram (g) from analyses at factory, if not given must be estimated from representative BioSample for the catch
BioSample	Name of sample with representative biological data for the catch scanned for PIT-tags
FactoryID	Reference to identification code (ID) of the factory where the catch was scanned
BioSampleID	Reference to the identification code (ID) of the exact data set found to be representative for a catch scanned
OutOfOrder	
Reason	Short description why factory is considered unacceptable in terms of scanning efficiency
FactoryID	Identification code of the factory where the mackerel was scanned, but found to be out of order and not acceptable for use as basis for stock assessment
Start	Norwegian start date-time (dd.mm.yyyy hh.mm.ss) for the period factory being out of order, time normally set to 00.00.00 for a specific date
End	Norwegian end date-time (dd.mm.yyyy hh.mm.ss) for the period factory was out of order, time normally set to 00.00.00 for a specific date
BioSampleCatches	
BioSampleID	Reference to the identification code (ID) of the exact data set representative for a catch
IndividualFishID	Reference to the identification code (ID) of biological data from individual fish included under BioSampleID for catch data
BioRawDataCatches	
IndividualFishID	Reference to the identification code (ID) of biological data from individual fish in the raw data from all years and all catches
StationNo	Name/number of the sampling station from a commercial catch
SampleNo	Number 1-n specific for a sample of a commercial catch within a year, but could be the same between years
Nation	The nation of origin for the commercial vessel sampled. Note that data on vessels used to sample are anonymized in open data but exist in data base.
CatchGear	Type of gear used to catch fish in sample, could be name or a code number
CatchDate	Date (dd.mm.yyyy) of catch sampled
Longitude	Longitude of sampled catch
Latitude	Latitude of samples catch
ICES_Rectangle	Position of sampled catch in terms of 0.5 deg latitude and 1 deg longitude areas used to by ICES to report landings ICES statistical rectangles
ICES_Area	Position of sampled catch in terms of larger statistical areas used to by ICES to report landings Maps and spatial information (ices.dk)
FishNo	Fish 1-n, identifying where in a sampling sequence the fish was sampled
Weight	The total body weight in grams (g)
Length	Total body length in centimeters (cm)
Sex	Definition of sex, female (1) or male (2)
Maturity	Subjective scale for maturity 1-n, definitions could differ between country sampling (1-2=immature, 3-4=maturing, 5=ripe, 6=spawning, 7=spent and 8=resting
Age	Age in years based on otoliths
YearClass	Year the sampled fish was born (year of sample minus age)