

## **Fisheries Natura Plan for mussel seed (*Mytilus edulis*) in Castlemaine Harbour, 2016-2023**

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### **Legal Basis**

Castlemaine Harbour includes both a Special Area of Conservation (SAC) and Special Protected Area (SPA). This fisheries Natura plan relates to mussel seed fishing in Castlemaine Harbour over the ten year period 2016-2023 and the subsequent husbandry practices associated with the seed within or adjacent to the relevant Natura 2000 sites.

The Minister for Agriculture, Food and the Marine, as a public authority under regulation 27 of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011), must exercise his functions so as to ensure compliance with the requirements of the Habitats Directive, the Birds Directive and the 2011 Regulations.

The European Union (Birds and Natural Habitats) (Sea-Fisheries) Regulations 2013 (SI 290 of 2013) as amended provide for the submission of a draft fisheries Natura plan and the appropriate assessment of a plan to identify where sea-fisheries may be allowed to proceed within appropriate guidelines to address risks to protected species and habitats (Regulation 5 assessment) to enable the fulfilment of the Minister's obligations.

The Minister for Agriculture, Food and the Marine also must exercise his functions so as to ensure compliance with the requirements of the Common Fisheries Policy (Regulation (EU) No. 1380/2013), with an emphasis on the article 2 objectives of aiming for the environmental sustainability of fisheries in the long term and applying the precautionary approach to fisheries management.

The plan was drafted by the Secretariat of the Bottom Grown Mussel Consultative Forum (BGMCF) in consultation with Bord Iascaigh Mhara (BIM), industry members in the area and the Committee of Management of the Castlemaine Harbour Co-operative Society Limited (persons affected by the designation). It was submitted to the Minister for Agriculture, Food and the Marine in April 2016. The plan was reviewed by the Marine Institute (MI) as part of the Regulation 5 assessment of the plan. The plan was modified and adopted by the Minister in accordance with Regulation 6 of SI 290 of 2013.

The plan covers fishing in the period 1 August 2016 to 31 December 2023.

On foot of the plan, a fisheries Natura declaration may be issued by the Minister in accordance with Regulation 9 of SI 290 of 2013.



Settlements on areas mapped as having infrequent settlements (in yellow on Fig. 1) have historically been reported to occur once every 10-15 years. Given the low frequency of occurrence of these settlement events, settlement in these areas may not occur over the lifetime of the plan. Thus it does not formally include a specific planning element for such a fishery although the local fishermen wish that such a possibility be kept open to cover the eventuality, however remote. In the case of such settlements, the MI would be notified through the annual survey reporting arrangements. At that point a determination could be reached, depending on the size and extent of the 'infrequent' seed spatfall, as to whether or not a further appropriate assessment for the purposes of opening that bed to fishing should be pursued.

The actual area to be fished, which will be a fraction (typically less than 50%) of the historic extent of the main bed, will be mapped and a permitted fishing area established and permitted by DAFM annually. The area shall be derived from the actual location of the seed mussel spatfall within the 'fishable ground' in a given year, and shall also be determined so as to take account of safety considerations to allow proper vessel operations and safe navigation. It shall be kept as compact as possible consistent with the above requirements.

### **Control Measures, Practices and Procedures**

Various control measures, practices and procedures are in place for the fishing and husbandry activities related to the fishery. These provide a series of complimentary safeguards against over-exploiting the mussel seed stock and for mitigating effects on the ecosystem.

The specific areas involved include:

1. Survey Arrangements
2. Harvest Volume
3. Operators
4. Seed Mussel Fishing
5. Husbandry
6. Activity Monitoring
7. Control and Management

#### **1. Survey Arrangements**

Annex 1 contains a detailed description in respect of surveying of Castlemaine Harbour for mussel seed. The annual BIM survey effort will initially concentrate on the known regularly recurring seed areas suitable for fishing identified in Fig. 1; a less detailed broad scale survey will also be undertaken annually to identify what additional inaccessible/non-exploitable seed areas have occurred. Both will be mapped and the maps transmitted to the MI and DAFM. If resources allow, the bed should be monitored for predators (starfish) within that period. Once the fishery is finished, an assessment survey of the seed should be completed.

#### **2. Harvest Volume**

Harvesting of seed mussel will be licensed through volumes expressed in the seed fishing authorisations and the Natura permits which effectively legislate a total allowable catch (TAC) for the fishery. The harvest rule of thumb is to reserve 33.33% of the biomass as prey for waterbirds with the remaining 66.66% being fished and relayed in the inner harbour where ongrowing stock may act as an additional prey source and as a source of future recruitment. It should also be noted that the seed mussels occurring

in the areas 'unsuitable for fishing' will also act as a substantial reserve of prey source for the diving birds over and above the other reserved sources already described.

### **3. Operators**

Mussel dredgers are licensed to fish mussel seed for aquaculture purposes operating in Castlemaine Harbour. The operators are members of the Castlemaine Harbour Co-operative Society Ltd. which holds the Mussel Fishery Order from 1979. In addition, all mussel dredgers fishing seed are registered and licensed as aquaculture fishing vessels or work boats. The vessels also require annual authorisations from DAFM to fish mussel seed, along with a Castlemaine fisheries Natura permit and the relevant movement authorisations.

### **4. Seed Mussel Fishing**

#### *Overview*

Seed mussel is fished from the sub-tidal seed areas identified in the surveys and either transferred for hardening on an intertidal nursery site in the mussel order area for 6 to 12 months, placed directly onto sub-tidal growing areas within the order or directly onto aquaculture sites within the harbour. Depending on the state of the tide, relaying on the nursery area may extend eastwards towards deeper water but will be restricted to the intertidal. Different strategies are adopted in line with the condition and size of the seed, with intertidal relaying providing protection from crabs.

If seed is placed on the nursery area it is subsequently transferred to sub-tidal plots and licensed sites for on-growing until harvest. Generally seed is moved to the sub-tidal between June and August but the duration and timing of stock movements from the nursery area to the sub-tidal is dependent on a number of factors such as market conditions, growth rates and the size of the original seed.

In response to unusual events such as an extended biotoxin closure, seed may remain on the nursery area for a longer period. If such an event is likely to occur the MI will be notified.

#### *Seed fishing*

Fishing takes place on suitable neap tides ( $\leq 7\text{m}$  as predicted in the Llanelli tide tables) subject to seed availability, allocation and suitable weather conditions.

The Co-op requests that the Castlemaine fishery be managed in line with seed fisheries elsewhere on the island of Ireland, i.e. a spring and autumn fishery subject to seed availability. Also in line with the management of other seed areas on the island, the force majeure clause may be initiated and a request made to the Minister through the Bottom Grown Mussel Consultative Forum to have the area opened at an earlier date, if the bed is subject to high predation pressure.

Currently in Castlemaine Harbour, 5-6 large vessels will access the seed using 2-4 single dredges each. The types of dredge used are 2m mussel dredges with a flat bar that is designed to skim the surface of the substrate and separate mussel seed from the underlying sediment of the substrate and remove the mussel seed. There is the potential for large boat infrastructure to increase to 9-10 vessels; however this would be subject to sourcing significant investment, and appropriate licencing.

Currently a number of smaller vessels (9-10) using single hand held dredges may also access the seed beds subject to licencing, safety and appropriate tracking equipment requirements. There is the potential for small boat infrastructure to increase to 18-20 vessels; however this would be subject to sourcing significant investment, and appropriate licencing.

### *Other Seed Sources*

Seed may also be sourced from the Irish Sea to supplement co-op re-seeding activities between 2016 and 2023.<sup>1</sup> This activity is not intended to increase the seed volume relayed in Castlemaine above historical levels but rather to replace the resource that is sometimes not available locally. The proposal therefore will not contribute to coverage levels in the relay area above that previously regarded as acceptable.

Operators that hold mussel seed allocations for aquaculture sites in Castlemaine and wish to fish for mussel seed outside of Dingle Bay will be able apply to do this during the annual “expression of interest” process for the fishery. A protocol will be agreed with the Co-op for how allocations of seed to be fished outside the bay should be managed. Mussel seed sourced from outside Dingle Bay will be permitted to be relayed only onto aquaculture sites where such seed is not prohibited by the aquaculture licence conditions for the site.

Any seed fished outside Dingle Bay will need to be screened for alien species under an alien species monitoring programme. Alien species observer monitoring will be carried out before the opening of the fishery, during the seed mussel surveys and pursuant to risk assessment procedures. As the mussel seed surveys may not survey all the beds potentially fished, a risk assessment process will have to be adopted to enable a wider monitoring of potential beds and risks.

BIM propose to engage a consultant to sample seed beds prior to the opening of the fishery in 2017. This will form part of their 2017 work programme. Data generated from this survey will inform a risk assessment process for all relaying areas and will inform the required level of future sampling and how the wider monitoring programme should be conducted into the future. This procedure will be agreed with the Department of Agriculture, Food and Marine prior to the 2018 and subsequent seed seasons.

Also, BIM, the MI and the National Parks and Wildlife Service (NPWS) propose to establish a working group with industry members to address the issue of shellfish associated alien species transfers. The alien species observer monitoring programme will be further informed by this new working group.

## **5. Husbandry**

### *General*

Due to the fluctuating seed input, the output from the licensed sites varies but generally ranges from 2,000 to 5,000 tonnes per annum. Annual returns are submitted by industry members to BIM documenting ground usage, tonnages and the quality of harvested product.

Mussels are on-grown on the mussel fishery order area (which is licensed in perpetuity) and on licensed aquaculture sites in the inner harbour (ten year renewal period). In general the details of production rotation are as follows, though it may vary slightly with individual operators:

- Seed placed directly on sub-tidal plots within the order or on licenced sites remains there until harvest (2-3 years);

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<sup>1</sup> Previously, the then Department of Arts, Heritage and the Gaeltacht expressed concerns with the fact that this activity had not been appropriately assessed (2011). Industry members in Castlemaine now contend that, given the assessment of the seed beds in the Irish sea and alien species sampling undertaken in 2013/2014, following the agreement of the AA in the Irish Sea and the submission of results from alien species sampling (assuming that no species of concern are identified), that movements should be permitted in order to ensure the survival of their businesses.

- Seed placed in the nursery area remains there for 6 to 12 months depending on market conditions, size of seed and growth rates, seed is transferred from the nursery to sub-tidal plots and licenced sites for on-growing until harvest, the sub-tidal grow-out phase lasts for a further 12 to 18 months, however if there is a seed shortage in a following year some operators hold back stock to ensure cash flow in poor years.

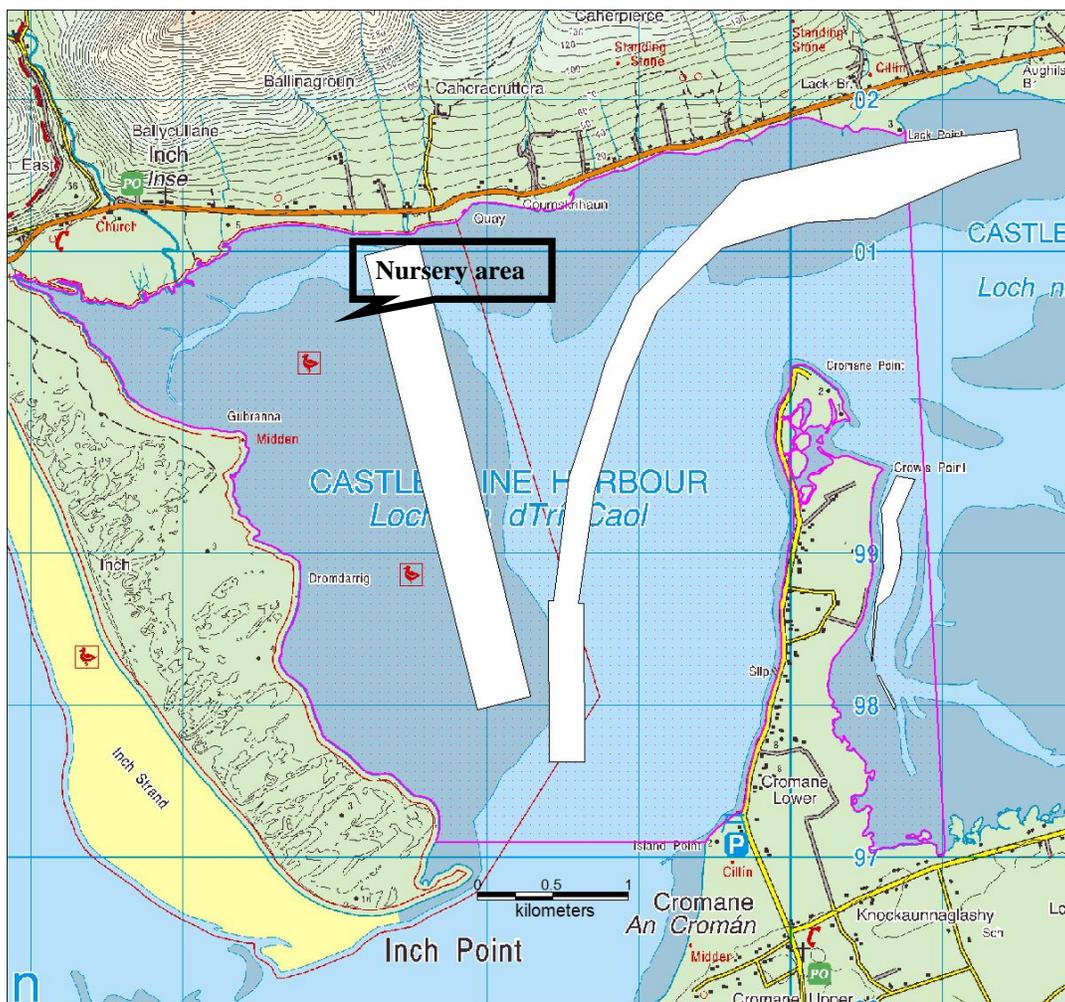
Harvesting takes place from late September until mid-March.

The nursery and on-growing areas are currently subdivided into plots determined by the Co-op and allocated on a ten year permit to the 57 permit holders who are members of the Co-op. Permit holders tend to work in groups consisting of one to seven members. The footprint of the nursery and on-growing areas will not change over the 2016-2023 period, however subdivisions within the areas may change.

### *Nursery area*

Within a few hours of seed being fished, the seed will be relayed in the nursery area (Fig. 2).

**Fig. 2: Castlemaine Nursery Area**



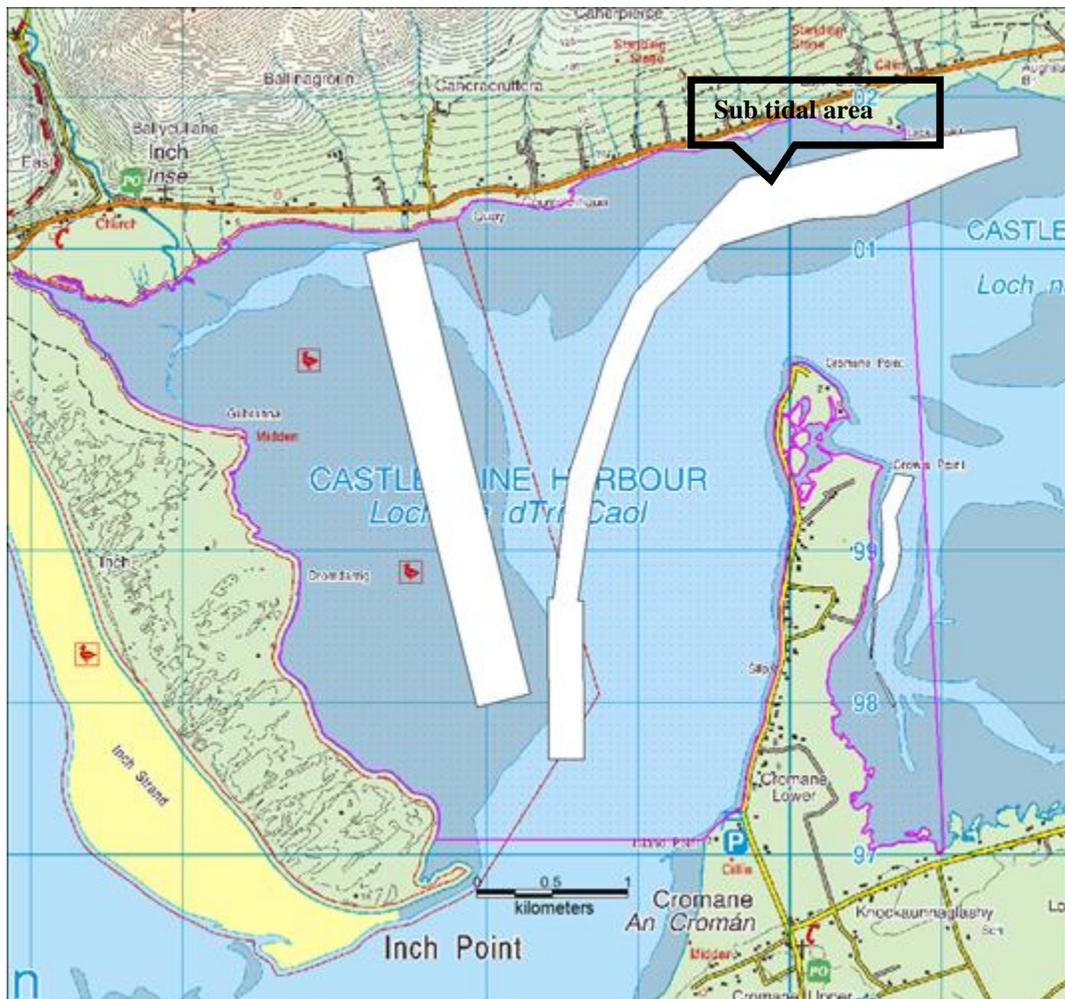
Vessels involved in transplantation of mussels from the seed fishery to the intertidal area will be appropriately licensed and equipped. Larger vessels transplant the seed by pumping it mixed with

seawater from the boats hold onto the nursery and grow out plots. The pattern of relaying is characterised by the vessels moving across the plots during pumping in an effort to achieve an even distribution of mussel on each plot. This will maximise survival and growth. Smaller vessels ‘punts’ operate a broadly similar seed fishing approach using single dredges to access the resource.

Mussel cover within the nursery plots typically varies between 12-42%. The nursery used for relaying seed represents only a small proportion of the intertidal area in the Fishery Order (approximately 30%). The nursery area is located on the low intertidal, with all the seed being exposed on extreme low water spring tides.

Generally the nursery area is cleaned of stock by dredging through the mussel mud that has built up underneath the stock. However due to the nature of the harvesting activity some residual patches will remain within the nursery plots particularly in the southern plots where smaller vessels operate and seaweed has become attached to mussel clumps.

**Fig. 3: Castlemaine Grow-out (Sub-tidal) Area**



### *Grow-out*

Licensed mussel vessels and licensed punts relay the stock on the sub-tidal area (Fig. 3). The licensed mussel vessels do this by pumping the seed mixed with seawater from the boat’s hold onto the grow-out

plots. This pattern of relaying is characterised by the vessels moving across the plots during pumping in an effort to achieve an even distribution of mussel on each plot in order to maximise survival and growth.

The punts collect the seed using beet forks/pikes and then deposit it on the sub-tidal over the side of the vessels. Again the pattern of relaying is characterised by the vessels moving across the plots in an effort to achieve an even distribution of mussel on each plot.

Relaying is generally at a density of 35-40t per hectare. Return rates of a minimum of 1:1 are expected and the final product is harvested to order by vessels, from the sub-tidal plots and licensed sites. All harvesting and sales activity is monitored by the Sea-Fisheries Protection Authority (SFPA) by a variety of mechanisms: gatherers documents, VMS plotting, establishment licensing, and depuration centres.

No waste is generated as the harvested product is placed directly into one tonne bags for export, via refrigerated truck from Cromane.

#### *Predator Control*

There is a green crab predator control programme associated with the sub-tidal plots, generally focusing on the channels entering the inner harbour. Up to 10 boats using up to 100 pots each are involved in the potting of the area for green crab, using waste from white fish processing establishments as bait. Currently only 5/6 boats are operating in this fishery. No bycatch has been detected in this fishery.

## **6. Activity Monitoring**

Fishing activity is tracked through the completion of log-books, compliance with the SMS stock tracking system and the output from the black box monitoring system. Operators track their nursery to sub-tidal relaying activity in their farm diaries in compliance with fish health requirements. Following consultation with individual producers, these records will be made available to the MI for inspection to facilitate assessment and monitoring. Harvesting activity is tracked through the completion of Gatherers Documents as required under the EU Health Packages.

Mussel cover in the Castlemaine Harbour Fishery Order (FO) area will be monitored annually by the MI and/or DAFM (Engineering Div). Monitoring of water bird numbers is routinely carried out by iWeBs. If this is not continued, the MI will initiate a separate programme. Assessments of the impacts of mussel cover on water birds will be carried out by the MI if the average mussel cover in the FO area is found to have increased significantly beyond 12%.

## **7. Control and Management**

#### *Legislative Basis*

The fishing of seed mussel and the operation of mussel dredgers is controlled primarily by the following legislation: the Sea-Fisheries and Maritime Jurisdiction Act 2006 (No 8 of 2006); the Mussel Seed (Fishing) Regulations 2006 (S.I. No. 311 of 2006); the Molluscan Shellfish (Conservation of Stocks) Regulations 2006 (S.I. No. 345 of 2006); the European Communities (Health of Aquaculture Animals and Products) Regulations 2008 (S.I. No. 261 of 2008); the European Communities (Natural Habitats and Birds) (Sea-fisheries) Regulations 2013 (S.I. No. 290 of 2013).

#### *General Management Arrangements*

Working from this legislative base, and from a fishery conservation point of view, and in the interests of minimising any possible adverse environmental impact, the following are the general terms and

conditions that will apply to all vessels involved in the sub-tidal fishery in Castlemaine Harbour from 2016-2023:

- The Castlemaine seed beds are monitored and surveyed by BIM. In consultation with industry members and the BIM inshore survey officer, the BGMCF makes recommendations to the Minister regarding decisions to open or close seed mussel beds on conservation grounds, i.e. if the seed is too small or fragile to transport. Depending on local navigation and safety conditions the numbers of vessels engaging in fishing activity in a specific location may also be regulated along with the times of fishing.
- All vessels participating in the fishery must hold a mussel seed authorisation and a Castlemaine Natura permit particular to that vessel. A vessel must have the correct documentation on board at all times of operation.
- Prior to the issuing of mussel seed authorisations, hull markings and black boxes will be certified by an authorised officer. All vessels will have each side of the stowage hold marked in 0.5m segments from the bottom to the top; 0m being the bottom or floor of the hold to facilitate estimation of catches on-board.
- Operators will specify which vessels will be fishing seed allocations on their behalf. The vessels will be registered and licensed to fish. Authorisations to fish and move mussel seed are linked to the aquaculture operators.
- Mussel dredgers over 15m in length are required to have the EU Vessel Monitoring System ('blue box'). Their position is monitored by the Naval Service every two hours as part of the normal fishing regulations. In addition any dredger fishing seed mussels is required to have a functioning black box system (which is a global positioning system that via a modem relays vessel speed heading and position). This system allows the vessels to be monitored and tracked on a more continuous basis and allows detailed tracks and locations to be recorded. All mussel dredger movements can be viewed and checked by base stations operated by the SFPA, BIM, the Loughs Agency and the Department of Agriculture, Environment and Rural Affairs (DAERA) in Northern Ireland, subject to data protection requirements.
- All vessels fishing seed mussels will maintain log books as required. The Master will inform a Sea Fisheries officer at least four hours in advance of their intention to fish for mussel seed and give the name of the holder of the authorisation on whose behalf he or she intends to fish. The Master will keep a record of the licensed site or place to which the mussel seed is transplanted, the amount of seed transplanted and the date of transplantation.
- Any authorised vessel will inform a Sea Fisheries Protection Officer in SFPA Office Dingle two hours in advance of his intention to re-lay mussel seed and will facilitate an on-board inspection and calculation of the quantity of seed carried if required.
- In line with requirements elsewhere on the island of Ireland, all seed fished in ROI waters must be notified via SMS to 00353 87 9885116 as part of a stock tracking system prior to boats leaving the seed fishing areas. The phone number of the skipper must be notified to DAFM prior to the fishing season and caller ID must be enabled on the skipper's phone. SMS messages must contain: (1) the boat's name, (2) the source of the seed, (3) the destination of the seed, including aquaculture licence number or plot number and bay, (4) gross seed tonnage, (5) net seed tonnage and (6) authorisation number.
- Operators recognise that under the European Communities (Health of Aquaculture Animals and Products) Regulations 2008 (S.I. No. 261 of 2008), the local sea fishery protection officer has the authority to prevent the movement of animals if they feel there will be heavy mortality.
- Fishing will only be take place between the hours of 06.00 and 18.00.
- The vessels engaged in the fishery will make available a boat or boats at Cromane from where the Sea Fisheries Protection Officer will be ferried to the vessel or vessels on-board which mussel seed has been notified as being carried for relaying purposes.

- It is understood that further mitigation measures may be included in the terms and conditions of the Natura permit.
- Mussel cover in the Castlemaine Harbour FO area will be monitored annually. Assessments of the impacts of mussel cover on water birds will be carried out by the MI if the average mussel cover in the FO area is found to have increased significantly beyond 12%. Where such an assessment recommends changes to the level of coverage, the relaying of seed into the harbour may be managed in line with the assessment's recommendations and advice from the MI.

## **ANNEX 1: SURVEYING INFORMATION**

### **Survey Formats**

Throughout the year three different survey formats could be used depending on weather conditions, availability of equipment and time constraints.

#### A) Survey Vessel T'Burke

An Bord Iascaigh Mhara's (BIM's) coastal survey vessel MV T'Burke is the main platform used for the search, assessment and mapping of seed mussel beds nationally. The vessel can also be used for stock assessment of existing aquaculture licences, and mussel stocks in the wider inner and outer harbour area. It is fully equipped with acoustic, video and sampling gear (see list below). All the relevant positional, side scan sonar data etc. can be processed and mapped in real time on board using ArcGIS.

On Board equipment list:

- Dual Frequency (400/1250 kHz) side scan sonar which can be deployed in shallow waters.
- Seabed classification system RoxSwath.
- Mini Remotely Operated Vehicle (ROV) for underwater colour footage.
- Black and white underwater video camera.
- Day grab (0.1m<sup>3</sup>) for density assessment.
- 1 meter wide dredge with small diameter mesh.
- Standard wheelhouse electronics of radar, DGPS, Sounder, Plotter etc.

In addition to this, the survey officer uses a handheld GPS to record certain survey points, a laptop with ArcMap for plotting points and inputting measured sample data via a set of electronic scales and callipers.

*Note:* Most of this equipment can be deployed to another vessel if required (apart from the RoxSwath system). Both the side scan sonar and the RoxSwath system are connected to a GPS for geo-positioning.

#### B) Local or other vessels

In cases where the MV T'Burke is not available (i.e. weather conditions, or deployment in another coastal location) then another vessel could be used for the survey. As mentioned above, relevant equipment from the MV T'Burke can be transferred onto another suitable vessel for a survey if required.

#### C) Diving Operation

For a detailed visual assessment of the beds (mainly pre and post fishing season), a BIM dive team can be deployed on the area using the BIM rib or a local boat. The divers are equipped with underwater communication (diver to surface and diver to diver), cameras and camcorder, quadrats, sampling bags etc. In addition a survey officer has to be on location with the equipment needed for sample measurement and mapping. The ROV can also be used by divers. An acoustic survey may be carried out prior to the dive operation.

### **Survey Protocol**

In most of the surveys of the seed mussel stocks in Castlemaine Harbour, the protocol outlined below is generally followed. Nevertheless, weather conditions, tidal current, sea state and water turbidity can

dictate which equipment can be used efficiently at any given time. All the positional data is recorded in WGS84.

#### A) Seed Mussel Survey

*Step one: "Search":* As the position of the main seed bed (if present) is generally already known (historic areas) a dredge is used for short tows (3 to 5 minutes on the seabed). Tows have to be made against the tide most of the time. If the current gets too strong, towing with the tide at very low speed is also an option. Towing across the tide or against a strong current can result in lifting the dredge from the seabed and would not give a good idea of what is on the ground.

GPS points are taken at the start and the end of each tow; those are entered in an Excel spread sheet with:

- tows name and colour code,
- coordinates (latitude/longitude for start and end),
- date,
- time,
- average depth,
- tidal current speed (estimated),
- content observation,
- towing speed.

At the end of the tow, the dredge is brought back on the deck where it is emptied into a fish box. A picture of the contents is taken as well as a sample, which will be processed later. Generally, biometric data of mussels (size, weight, percentage of waste, number of pieces per kilograms) is collected from the dredge samples along with details of predators etc.

Each tow is named with the code TD for Tow Dingle followed by a number. When the tows are depicted graphically on a map in the report a colour code is used. The colour code is generally: **GREEN** for mussels, **ORANGE** for shells, stones, seaweed, **PURPLE** for other species (i.e. clams, large amounts of starfish) and **RED** when there is nothing in the dredge.

*Step two: "determination of the extent":* Once three or four successful tows have been made on the location; the extent of the settlement must be identified using acoustic equipment such as the side scan sonar or RoxSwath. The side scan sonar will be used to check the border of the bed; a number of tows must be made until the required area is covered. The high frequency setting will be preferably used to get as much detail as possible; the coverage width is approximately 25 meters each side of the towfish (depending on depth). Tows must overlap to cover the nadir (acoustic blind spot under the towfish). The data is then reviewed on land and borders are established and plotted on ArcMap. The data can be post processed to get a Geotiff image format of the tows, which can be used on ArcMap also.

The area is then cross checked with RoxSwath for sediment type and bathymetric data. The system must be calibrated *in situ* at first for sediment type (using ground truthing such as camera and/or grabs); then the survey vessel must do several passages on the survey plot to gain full coverage. The data can then be exported to Surfer (Computer programme) for 3D bathymetric/sediment type image or to ArcMap in point format.

The combination of the two acoustic systems gives a very good idea of the border of the seed bed with reasonable accuracy.

*Step three: “density and tonnage estimation”:* When the borders of the bed have been established, tonnage is determined by looking at the density and distribution of the mussels over the whole area using grab samples and underwater footage.

By reviewing acoustic data, sampling points are defined by the survey officer. At first, a series of grab samples will be taken to estimate the weight per metre squared (gross and net weight). A maximum of three grabs will be taken for each point. Each grab location is recorded on the handheld GPS and on the Excel survey spreadsheet with the following details:

- Grab code (name and colour),
- Position (latitude/longitude),
- Date and time,
- Depth,
- Weather conditions,
- Grab content observation,
- Tidal current speed,
- RoxSwath reading or side scan target number.

Grab samples have to be taken on the slack of the tide or with a maximum of 0.5 knots of current. The recorded code name for each grab (on the GPS and the spreadsheet) is as follows: G for Grab followed by the sample number i.e. G34 for Grab sample 34. The colour code used for the report is the same one that is used for the tows (see above).

The underwater black and white camera or the ROV then can be used to cover a transect and to recheck grab sample locations. Both cameras can be towed across a section of the bed. All footage is recorded on video and entered in the survey spreadsheet with usual details:

- Name and colour code,
- Position (latitude/ longitude; start and end if towed),
- Date and time,
- Depth (average if towed),
- Weather conditions,
- Observation,
- Tidal current speed,
- RoxSwath reading or side scan target number.

In addition to this, the ROV displays on screen: time, date, depth and water temperature.

All grabs and videos are then plotted on ArcMap using the colour codes. All the grab data is recorded on a single spreadsheet with relevant details and a picture of the sample.

Finally, a survey map is issued with the bed borders and all the data collected; followed by a seed mussel survey report containing the details of the survey, the bed coordinates, the biometrics measurement and some recommendations. After review and editing, the summary report and the map are communicated to the industry and published on the BIM website usually within a week of the survey being completed.

*Inter-tidal areas:* On inter-tidal beds, the survey can be carried out on foot from the shore at low tide. The survey officer must be equipped with a handheld GPS (Garmin or Trimble), sampling bags with tags, a 50cm x 50cm quadrat, a camera, a small spring loaded scale and a note pad.

The bed co-ordinates must be entered in the GPS and a random set of sampling points must be defined prior to the survey. The sample should be taken within a 2 meter radius of the point selected and can be weighed directly on site or later after the survey. Pictures can be taken to show different density patches, their positions must be recorded in the GPS and the notepad with observations. All the results are then recorded on an Excel spreadsheet and a density map can be produced on ArcMap.

## ANNEX 2: MODIFICATIONS TO FNP FOR CASTLEMAINE HARBOUR

<b>Amendment</b>	<b>Rationale</b>
Period of application: 2016 to 2023 (rather than 2026)	A large number of aquaculture licences for mussels will expire and become eligible for renewal from mid-2023. It would be sensible to align the re-assessment of aquaculture and fishing activity associated with mussels if possible and practical. Period of application is specified in the text.
Addition of legal basis	To clearly state the basis under which the plan is being brought forward.
Addition of rationale for mitigation	To clearly state the reasons mitigation of some aspects of the fishery are needed.
Amend text in “Seed Mussel Fishing: Other Seed Sources”	To take account of the need to establish procedures to screen seed sourced from outside Dingle Bay for alien species. The new text was developed in conjunction with the MI and BIM, as Secretariat to the BGMCF.
Amend text in “Activity Monitoring”	To take account of the need to monitor changes in mussel cover in Castlemaine and to assess any impacts such changes may have on bird populations there. The text was updated in conjunction with the MI.
Amend text in “Control and Management: General management arrangements”	To take account of the need to monitor changes in mussel cover in Castlemaine and to assess any impacts such changes may have on bird populations there. The text was updated in conjunction with the MI.
Reformatting and rearrangement of sections of the plan	To make the format and order of the plan more consistent with those of other fisheries Natura plans.