**Survey of Potentially Harmful Medusae and**

**Toxic Phytoplankton**

**In Donegal Bay.**

**Produced by**

**AQUAFACT International Services Ltd**

**On behalf of**

**ABCO**

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# Report Approval Sheet

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| 1 | Draft | | Harmful medusae and toxic phytoplankton, Killybegs | C. Tweedy | B.O'Connor |
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## 1. Introduction.

AQUAFACT was commissioned by ABCO to carry out monthly plankton sampling surveys during the period when dredge spoil from Killybegs Harbour was being disposed of in the central part of Donegal Bay. Specifically, the samples were collected to determine if any potentially harmful medusae or toxic phytoplankton to farmed salmon were present in the water column.

Plankton sampling was carried out on September 12th, October 30th, November 25th., 2019 and January 30th, February 28th, March 26th, May 27th, June 26th, July 29th, August 27th and September 25th., 2020. Due to the outbreak of the COVID 19 virus in 2020, dredging operations ceased in April and no plankton sampling was carried out during that month.

Plankton sampling was carried out at 4 locations marked below as P1 – P4 below. P1 is located within McSwyne's Bay adjacent to a salmon farm and water depth is 30m. P2 is to the southeast of St. John's Point in 35m water depth, again adjacent to another salmon farm while P3 is due south of St. John's Point where water depth is *ca* 55 m. A control site was located *ca* 4 km west of St. John's Point and water depth is 60m. All four sites can be described as oceanic in oceanographic terms.

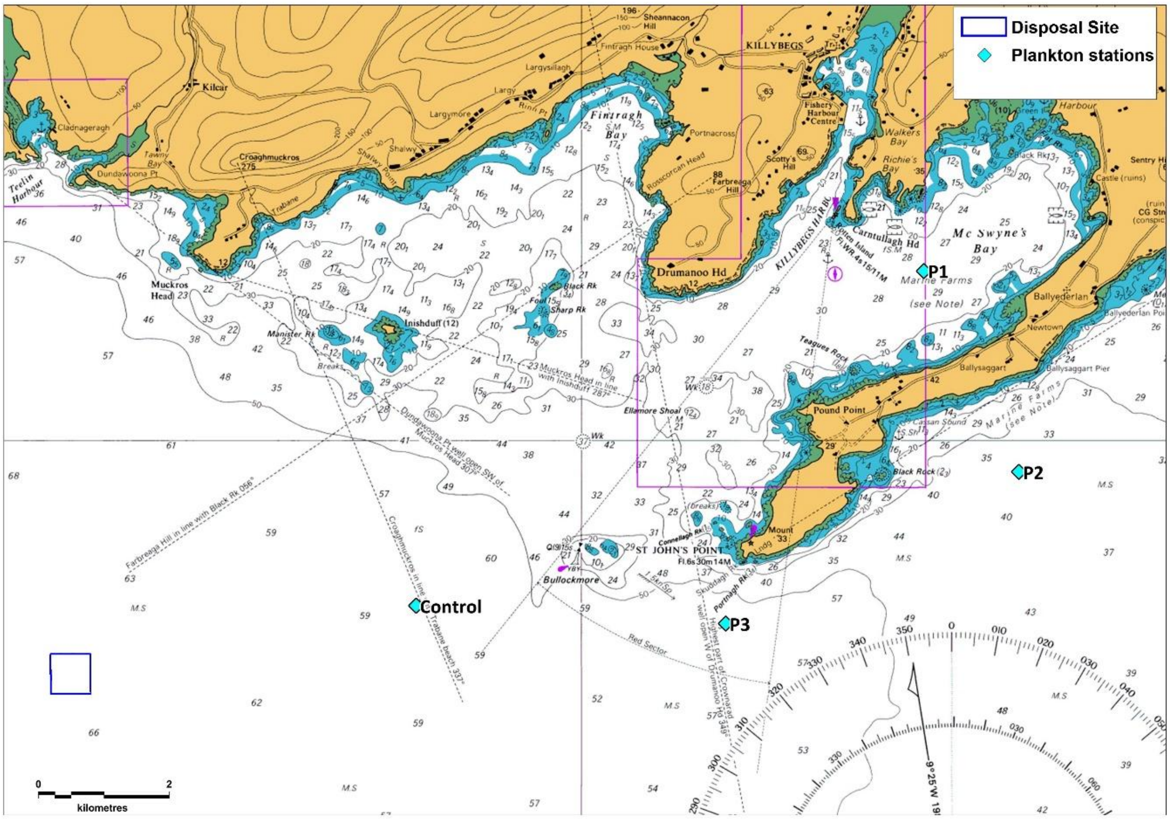


Figure 1. Location of disposal site and plankton sampling locations.

## 2. Materials and methods.

*Phytoplankton*

For the phytoplankton sample, a sample of sea water was collected from the sea surface and fixed in Lugol's iodine for later examination in the laboratory. Phytoplankton samples were examined using the inverted microscope technique. 10 ml or 25 ml samples were examined with the entire chamber base surveyed.

*Zooplankton*

Before deployment, the plastic container at the cod end of the zooplankton net was tightly secured. A "U" shaped plankton tow was carried out at each location. In order to do this, a weight *was* tied *ca* 1m in front of the net opening to ensure it would fall vertically down through the water column and sample zooplankton. The water depth of the station was used to determine how much line was fed out. When the net reached the approximate depth of the sea bed, the net was towed back up to the surface. Once back on deck, the inside of the net was washed out with a deck hose to ensure that any organisms that were adhered to the net would be washed down into the plastic container. This was then opened and the plankton sample was poured into a larger, labelled sample jar containing 4% buffered formalin.

The outside and inside of the zooplankton net were then washed out as well as the cod end lid in preparation for the next station.

Back in the laboratory, each sample was sorted under a x10 binocular microscope and potentially harmful gelatinous medusae and ctenophores were picked out for later identification and enumeration suing the same type of microscope.

The following keys were used in the identification process of phytoplankton and zooplankton:

Tomas, C. (Editor). 1997. Identifying marine phytoplankton. Elsevier Press. 858 pps.

Conway, D. Marine zooplankton of southern Britain. Part 1. M.B.A. Occasional publication, no. 25. 117 pps.

Kirkpatrick, P. and Pugh, P. 1984. Synopsis of the British Fauna, no. 29. Siphonophores and velellids.

Newell, G. and Newell, R. 1973. Marine Plankton – a practical guide. Hutchinson Educational.pps. 224.

Russell, F. 1953 and 1970. Medusae of the British Isles. Vol. I: Hydromedusae and Vol.2: Scyphomedusae. Cambridge University Press.

## 3. Results.

*Phytoplankton*

2019

September 12th

P1 No toxic phytoplankton

P2 No toxic phytoplankton

P3 *Dinophysis tripos*

P4 No toxic phytoplankton

October 30th

No toxic phytoplankton in any sample.

November 25th

P1 No toxic phytoplankton

P2 *Noctiluca scintillans, Akashiwo, Dinophysis acuta*

P3 *Akashiwo, Dinophysis acuta*

P4 *Akashiwo, Dinophysis acuta*

2020

January 30th

No toxic phytoplankton in any sample.

February 28th

P1 No toxic phytoplankton

P2 *Akashiwo*

P3 No toxic phytoplankton

P4 No toxic phytoplankton

March 26th

P1 *Myrionecta*

P2 No toxic phytoplankton

P3 No toxic phytoplankton

P4 No toxic phytoplankton

May 27th
No toxic phytoplankton in any sample.

June 26th

P1 *Alexandrium* sp

P2 No toxic phytoplankton

P3 *Karenia mikimotoi*

P4 *Alexandrium* sp

July 29th

P1 *Dinophysis acuminata*

P2 No toxic phytoplankton

P3 No toxic phytoplankton

P4 No toxic phytoplankton

August 27th

P1 No toxic phytoplankton

P2 *Dinophysis acuminata*

P3 No toxic phytoplankton

P4 *Dinophysis acuminata*

September 25th

P1 *Dinophysis acuminata Ceratium hexacanthum*

P2 *Dinophysis acuminata*

P3 No toxic phytoplankton

P4 *Dinophysis acuminata* and *D. acuta*

*Medusae*
The results of the microscopic analysis of each of the 4 sampling locations and for each sampling date are presented below and include the names of the potentially harmful medusae and the numbers present in each sample.

September 12th 2019

P1.

*Phialella quadrata* 4

*Agalma elegans* 4

*Muggiaea atlantica* 21

P2.

*Phialella quadrata 2*

*Muggiaea atlantica* 72

P3.

*Phialella quadrata* 3

*Agalma elegans* 2

*Muggiaea atlantica* 33

P4.

*Phialella quadrata* 6

*Agalma elegans* 8

*Muggiaea atlantica* 4

October 30th

P1.

*Phialella quadrata* 5

*Obelia* spp. 4

*Agalma elegans* 3

*Muggiaea atlantica* 12

P2.

*Obelia* spp. 7

*Muggiaea atlantica* 21

*Phialella quadrata* 2

*Agalma elegans* 5

P3.

*Obelia* spp.6

*Agalma elegans* 7

*Phialella quadrata* 3

*Sarsia tubulosa* 1

*Muggiaea atlantica* 2

P4.

*Muggiaea atlantica* 4

*Agalma elegans* 3
*Lizzia blondina* 1

November 25th 2019

P1.

*Agalma elegans* 4

*Muggiaea atlantica* 4

*Phialella quadrata* 1

*Obelia* spp 1

P2.

*Obelia* spp 2

*Muggiaea atlantica 3*

*Agalma elegans* 1

P3.

*Aglantha digitale* 2

*Agalma elegans* 1

*Muggiaea atlantica* 4

*Rathkea octopunctata* 1

P4.

*Agalma elegans* 3

*Obelia* spp. 3

*Phialella quadrata* 2

*Muggiaea atlantica* 4

January 30th, 2020

P1.

*Obelia* spp. 3

*Phialella quadrata* 1

*Muggiaea atlantica* 3

*Aglantha digitale* 2

*Phialella quadrata* 1

P2.

*Phialella quadrata* 1

*Obelia* spp 1

*Muggiaea atlantica* 2

P3.

*Agalma elegans* 3

*Muggiaea atlantica* 2

P4.

*Muggiaea atlantica* 2

*Obelia* spp 3

February 28th

P1.

*Aglantha digitale* 2

*Obelia* spp 2

*Phialella quadrata* 4

P2.

*Muggiaea atlantica* 4

*Aglantha digitale* 4

*Agalma elegans* 2

P3.

*Muggiaea atlantica* 6

*Obelia* spp 1

*Phialella quadrata* 1

P4.

*Aglantha digitale* 3

*Muggiaea atlantica* 2

March 26th

P1.

*Obelia* spp 4

*Phialella quadrata* 6

*Sarsia tubulosa* 2

*Rathkea octopunctata* 3

*Leucartiara octona* 2

*Aglantha digitale* 2

*Muggiaea atlantica* 3

P2.

*Muggiaea atlantica* 3

*Aglantha digitale* 2

*Obelia* spp 7

*Phialella quadrata* 6

*Eutima* spp 1

P3.

*Aglantha digitale* 2

*Muggiaea atlantica* 3

*Obelia* spp 8

*Phialella quadrata* 12

*Eutima gracilis* 3

*Sarsia tubulosa* 3

P4.

*Obelia* spp 3

Ephyra larvae 3

*Phialella quadrata* 6

*Sarsia* spp 2

*Bougainvillia ramosa* 2

*Muggiaea atlantica* 6

*Agalma elegans* 3

May 27th

P1.

*Phialella quadrata* 3

*Obelia* spp 2

P2.

*Phialella quadrata* 2

*Obelia* spp 5

P3.

*Phialella quadrata* 1

*Obelia* spp 3

*Phialidium* spp 1

*Cosmetira pilosella* 1

P4.

*Phialella quadrata* 6

*Obelia* spp 2

*Hybocodon prolifer* 1

June 26th

P1

*Obelia* spp 12

*Phialella quadrata* 9

P2

*Obelia* spp 7

*Phialella quadrata* 7

*Tiaropsis multicirrata* 2

*Agalma elegans* 2

P3

*Tiaropsis multicirrata* 1

*Leucartiara octona* 2

*Phialella quadrata* 9

*Obelia* spp 10

*Agalma elegans* 3

*Rathkea octopunctata* 2

P4

*Tiaropsis multicirrata* 2

*Leucartiara octona* 3

*Phialella quadrata* 8

*Obelia* spp 9

*Agalma elegans* 2

July 29th

P1

*Tiaropsis multicirrata* 1

*Leucartiara octona* 3

*Phialella quadrata* 8

*Obelia* spp 9

*Agalma elegans* 1

P2

*Tiaropsis multicirrata* 2

*Leucartiara octona* 3

*Phialella quadrata* 8

*Obelia* spp 14

*Agalma elegans* 3

P3

*Tiaropsis multicirrata* 1

*Leucartiara octona* 3

*Phialella quadrata* 6

*Aeqourea forskali* 2

*Obelia* spp 10

*Agalma elegans* 3

P4

*Tiaropsis multicirrata* 2

*Phialella quadrata* 6

*Obelia* spp 31

*Agalma elegans* 3

August 27th

P1

*Aeqourea forskali* 1

*Phialella quadrata* 6

*Muggiaea kochi* 16

*Obelia* spp 19

P2

*Phialella quadrata* 3

*Muggiaea kochi* 5

*Obelia* spp 6

P3

*Aglantha digitale* 4

*Phialella quadrata* 2

*Muggiaea kochi* 11

*Obelia* spp 10

P4.

*Aglantha digitale* 3

*Phialella quadrata* 6

*Muggiaea kochi* 12

*Obelia* spp 15

September 25th

P1

*Muggiaea kochi* 7

*Obelia* spp 26

*Phialella quadrata 4*

P2

*Muggiaea kochi* 3

*Obelia* spp 1

P3

*Phialella quadrata* 2

*Aglantha digitale* 1

*Muggiaea kochi* 2

*Obelia* spp 3

*Aeqourea forskali* 3

P4

*Aglantha digitale* 2

*Muggiaea kochi* 4

*Obelia* spp 7

## 4. Discussion.

*Phytoplankton.*

The phytoplankton results record the presence of potential red tide causing organisms in the samples examined. Numbers were very low with no more than 100 cells per litre in all cases. These numbers would generally be too low to cause problems for aquaculture with the possible exception of shellfish poisoning by *Dinophysis*.

*Myrionecta rubra* can colour water if present in very large numbers but is not known to be harmful.

*Alexandrium* sp. can cause serious toxicity in shellfish if a toxic species is present in sufficient quantity but many species are not harmful to shellfish.

*Karenia mikimotoi* is toxic to farmed fish when present in large numbers and can also colour sea water brown. Only one cell was seen in this survey.

The non-toxic but occasionally problematic species *Noctiluca scintillans* was also recorded.

*Dinophysis acuminata* can cause shellfish toxicity but in this case only low numbers, 100 cells per litre were seen.

In general the samples examined had very low cell numbers. Samples in June July and August mainly contained dinoflagellates, especially *Ceratium* sp. The presence of *Ceratium hexacanthum* indicates an offshore or "oceanic high salinity" influence.

*Akashiwo sanguinea* is reputed to cause fish mortalities but as yet, not in Ireland. Low numbers of this species were recorded in Winter (November to February).

In general terms, species succession appears typical of Irish Atlantic coasts. Autumn (September to November) samples are dominated by dinoflagellates, many of which originate off shore such as *Dinophysis tripos* or *Ceratium hexacanthum*. Little plankton was noted thereafter other than *Coscinodiscus* sp. (a diatom) in Spring.

*Medusae*

As most species of medusae are meroplanktonic species, number of species and numbers of individuals are lower in the Winter months compared to the Spring/Summer months and this trend is evident in the data presented above. Holoplanktonic taxa such as *Agalma, Muggiaea* and *Aglantha* can be present in the samples all year round.

The leptomedusa, *Tiaropsis multicirrata,* has not been recorded frequently in Irish waters.

A number of taxa of gelatinous zooplankton have been associated with causing mortalities to farmed salmon in the North East Atlantic and these include the medusae *Phialella quadrata Solmaris coronae, Phialidium* sp.*, Leucartiara octona, Aurelia aurita, Cyanea capillata* and *Pelagia noctiluca,* the siphonophores *Muggiaea atlantica* and *Apolemia uvaria,* and the ctenophore, *Bolinopsis infundibulum* (Purcell *et al.,* 2013). (Curiously, the common and strongly stinging *Chrysaora hysocella* and the less common, though also strongly stinging *Cyanea lamarkii* are not included in this list.)

As can be seen from the results above, four of these taxa were recorded during the surveys and these were *Phialella quadrata, Leucartiara octona, Agalma elegans* and *Muggiaea atlantica*. However, it is considered that the numbers recorded at all sampling locations are too low to be of concern to cause mortalities to farmed salmon.

## 5. References

Conway, D. Marine zooplankton of southern Britain: Cnidaria and Ctenophora. Marine Biological Association Occasional publication No. 25.

Newell, G and Newell, R. 1973. Marine Plankton. Hutchinson Educational. 244pps.

Purcell, J., Baxter, E. and Fuentes, V. 2013. Jellyfish as products and problems of aquaculture. In "Advances in aquaculture hatchery technology". Chapter 13, pps 404 – 430. Eds. Allen, G. and Burnell, G.

Tomas, C. (Editor) 1997. Identifying marine phytoplankton. Elsevier Press, 858 pps.