Lake Diver Distinctive Specialty Course Instructor Outline

This course provides the training required to allow the candidates to competently and safely dive in lake diving situations

1. Course Objectives and Standards

A. Course Goals

The goals of the Lake Diver course are to:

a) Introduce the student to various lake diving environments

b) Explain how lakes are formed

c) Define limnological terms

b) Introduce techniques, problems and fascination of lake diving with particular emphasis on aquatic life, altitude considerations, natural and man-made hazards

B. Course Requirements

1. Minimum prerequisite certification: PADI Junior Open Water Diver (or equivalent)

2. Minimum age of 12

3. Student to Instructor ratio: 8:1

4. Maximum depth 18 meters [30m if certified as PADI Advanced Open Water or Adventure diver with deep diving experience (or equivalent)]

5. Two (2) Open water dives

6. Minimum course duration is dependent on class size. As a guideline – a nominal duration for a class size of eight (8) students would be two (2) hours for theory; eight hours for practical exercises.

7. Minimum Instructor rating: Open Water Scuba Instructor and Specialty Instructor in the Distinctive Specialty of Lake Diving

C. Student and Instructor Equipment Requirements

1. Student equipment

a. All standard diving equipment

b. Slate

c. Camera

2. Instructor equipment

a. All standard diving equipment

b. Slate or Camera

c. Student Record File

d. Class Roster

e. First Aid supplies and equipment including pocket mask and oxygen

D. References

•Bronmark,C and Hansson,L 2000 The Biology of Lakes and Ponds Published by Oxford University Press ISBN 0 19 854972 5 (216pp)

•Giller,P and Malmquist,B 2001 The Biology of Streams and Rivers Published by Oxford University Press ISBN 0 19 854977 6 (296pp)
•Wetzel, R.G. 1983 Limnology Published by Saunders College Publishing ISBN 003 057913 9 (765pp)
•Miller, R. 1996 Freshwater Invertebrates Published by the Gould League ISBN 0 909858 49 7 (28pp)
•Herbert,B and Peeters,J 1995 Freshwater Fishes of Far North Queensland Published by Publishing services DPI ISBN 0 7242 5942 2 (74pp)
•Sainty, G.R., and Jacobs, S.W.L., 1994 WATERPLANTS in Australia Published by South China Printing Co. (1988) Ltd ISBN 0 646 15939 9 (327pp)
•Allen, G.R., Midgley, S.H. 2002 Field Guide to the Freshwater Fishes of Australia, CSIRO Publications
•Gooderham, J and Tsyrlin, E. 2002 The Waterbug Book
•PADI Adventures in Diving 2000 Published by International PADI Inc.ISBN 1 878663 08 9 (372pp)
•AWARE - Our World, Our Water 2000 Published by International PADI Inc. ISBN 1 878663 26 7 (164pp)

E. Recognition materials

a. PIC envelopes (or PICs on-line)

b. Specialty Diver Certificates

F . Knowledge Development Topics

The following is an actual presentation outline. Directions to, or comments for, the instructor are enclosed in [brackets]

Introductions, welcome to the course and course overview:
a. Introduce yourself and your assistants
b. Student introductions
c. Course goals

2. Course overview
a. Classroom presentations. [Note to instructor: Academic information will be via a short classroom discussion but essentially covered on-site at the dive site location/s. Other academic background will be reviewed through reading web-based text. Give the dates and locations of venue.]
b. Open water training dives.
c. Performance assessment. [Note to instructor: You are to ensure that all performance requirements have been met. Skills performed onsite are to be directly observed. Academic assessment may be accomplished through discussions with students and oral quizzes. Tell the class how their performance will be evaluated.]
d. Certification: Upon successful completion of the course, you will be awarded the PADI Distinctive Specialty Diver

Certification as Lake Diver.

e. Class requirements: Course costs [Explain all course costs], Equipment needs, and materials used during the course and attendance requirements.

f. Administration: Collect course fees, enrolment forms, [Continuing Education Administrative Document or Standard Safe Diving Practices Statement of Understanding, PADI Medical Statement, Liability Release and Express Assumption of Risk].

3. Why Lake diving?

Lake diving is available almost anywhere and more often than not, accessible and relatively inexpensive to do. Common venues in the geographical location of the Far North of Queensland, for instance, where most divers think mainly about the Great Barrier Reef, fit into this category. These alternate venues offer many other attractions to warrant further investigation. Dive sites often visited include Lake Eacham and Lake Barrine, Caves at Chillagoe and abseiling to sump dives at Stannery Hills.

(a) Venue examples

Lake Barrine 760m above sea level (ASL)

Lake Eacham 760m ASL

4. Knowledge Development

Objectives to achieve and/or subject descriptions are listed as relevant to each of the following sections:

a. How lakes are formed

b. Lake types

c. Limnological Terms

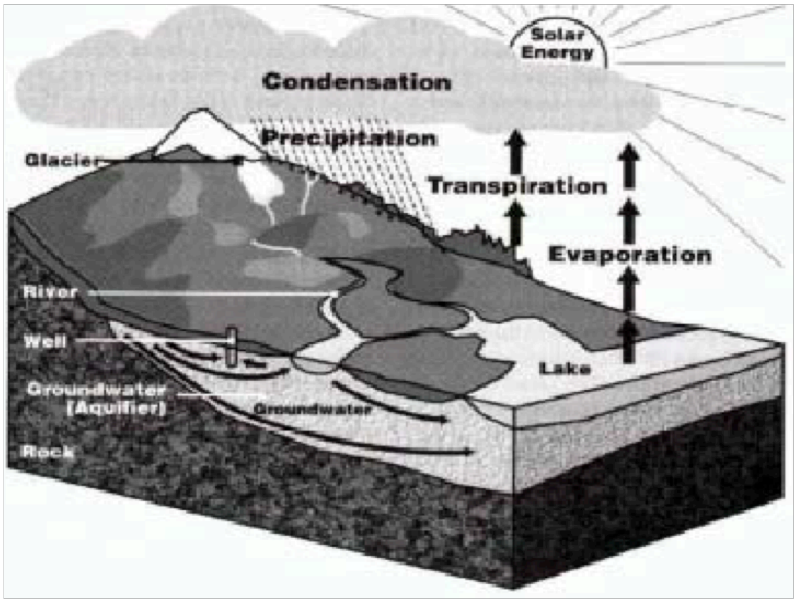
d. Aquatic life, special equipment

e. Hazards

f. Altitude considerations

a. How lakes are formed

The Hydrologic Cycle



The Hydrologic Cycle

The hydrologic cycle can be thought of as a series of reservoirs, or storage areas, and a set of processes that cause water to move between those reservoirs. The largest reservoir by far is the oceans, which hold about 97% of Earth's water. The remaining 3% is the freshwater so important to our survival, but about 78% of that is stored in ice in Antarctica and Greenland. About 21% of freshwater on Earth is groundwater, stored in sediments and rocks below the surface of Earth. The freshwater that we see in rivers, streams, lakes, and rain is less than 1% of the freshwater on Earth and less than 0.1% of all the water on Earth.

http://www.visionlearning.com/en/library/Earth-Science/6/The-Hydrologic-Cycle/99

b. Lake Types

Describe at least ten types of lakes

•Tectonic-formed by the faulting and folding of the earth's crust. Steep walls and typically very deep. Lakes Baikal and Tanganyika (1435m deep) are examples

•Volcanic-filled with various sediments including diatomite. Noticeably silty bottom. Outcroppings of scoria gives picturesque underwater landscape

•Glacial-Advance and retreat of glaciers have produced erosion debris and outwash gravels deposited in huge quantities. Lakes so formed show significantly "rubbly" bottoms.

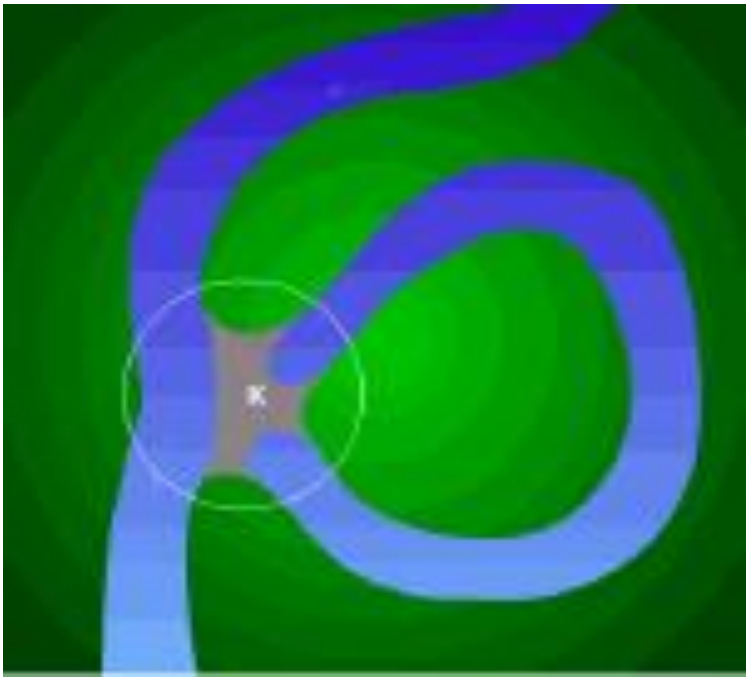
Glacial fed lake. Lake Lanthe West Coast NZ

•Landslide-Originate through blockage of drainage in valleys by debris from landslide. Even large lakes of this variety fill in relatively quickly. It is suspected that many are synchronous with seismic activity. These are categorised in turn as "temporary" lakes on large rivers that are soon destroyed and "permanent" on tributaries that may remain for thousands of years . An example of this type would be Lake Waikeremoana in NZ. Typical topography is V-sided and dendritic (mineral forms with embedded vegetation)

•Phytogenic- These lakes have been formed primarily by organic accumulation. Ponds and small lakes may also develop on peat surfaces because of differing rates of peat formation. Silty and water is "tea" coloured

•Riverine- Lakes formed in abandoned channels and as a result of dykes blocking drainage are widespread on flood plains. Often referred to as "Oxbow" lakes. Normally shallow and very silty

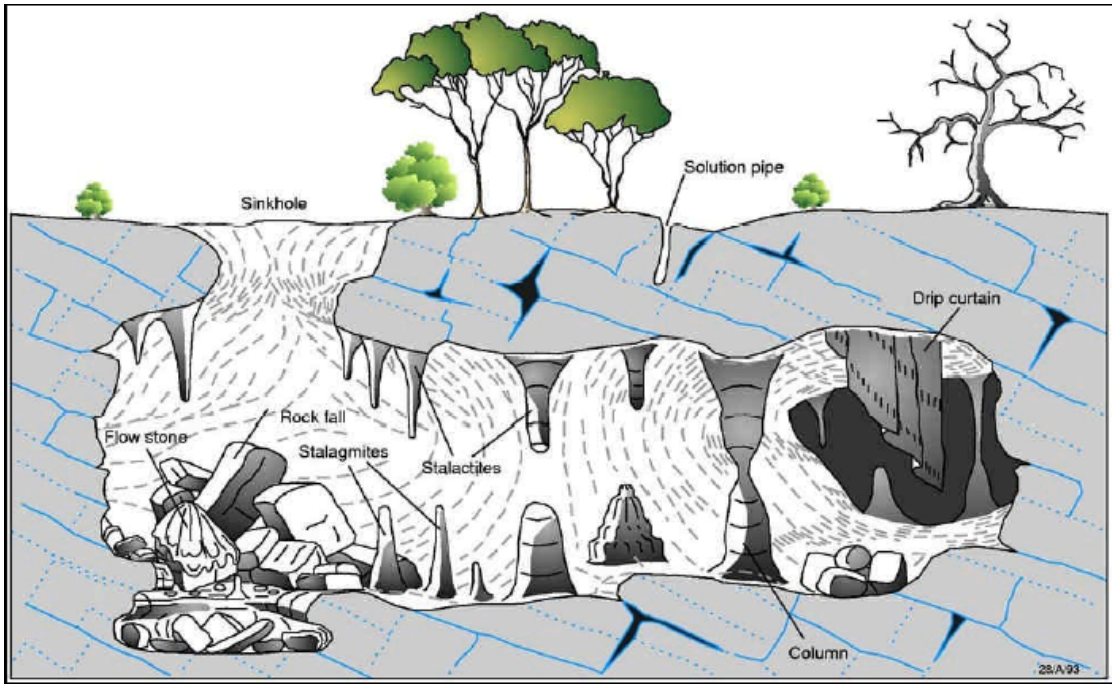
Oxbow lake formation



•Windblown- Dune-Sand dune lakes originate by the blocking of valleys or depressions by wind blown sand deposits. Beaches often sandy with silty bottoms. Some contain freshwater crabs(small)

•Barrier(Shoreline)-Relatively uncommon. Formed by the enclosure of inlets by barrier bars or spits. The barriers form through wave action coupled with tectonic movements and sea level fluctuations. Usually adjacent to river mouths, close to the sea. Typically D-shaped, brackish and shallow

•Karst-Lakes associated with Karst landscapes(or solution lakes) occur in enclosed depressions and are typically temporary



Schematic of a 2-D, karst terrain with caves, solutions, pipes and sinkholes.

•Man-made-Most of these have been made since the 1950's. In general, these have been formed for hydro-electric power generation or reservoirs for growing urban and rural water supplies or irrigation systems. These often have deliberate shaping containing submerged vegetation and outlets posing extreme danger for divers

Hydro-Dam showing outflow and the safest side on which to dive.

c. Limnological terms

•Define at least 10 limnological terms associated with lake and river description

•Aphotic-the depth beyond which less than 1% of the surface light reaches. Insufficient for photosynthesis

•Biomass-total mass of living organisms per unit surface or volume

•Detritus-dead organic matter

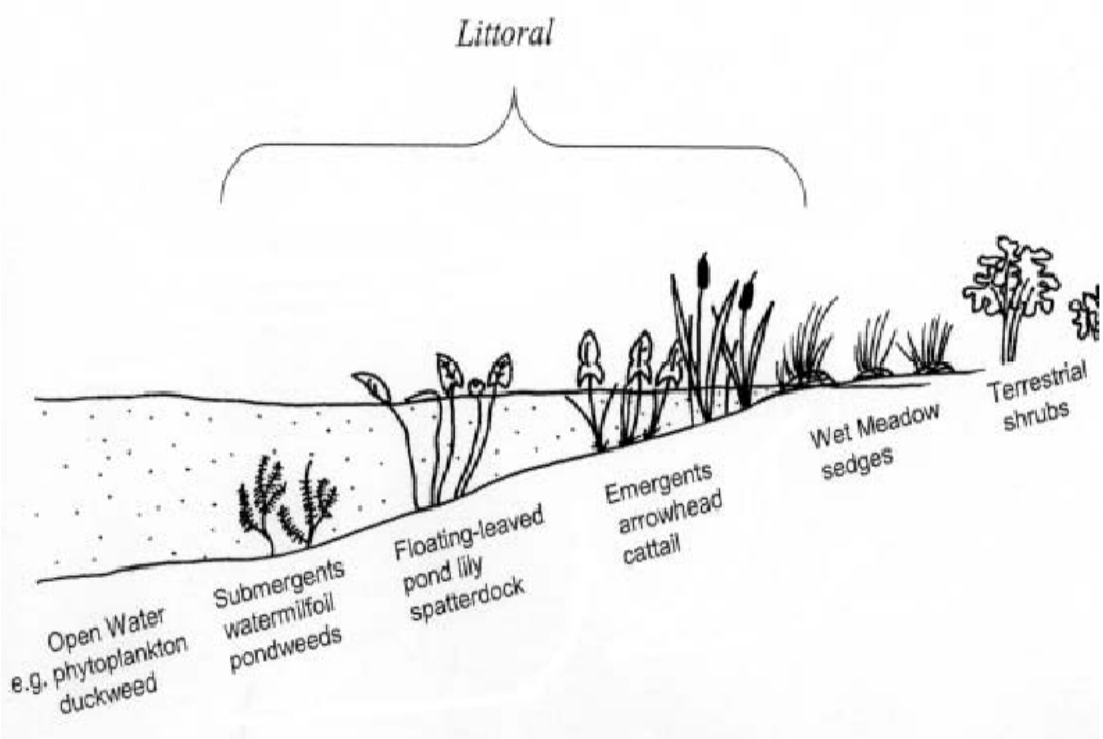
•Epilimnion-the stratum of warm, well mixed water above the thermocline

•Epiphytic-growing on plants

•Hypolimnion-the stratum of water below the thermocline

•Limnology!-the study of freshwater communities and their interactions with physical, chemical and biotic environmental variables

•Littoral zone-the shallow, nearshore part of a lake or pond characterised by light penetration to the bottom



•Pelagic-The area beyond the influence of the shore or bottom of lakes

•Photic zone-where the light intensity is above 1% of surface light; where light availability is high enough to allow photosynthesis

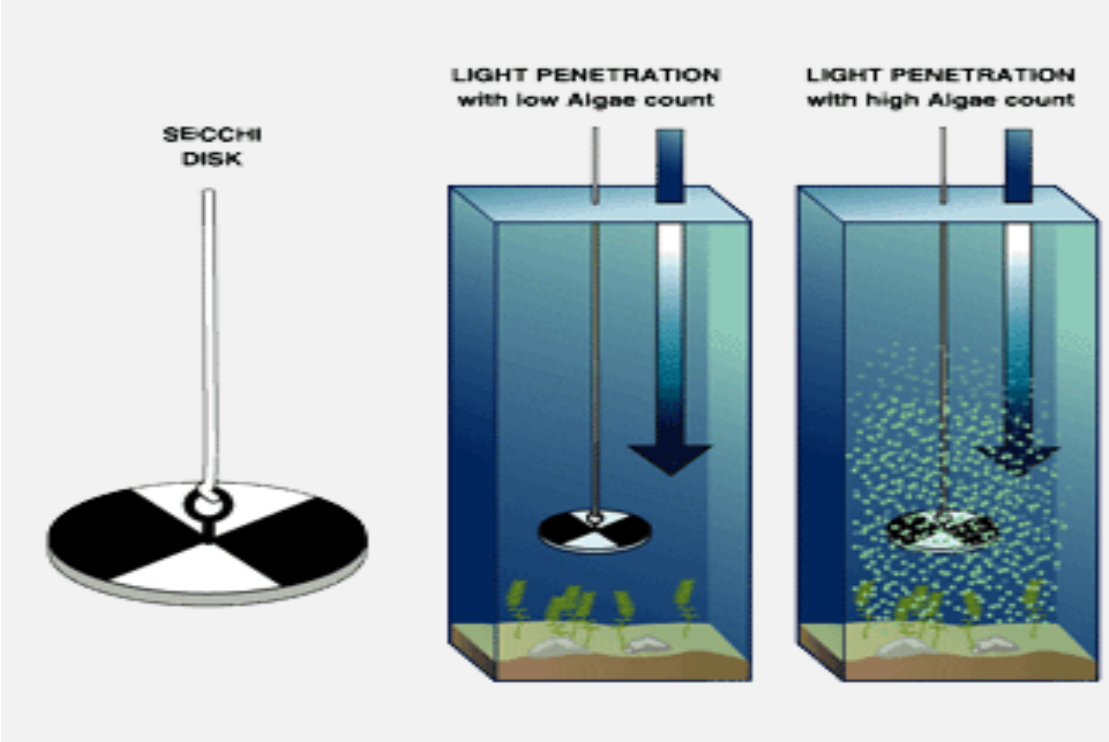
•Photosynthesis-the process in plants where large organic molecules are produced from inorganic carbon using light as the energy source

•Plankton-an organism that is suspended in the water

•Secchi disk-a circular metal plate with the upper quadrants painted black and white. Used for determining water clarity

•Thermocline-the stratum between the epilimnion and hypolimnion exhibiting a marked thermal change

•Zooplankton-floating and drifting animal life



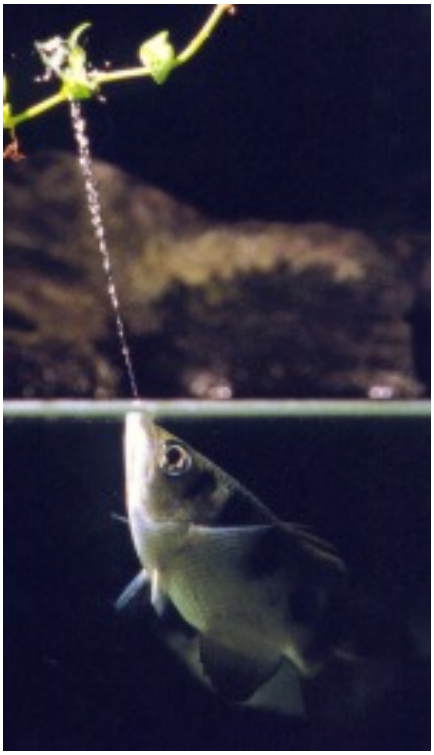
d. Aquatic life

•Identify at least 2 types of freshwater fish

•Identify at least 2 types of freshwater aquatic plants

•Identify at least 4 other types of animals that are found in the freshwater environment

Tilapia – considered a pest fish



Archer fish

•Freshwater Fish-refer local texts

•Freshwater Aquatic Plants-refer text

•Other animals-refer texts: *Freshwater invertebrates and*

Biology of Lakes and Ponds and Biology of Streams and Rivers

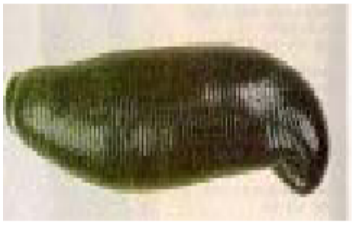
•Most animals and freshwater plant life illustrated are found universally

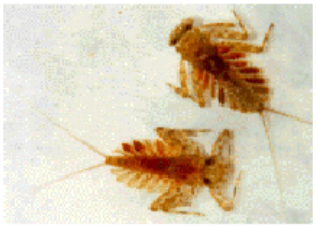
Tandanus-Eel-Tailed Catfish

Barramundi

Red Claw crayfish

Time for the books!





e. Equipment considerations

•Recognise the need for weight reduction and an effective BCD

•Recognise the historical value of and use of a capillary depth gauge

•Identify the method required to adjust (if necessary) personal diving computers for altitude change

Capillary depth gauge

•Now almost unobtainable, the capillary depth gauge was used in the early years of diving as it was the only depth measuring instrument that automatically compensated for changes in ambient pressure. This gave relative depths useable directly with standard dive tables. Now, this instrument has been well superseded by automatically equilibrating computers.

•Because of excessive silt build up in many lakes, a review of effective buoyancy control should be made to avoid “brown out”. It is strongly recommended that the PADI Peak Performance Buoyancy Specialty Course be taken to enhance lake diving skills

•Freshwater is less dense than sea-water hence weights required for neutral buoyancy are often less than those required for ocean diving. Dependent on other factors regarding changes in other dive equipment such steel or aluminium cylinders? Thicker wet

suits or drysuits?

•As many lakes are located at altitude, the ambient air pressure may be much reduced from that which our conventional depth gauges and RDP are designed for. Because of this (and as implied above) it is recommended that we use altitude adjustable instrumentation and use the altitude correction tables in conjunction with the RDP

f. Hazards of Lake Diving

•Recognise 6 types of hazards that the diver may encounter on a lake dive

•Identify the best method of handling each type of hazard identified

•Silting- Lakes, like many coastal beaches and bays, are subject to buildups of sediment from earth and debris being washed in as a result of rainfall. Also, as there is little, if any, current, this continues to build up and form a very loose bottom.

•Consequently, any slight disturbance will result in the silt rising and mixing with the water creating poor visibility. This is often referred to as “silt-up”or “brown-out”

•Avoidance of this problem can be achieved by proper buoyancy control.

•Movement across the bottom is best performed at least one metre above the silt and using the fins in a horizontal motion

(frog-kick).

•Trees, Weeds, Wrecks and other underwater obstacles

•The greatest concern with any underwater obstacle is entrapment or entanglement.

•Usually, local information will indicate what may be in the lake to be dived and make avoidance of difficulties easier

•All obstacles should be swum around not into. This assists preservation through minimal disturbance. Wrecks should not be penetrated unless trained to do so.

•The PADI Wreck Diving Specialty Course is an obvious choice here to enhance this activity.

•Depth from Drop-offs

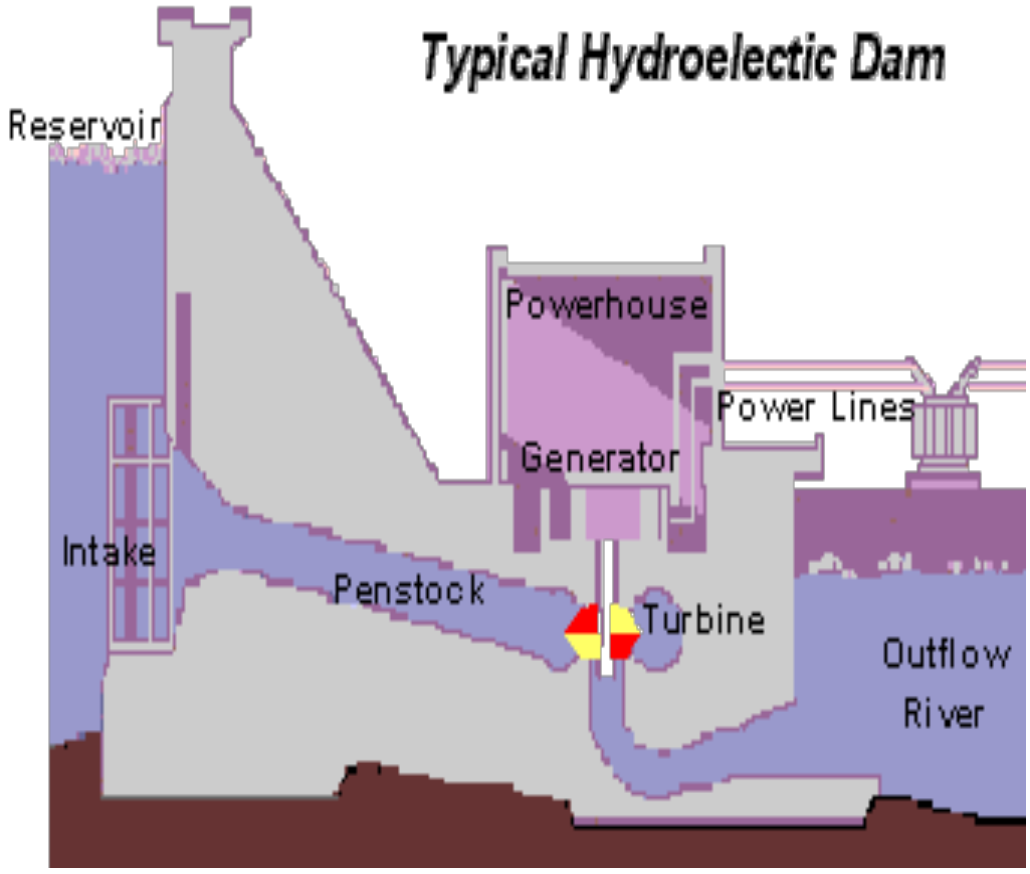
•Some lakes are very deep, have sheer sides and are very deceptive because of unusually clear water. Check Admiralty charts and ensure your depth readings are clear. Are depths indicated in feet, meters or fathoms?

•Diving in this type of lake should be approached with a great deal of caution and again, further training in both Altitude and Deep Diving is encouraged prior to this challenge.

•Man-Made Weirs, Dams and Intakes

•Again, check local knowledge first but if there is any likelihood of man-made construction, the best approach is complete avoidance. Difficulties here could arise from extreme currents near intakes that can not be countered or mechanical obstructions which may be mobile through careless fitting or

just corrosion



Intake areas such as these give suction forces that are impossible for the diver to compete against. Intakes are particularly hazardous and there is simply no positive outcome for getting caught in the inflow

•Thermoclines- By themselves they should pose no real problem other than giving a sharp decrease in temperature and a consequent increase in cooling

•Hypothermia could be a concern but can be easily avoided by wearing adequate exposure protection. A benefit in reaching a

thermocline is that the visibility becomes better below it and on return to the shallower water, it feels like you're getting into a warm bath!

•Currents-although not usually present in lakes to any significant amount, the speeds of rivers leading from lakes [such as the Waikato river leading from Lake Taupo in the North Island of New Zealand] can be from sluggish to the outright dangerous, particularly so after periods of intense rainfall. Local knowledge is vital here. The speed of some currents could find the diver tumbled against rocks causing bruising at best, unconsciousness at worst. During flood periods, debris such as trees and branches are carried downstream and many lodge in such manner as to form spear like protrusions. At even low speeds these can be deadly. And look out for the waterfalls!!

•Environmental hazard- make sure that when you leave a freshwater body that you, your equipment and the boat you may have used for transport are washed down thoroughly and that no weed or fish is transported to other freshwater bodies - alive or dead. Many native species have been marginalised by introduced and noxious plants and animals. There are heavy penalties for transferring noxious plants or animals from one location to another in most countries

•Any noxious plants or animals recognised should be reported immediately to the relevant authorities

•Waterborne diseases

•Recreational water illnesses can cause a wide variety of symptoms, including skin, ear, respiratory, eye, and wound infections. The most commonly reported RWI is diarrhea. Diarrheal illnesses can be caused by germs such as Crypto, short for Cryptosporidium, Giardia, Shigella, and E. coli O157:H7.

g. Altitude diving

•Define altitude diving and use the special procedures required for altitude diving

•Altitude diving is considered to be any dive performed at an altitude at 300m above sea level or greater

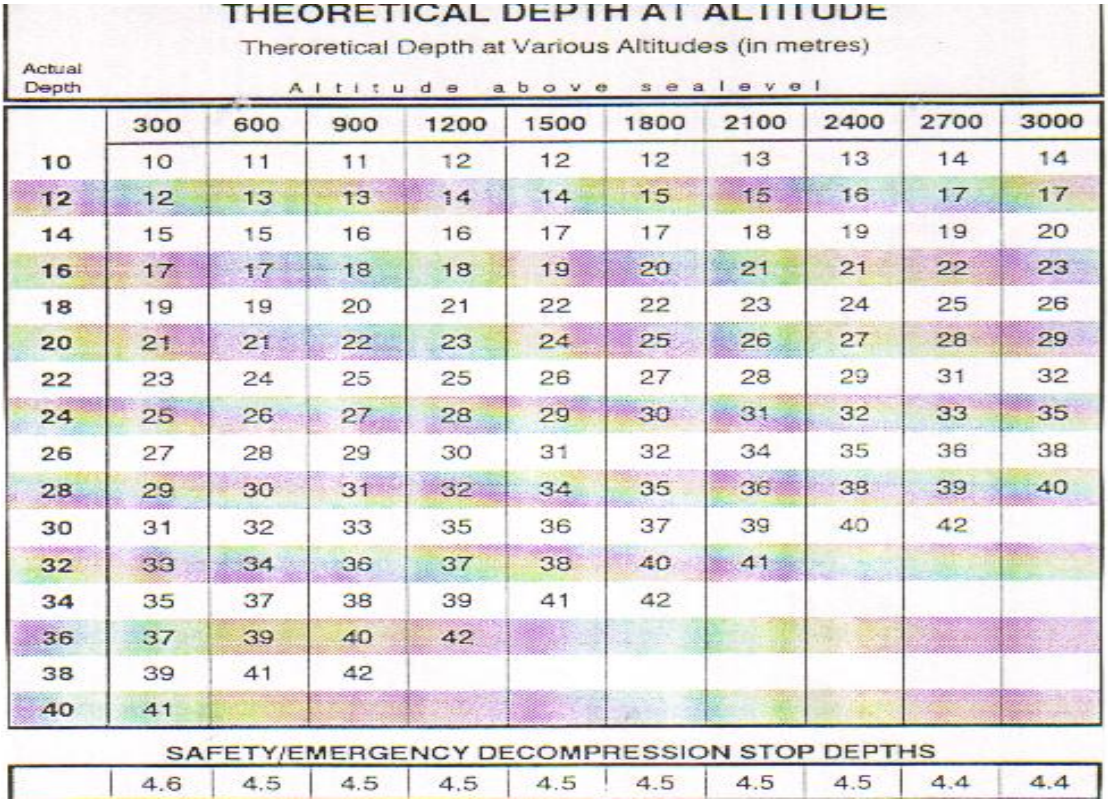
•Special procedures required for altitude diving

•Weight belt adjustment – One suggestion is to remove at least 2.5% of total weight of diver and gear (approximately 1.5-2.5 kg). Best method is to adjust in the shallows before continuance.

•Flying after diving-Refer RDP

•Diving on the same day as arrival at altitude -Treat as a repetitive dive. A rule if thumb is to add 2 Presure Groups (PG's) for each 300m of altitude and round up.

•RDP Use - use with reference to the Altitude correction tables found in the Altitude Diving section of the PADI Adventures in Diving Text



THEORETICAL DEPTH AT ALTITUDE

Theroretical Depth at Various Altitudes (in metres)

Actual Depth	Altitude above sealevel									
	300	600	900	1200	1500	1800	2100	2400	2700	3000
10	10	11	11	12	12	12	13	13	14	14
12	12	13	13	14	14	15	15	16	17	17
14	15	15	16	16	17	17	18	19	19	20
16	17	17	18	18	19	20	21	21	22	23
18	19	19	20	21	22	22	23	24	25	26
20	21	21	22	23	24	25	26	27	28	29
22	23	24	25	25	26	27	28	29	31	32
24	25	26	27	28	29	30	31	32	33	35
26	27	28	29	30	31	32	34	35	36	38
28	29	30	31	32	34	35	36	38	39	40
30	31	32	33	35	36	37	39	40	42	
32	33	34	36	37	38	40	41			
34	35	37	38	39	41	42				
36	37	39	40	42						
38	39	41	42							
40	41									

SAFETY/EMERGENCY DECOMPRESSION STOP DEPTHS

	4.6	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.4	4.4

•Complete the PADI Altitude Diver Specialty Course to further enhance your knowledge and enjoyment of lake diving at altitude

5. Planning and organizing dives

This should be performed no differently than normal.
Buoyancy control is a very important issue for streamlining and avoidance of silting up or other hazards such as submerged trees with sharp branches protruding in low visibility waters.

Attending a Peak Performance Buoyancy workshop is recommended to improve this ability.

6. Open Water Dives

1. Open Water Training Dive One - Photos

Learning Objectives.

By the end of this dive, you will be able to:

•Plan dive using RDP and altitude table corrections. Adjust instrumentation

•Determine the type of lake dived

•Correct weighting and buoyancy procedures at depth to prevent "silt up"

•Identify at least two types of marine invertebrate

•Using natural navigation techniques, follow a reciprocal course and exit no more than 10 metres from entry point

•Compare readings on yours and buddy's instrumentation

•Ascent rate 9m/min

a. Briefing

• Evaluate conditions

• Facilities at dive site

• Entry technique to be used-location

• Exit technique to be used-location

• Bottom composition, expected features and points of interest

• Depth range

• Planned air supply limit
• Review communication
• What to do if separated from class/buddy
• What to do if an emergency arises
• Buddy assignments

b. Plan Dive

• Assign depth; have students determine theoretical depth (if dive site at altitude and/or using enriched air) and no-decompression limit [Instructor note: you should check these]
• Record no-decompression limit, maximum actual depth and maximum theoretical depth on slates
• Review depth gauges and instrumentation; each student should know how to account for behaviour of his/her instrument while diving
• Assign maximum planned dive time

c. Predive
• Prepare personal equipment including slates/cameras, accessories and all extra emergency equipment
• Don equipment
• Predive safety check
• Proper entry
• Weight adjustment for neutral buoyancy

• Maintain buddy contact

d. Open Water Training Dive One

• Descend in buddy teams

• Use slates and/or cameras to assist in identification of marine species and any useful landmarks for future investigation

• Ascent not to exceed 9 metres/minute with a three-minute stop at the depth prescribed from the altitude correction tables (if necessary) .

e. Post dive

• Proper exit

• Remove and stow equipment

• Rinse cameras

f. Debrief

• Assess performance, make suggestions, give positive reinforcement

• Students calculate their ending pressure groups—review for correct calculation

• Log dive (Instructor signs log)

2. Open Water Training Dive Two

Learning Objectives.
By the end of this dive, you will be able to:
•Establish suitable entry and exit points
•Recognise possible hazards and prepare to avoid them
•Identify at least 2 types of aquatic water plants
Identify at least 2 local fish species

a. Briefing

- Evaluate conditions
- Facilities at dive site
- Entry technique to be used-location
- Exit technique to be used-location
- Bottom composition, expected features and points of interest
- Depth range
- Planned air supply limit
- Review communication
- What to do if separated from class/buddy
- What to do if an emergency arises
- Buddy assignments

b. Plan Dive

[Instructor note: Have students plan this dive in buddy teams for your assessment and approval]

• Ensure that students record no-decompression limit, maximum actual depth and maximum theoretical depth on slates (if dive site at altitude and/or using enriched air).

c. Predive

• Prepare personal equipment including action camera and requisite accessories

• Don equipment

• Predive safety check

• Proper entry

• Weight adjustment for neutral buoyancy

• Maintain buddy contact

d. Open Water Training Dive Two

• Descend in buddy teams

• Recognise possible hazards and identify at least two types of aquatic water plants and local fish species.

• Ascent not to exceed 9 metres/minute with a three-minute stop at the depth prescribed from the altitude correction tables (if necessary).

e. Post dive

• Proper exit

• Remove and stow equipment

• Rinse cameras

f. Debrief

• Assess performance, make suggestions, give positive reinforcement

• Students calculate their ending pressure groups—review for correct calculation

• Log dive (Instructor signs log)

• Complete certification paperwork

7. Lake Diver Knowledge Review

1 Describe the expected topography of the following lake types:

a Volcanic

b Glacial

c Landslide

2 Describe the following terms:

a Littoral

b Aphotic

c Photosynthesis

d Pelagic

3 List 4 commonly found freshwater fish

4 List 2 commonly found freshwater plants

5 List at least two special considerations for altitude diving

6 Describe at least two equipment considerations necessary for lake diving

7 List at least four hazards related to lake diving

8 Describe what actions to take on finding noxious weeds in a lake

9 What types of lake would a diver expect to find in a:

a coastal area

b Mountainous area?

10 What unique types of freshwater animals could a diver expect to see in a Wind-blown dune lake?

8. Lake Diver Knowledge Review Model Answers

1	Describe the expected topography of the following lake types:
a	Volcanic --- filled with various sediments including diatomite. Noticeably silty bottom. Outcroppings of scoria
b	Glacial--- outwash gravels indicating “rubbly” bottoms
c	Landslide--- debris from landslide, V-sided and dendritic
2	Describe the following terms:
a	Littoral--- the shallow, near-shore part of a lake or pond characterized by light penetration to the bottom
b	Aphotic--- the depth beyond which less than 1% of the surface light reaches. Insufficient for photosynthesis
c	Photosynthesis--- the process in plants where large organic molecules are produced from inorganic carbon using light as the energy source
d	Pelagic--- the area beyond the influence of the shore or bottom of lakes
3	List 4 commonly found freshwater fish--- bony bream, “mouth almighty”, barramundi, rainbow fish, barred grunter, threadfin, bullrout, archer fish, tandanus (eel-tailed catfish)
4	List 2 commonly found freshwater plants--- elodea, myriophylum (watermill foil), lagarosyphon, cyperus (umbrella sedge)
5	List at least two special considerations for altitude diving--- altitude correction tables, increased likelihood of hypoxia, hypothermia
6	Describe at least two equipment considerations necessary for lake diving--- capillary depth gauge or altitude adjustable computer, alteration in weight system
7	List at least four hazards related to lake diving--- silting, submerged tress, wrecks in low visibility water, drop-offs, man-made weirs, thermoclines, waterborne diseases
8	Describe what actions to take on finding noxious weeds in

	a lake --- Report to EPA!
9	What types of lake would a diver expect to find in a:
a	coastal area---windblown, barrier (shoreline)
b	mountainous area? ---glacial, landslide, karst
10	What unique types of freshwater animals could a diver expect to see in a Wind-blown dune lake? --- shrimps & crabs